Modular Geo-Void Systems

Total Water Management

Maintenance & Access



ENVIRONMENTAL SUSTAINABLE SOLUTIONS LTD

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Maintenance

Introduction

The purpose of maintenance regimes and preventative design measures is to ensure the sustainability of the hydraulic operation of the installation. The typical stated life of geocellular installations is 50 years.
Geocellular units invariably comprise plastic elements, sometimes referred to as 'crates' usually arranged in a stacking or interlocking configuration. The types of units available are diverse; however, many unit have a complex internal structure of columns, end plates, cover plates and bracing. The units typically have an initial void ratio of 95% and allow water to be stored and flow virtually unimpeded between adjacent units. However, this complex internal structure, which provides the strength, contributes to the low weight and the relatively low cost of the units, also makes them difficult to access internally for inspection and maintenance once constructed and backfilled.
The units in attenuation applications are generally enclosed in a water tight sealed membrane, protective fleece geotextile and buried to varying depths and so direct visual inspection of the units is not possible in nearly all cases.
Therefore maintenance strategies are required that protect the geocellular units and reduce the rate of performance loss over the life of the installation, along with an allowance that some storage volume loss will inevitably occur. This is the approach adopted by most suppliers.

Damage to geocellular units

The performance of the geocellular units and therefore the installation could be severely affected by damage to the units. Care will be required in the storage, installation, back-filling and protection pre commissioning of the geocellular units. Damaged units should be discarded and replaced before installation.

Unit handling

The units must be stored appropriately and undamaged prior to use as sharp edges for instance could pierce the membrane from within once backfilled. In addition damaged units are likely to affect the structural performance of the tank.

Root damage and vegetation

Many units are placed within landscaping areas. In these cases care will have to be taken to ensure large trees do not exist nearby and large specimen trees are not planted as part of a vegetation scheme within a defined exclusion zone created around the installation. This distance could vary depending on the species and size of the vegetation being considered. However, a reasonable guide is that tree roots will extend as far as the mature height of the tree and therefore for a small/medium tree, such as Hawthorn, Rowan (Mountain Ash) or Ornamental Cherry a distance of 6 to 7 metres would be appropriate. For larger trees such as Oak over 20 m distance would be recommended. Specific guidance can be found in the NHBC standards Chapter 4 Foundations section 4.2 'Building Near Tees' concerning trees in proximity of building works. It should also be borne in mind that trees and their root systems will actively seek out water sources, typically leaking drains, and therefore infiltration systems or poorly sealed attenuation tanks could see root penetration over time if large trees are situated nearby. Positioning of installations should not be under the canopy of mature trees as there is a risk of damage to both the units via the roots and by destabilising or affecting the health of the tree.



Membrane damage

The geocellular units are wrapped in a relatively vulnerable membrane and the effective operation of the installation depends on this being watertight. For attenuation and storage installations, damage to the membrane will compromise the effectiveness of the whole installation. A leaking membrane will overtime likely lead to wash out of the surrounding backfill, which could further damage the units by concentrating load, allowing external wash through of materials into the tank and lead to subsidence due to loss of material at the surface, damaging pavements above.

The installation of the membrane is a specialist operation with the seams welded and tested during construction. Once covered and buried to varying depths repairs are difficult to detect, locate and access for repair.

Installation precautions often call for the first 150 to 400mm of backfill to be either non-compacted or with hand driven 'light' equipment only. A protective geotechnical 'fleece' layer is also provided around the membrane and a sand blinding layer beneath the installation to distribute loadings and ensure that there is no large or sharp debris present which could perforate the membrane.

There is no practical remedial maintenance that can be undertaken for the membrane and once installed; it is designed to last the life of the installation.

Damage in construction or operation

Due to the modular nature of the units and the way installations are formed, there is generally little that can be done in the form of straightforward repairs. If there is a structural local failure then this is likely to propagate through the installation and if flotation occurs during construction the units are likely to become distorted resulting in the removal and reassembly of the whole installation. The units are also vulnerable to damage post commission from installation of new unrelated services above or future construction activities. Warning tape / mesh a minimum 300mm above the units shall be provided below the covering pavement / surface material to prevent excavation on top of the units and above ground clear permanent signs should be placed to warn of the location and depth to the units.

Construction records and the recommended maintenance regime should be passed on to the client, usually contained within the CDM Health and Safety Manual.

Siltation

To enable the units to perform well during their operation and design life, siltation has to be considered as the primary maintenance issue. The hydraulic performance of the units will be affected and the capacity will gradually be reduced when materials are washed into or settle out of the water being stored and discharged through the unit. Once material has collected in the geocellular units it is usually difficult to remove due to the internal structure of the units.

In operation the volume of silt or suspended solids carried within the runoff or water carried into the units is dependent on the type and area being drained. However, a key consideration and time period of high risk is during the construction period. During this phase of works, either from the installation directly or from general construction activities within the development, surface water will be highly loaded with silt and other debris. Precautions and measures will have to be undertaken to prevent surface water entering the installation during the construction period. This can be done by sealing the pipework to isolate the geocellular units until they are ready to commission.

Guidance exists; see Table 6.1 below and from manufactures for the percentage loss of capacity for an installation due to siltation that can be allowed for in design. The guidance indicates a percentage loss of capacity during a 50 year design life period of between 2 to 8.5%. However, it is understood that manufacturers and designers conservatively allow up to 10% loss for siltation due to material that cannot be removed in the hydraulic design considerations. Table 6.1 displays the silt loading levels for various categories of runoff surfaces.

Silt loading levels and potential loss of storage

Location:	Worse case silt load (TSS):* (kg/ha/yr)	Max. potential loss of storage after 50 years:
Highways	723	7%
Commercial	840	8.5%
Low Density Residential	340	3%
High Density Residential	755	8%
Car Parks	762	8%
Roofs	216	2%

*CIWEM give typical silt loadings (in terms of Total Suspended Solids). The information is included in the following reference - D'Arcy B J, Ellis J B, Ferrier R C, Jenkins A and Dils R (2000). Diffuse pollution impacts, the environmental and economic impacts of diffuse pollution in the UK. CIWEM.

The general approach for siltation control is in the provision of external maintainable elements that prevent some materials entering the installation. An alternative approach is for low flow channels or sediment forebays to be provided. These can be regularly cleaned and maintained, thereby affording some protection to the main geocellular units/installation and slowing the rate, but not preventing, siltation. While these devices are generally effective they are subject to washout during storm events and very fine suspended solids will pass through. The sediment forebay is used in infiltration systems and allows an easily accessible section of the installation to be provided near to the inlet. Regular inspections of the forebay should be made and it should be cleaned as necessary.

In attenuation or storage installations a sediment tunnel is often specified and provided. This will allow the water to fill the tank efficiently and perform during use but also act as both the 'low flow' path and sediment trap where sediments are likely to build up. The tunnels are designed to be easily accessible and can be flushed through to clean.



Plan of geocellular installations showing a sediment tunnel and sediment forebay.

For both types of system, inspections are likely to be once a month initially after commissioning reducing to every three months and also after the first 'flood' event to assess the rate of siltation. Figure 6.1 above shows a plan view of the layout for both types of system.



Plan of geocellular installations showing an offline solution.

Installations should be provided with means of isolation via valves and it is recommended that offline bypass pipes are provided to allow low flows to avoid the tank altogether, see Figure 6.2 above. Typically inspection chambers are provided at the inlet and outlet of the tank system. These will be easily accessible and may provide the means of undertaking survey work (CCTV) and also as the primary means of regular maintenance silt removal etc. Figure 6.3 below gives a diagrammatic view of a typical tank layout with fore and aft inspection chambers. The design of the catchpits can often include separators and silt traps to retain as much of the suspended materials as possible and assist in the maintenance.



Typical geocellular tank layout with inspection chambers/sediment catch pits details.

Inspection

The inspection of the units once installed and back filled is difficult to achieve for the entirety of the geocellular structure. In practice the internal structure can make it very difficult to undertake a CCTV survey, as the camera will snag and likely be lost. It is possible to undertake survey of the central pipework or manifold but this will leave the majority of the installation un-inspected. Nevertheless, these inspections can indicate the level of siltation, water levels and possibly unit damage present. To reach the geocellular units proprietary product specific units are often provided by the manufactures for inspection chambers etc. Should standard inspection chambers be used above units then consideration of the detailing will have to be made so that when loaded from above by vehicular movements etc. the load is not transmitted directly to the units resulting in damage. It should be noted that some geocellular units have an 'open' internal structure with little in the way of internal elements and these may be possible to CCTV survey and also jet out silt that may have built up. However, even if jetting is feasible large volumes of water will be required and the process can be expensive. The recommended frequency and type of inspection for geocellular tanks is given below in Table 6.2 below which is based on Table 13.2 from CIRIA C697 'The Suds Manual', but with the addition of the pre-commission survey.

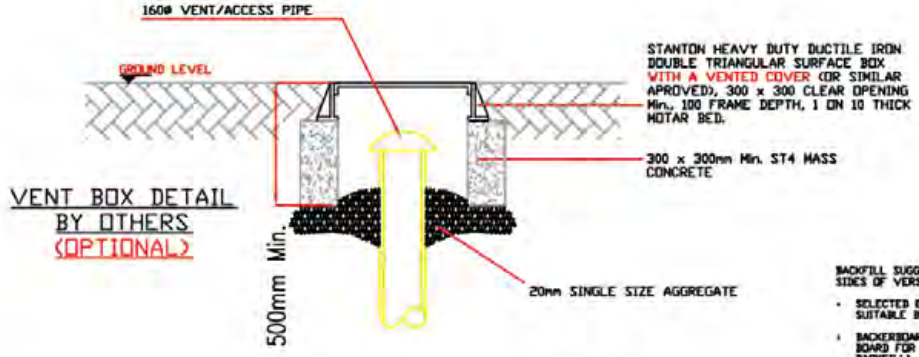
Recommended maintenance schedule

Maintenance schedule	Required Action	Recommended Frequency
At Commission	Inspect all areas to ensure free from construction debris and silt	Once at Commission
Regular maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial actions.	Monthly for 3 months then 6 monthly
	Debris removal from catchment surface (where may cause risk to performance)	Monthly
	Where rainfall infiltrates into blocks from above, check surface 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, outlet, overflows and vents to ensure in good condition and operating as required.	Annually and after large storms

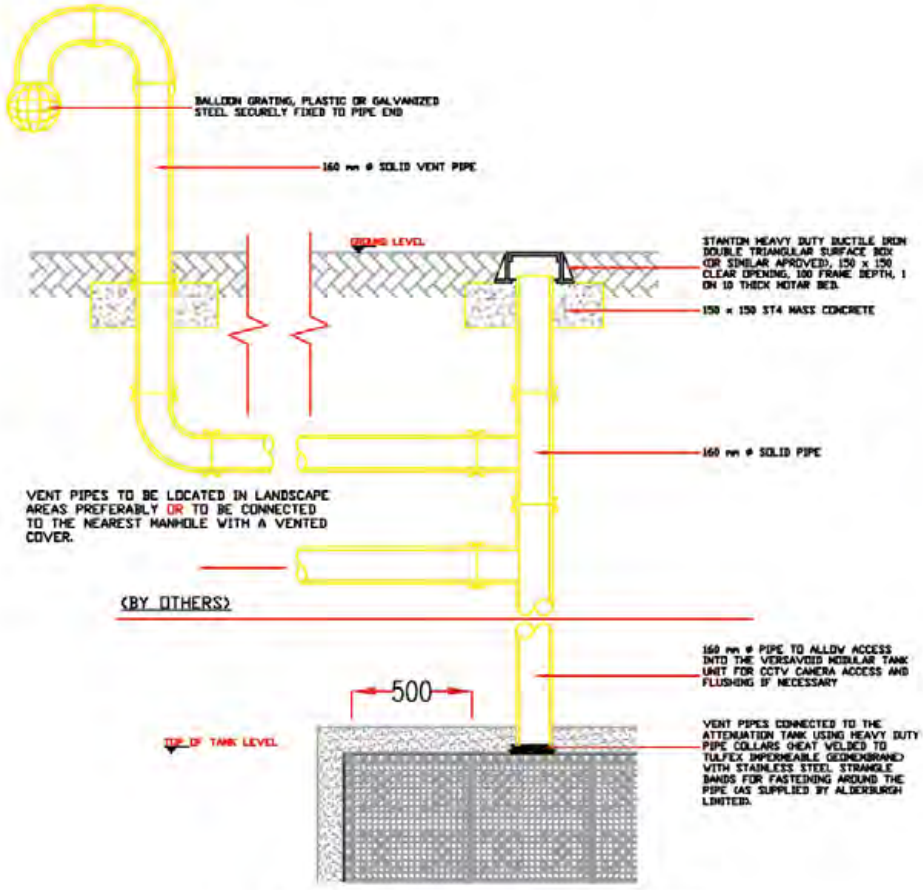
Maintenance strategies

In order to protect geocellular installations from damage, siltation and reduce onerous maintenance and inspection, systems are designed to protect the tanks from direct damage and intercept suspended solids. Recommended design measures and good practise to include in the specification for the installation are given below:

- Tanks are recommended to be designed to be "off-line" but "on-line" tanks incorporating a low flow bypass pipeline usually minimum 150mm in diameter is usually acceptable.
- Silt traps, hydrodynamic separators or similar should be installed "upstream" of the tank inlets.
- Allowance should be made for siltation and a percentage loss of capacity agreed over the design life of the installation.
- Where direct connections are to be made a temporary geotextile is recommended to be placed over/ around the units inlet pipes to prevent silt ingress during construction. This is removed prior to final commissioning.
- Isolation / Penstock control units should be provided to isolate the installation for maintenance and to prevent / control contaminated flows.
- Geocellular installation pipework / manifolds shall be CCTV accessible for inspection.
- No large shrubs to be planted over the geocellular installation plus or within 3m in all directions and 6m from small/medium specimen tree planting. Large trees such as Oaks should not be planted within 20m of the installation.
- Geocellular installation should not be constructed beneath the existing or the predicted full mature canopy of trees.
- A specialist contractor must be used for the sealing of the membrane which should be by automatic heat welding unit. Use of taped seams even on soakaway installations is not recommended.
- Warning tapes or a grid should be provided 300mm above the installation to visually indicate that there is a buried structure.
- Permanent above ground signage detailing location and depth should be provided.
- A pre agreed maintenance and inspection regime should be in place at handover to the client.

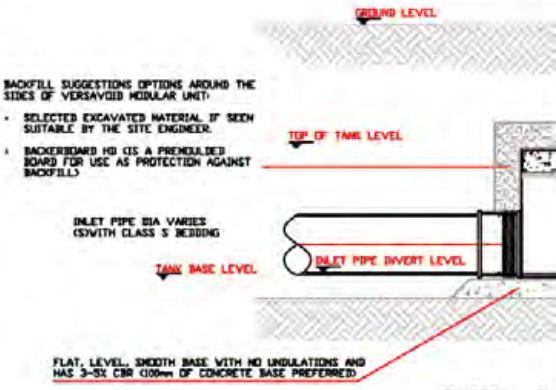


VENT BOX DETAIL
BY OTHERS
(OPTIONAL)



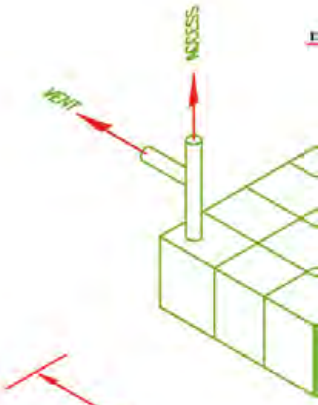
TYPICAL 160 mm ø VENT PIPE CONNECTION

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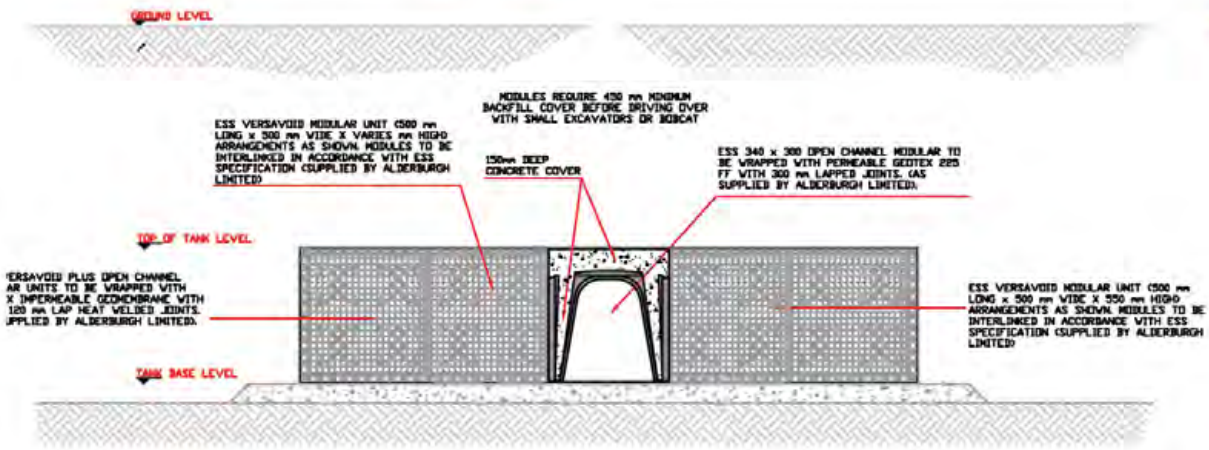


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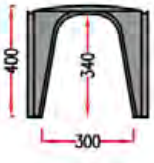
THE CONTRACTOR SHALL PROHIBIT THE MOVEMENT OF CONSTRUCTION PLANT ACROSS THE STORAGE TANK AND WHERE NECESSARY PROVIDE ADDITIONAL SUPPORT AND PROTECTION TO THE STRUCTURE. PARTICULARLY POST CONSTRUCTION. TEMPORARY FENCING CAN BE USED TO PROHIBIT TRADE STOCKS, PILLING MATERIALS, HEAVY PLANTS ETC.,



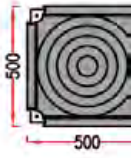
DIAGRAMATIC TANK LAYOU



TYPICAL DETAILS OF ATTENUATION TANK USING VERSAVOID WITH 340x300 OPEN CHANNEL MODULAR UNITS

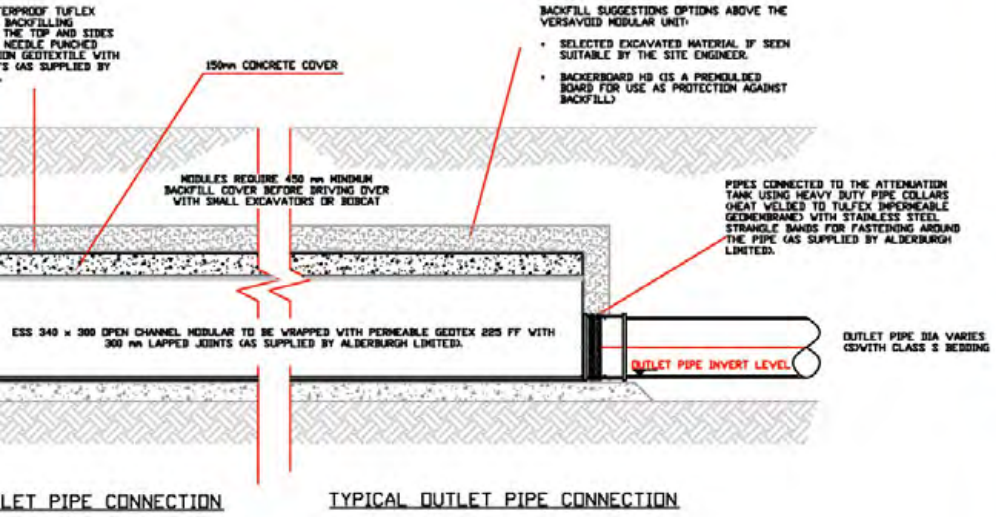


SIDE 2



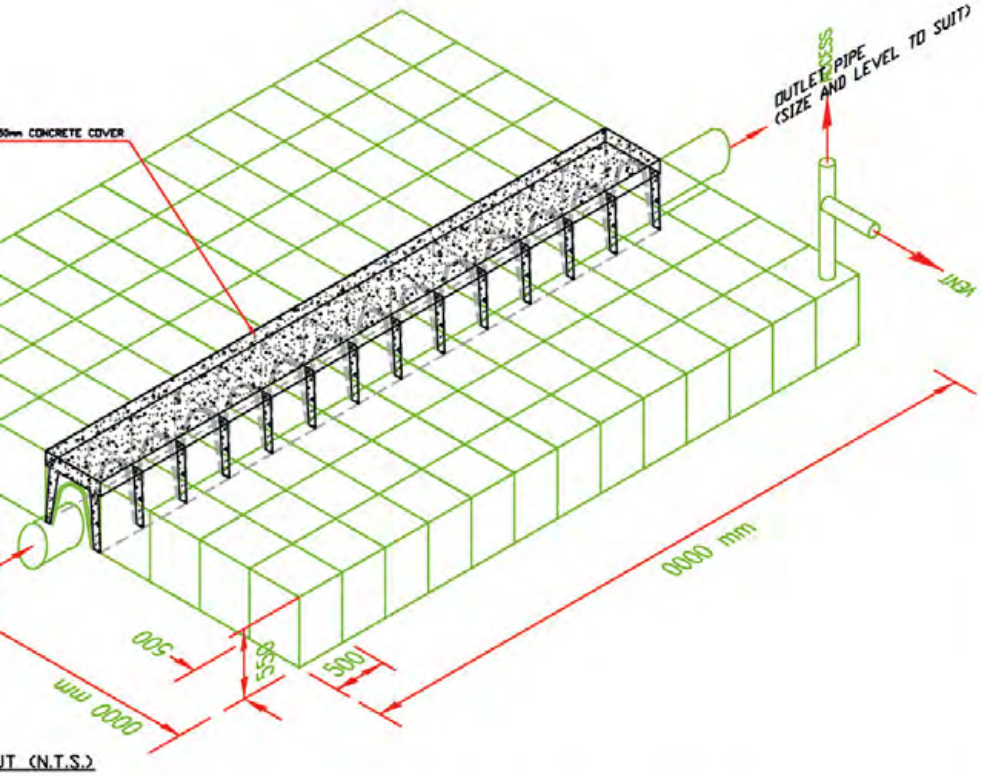
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Versa Void



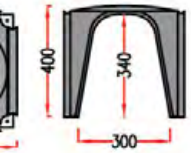
TYPICAL DETAILS OF ATTENUATION TANK USING VERSAVOID AND WITH 340x300 OPEN CHANNEL MODULAR UNITS

INLET/OUTLET PIPES MUST BE SUPPORTED WITH CONCRETE TO PROTECT IT DURING BACKFILLING

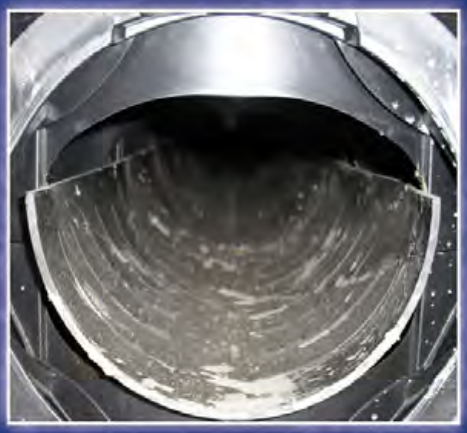


UT (N.T.S.)

