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SUDS & Below Ground Drainage

Maintenance Guide

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1.0 INTRODUCTION

The purpose of this document is to provide the necessary information required to maintain the drainage system, all drainage attenuation features and accessories operational and serviceable. Refer to Appendix A for extent of SUDS features and the Drainage Layout.

The report does not replace the requirement to adhere to manufacturer's recommendations for the various products used and should be read in conjunction with the relevant manufacturer's manuals.

2.0 CONVENTIONAL DRAINAGE SYSTEMS

2.1 Gullies, Silt Traps, Manholes, Catchpits & Pipework

2.1.1 Operation and maintenance requirements

On completion of construction, internal surfaces of sewers and manholes shall be thoroughly cleansed to remove all deleterious matter, without such matter being passed forward into existing public sewers or watercourses. Maintenance responsibility for a drainage system should be always placed with an appropriate organisation.

All silt trapped gullies, silt traps, manholes and catchpits to be regularly inspected every three months and cleared out on a regular frequency for the first nine months. After this period, the frequency can be reduced to every six months.

All drainage runs to be inspected once a year. The system is to be jetted clear if necessary. Refer to Appendix A for the extent of the below ground drainage.

3.0 SUDS FEATURES

3.1 Regular inspection and maintenance is important for the effective operation of SUDS features as designed. Maintenance responsibility for SUDS features should always be placed with an appropriate organisation. Initially this should be the installer or supplier of the system who should then be responsible for handing maintenance to a suitably qualified person.

3.2 Geo-cellular attenuation tank

3.2.1 Operation and maintenance requirements

Maintenance requirements for modular system are described in Table 1.

Table 1

Maintenance Schedule	Required action	Frequency
Regular maintenance	Inspect and identify any areas that are not operating correctly, if required, take remedial works	Monthly for 3 months, then six monthly.
	Debris removal from catchment surface (where may risk to performance.	Monthly.
	Where rainfall infiltrates into blocks from above, check surface of filter for blockage by silt, algae or other matter. Remove and replace surface infiltration medium as necessary.	Monthly (and after large storms).
	Remove sediment from pre-treatment structures.	Annually, or as required.
Remedial actions	Repair/rehabilitation of inlets, outlet, overflows and vents.	As required.
Monitoring	Inspect /check all inlets, outlets, vents and overflowing to ensure that they are in good condition and operating as designed.	Annually, and after large storms.

3.2.2 Manufacturer recommendations

If debris enters the attenuation tank, the still water within the unit will have insufficient velocity to keep the particles moving. This can lead to any of the following undesirable consequences:

- Debris will be deposited in the attenuation tank around the pipe entry
- Some of the void intended for water storage will begin to fill up
- Organic matter may start to decay
- Noxious gases may build up.

3.2.3 Prevention

To prevent siltation, silt trap manholes are installed (as shown on drainage layout drawing in Appendix 1). To be effective, there must be a maintenance plan that ensures regular cleaning of the silt traps and catchpits as note in Table 1 above. Otherwise, if the trap is full, any additional debris will simply pass into the tank. Chatchpits should be regularly inspected once a year and any debris, silt to be removed from the sump.

Also before connecting to the tank, the system is to be jetted clear to remove any debris that has got collected in the inlet pipes and manholes during the installation.

3.3 Permeable Pavements

3.3.1 Operation and maintenance requirements

Regular inspection and maintenance is important for the effective operation of pervious pavements. Before handing over the facility to the client, it should be inspected for clogging, litter, weeds and water ponding and all failures should be rectified. After handover, the facility should be inspected regularly, preferably during and after heavy rainfall to check effective operation and to identify any areas of ponding.

Pervious surface need to be regularly cleaned of silt and other sediments to preserve their infiltration capability. Experience in the UK is limited, but advice issued with permeable precast paving has suggested a minimum of three surface sweeping per year.

Manufacturer's recommendations should always be followed.

A brush and suction cleaner, which can be a lorry-mounted device or smaller precinct sweeper, should be used and the sweeping regime is as follows:

- End of winter (April) – to collect winter debris.
- Mid-summer (July/August) – to collect dust, flower and grass type deposits.
- After autumn leaf fall (November).

Care should be taken in adjusting vacuuming equipment to avoid removal of joining material. Any lost material should be replaced.