A 3 - 5% CBR HAS BEEN ASSUMED AT SUB-BASE LEVEL. SHOULD THE CBR BE TESTED AND FOUND TO BE LESS THAN 3% THEN WE SUGGEST USING A LAYER OF COMBIGRID 40/40 AND 200mm WELL COMPACTED CLEAN, SINGLE SIZE ANGULAR GRANULAR MATERIAL FROM WITHIN THE RANGE 10 TO 20mm - TO BE VERIFIED BY GROUND ENGINEER

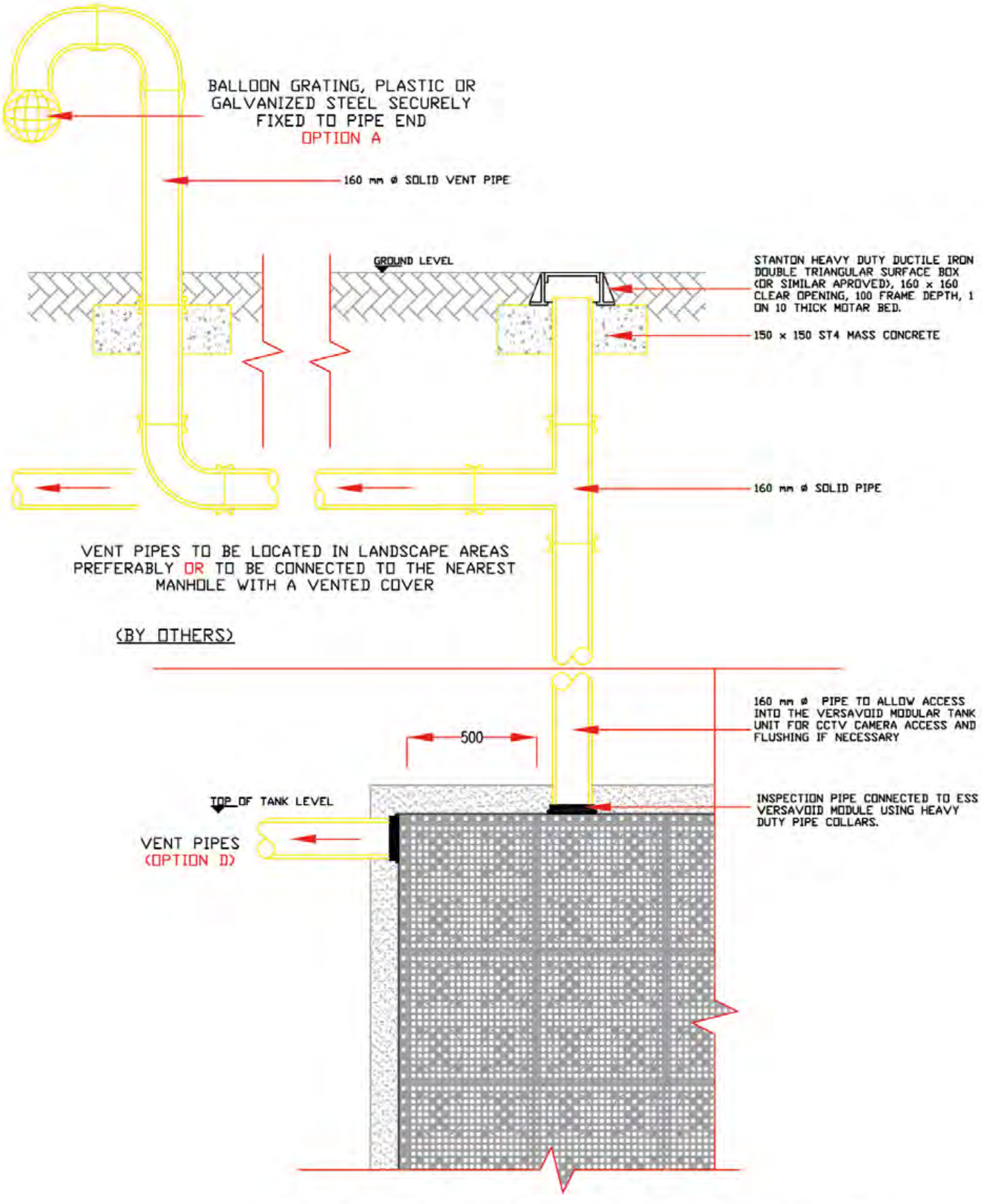


SIDE 1



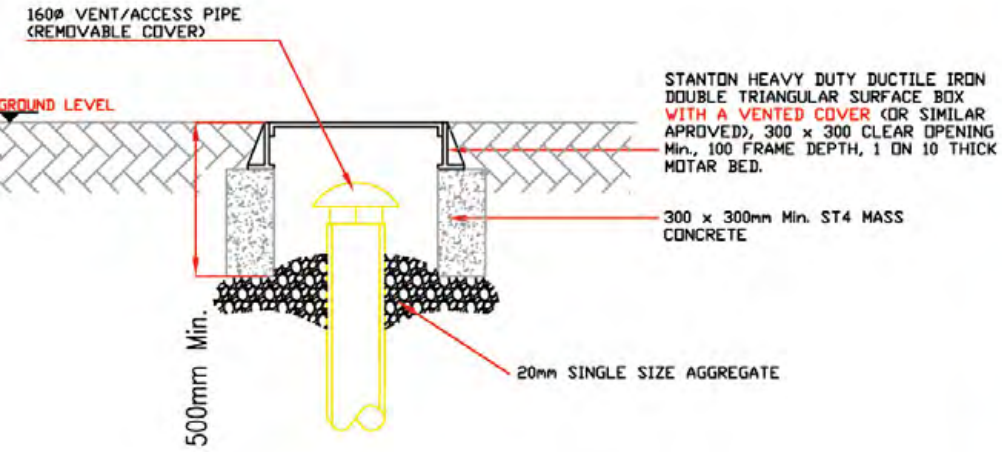






TYPICAL 160ø VENT/INSPECTION PIPE CONNECTION

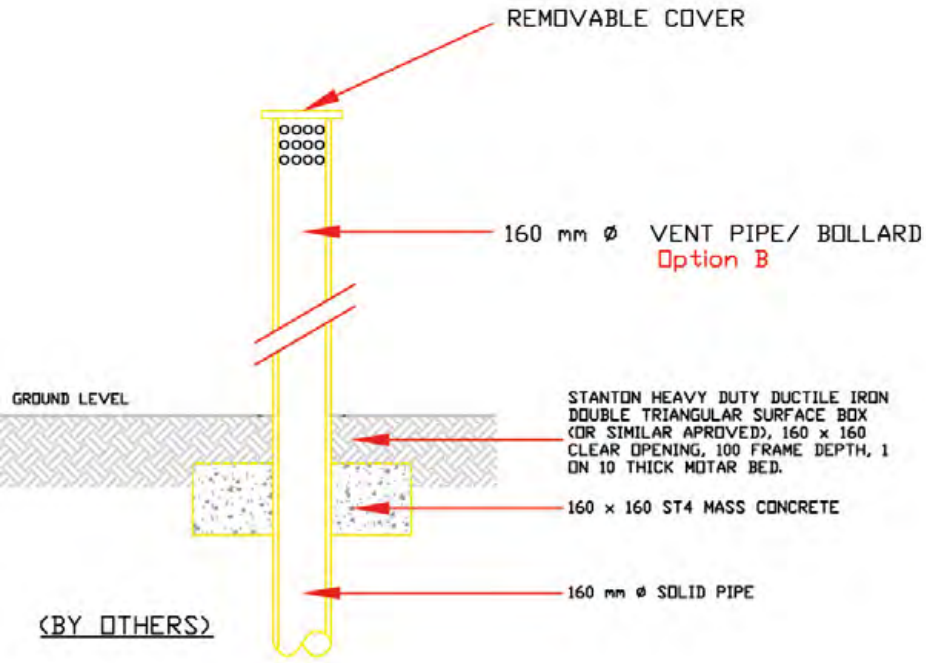
Versa Void



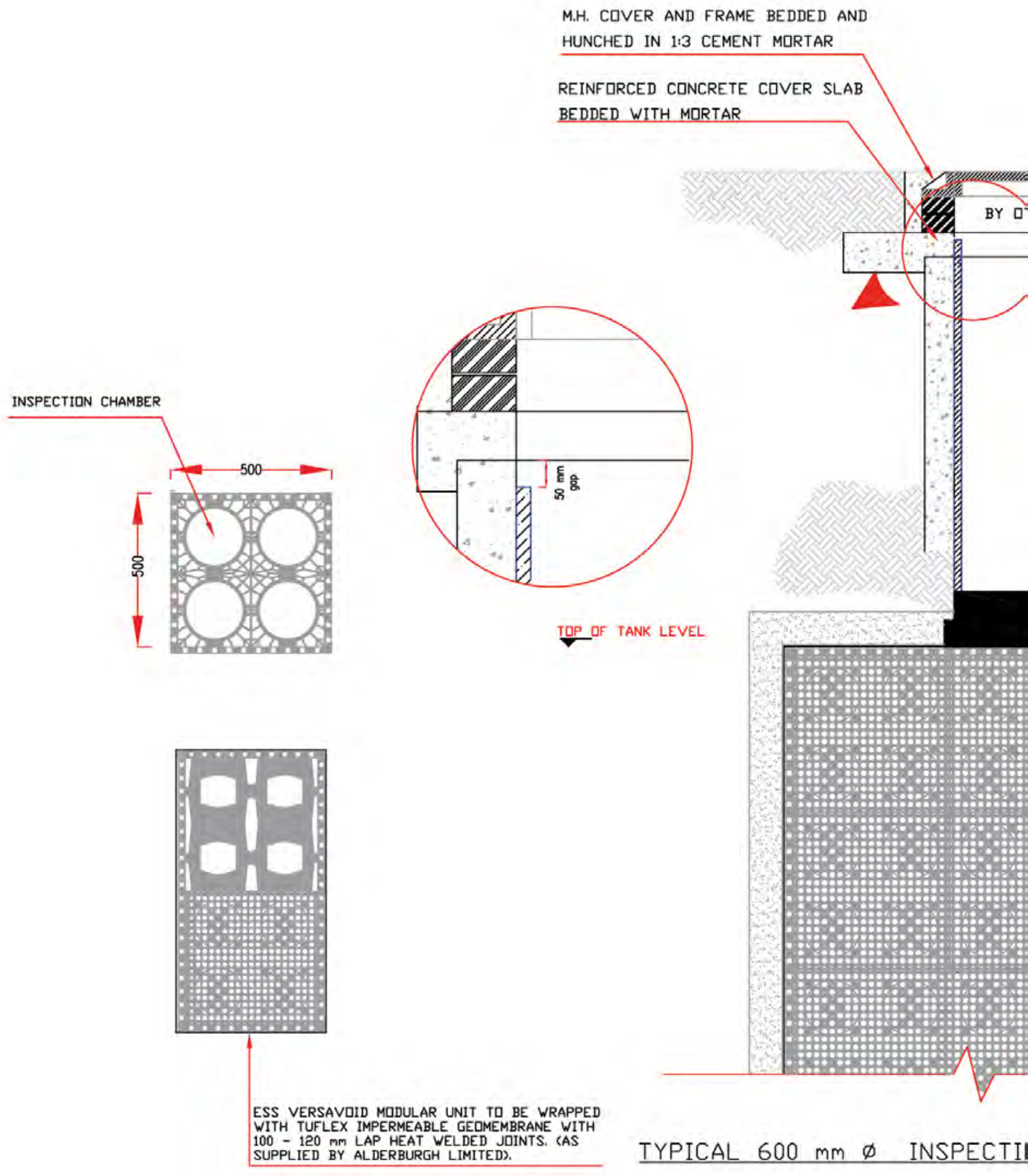
VENT BOX DETAIL
BY OTHERS
Option C









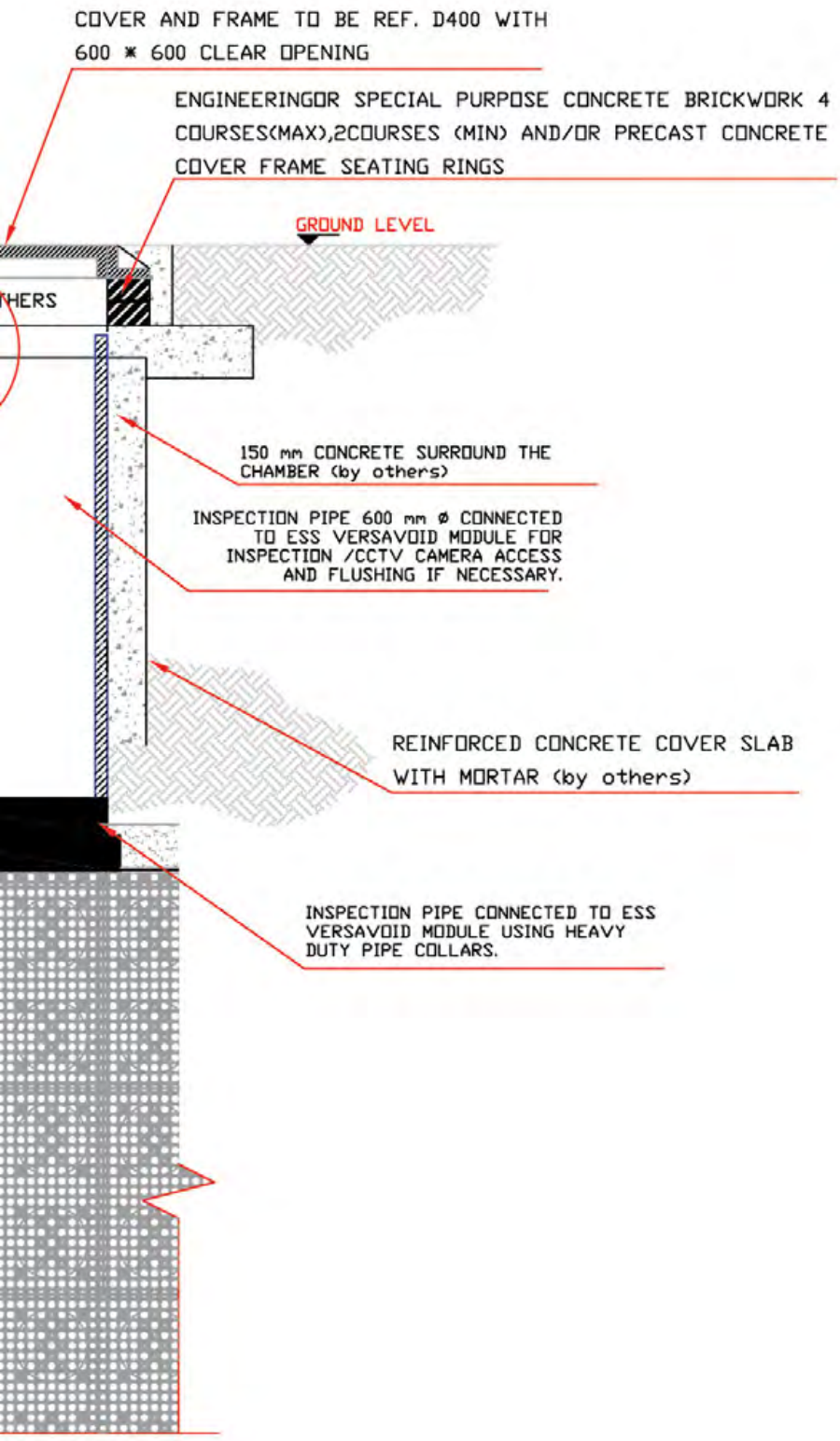


TYPICAL 600 mm ø INSPECTI

NOTE:

1-CONCRETE SLAB FOR THE OPINING SHOULD NOT BE IN TOUCH WITH PLASTIC CHAMBER.

2-MANHOLE COVER AND ALL THE CONCRETE WORKS BY OTHERS.



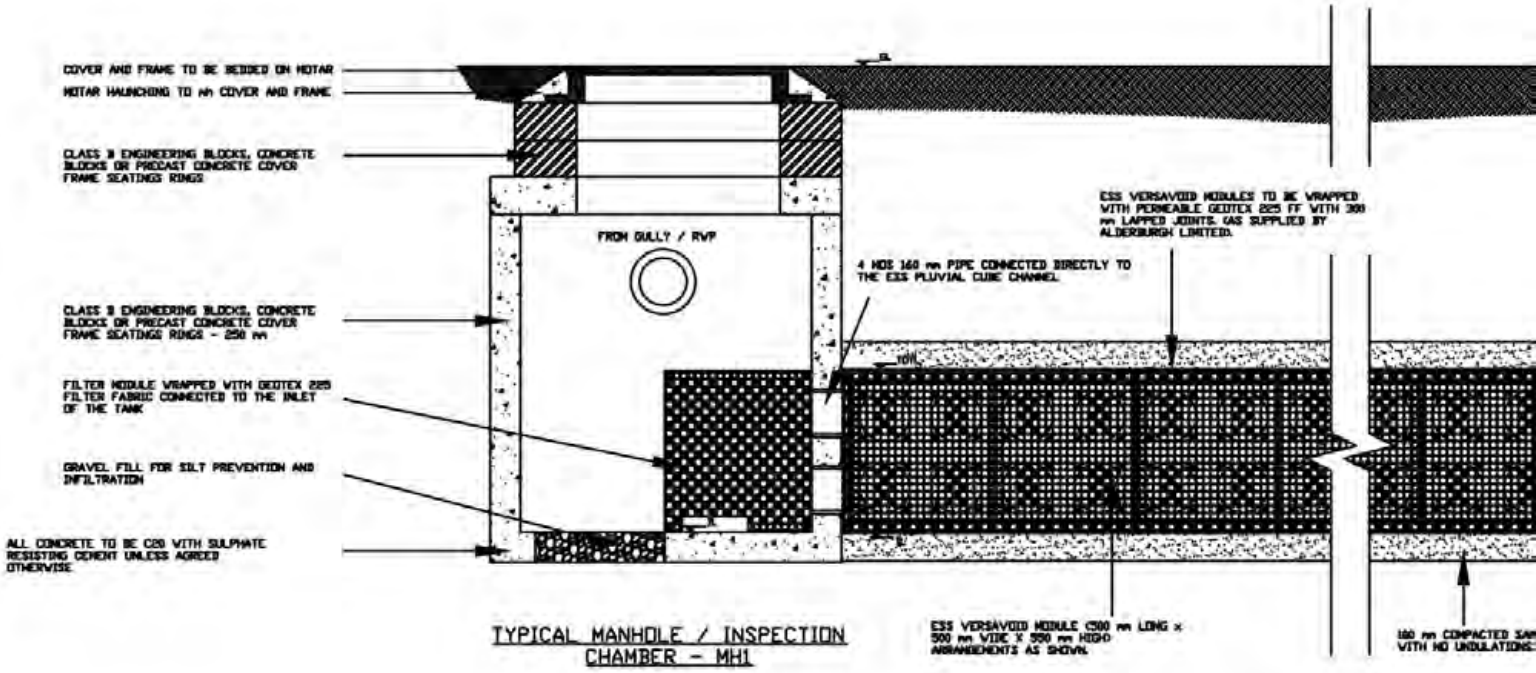
ON PIPE CONNECTION

Versa Void







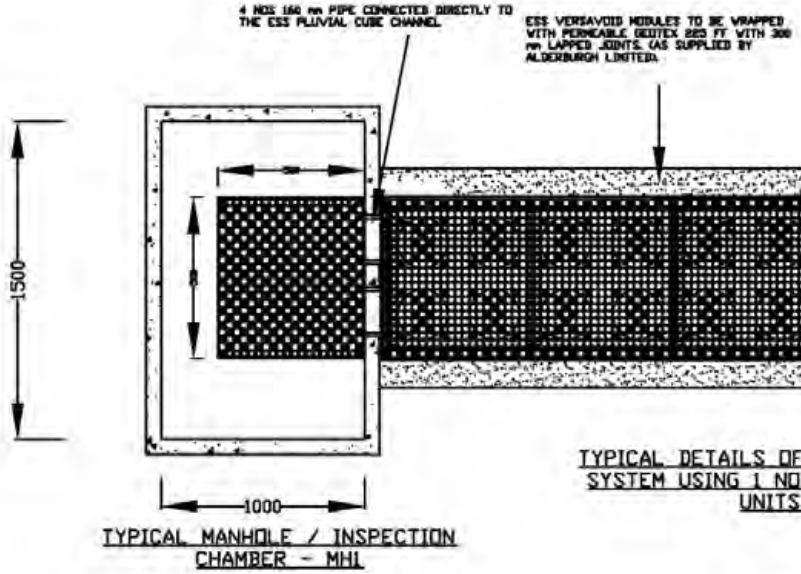


TYPICAL MANHOLE / INSPECTION CHAMBER - MH1

TYPICAL DETAILS OF LINEAR RUNOFF COLLEC
SYSTEM USING 1 NO SINGLE VERSAVOID MOD
UNITS - CROSS SECTION VIEW

CROSS SECTIONAL VIEW

A 3 - 5% CBR HAS BEEN ASSUMED AT SUB-BASE LEVEL SHOULD THE CBR BE TESTED AND FOUND TO BE LESS THAN 3% THEN THE ENGINEER SHALL BE NOTIFIED. ALSO, ANY SOFT SPOTS FOUND AT SUB-BASE LEVEL SHALL BE REPORTED TO THE ENGINEER

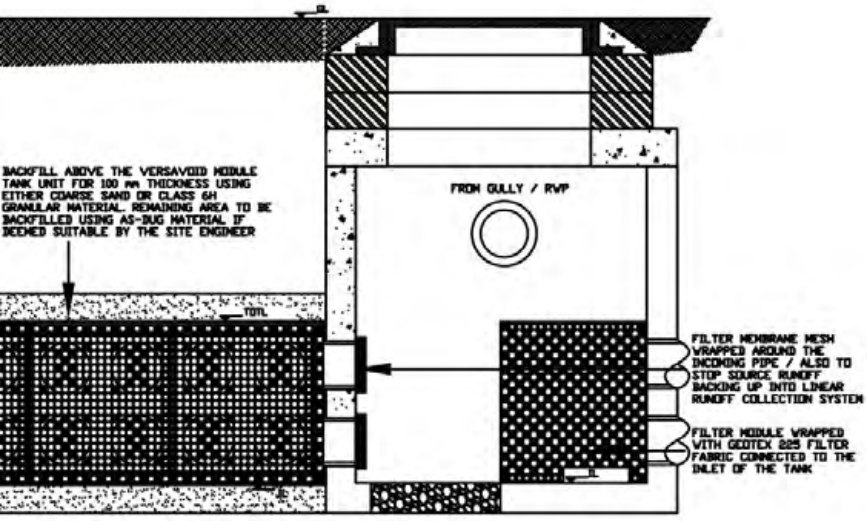


TYPICAL MANHOLE / INSPECTION CHAMBER - MH1

TYPICAL DETAILS OF LINEAR RUNOFF COLLEC
SYSTEM USING 1 NO SINGLE VERSAVOID MOD
UNITS - PLAN VIEW

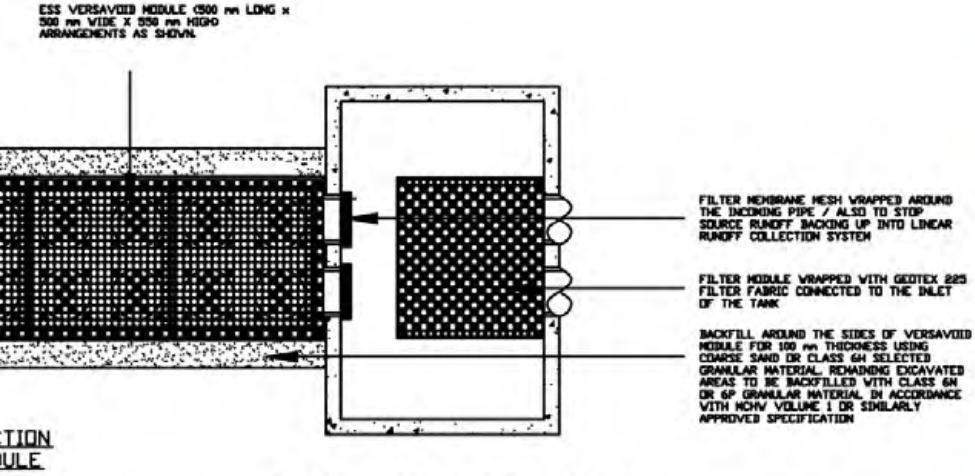
PLAN VIEW

Versa Void



TYPICAL MANHOLE / INSPECTION CHAMBER - MH2

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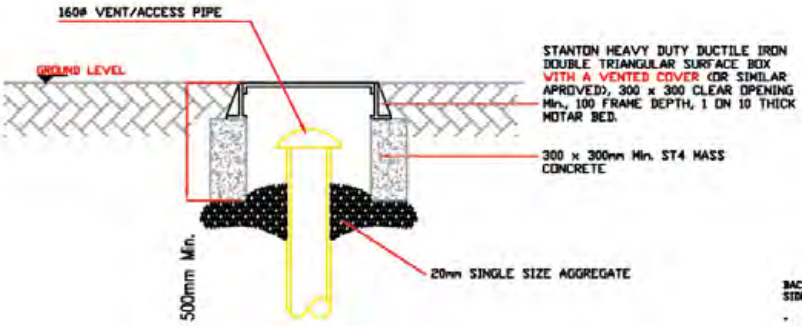


TYPICAL MANHOLE / INSPECTION CHMABER - MH2



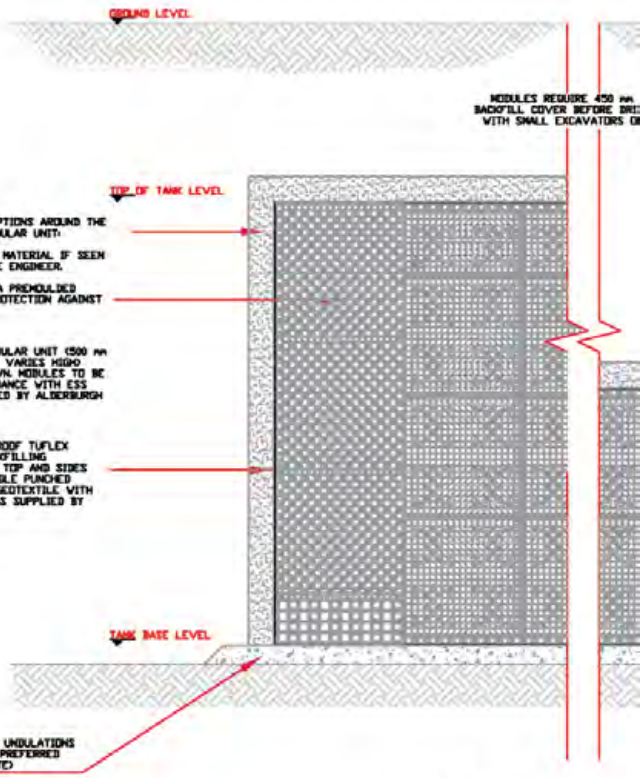




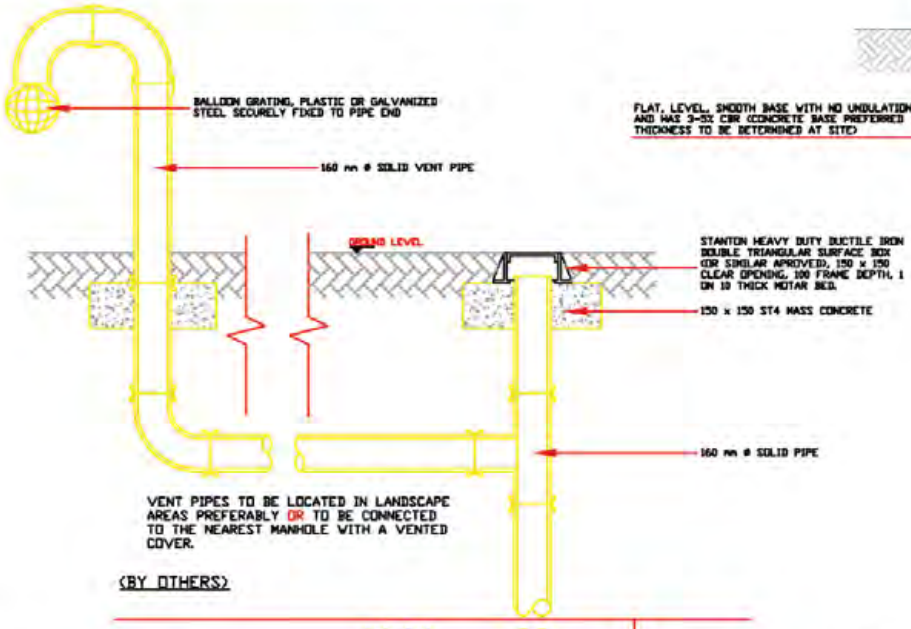


VENT BOX DETAIL
BY OTHERS
(OPTIONAL)

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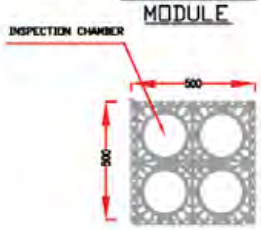
TYPICAL DETAILS OF ATTEN
VERSAVOID AND PLUVIAL C





AQUADRAIN
MODULE

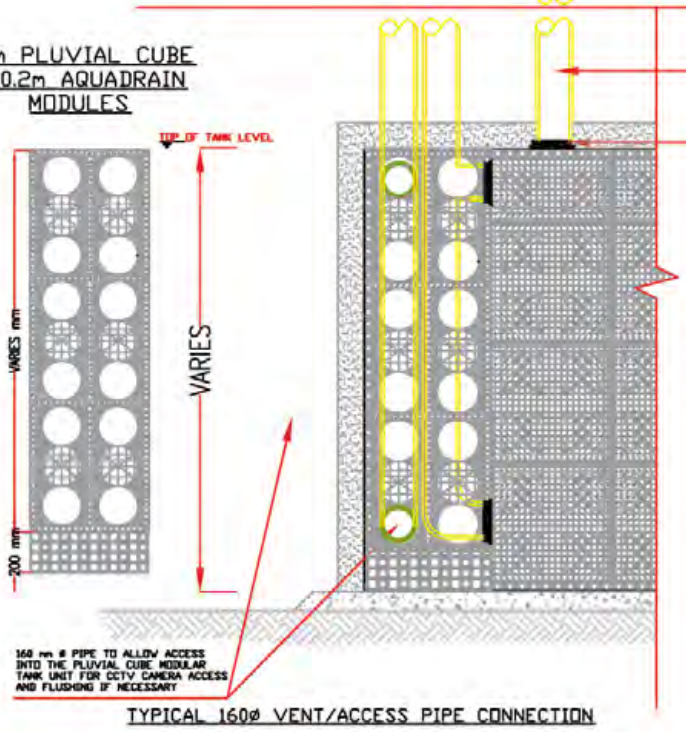
VERSAVOID
MODULE





ESS VERSAVOID MODULAR UN
WITH TUFLEX IMPERMEABLE
100 - 120 mm LAP HEAT WE
SUPPLIED BY ALDERBURGH L

1.6m PLUVIAL CUBE
+ 0.2m AQUADRAIN
MODULES



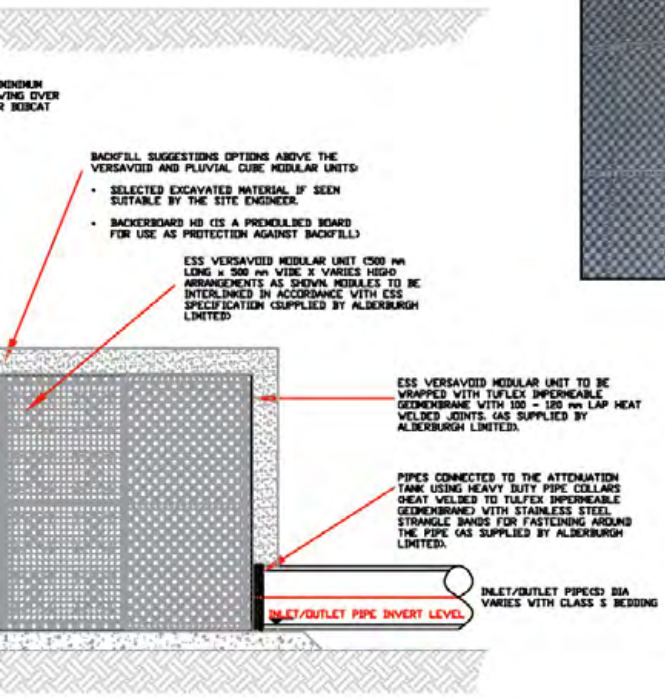
TYPICAL 160ø VENT/ACCESS PIPE CONNECTION

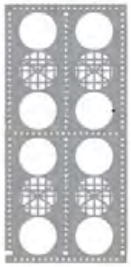
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Versa Void & Pluvial Cube





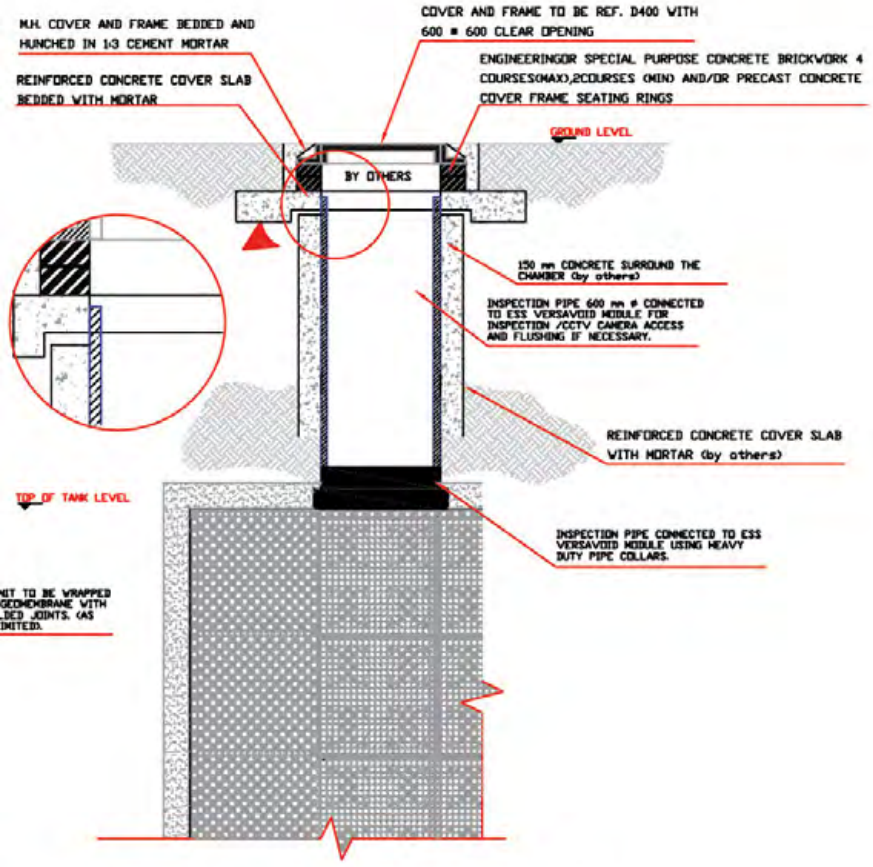


PLUVIAL CUBE MODULE

TYPICAL INLET/OUTLET PIPE CONNECTION

NUATION TANK USING
CUBE MODULAR UNITS

INLET/OUTLET PIPES MUST BE SUPPORTED WITH CONCRETE TO PROTECT IT DURING BACKFILLING



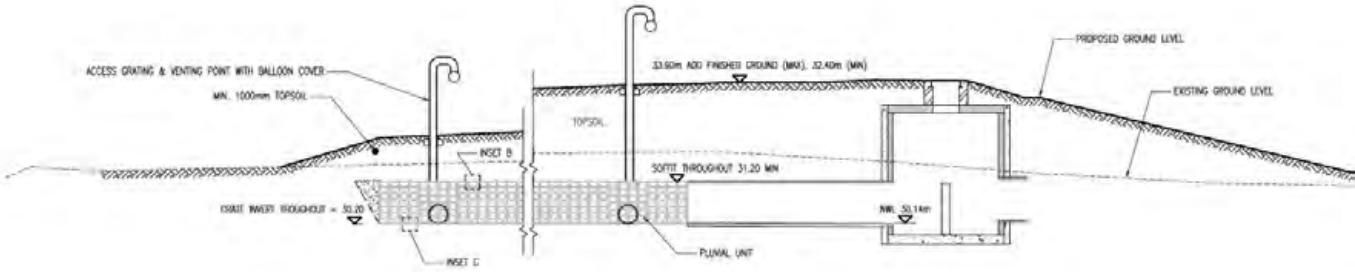
TYPICAL 600 mm ø INSPECTION PIPE CONNECTION