The likely design life (or period before pavement rehabilitation is required) has yet to be established for UK. However, it should be no different from standard paving assuming that an effective maintenance regime is in place to minimise the risk of infiltration clogging.

If reconstruction is necessary, the following procedure should be followed;

1. Lift surface layer and laying course.
2. Remove any geo-textile filter layer.
3. Inspect sub-base and remove, wash and replace if required.
4. Renew laying course, joining material and concrete block paving.

The reconstruction of failed areas of concrete block pavement should be less costly and disruptive than the rehabilitation of continuous concrete or asphalt porous surfaces due to the reduced area that is likely to be affected. Material removed from the voids or layers below the surface may contain heavy metals and hydrocarbons and may need to be disposed of as controlled waste. Sediment testing should be carried out before disposal to confirm its classification and appropriate disposal methods.

Maintenance plans and schedules should be prepared during the design phase. Specific maintenance needs of pervious pavement should be monitored and maintenance schedules adjusted to suit requirements.

Table 1

Maintenance Schedule	Required action	Frequency
Regular maintenance	Brushing and vacuuming	Three times/year at end of winter, mid-summer, after autumn leaf fall, or as required based on site specific observations of clogging or or manufacturers' recommendations.
Occasional maintenance	Stabilise and mow contributing and adjacent areas.	As required.
	Removal of weed.	As required.
Remedial actions	Remediate any landscaping which , through the vegetation maintenance or soil slip, has been raised to within 50mm of the level of paving	As required.
	Remedial works to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users.	As required.
	Rehabilitation of surface and upper sub-structure.	As required (if infiltration performance is reduced as a result of significant clogging).
Monitoring	Initial inspection.	Monthly for 3 months after installation.
	Inspect for evidence of poor operation and/or weed growth. If required take remedial action.	3 monthly. 48h after large storms.
	Inspect silt accumulation rates and establish appropriate brushing frequencies.	Annually.
	Monitor inspection chamber.	Annually.

3.4 Blue/ Green Roof

Ensure safe access can be gained to the roof and that relevant Health and Safety procedures are followed when working at roof level. It is advised that the contractor should always seek proof of current maintenance for any roof access, fall arrest / restraint systems prior to proceeding with the work on site.

Remove all dead vegetation and debris from the roof and ensuring all outlets, gutters and downpipes are clear. Where the species mix incorporates wild flowers and grasses it is recommended that all dead vegetation is mown / strimmed down and the waste is removed from the roof and disposed off.

Any vegetation which has encroached into drainage outlets, walkways and the vegetation barriers (pebbles) should be removed. Weeding an extensive green roof is necessary to maintain a healthy roof and all aggressive species of shrub sapling and undesirable plants should be removed. Some weeds however are helpful to the biodiversity of the roof and considered as a problem only of aesthetics. If considered excessive, they can be removed ensuring that care is taken to follow specific instructions as to the type and species of vegetation removed. All extensive green roof installations will at times include some moss and grass.

Areas of dead vegetation / bare patches can be easily repaired and this is best done during the main growing seasons of March/April or from late August until the end of September. Take plug plants (new) or vegetation cuttings from surrounding areas of healthy mature plants and place on bare patches, pressing gently into the soil. A light sprinkling of sand mixed with compost should then be dressed over the affected area and watered to improve the uptake of the cuttings. If the vegetation is showing signs of distress, but has received regular rainfall, then the most likely problem is a lack of nutrient and a fertiliser should be applied.

Remove the lids of all Inspection chambers, ensure that all rainwater outlets and downpipes are free from blockages and that water can flow freely away, clean filters to outlets twice yearly and replace every three years. Ensure that any protective metal flashings and termination bars remain securely fixed in place.

Examine all mastic sealant and mortar pointing for signs of degradation. Check that all promenade tiles and paving slabs are securely fixed to the roof surface and in good condition.

Advise the client of the need to repair or renew any defects as necessary.

Ensure that any new items of plant/equipment on the roof are mounted on suitable isolated slabs and that any fixings used to secure the plant/equipment in place do not penetrate the waterproofing. Report signs of damage or degradation to the waterproofing to ABG immediately, in order that arrangements can be made for remedial work to be carried out if necessary. It is recommended that a record is kept of the findings of the inspection to avoid confusion and provide an on-going record of roof performance. Plants suitable for an extensive green roof which will colonise in partial and full shade will generally be greener in colour and grow “taller” in these locations. There will be a significant variance in the growth and colour between the plants growing in full or partial shade and those exposed to full sunlight and this should be recognised as a feature of the biodiversity of each individual roof.