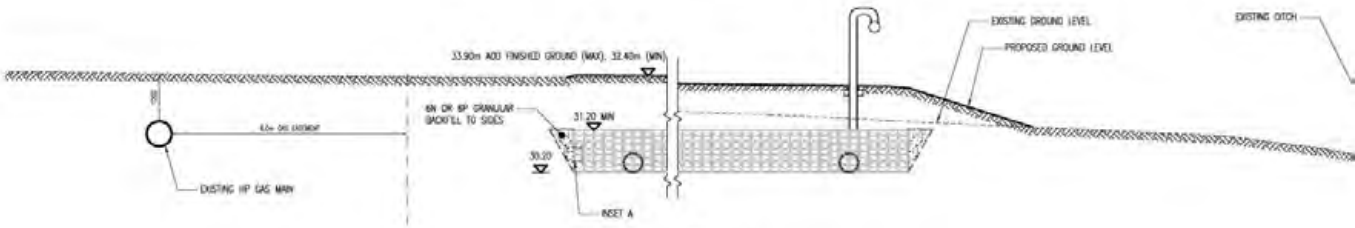




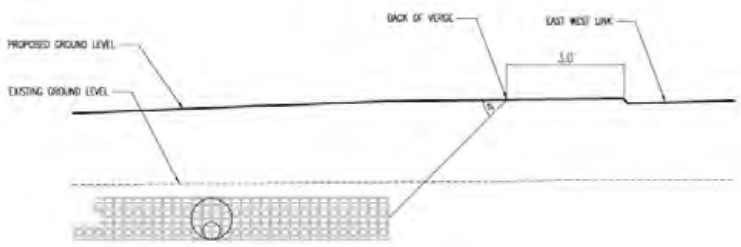




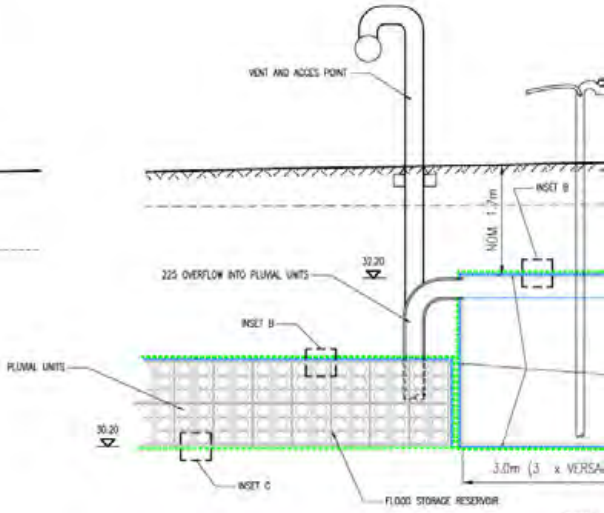
SECTION Y-Y
SCALE 1:100

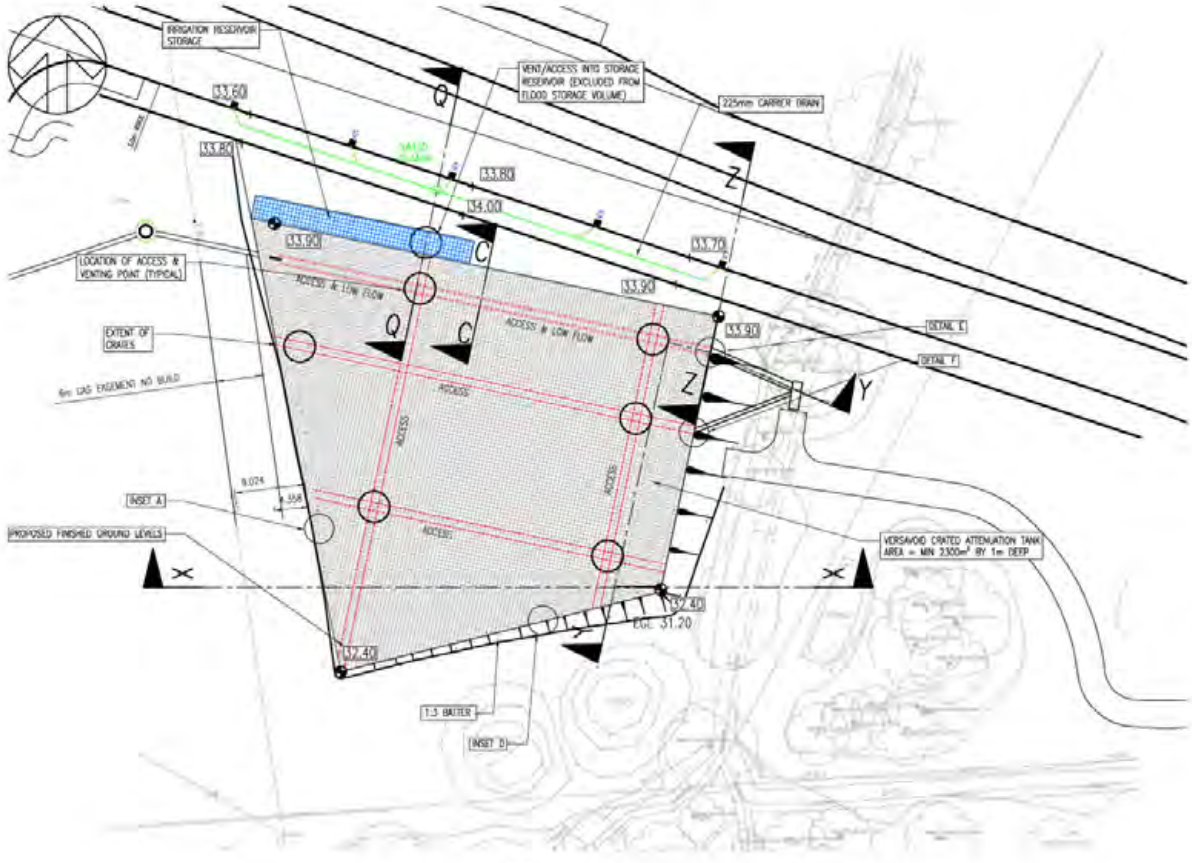


SECTION X-X
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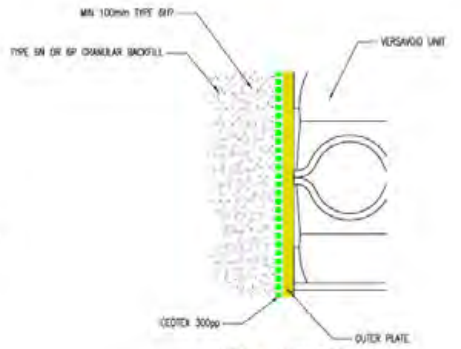


SECTION Z-Z
PROXIMITY OF CRATES AT CLOSEST POINT TO HIGHWAY
SCALE 1:100

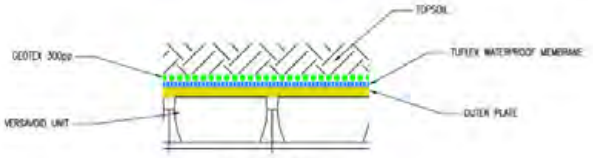




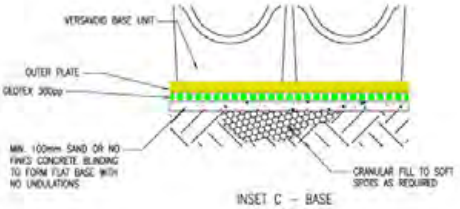
PLAN
SCALE 1:500



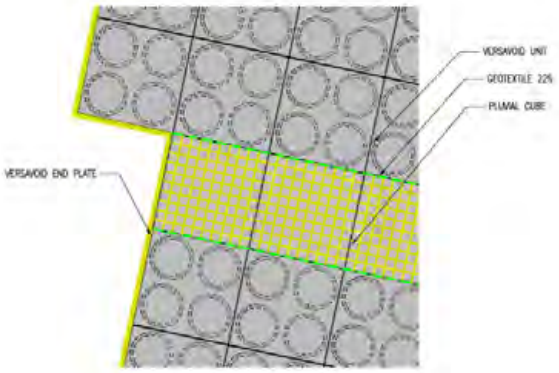
INSET A – WEST SIDE
NOT TO SCALE



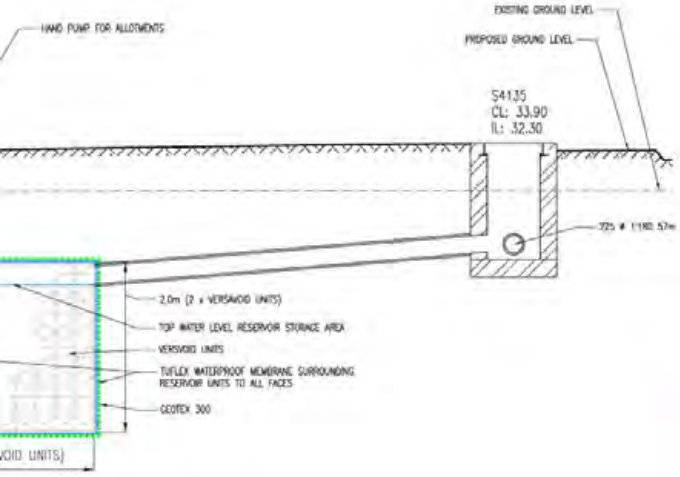
INSET B – ROOF
NOT TO SCALE



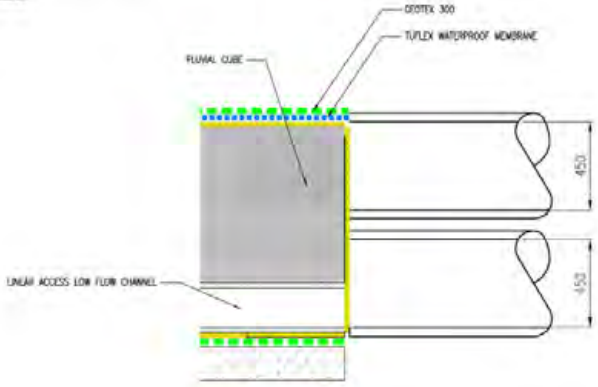
INSET C – BASE
NOT TO SCALE



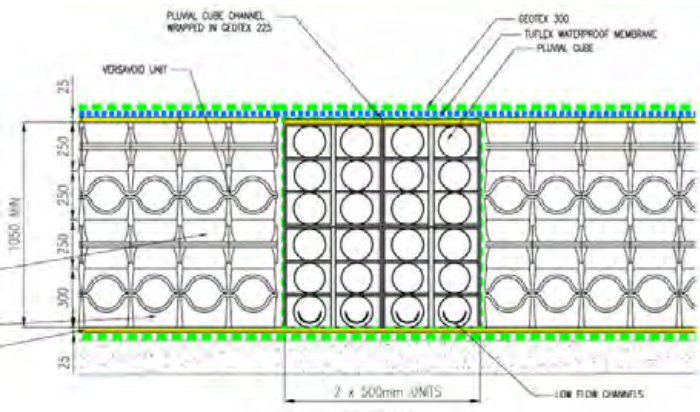
DETAIL OF DOG-TOOTH ARRANGEMENT OF
UNITS ALONG WESTERN AND SOUTHERN EDGES OF TANK
SCALE 1:20



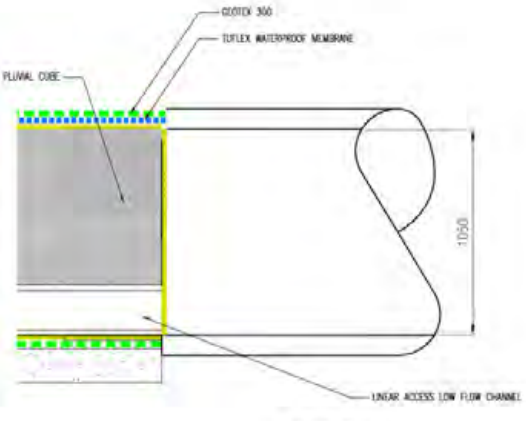
SECTION Q–Q
H ALLOTMENT IRRIGATION RESERVOIR
SCALE 1:50