3.5 Swales/Rain Gardens

3.5.1 Operation and maintenance requirements

Regular inspection and maintenance is important for the effective operation of swales and rain gardens as designed. Maintenance responsibility for a swale or rain garden should be always placed with an appropriate organisation.

Adequate access must be provided to all swale and rain garden areas for inspection and maintenance, including for appropriate equipment and vehicles. Operation and maintenance requirements are described in Table 3.

Sediments excavated from swales and rain gardens that receive runoff from residential or standard road and roof areas are generally not toxic or hazardous material and can be safely disposed of by either land application or landfilling. However, consultation should take place with the environmental regulator to confirm appropriate protocols. Sediment testing may be required before sediment excavation to determine its classification and appropriate disposal methods. For industrial site runoff, sediment testing will be essential. In the majority of cases, it will be acceptable location to distribute the sediment on site if there is an appropriate safe and acceptable location to do so.

Many of the specific maintenance activities for swales can be undertaken as part of a general landscaping contract and, therefore, if landscape management is already required at the site, should have margined cost implications.

Table 3

Maintenance Schedule	Required action	Frequency
Regular maintenance	Litter and debris removal.	Monthly (or as Required).
	Grass cutting - to retain grass height within specific specific design range.	Monthly (during growing season or as required).
	Manage other vegetation and remove nuisance plants.	Monthly (at start, then as required).
Occasional maintenance	Check for poor vegetation growth due to lack of sunlight or dropping of leaf filter, and cut back adjacent vegetation where possible.	Annually
	Re-seed areas of poor vegetation growth. After plant types to better suit conditions, if required.	Annually, or if bare soils is exposed over 10 % or more of the swale treatment areas.
Remedial actions	Repair erosion or other damage by re-turfing or reseeding	As required.
	Re-level uneven surfaces and reinstate design levels.	As required.
	Scarify and spike topsoil layer to improve infiltration performance, break up silt deposits and prevent compaction of the soil surface.	As required.
	Remove build up of sediment on upstream gravel trench, flow spreader or at the top of filter strips.	As required.
	Remove and dispose of oils or petrol residues using safe standard practices.	As required.
Monitoring	Inspect inlets, outlets and overflows for blockages, and clear if required.	Monthly.
	Inspect infiltration surfaces for ponding, compaction, silt accumulation. Record areas where water is ponding for > 48 hours	Monthly or when required.
	Inspect inlets and facility surface for silt accumulation. Establish appropriate silt removal frequencies.	Half early.

3.6 Pump Stations

3.6.1 Inspection

Pump sets should be inspected monthly by observing at least two switching cycles and checking the operation.

3.6.2 Operation and maintenance requirements

Regular inspection and maintenance is important for the effective operation of pump sets as designed. Maintenance responsibility for a pump set should be always placed with an appropriate organisation. The time between maintenance checks shall not be greater than;

- 1/4 year for pump station in commercial premises;
- 1/2 year for plants serving multiple dwellings;
- 1 year for plants in single dwellings;

Operation and maintenance requirements for pump sets are described below.

3.6.3 Regular Maintenance shall include:

1. Checking by visual inspection all connection points for leakage;
2. Operation of valves, checking ease of operation and sealing. If necessary, reset and grease;
3. Opening and closing of non-return valves; checking seating and ball/flap; functional check;
4. Cleaning the pumping unit and the pipework directly connected to it; checking impeller and bearings;
5. Checking oil level, where necessary, refill or change oil (if oil chamber fitted);
6. Internal cleaning of tank (if required or under special circumstances);
7. Checking that vent pipe is functioning.
8. Visual inspection of the electrical part of plant;
9. Visually checking condition of collection tank;
10. Every two years rinse out plant with water.

After carrying out maintenance, the plant shall be recommissioned in accordance with the clause below. A log should be kept of all maintenance work, detailing any work carried out and the applicable information. If faults are found that cannot be corrected, these shall be notified in writing to the operator of the wastewater pump set and an acknowledgement requested.

3.6.4 Commissioning

The pump set shall be commissioned by a suitably qualified person. The supplier of the wastewater pump set is responsible for ensuring the availability of this person. Testing with water for a minimum of two switching sequences is required for commissioning. During the test, dry running shall be avoided. The following items shall be checked before, during and after testing:

1. electrical safety in accordance with IEC or local regulations;
2. direction of rotation of the motor;
3. valves (operation, opening, sealing);
4. switching and setting of the control levels in the collection tank, where not present by the manufacturer;
5. watertightness of pump, valves and pipes;
6. rated voltage and frequency;
7. functional test of the non-return valve;
8. warning device; in combination with a second switching circuit where applicable;
9. discharge pipework support;
10. motor protection switch (by removing individual fuses (two-phase running));
11. oil level (if oil chamber fitted);
12. control lights, gauges and meters;
13. operation of hand pump; where fitted.

Commissioning shall be recording in writing, including important data such as the setting of the motor overload switch and the reading from hours-run meters.

3.6.5 Testing

The pump sets shall be tested at the manufacturer's premises to BS 5316: Part1: Class C Annex B (ISO 2548) to demonstrate that they are capable of achieving the specified design duty. Type-test curves are acceptable for verification of performance.

Characteristic curves of pump generated head, efficiency, and pump and pump sets absorbed power versus flow rate shall be provided before the pump sets are delivered to site.

Hydraulic drop test shall be carried out by the Developer on site in the presence of the Undertaker to verify the theoretical performance of each pump set.

Hydrobrake manhole

3.6.6 Operation and maintenance requirements

Chamber to be regularly inspected once a year and any debris, silt to be removed from the sump.

4.0 OWNER'S MANUAL

4.1 This document should be provided to the Client as an owner's manual on completion of the scheme. The manual should include all relevant construction drawings and aims to provide the following:

- Locations of all drainage elements on the site.
- A summary of how each element is designed to operate, their purpose, and the do's and don'ts of everyday use.
- Advice on maintaining the drainage elements to ensure efficiency is retained for the designed lifetime of each element.
- An action plan for dealing with accidental pollution events

APPENDIX A

Drainage Layout

Linetype Legend:

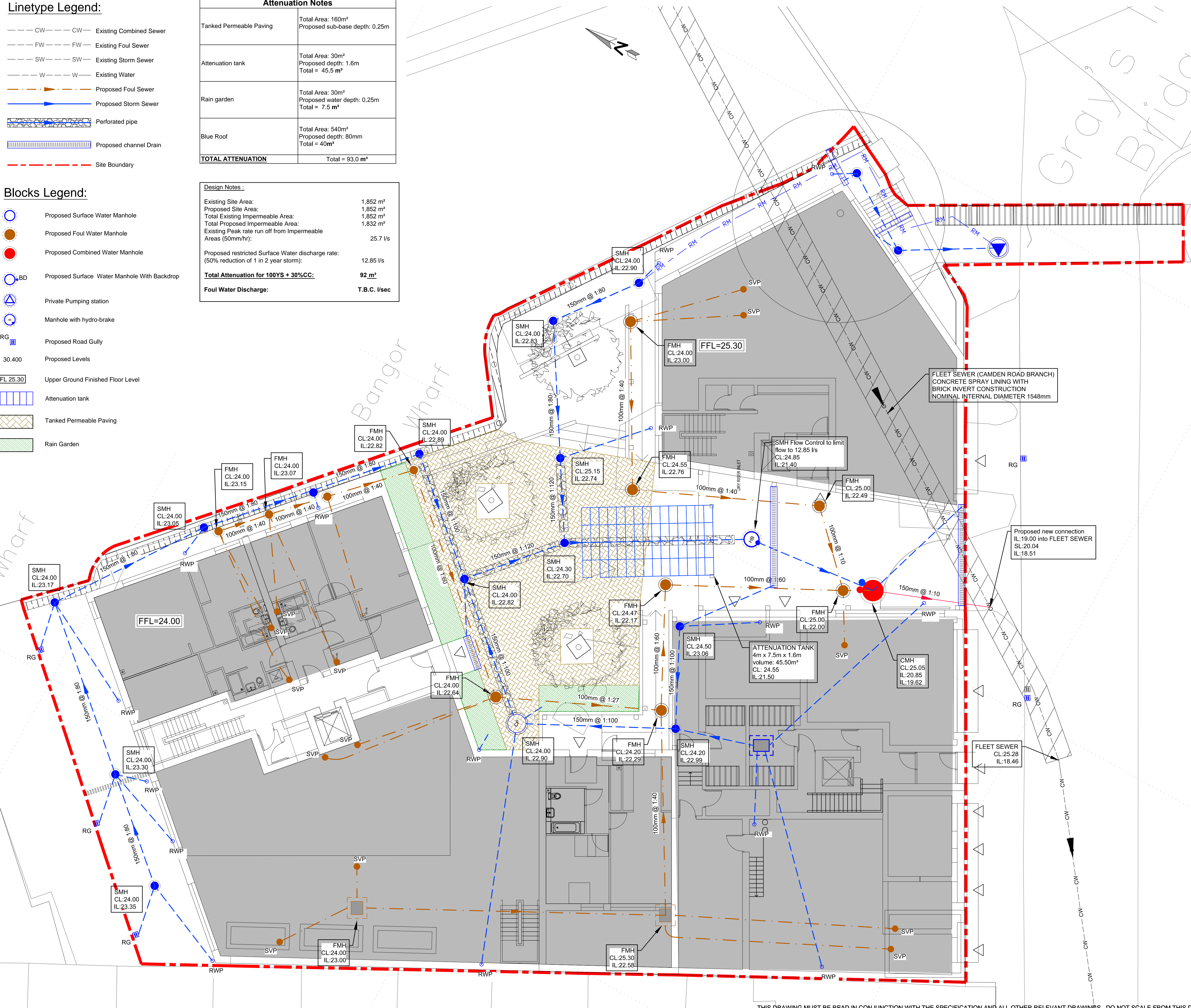
- CW --- CW --- Existing Combined Sewer
- FW --- FW --- Existing Foul Sewer
- SW --- SW --- Existing Storm Sewer
- W --- W --- Existing Water
- - - - - Proposed Foul Sewer
- - - - - Proposed Storm Sewer
- ▬▬▬▬▬▬▬ Perforated pipe
- ▬▬▬▬▬▬▬ Proposed channel Drain
- - - - - Site Boundary