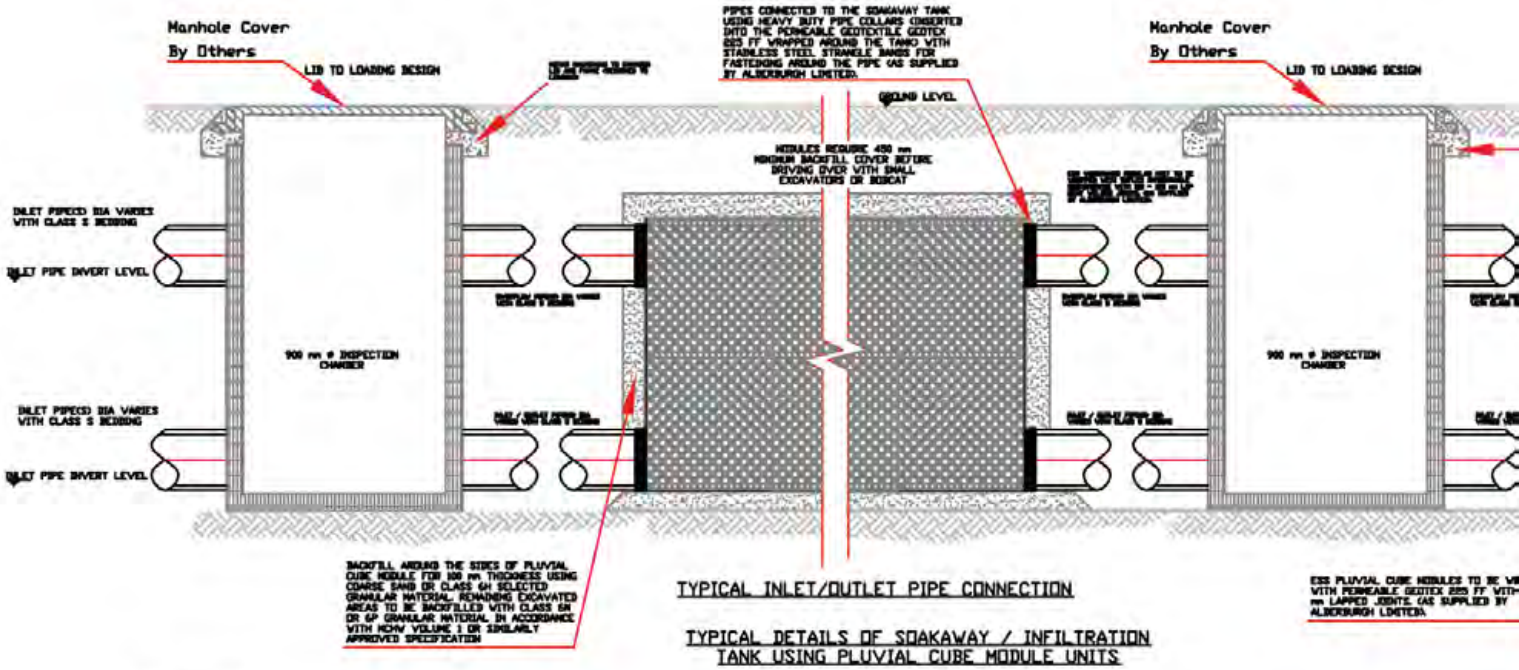
SECTION DETAIL F
NOT TO SCALE



SECTION C–C
PLUVIAL DISTRIBUTION UNITS
WITHIN VERSAVOID UNITS
NOT TO SCALE

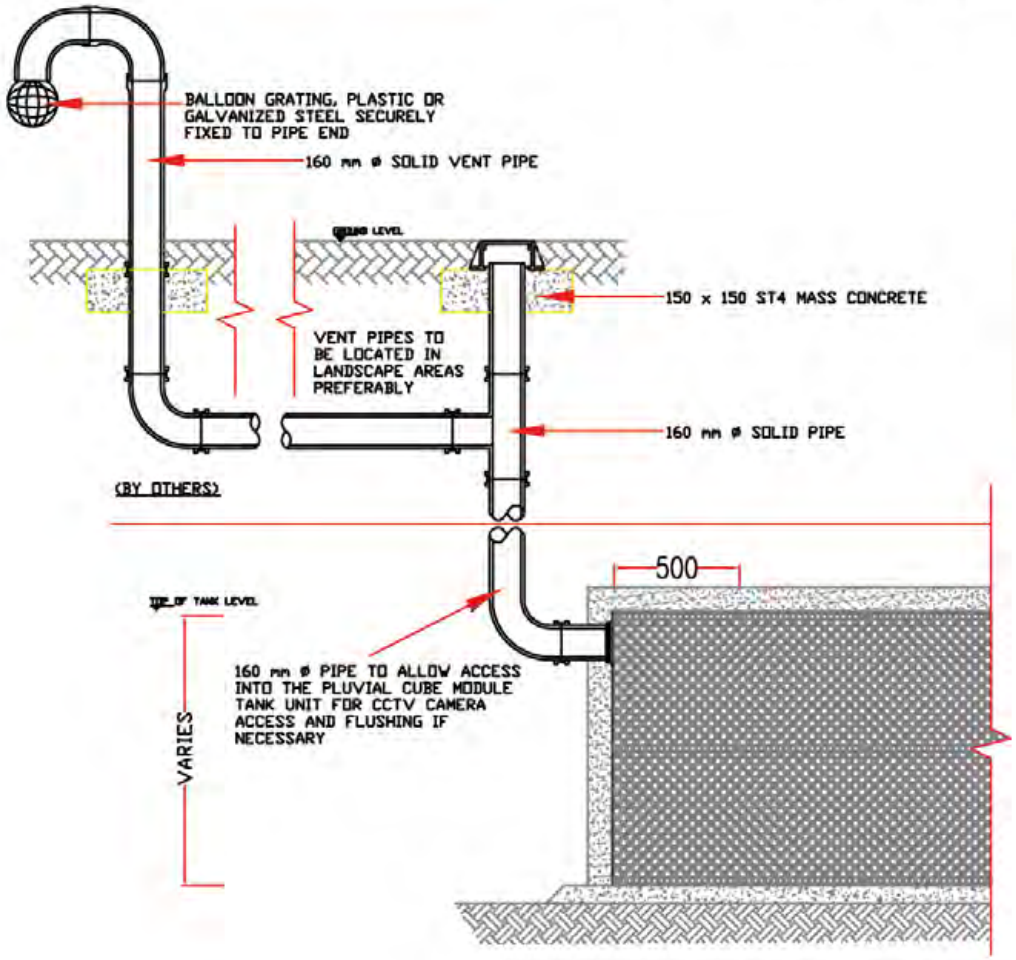


SECTION DETAIL E
NOT TO SCALE

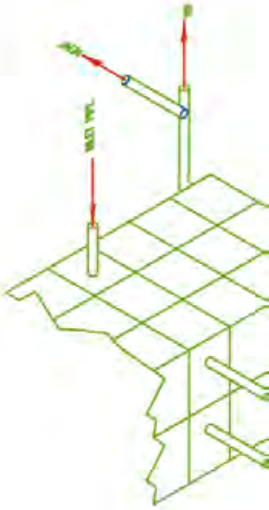


TYPICAL INLET/OUTLET PIPE CONNECTION

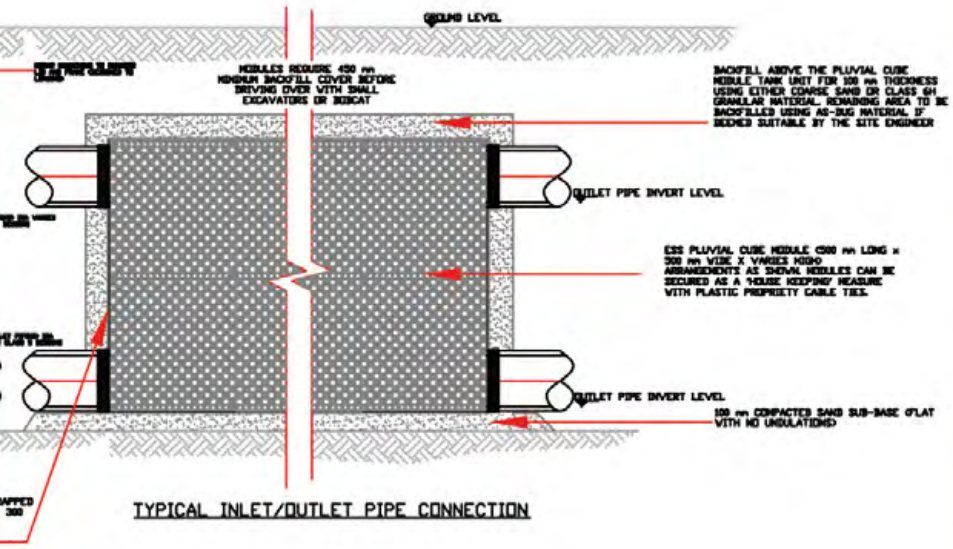
TYPICAL DETAILS OF SOAKAWAY / INFILTRATION TANK USING PLUVIAL CUBE MODULE UNITS



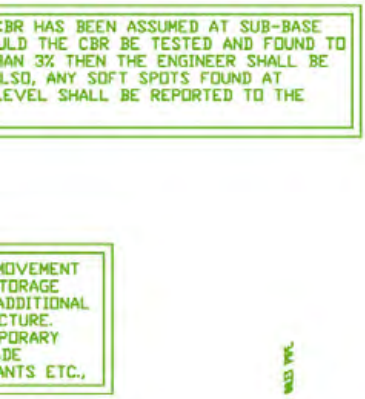
TYPICAL 160 mm ø VENT PIPE CONNECTION



Pluvial Cube



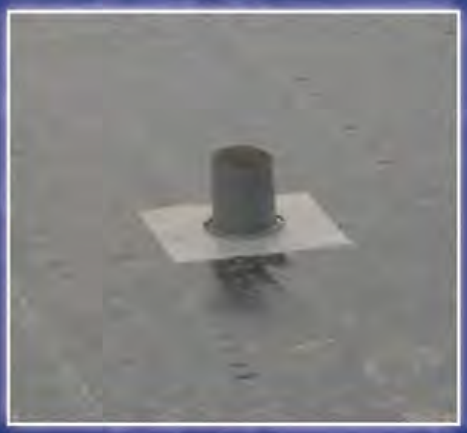
TYPICAL INLET/OUTLET PIPE CONNECTION

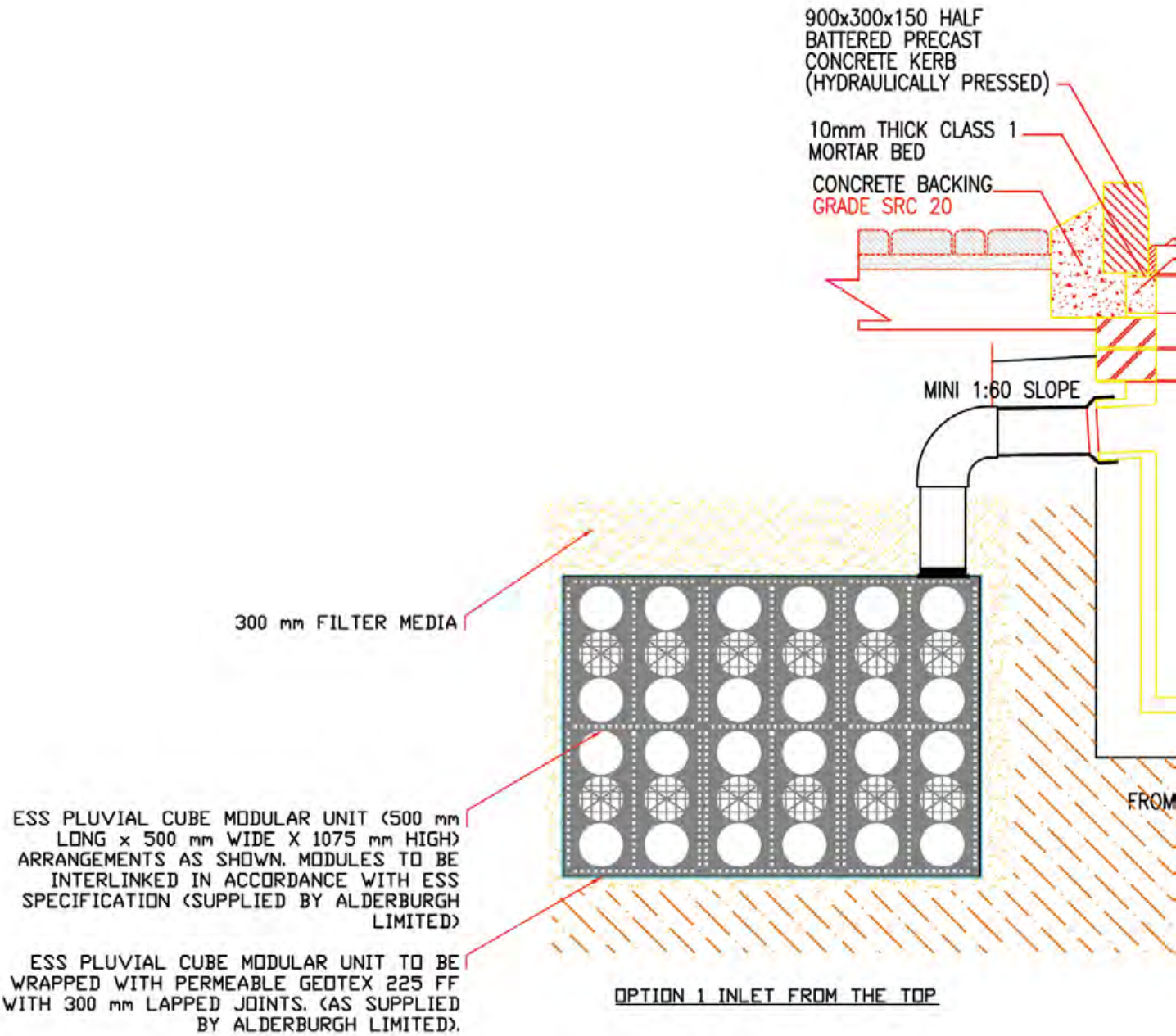


DIAGRAMATIC TANK LAYOUT

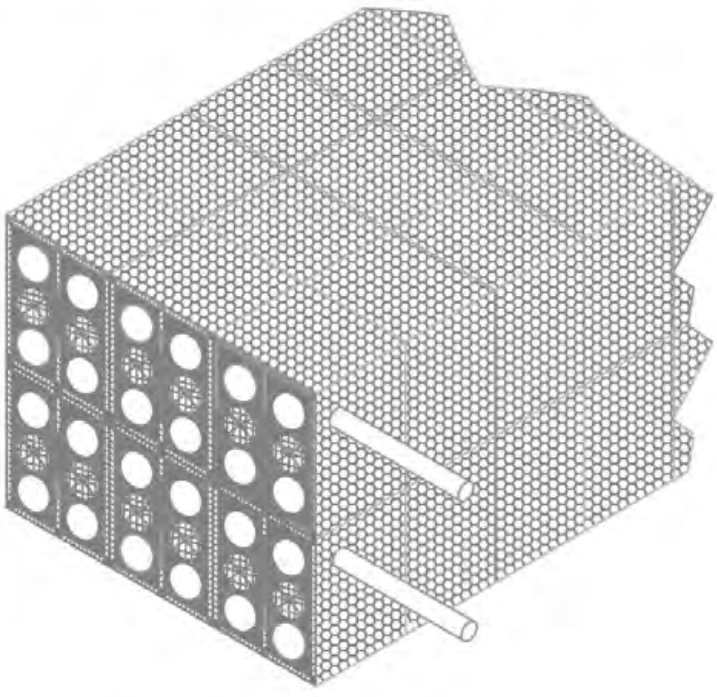








OPTION 1 INLET FROM THE TOP

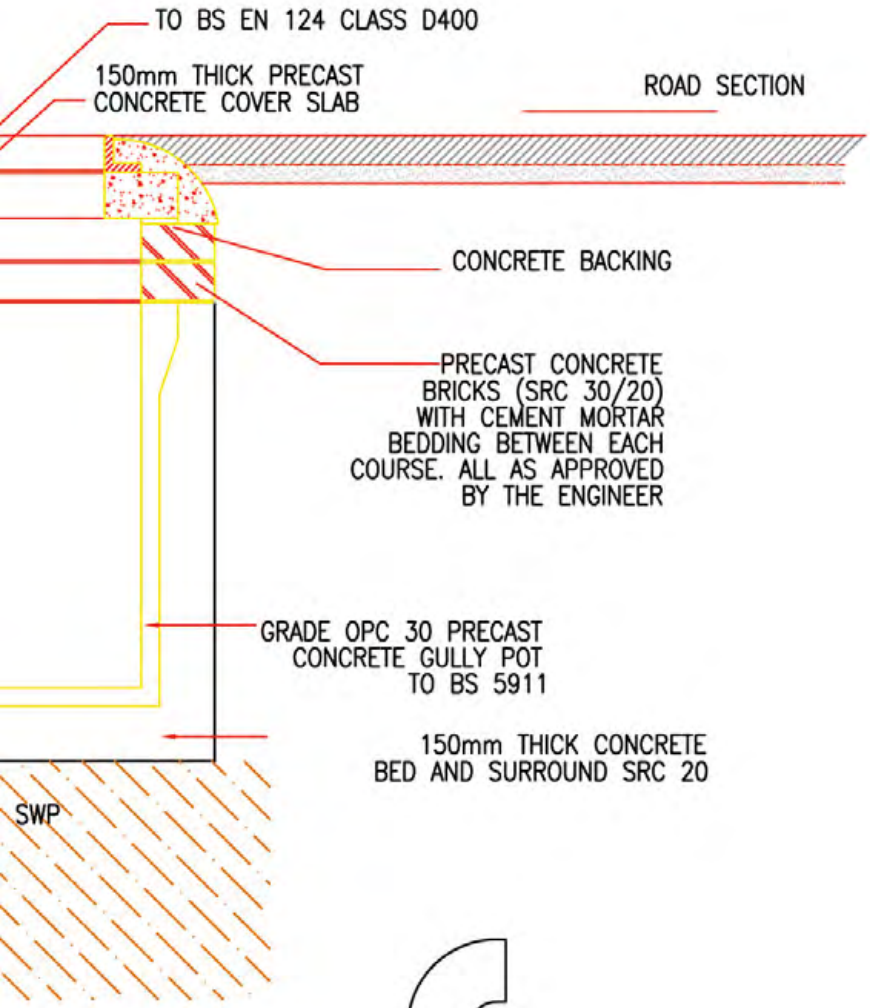


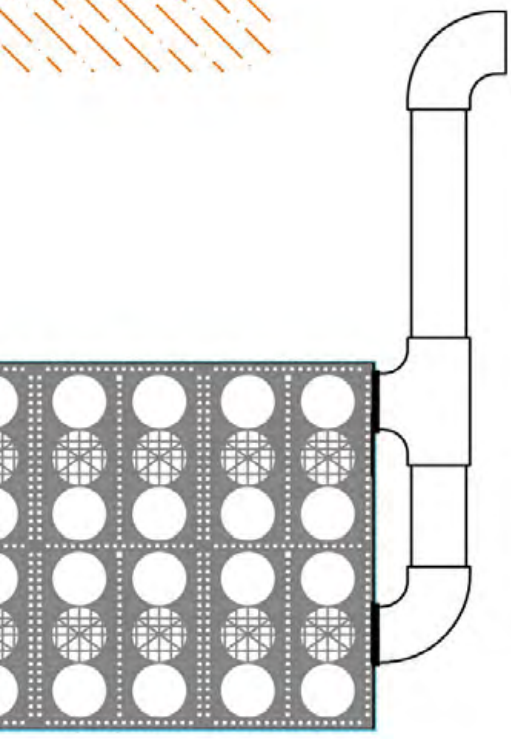


OPTION

DIAGRAMATIC TANK LAYOUT

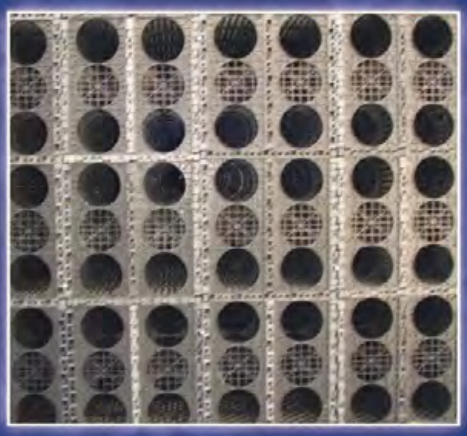
Pluvial Cube





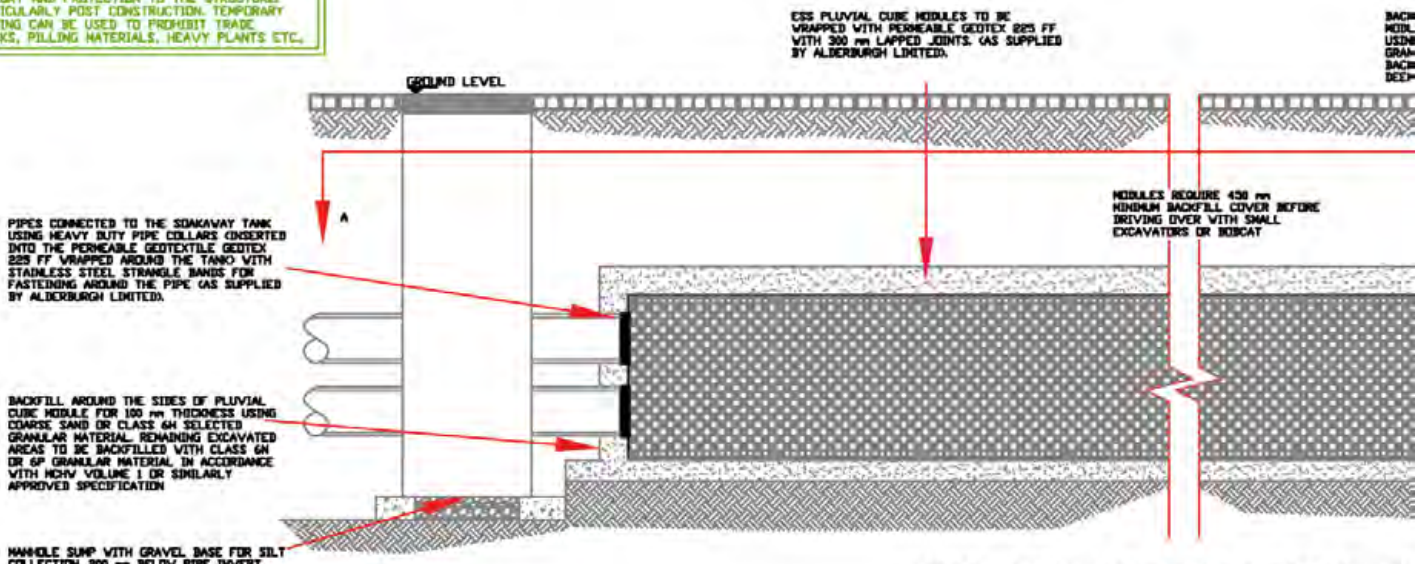
N 1 INLET FROM THE SIDE







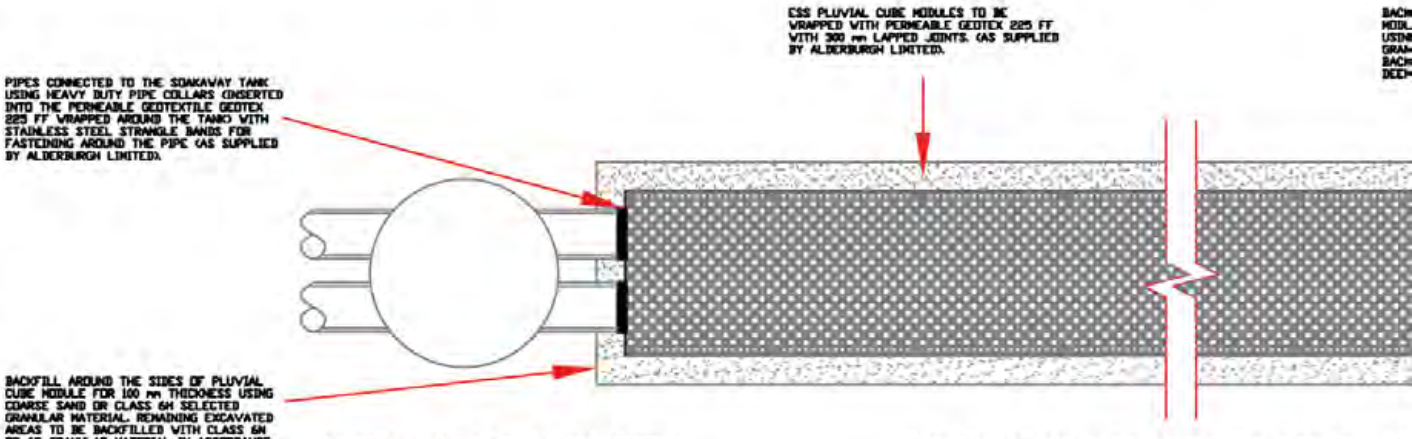
THE CONTRACTOR SHALL PROHIBIT THE MOVEMENT OF CONSTRUCTION PLANT ACROSS THE STORAGE TANK AND WHERE NECESSARY PROVIDE ADDITIONAL SUPPORT AND PROTECTION TO THE STRUCTURE. PARTICULARLY POST CONSTRUCTION. TEMPORARY FENCING CAN BE USED TO PROHIBIT TRADE STOCKS, PILLING MATERIALS, HEAVY PLANTS ETC.



TYPICAL MANHOLE / INSPECTION CHMABER (TO ENGINEERS SPECIFICATION)

TYPICAL DETAILS OF LINEAR RUNOFF COLLEC SYSTEM USING PLUVIAL CUBE MODULE UNI

CROSS SECTION

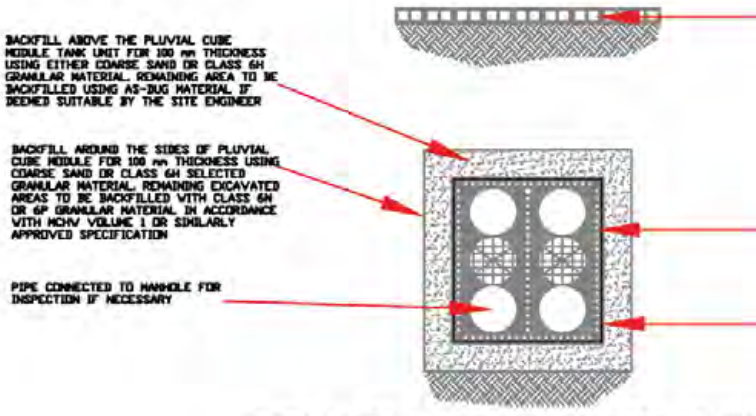


TYPICAL MANHOLE / INSPECTION CHMABER (TO ENGINEERS SPECIFICATION)

TYPICAL DETAILS OF LINEAR RUNOFF COLLEC SYSTEM USING PLUVIAL CUBE MODULE UNI

SECTION VIEW A - A (PLAN)

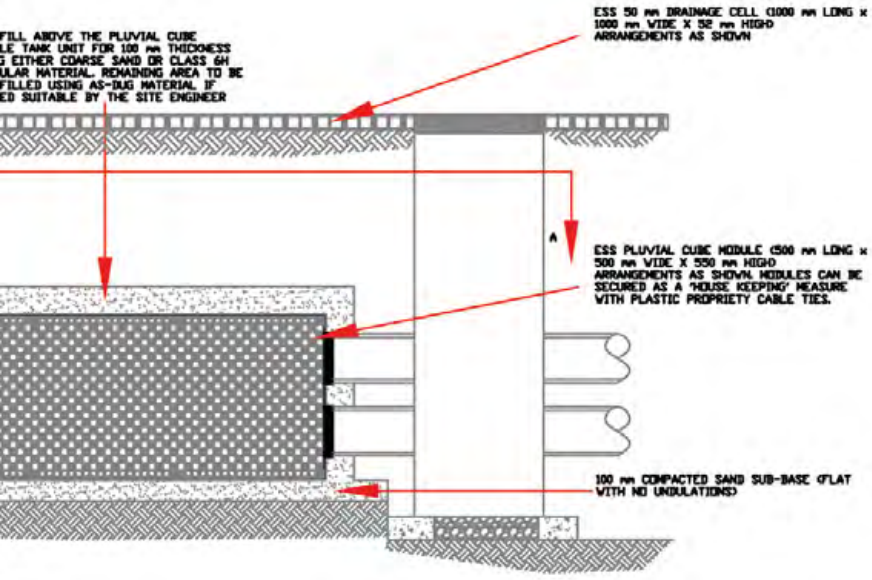
A 3 - 5% CBR HAS BEEN ASSUMED AT SUB-BASE LEVEL SHOULD THE CBR BE TESTED AND FOUND TO BE LESS THAN 3% THEN THE ENGINEER SHALL BE NOTIFIED. ALSO, ANY SOFT SPOTS FOUND AT SUB-BASE LEVEL SHALL BE REPORTED TO THE ENGINEER



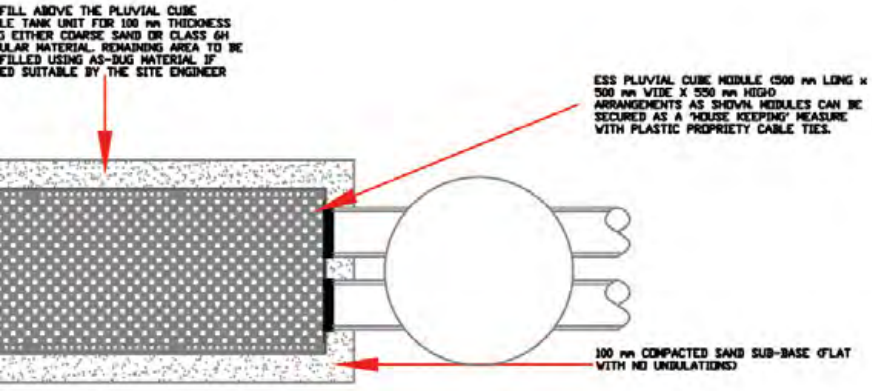
TYPICAL DETAILS OF LINEAR RUNOFF COLLEC SYSTEM USING PLUVIAL CUBE MODULE UNI

SIDE VIEW

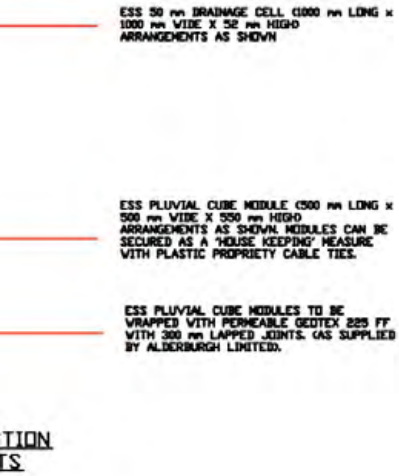
Pluvial Cube



TYPICAL MANHOLE / INSPECTION CHMABER (TO ENGINEERS SPECIFICATION)