Attenuation Notes	
Tanked Permeable Paving	Total Area: 160m ² Proposed sub-base depth: 0.25m
Attenuation tank	Total Area: 30m ² Proposed depth: 1.6m Total = 45.5 m ³
Rain garden	Total Area: 30m ² Proposed water depth: 0.25m Total = 7.5 m ³
Blue Roof	Total Area: 540m ² Proposed depth: 80mm Total = 40m ³
TOTAL ATTENUATION	Total = 93.0 m³

Blocks Legend:

- Proposed Surface Water Manhole
- Proposed Foul Water Manhole
- Proposed Combined Water Manhole
- BD Proposed Surface Water Manhole With Backdrop
- △ Private Pumping station
- ⊖ Manhole with hydro-brake
- RG Proposed Road Gully
- + 30.400 Proposed Levels
- FFL 25.30 Upper Ground Finished Floor Level
- ▬▬▬▬▬▬▬ Attenuation tank
- ▬▬▬▬▬▬▬ Tanked Permeable Paving
- ▬▬▬▬▬▬▬ Rain Garden

Design Notes:	
Existing Site Area:	1,852 m ²
Proposed Site Area:	1,852 m ²
Total Existing Impermeable Area:	1,852 m ²
Total Proposed Impermeable Area:	1,832 m ²
Existing Peak rate run off from Impermeable Areas (50mm/hr):	25.7 l/s
Proposed restricted Surface Water discharge rate: (50% reduction of 1 in 2 year storm):	12.85 l/s
Total Attenuation for 100YS + 30%CC:	92 m³
Foul Water Discharge:	T.B.C. l/sec



NOTES

1. Invert levels and positions of existing drains / chambers / sewers where new connections are to be made must be checked and confirmed to the engineer prior to the commencement of any works.
2. All drainage works shall be carried out in accordance with the requirements of the Local Authority, the Environment Agency and in conjunction with all relevant British Standards, Codes of Practice and 'Sewers for Adoption' 7th Edition and any addendums as appropriate.
3. All drainage shall comply with the typical details and the requirements of BS EN 752 and Part H of the Building Regulations.
4. Any part of the existing drainage system to be retained as part of the new scheme shall be cleaned and inspected. Any structural defects shall be repaired using appropriate and approved means.
5. For setting-out dimensions of SVP's, RWP's etc, refer to Architect's or Mechanical Engineer's drawings. Positions shown are indicative and subject to final design.
6. All foul and RWP connections shall be 100mm diameter unless otherwise specified.
7. All precast concrete units used in the drainage works shall be manufactured using sulphate resisting cement.
8. Manhole covers and frames shall be to BS EN 124 and shall be Kitemarked. Covers and frames shall be heavy duty D400 in carriageways and vehicular areas and medium duty B125 in footways and soft landscaping. In blocked/concrete paved areas covers shall be recessed fabricated steel. All recessed covers shall in accordance with the FACTA association gradings.
9. All internal inspection chambers to be recessed, double sealed with screw down covers.
10. Cover levels are to be adjusted locally to suit finished ground levels.
11. At least one soil pipe at the head of each foul run shall vent to the atmosphere.
12. Existing drainage to be removed is to be broken out to bed level and void backfilled with granular material, compacted in layers not exceeding 250mm.
13. All drain runs from SVP's, stub stacks or FW gullies to be laid at 1:40 gradient unless otherwise stated. All RWP's to be laid 1:80 min unless otherwise stated.
14. All manholes / inspection chambers in block paved areas, to have recessed covers. MH covers in paved areas to have cover & frame orientated 'square' with paving to minimise cut slabs or blocks.
15. All private drainage to be laid to levels shown using flexibly jointed pipes, either uPVC to BS 4660 and BS 5481 or vitrified clayware to BS EN 295. Pipes below structural building slabs or basements shall be Cast Iron to BS 437.
16. Rodding eyes, etc are to be laid to manufacturers minimum cover and depth to allow adequate fall from adjoining unit.
17. All proposed trees to have appropriate tree barrier details linking pits to ensure roots are directed away from drainage.
18. Where new sewers are constructed within 5m of a new or existing tree the sewer shall be concrete encased against root intrusion. Refer to drainage details.
19. All new drainage to be jetted and CCTV surveyed on completion. Contractor to make sure that the drainage is fully operational. Refer to Drainage maintenance manual for maintenance details.
20. All runs connecting into the public drainage network to be vitrified clay, extra length to BS EN 295 or BS65 with plain sleeved or socketed flexible joints.
21. CDM note: All pipework, silt traps, catchpits, trapped gullies and attenuation tanks to be regularly inspected every three months and cleared out on a regular frequency for the first nine months. After this period the frequency can be reduced to every six months. Porous surface to be regularly swept three times a year to remove the silt.
22. This drawing is to be read in conjunction with all relevant Conisbee drawings.
23. HEALTH AND SAFETY: The works shall be carried out by specialist competent and experienced contractors who are members of a recognised national organisation. Operatives shall have received full and appropriate training for the operations they are to undertake. All work shall be carried out in accordance with all pertinent Health and Safety Regulations.