TYPICAL MANHOLE / INSPECTION CHMABER (TO ENGINEERS SPECIFICATION)

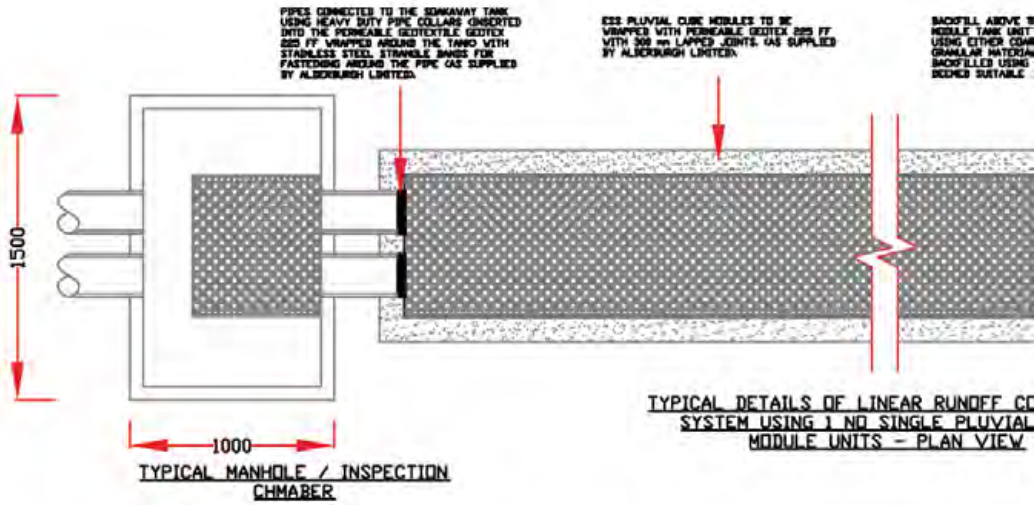






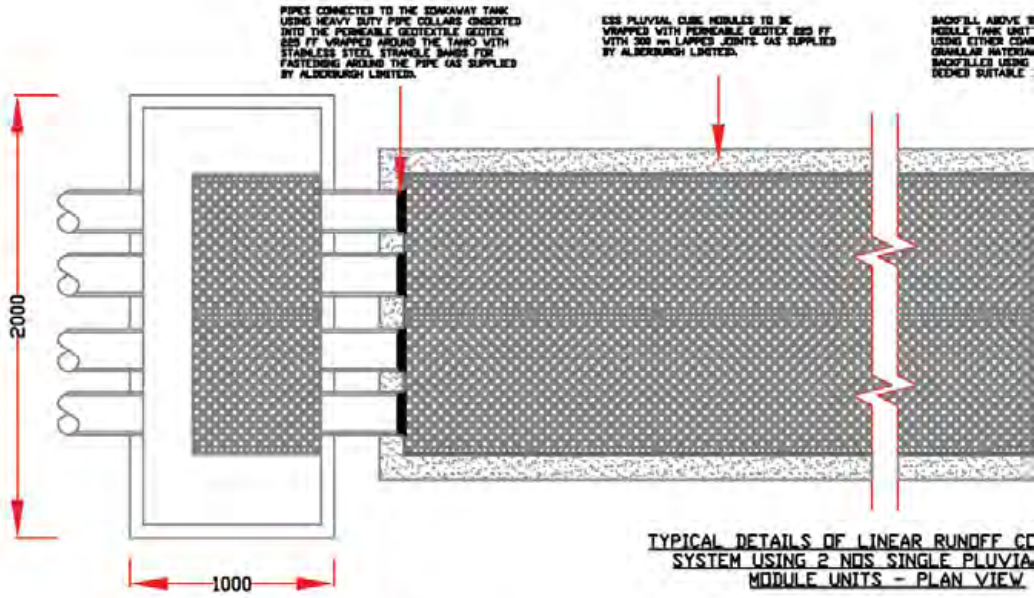


THE CONTRACTOR SHALL PROHIBIT THE MOVEMENT OF CONSTRUCTION PLANT ACROSS THE STORAGE TANK AND WHERE NECESSARY PROVIDE ADDITIONAL SUPPORT AND PROTECTION TO THE STRUCTURE. PARTICULARLY POST CONSTRUCTION. TEMPORARY FENCING CAN BE USED TO PROHIBIT TANGE STOCKS. PILLING MATERIALS. HEAVY PLANTS ETC..



TYPICAL MANHOLE / INSPECTION CHMABER

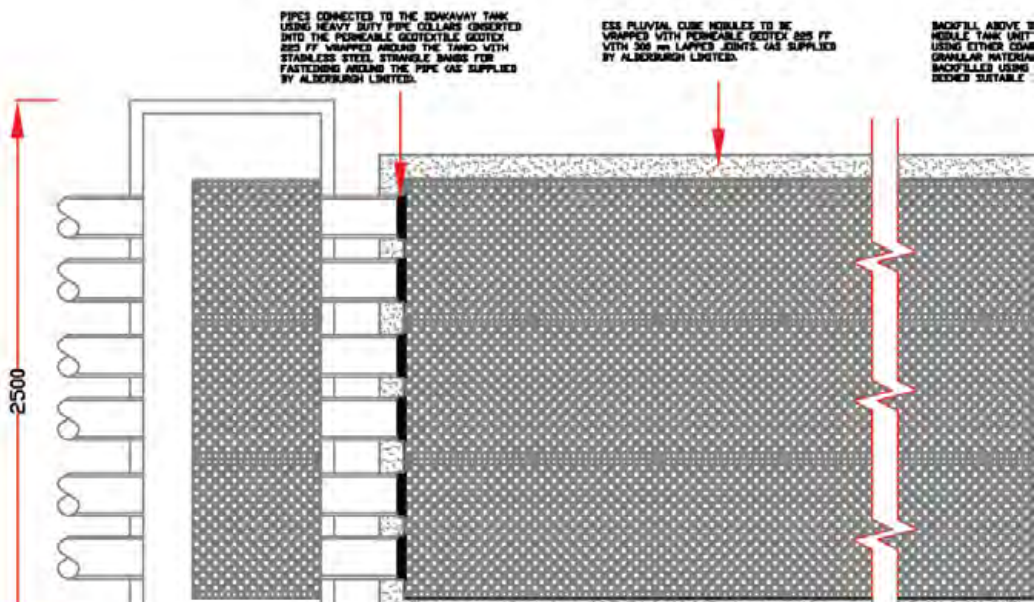
TYPICAL DETAILS OF LINEAR RUNOFF CO SYSTEM USING 1 NO SINGLE PLUVIAL MODULE UNITS - PLAN VIEW



TYPICAL MANHOLE / INSPECTION CHMABER

TYPICAL DETAILS OF LINEAR RUNOFF CO SYSTEM USING 2 NOS SINGLE PLUVIA MODULE UNITS - PLAN VIEW

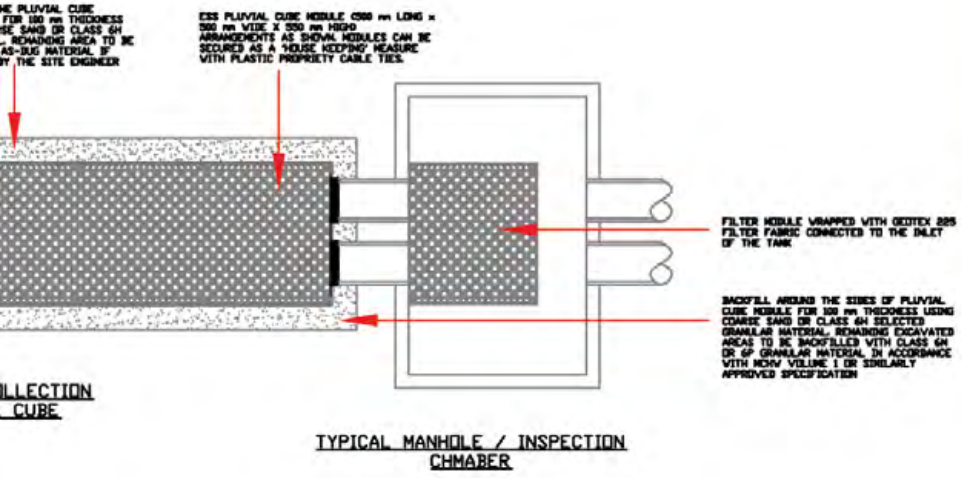
A 3 - 5% CBR HAS BEEN ASSUMED AT SUB-BASE LEVEL SHOULD THE CBR BE TESTED AND FOUND TO BE LESS THAN 3% THEN THE ENGINEER SHALL BE NOTIFIED. ALSO, ANY SOFT SPOTS FOUND AT SUB-BASE LEVEL SHALL BE REPORTED TO THE ENGINEER



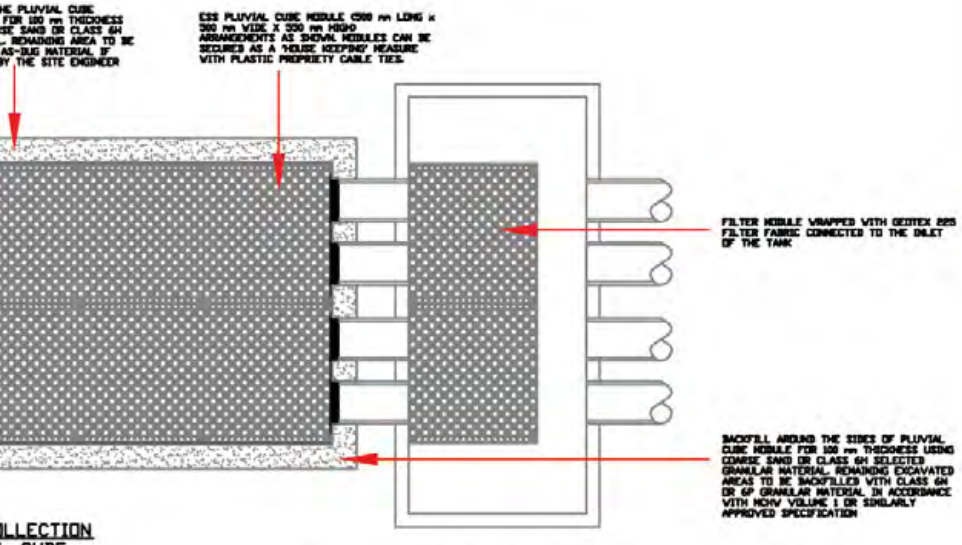
TYPICAL MANHOLE / INSPECTION CHMABER

TYPICAL DETAILS OF LINEAR RUNOFF CO SYSTEM USING 3 NOS SINGLE PLUVIA MODULE UNITS - PLAN VIEW

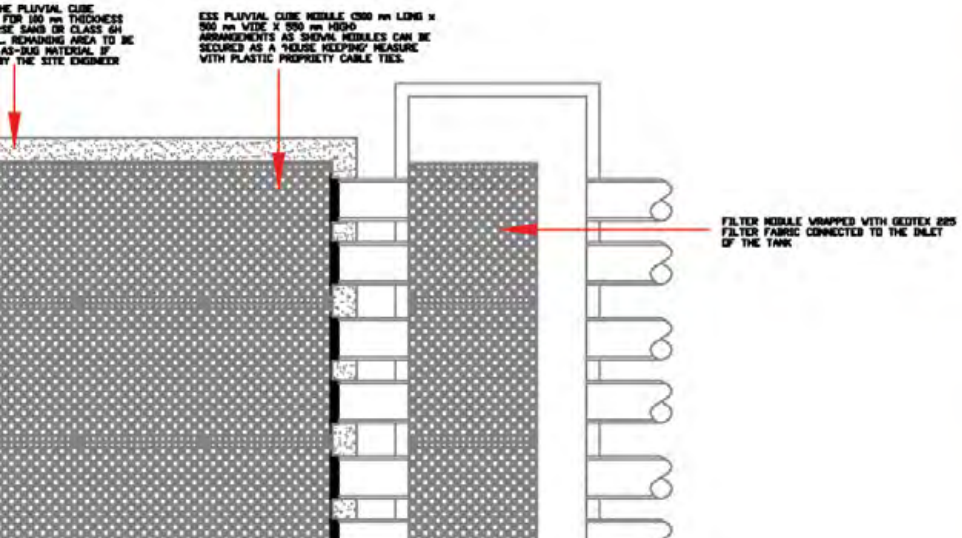
Pluvial Cube



TYPICAL MANHOLE / INSPECTION CHMABER



TYPICAL MANHOLE / INSPECTION CHMABER

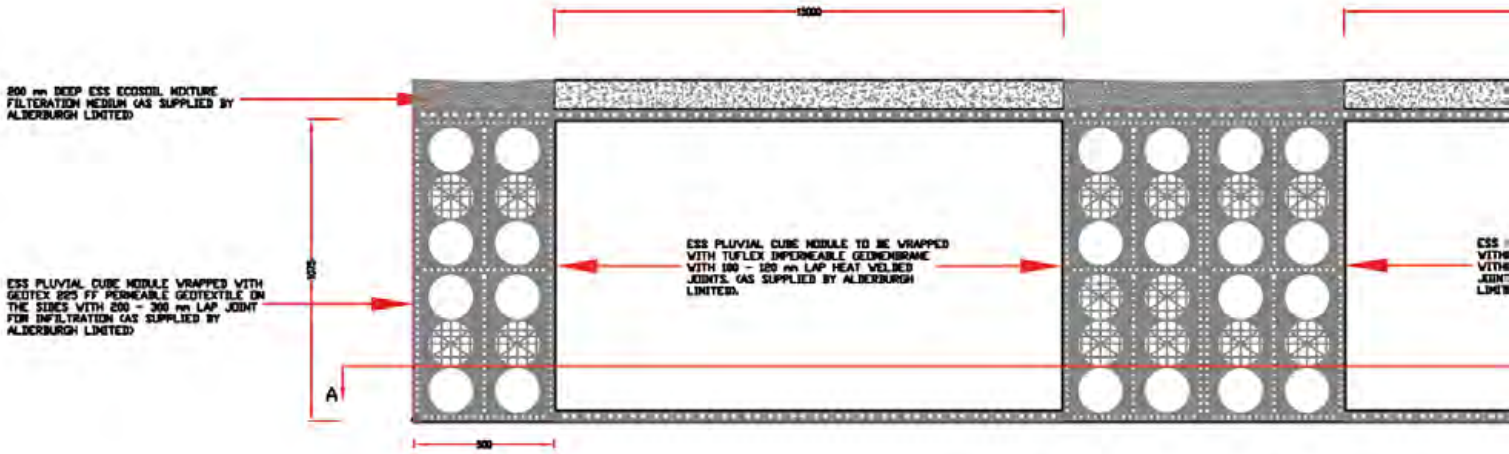


TYPICAL MANHOLE / INSPECTION CHMABER

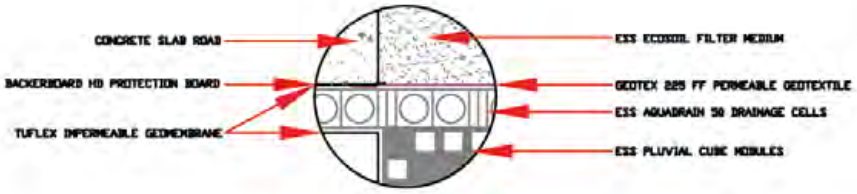




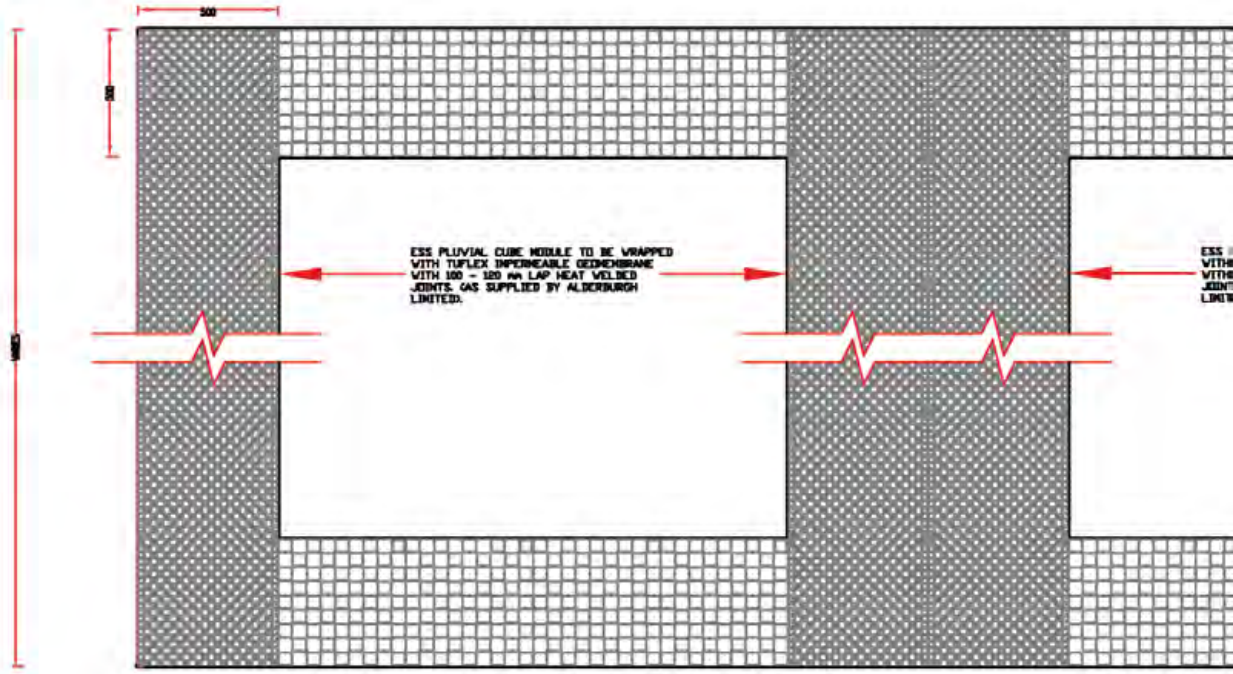




TYPICAL DETAILS OF ESS ROADSIDE DRAINAGE USING PLUVIAL CUBE MODULAR UNITS



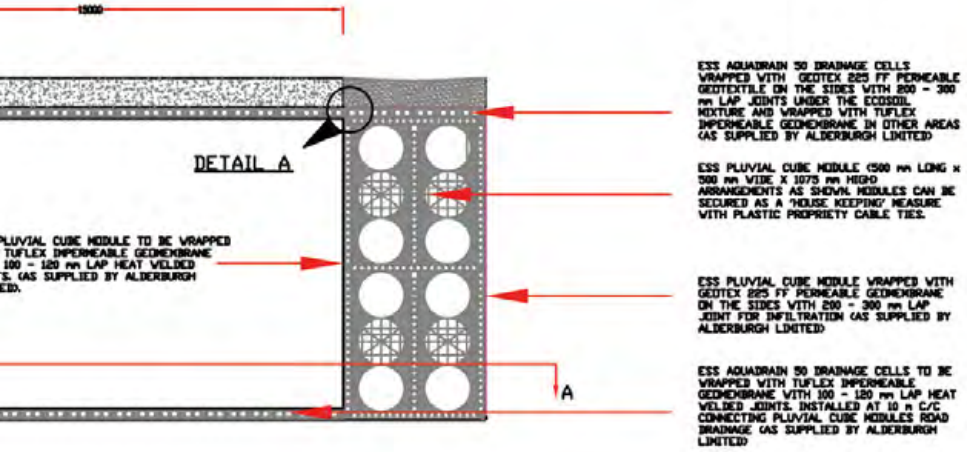
DETAIL A



A 2 - 5% CBR HAS BEEN ASSUMED AT SUB-BASE LEVEL SHOULD THE CBR BE TESTED AND FOUND TO BE LESS THAN 5% THEN THE ENGINEER SHALL BE NOTIFIED. ALSO, ANY SOFT SPOTS FOUND AT SUB-BASE LEVEL SHALL BE REPORTED TO THE ENGINEER

VIEW (A - A) OF ESS ROADSIDE DRAINAGE USING PLUVIAL CUBE MODULAR UNITS

Pluvial Cube



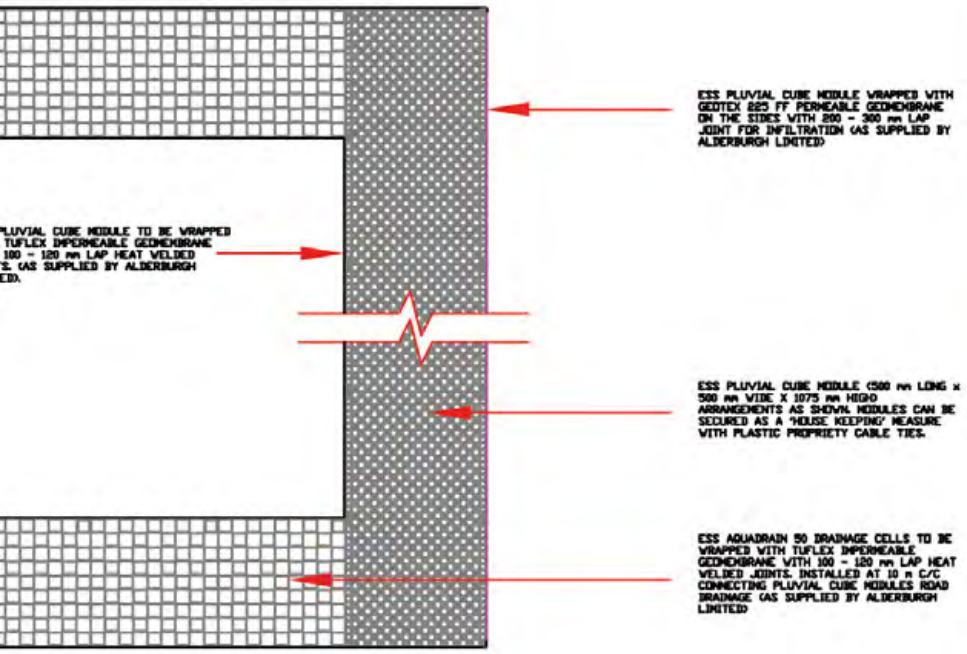
ESS AQUADRAIN 50 DRAINAGE CELLS WRAPPED WITH GEOTEX 225 FF PERMEABLE GEOTEXTILE ON THE SIDES WITH 200 - 300 mm LAP JOINTS UNDER THE ECOSOIL MIXTURE AND WRAPPED WITH TUFLEX IMPERMEABLE GEOMEMBRANE IN OTHER AREAS (AS SUPPLIED BY ALDERBURGH LIMITED)

ESS PLUVIAL CUBE MODULE (500 mm LONG x 500 mm WIDE X 1075 mm HIGH) ARRANGEMENTS AS SHOWN. MODULES CAN BE SECURED AS A 'HOUSE KEEPING' MEASURE WITH PLASTIC PROPRIETY CABLE TIES.

ESS PLUVIAL CUBE MODULE WRAPPED WITH GEOTEX 225 FF PERMEABLE GEOMEMBRANE ON THE SIDES WITH 200 - 300 mm LAP JOINT FOR INFILTRATION (AS SUPPLIED BY ALDERBURGH LIMITED)

ESS AQUADRAIN 50 DRAINAGE CELLS TO BE WRAPPED WITH TUFLEX IMPERMEABLE GEOMEMBRANE WITH 100 - 120 mm LAP HEAT WELDED JOINTS. INSTALLED AT 10 m C/C CONNECTING PLUVIAL CUBE MODULES ROAD DRAINAGE (AS SUPPLIED BY ALDERBURGH LIMITED)

THE CONTRACTOR SHALL PROHIBIT THE MOVEMENT OF CONSTRUCTION PLANT ACROSS THE STORAGE TANK AND WHERE NECESSARY PROVIDE ADDITIONAL SUPPORT AND PROTECTION TO THE STRUCTURE. PARTICULARLY POST CONSTRUCTION. TEMPORARY FENCING CAN BE USED TO PROHIBIT TRADE STOCKS, PILLING MATERIALS, HEAVY PLANTS ETC.



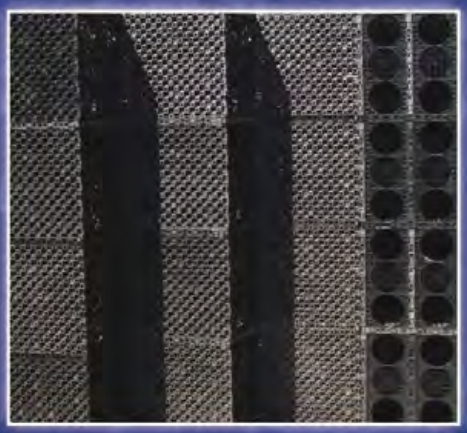
ESS PLUVIAL CUBE MODULE WRAPPED WITH GEOTEX 225 FF PERMEABLE GEOMEMBRANE ON THE SIDES WITH 200 - 300 mm LAP JOINT FOR INFILTRATION (AS SUPPLIED BY ALDERBURGH LIMITED)

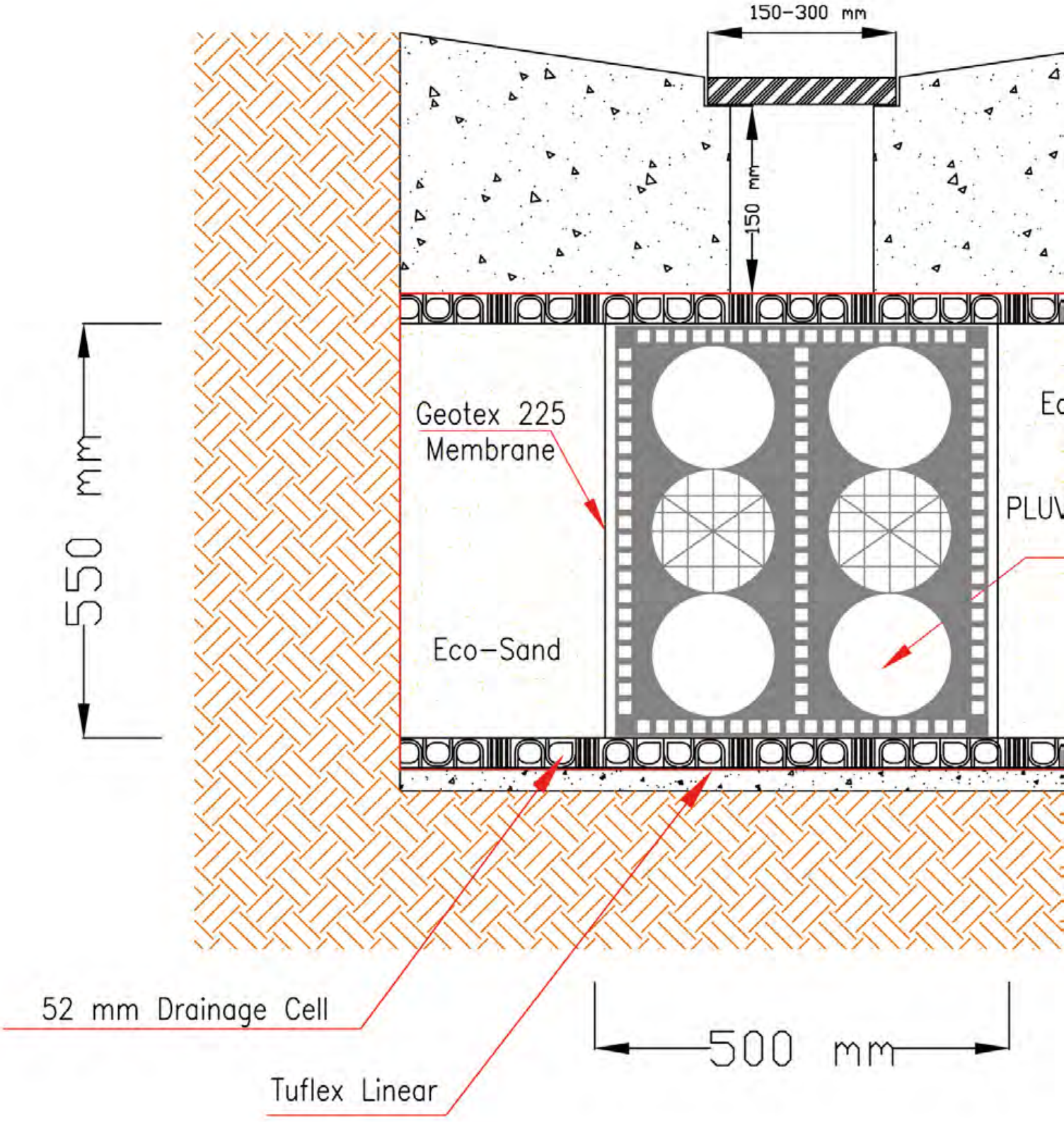
ESS PLUVIAL CUBE MODULE (500 mm LONG x 500 mm WIDE X 1075 mm HIGH) ARRANGEMENTS AS SHOWN. MODULES CAN BE SECURED AS A 'HOUSE KEEPING' MEASURE WITH PLASTIC PROPRIETY CABLE TIES.

ESS AQUADRAIN 50 DRAINAGE CELLS TO BE WRAPPED WITH TUFLEX IMPERMEABLE GEOMEMBRANE WITH 100 - 120 mm LAP HEAT WELDED JOINTS. INSTALLED AT 10 m C/C CONNECTING PLUVIAL CUBE MODULES ROAD DRAINAGE (AS SUPPLIED BY ALDERBURGH LIMITED)

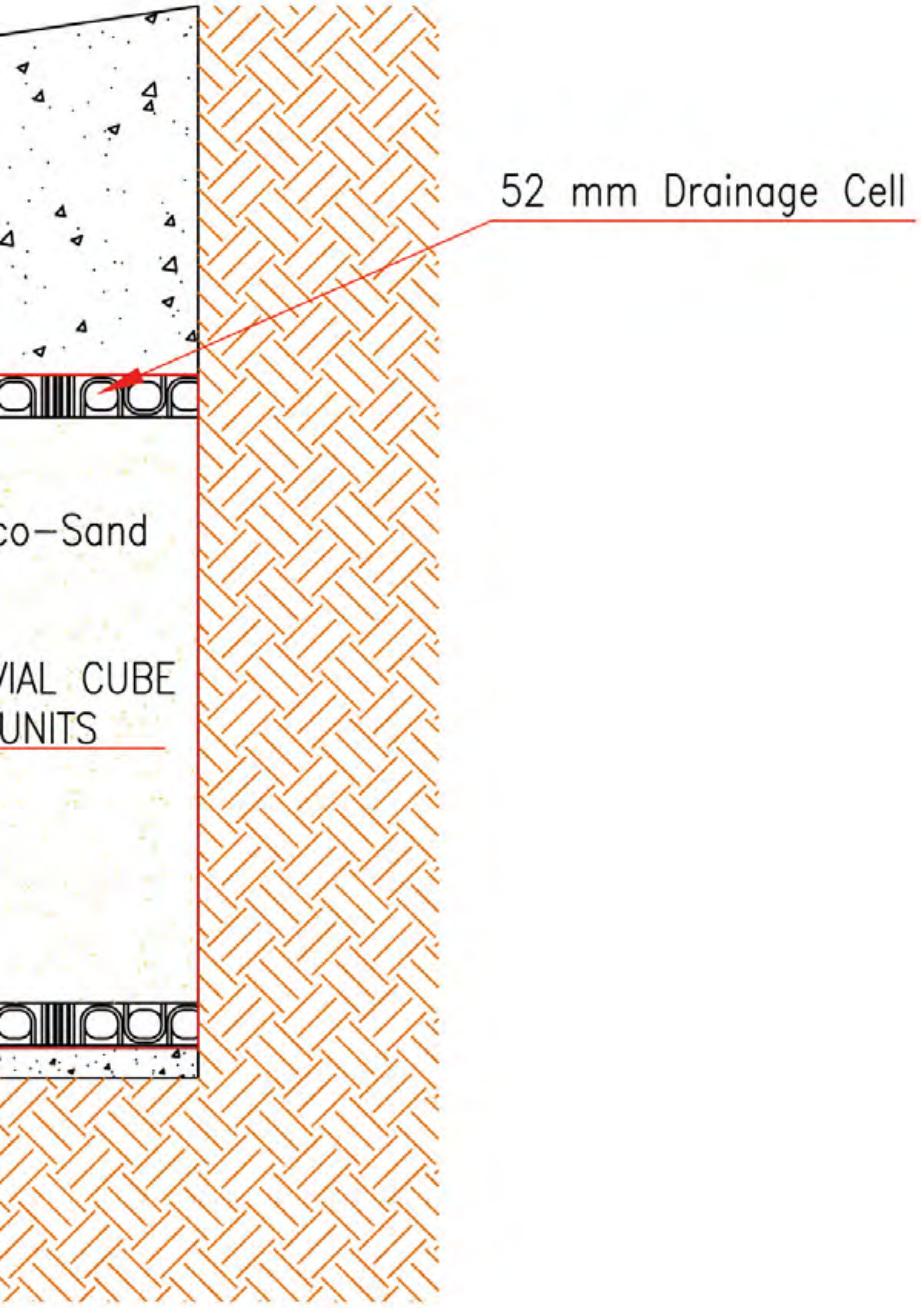







150–300 mm
150 mm
550 mm
Geotex 225
Membrane
Eco–Sand
52 mm Drainage Cell
Tuflex Linear
500 mm

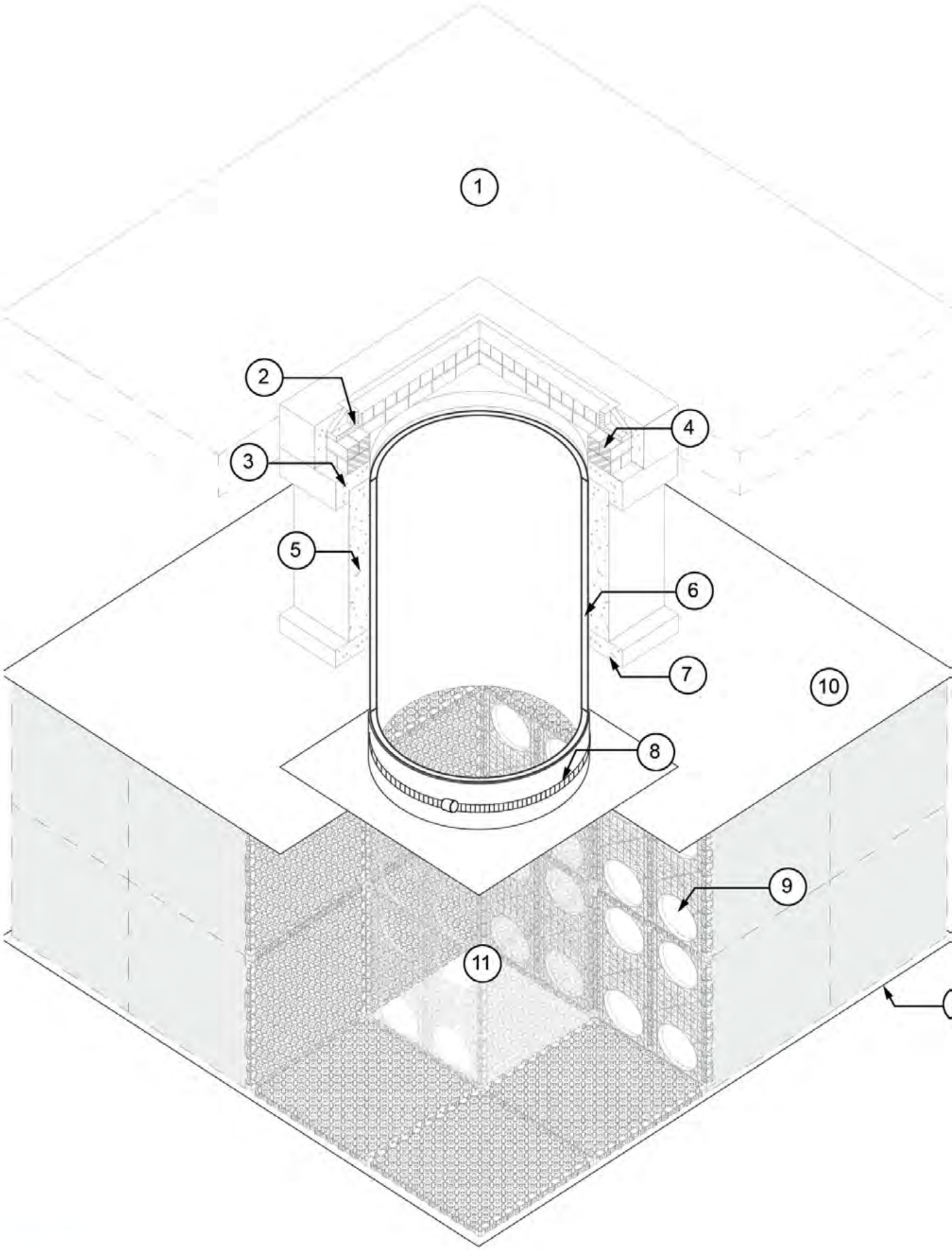
Pluvial Cube










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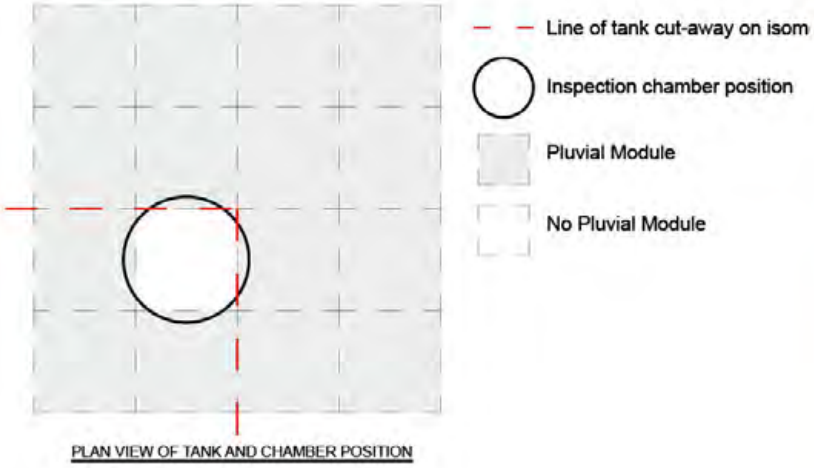
Pluvial Cube

KEY:

1. Finished Ground Level
2. M.H. Cover and Frame bedded and haunched in 1:3 cement mortar
3. Reinforce Concrete Cover Slab bedded with mortar
4. Enginnering or Special Purpose Concrete Brickwork: 4 courses max, 2 courses min and/or precast concrete cover frame seating rings
5. 150mm Concrete Surround (by others)
6. Inspection Pipe 600mm Ø connected to ESS Pluvial Modules for inspection/CCTV camera access and flushing if necessary. Inspection pipe sits along edge of surrounding Pluvial modules for initial support.
7. Reinforced concrete cover slab with mortar (by others)
8. Inspection Pipe connected to tank using Tuflex heavy duty pipe collars heat welded to Tuflex impermeable membrane and fastened to inspection pipe using stainless steel strangle bands
9. Pluvial Modules with clear 160mm access channels running along length of tank
10. Tuflex impermeable membrane heat welded at all joints and at junction with heavy duty pipe collar
11. 500 x 500mm clear vertical access beneath inspection chamber created by the removal of one Pluvial module on plan by the respective no. of modules deep (dependent on tank configuration).

NOTE:

Geotex 300PP Protection Fleece not shown, but should be installed to cover the entire tank and protect Tuflex impermeable membrane from tears or punctures.