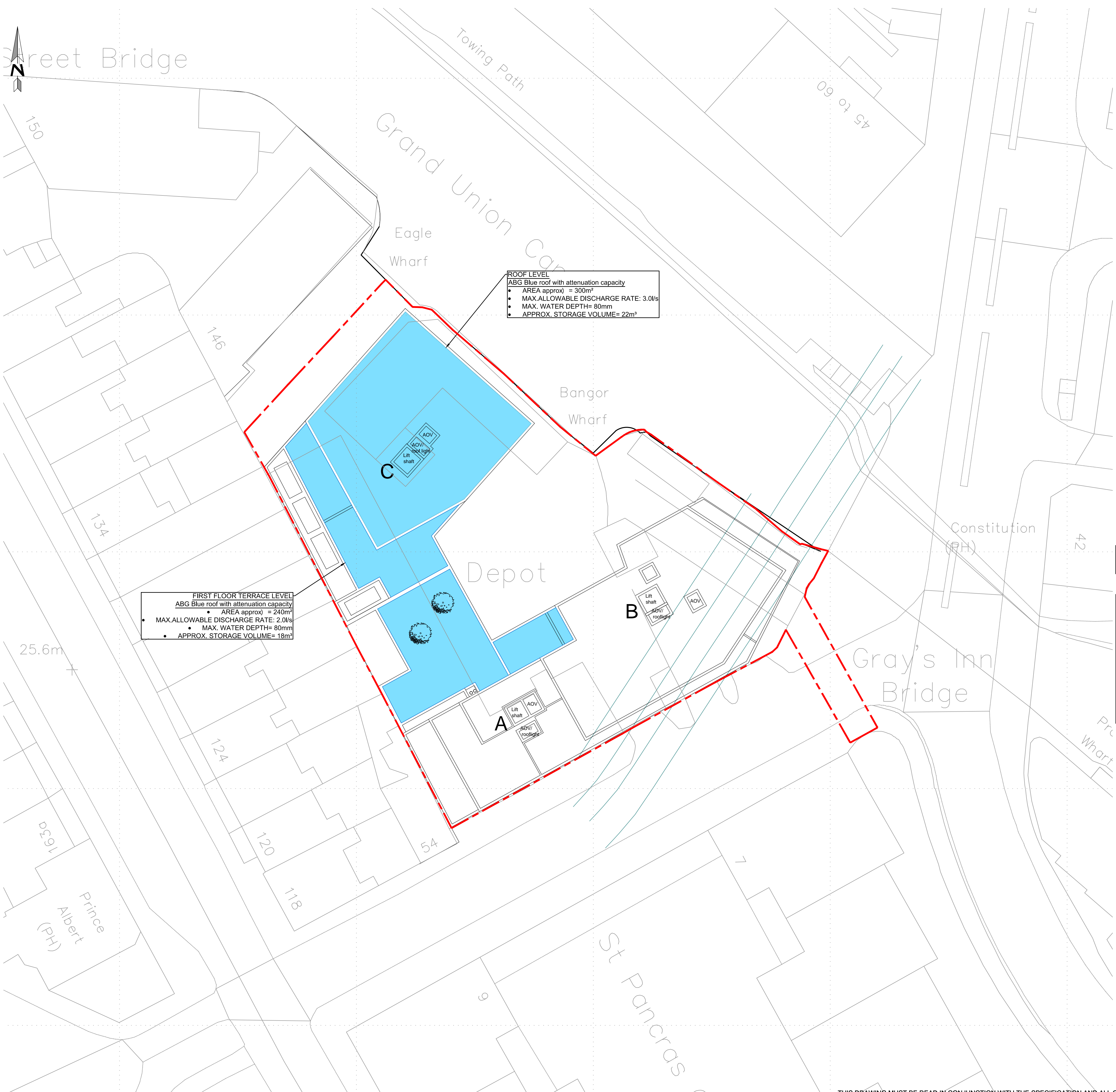
NOT FOR CONSTRUCTION

P3	19.02.16	RWP position changed	AW	TG
P2	15.02.16	New landscape layout	AW	TG
P1	13.10.14	Issued for Comments	AW	TG
Rev	Date	Description	Drawn	Check

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Drawing Status	Date	SEPT 2015
PRELIMINARY	Scale	1:200 @A1
Project	Drawn	MP
BANGOR WHARF GEORGIANA STREET London, NW1 0QS	Engineer	TG
Title	Project No	150032
PROPOSED DRAINAGE LAYOUT GROUND FLOOR LEVEL	Drawing No	C100
	Revision	P3



ROOF LEVEL
 ABG Blue roof with attenuation capacity
 • AREA (approx) = 300m²
 • MAX.ALLOWABLE DISCHARGE RATE: 3.0l/s
 • MAX. WATER DEPTH= 80mm
 • APPROX. STORAGE VOLUME= 22m³

FIRST FLOOR TERRACE LEVEL
 ABG Blue roof with attenuation capacity
 • AREA (approx) = 240m²
 • MAX.ALLOWABLE DISCHARGE RATE: 2.0l/s
 • MAX. WATER DEPTH= 80mm
 • APPROX. STORAGE VOLUME= 18m³

Linetype Legend:

- CW --- CW --- Existing Combined Sewer
- FW --- FW --- Existing Foul Sewer
- SW --- SW --- Existing Storm Sewer
- W --- W --- Existing Water
- Proposed Foul Sewer
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- Proposed private foul water vent pipe.
- Site Boundary

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NOT FOR CONSTRUCTION

P2	15.02.16	Issued for Comments	AW	TG
P1	13.10.15	Issued for Comments	AW	TG
Rev	Date	Description	Drawn	Check

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Drawing Status	Date	SEPT 2015
PRELIMINARY	Scale	1:200 @A1
Project	Drawn	MP
BANGOR WHARF GEORGIANA STREET London, NW1 0QS	Engineer	TG
Title	Project No	150032
PROPOSED DRAINAGE LAYOUT ROOF LEVEL	Drawing No	C101
Revision		P2