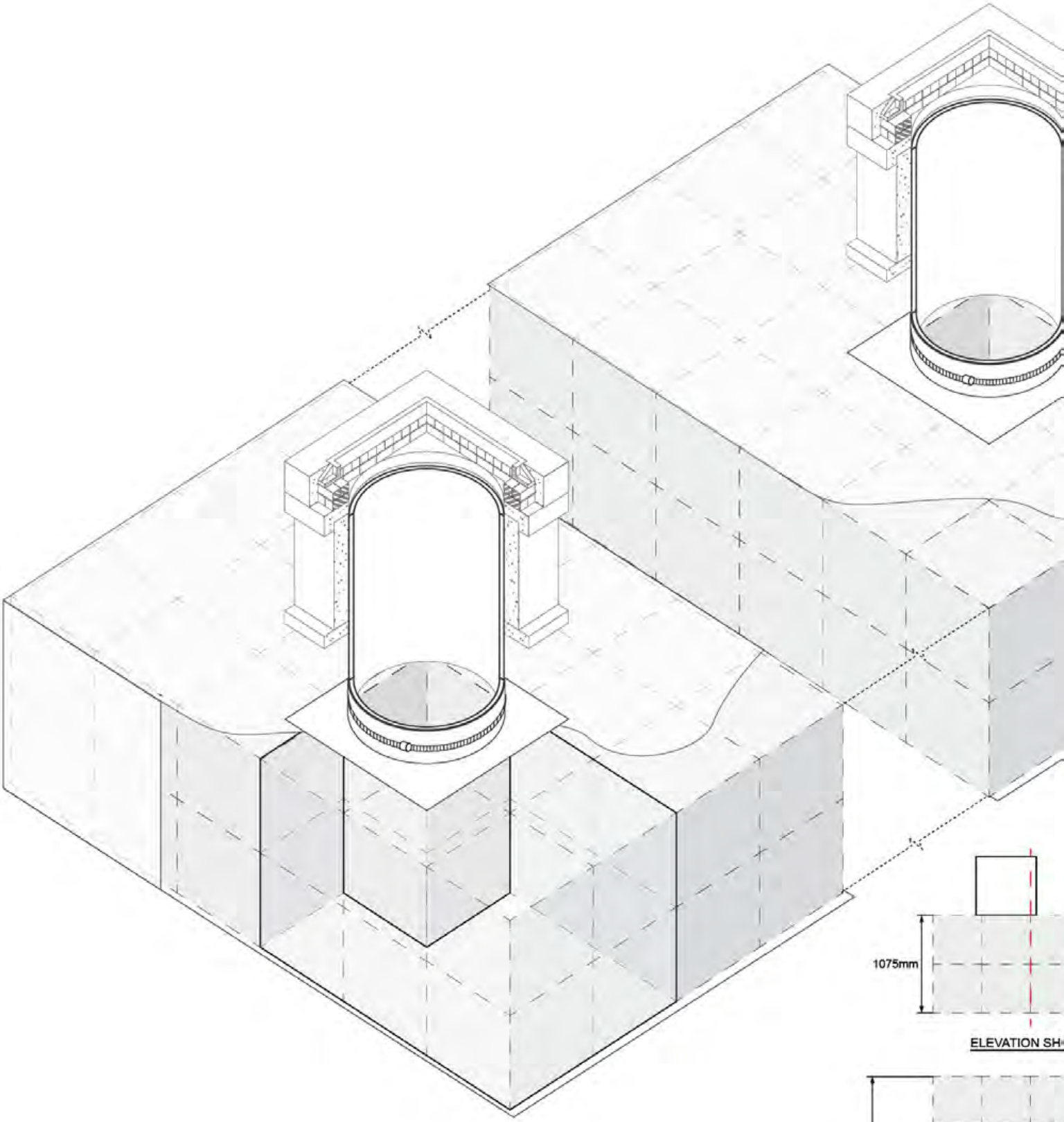


PLAN VIEW OF TANK AND CHAMBER POSITION

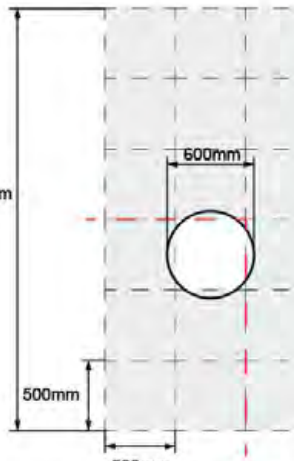




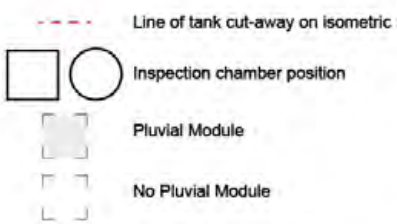




ELEVATION SH



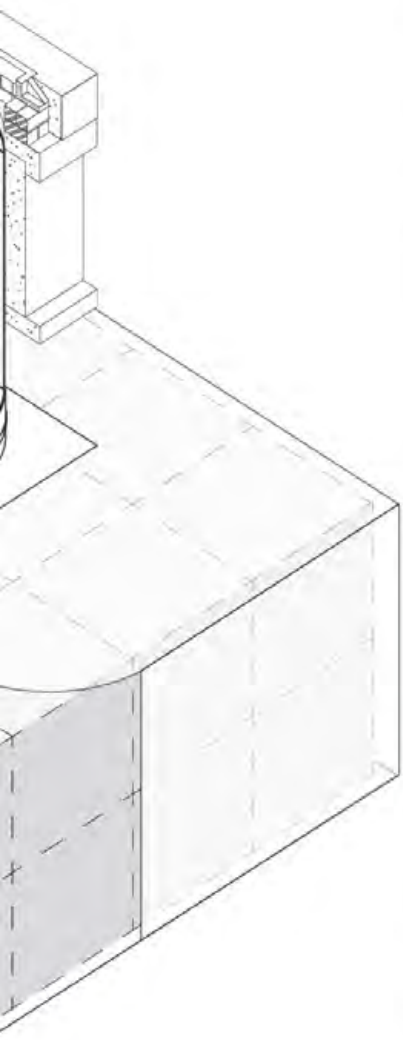
PLAN VIEW

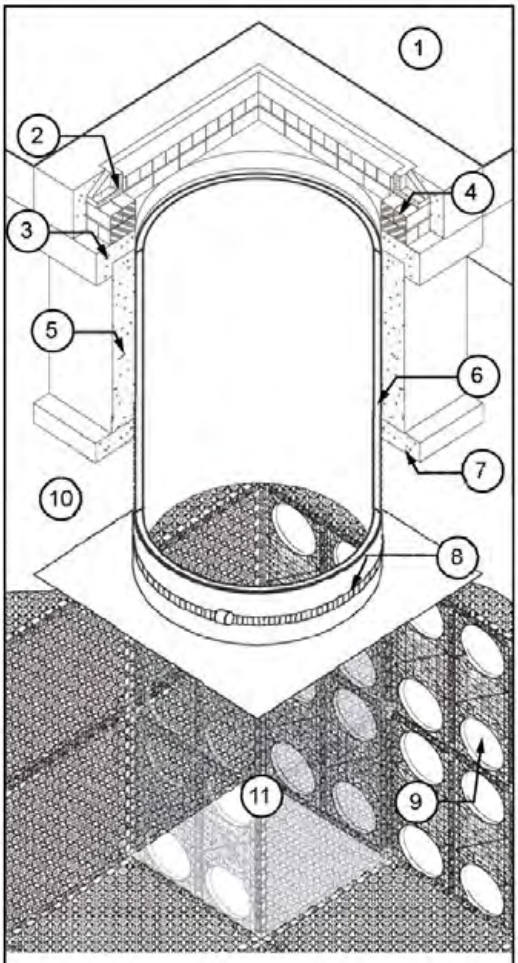


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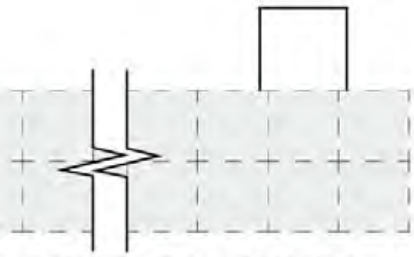
Pluvial Cube



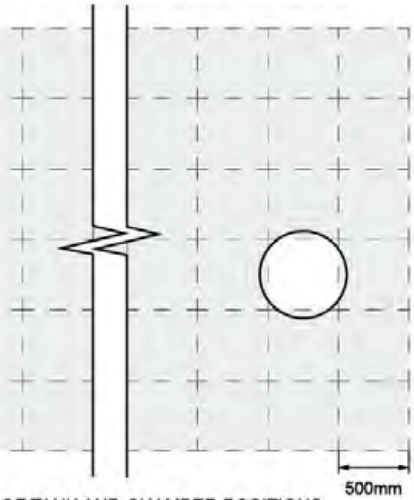


KEY:

1. Finished Ground Level
2. M.H. Cover and Frame bedded and haunched in 1:3 cement mortar
3. Reinforce Concrete Cover Slab bedded with mortar
4. Enginnering or Special Purpose Concrete Brickwork: 4 courses max, 2 courses min and/or precast concrete cover frame seating rings
5. 150mm Concrete Surround (by others)
6. Inspection Pipe 600mm Ø connected to ESS Pluvial Modules for inspection/CCTV camera access and flushing if necessary. Inspection pipe sits along edge of surrounding Pluvial modules for initial support.
7. Reinforced concrete cover slab with mortar (by others)
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OWING TANK AND CHAMBER POSITIONS

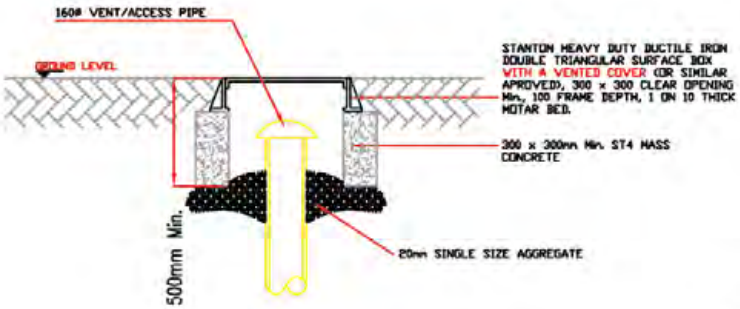


OF TANK AND CHAMBER POSITIONS





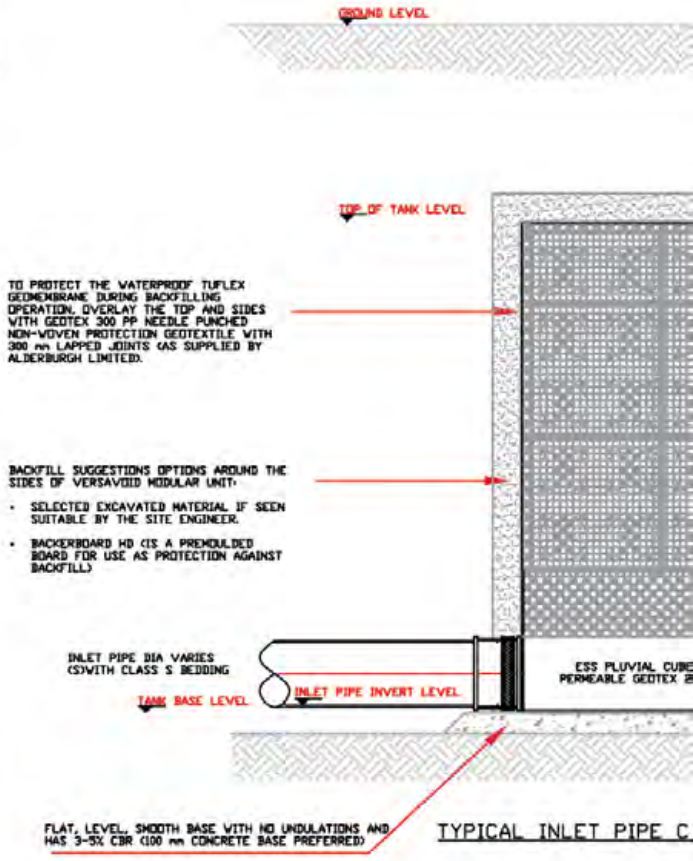




VENT BOX DETAIL
BY OTHERS
(OPTIONAL)

THE CONTRACTOR SHALL PROHIBIT THE MOVEMENT OF CONSTRUCTION PLANT ACROSS THE STORAGE TANK AND WHERE NECESSARY PROVIDE ADDITIONAL SUPPORT AND PROTECTION TO THE STRUCTURE. PARTICULARLY POST CONSTRUCTION. TEMPORARY FENCING CAN BE USED TO PROHIBIT TRADE STOCKS, PILLING MATERIALS, HEAVY PLANTS ETC.,

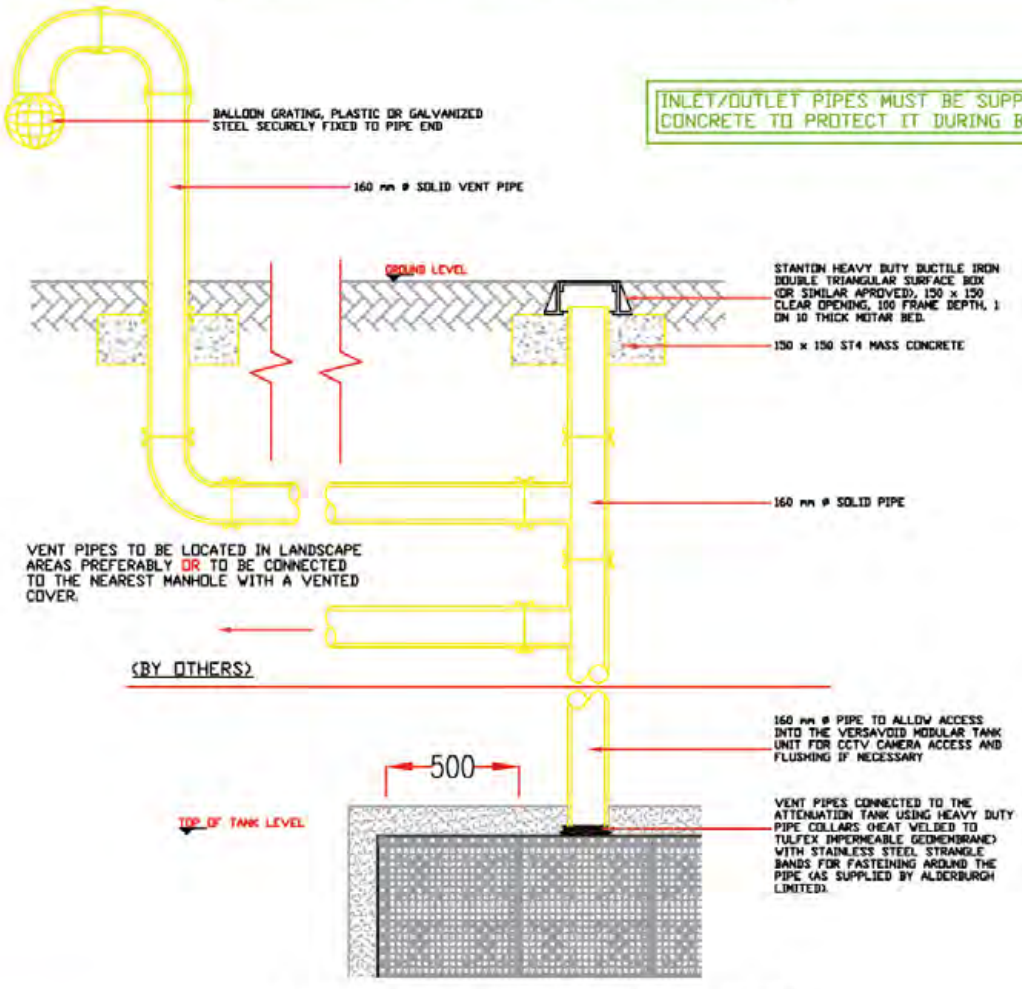
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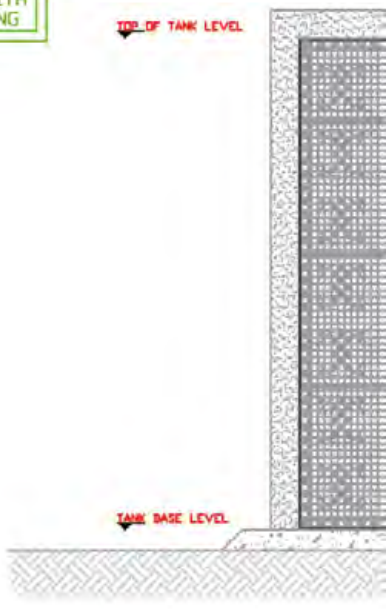
TYPICAL INLET PIPE C

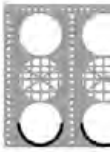
TYPICA

INLET/OUTLET PIPES MUST BE SUPPORTED WITH CONCRETE TO PROTECT IT DURING BACKFILLING



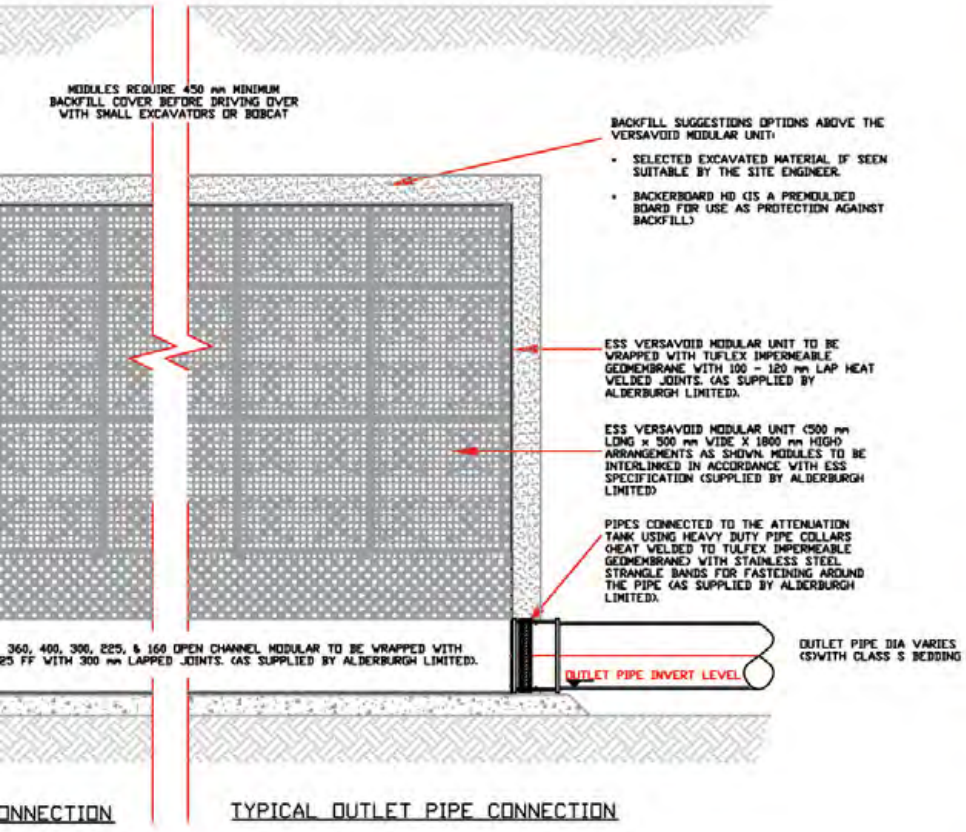
TYPICAL 160ø VENT/ACCESS PIPE CONNECTION





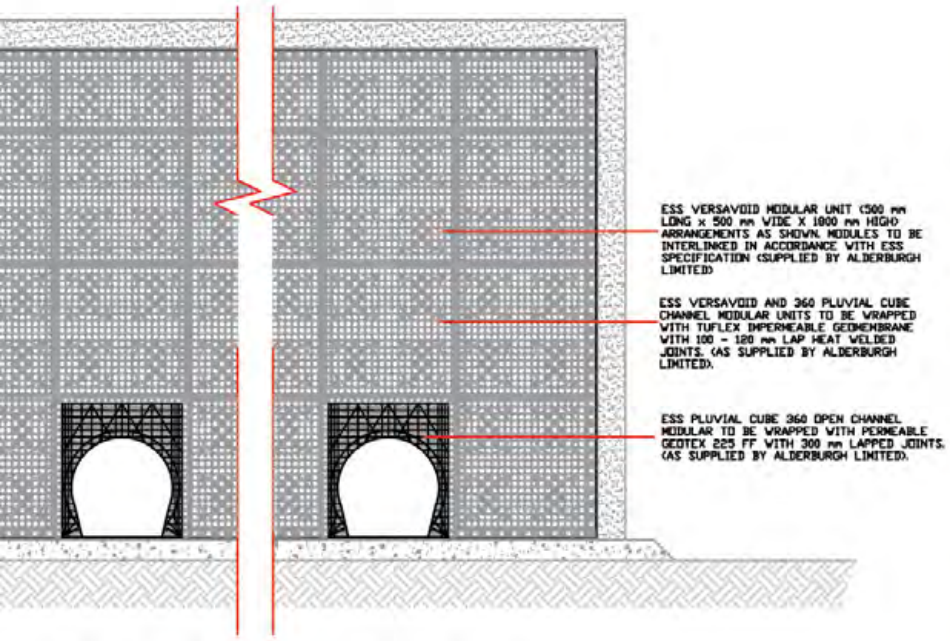
2No. 160

Low Flow

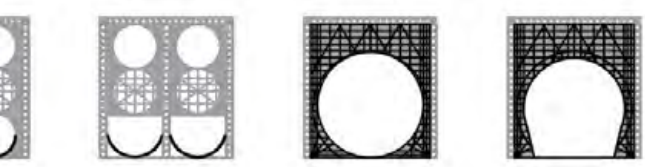


ONNECTION TYPICAL OUTLET PIPE CONNECTION

L DETAILS OF ATTENUATION TANK USING VERSAVOID MODULAR UNITS



TYPICAL DETAILS OF ATTENUATION TANK USING VERSAVOID WITH 360Ø PLUVIAL CUBE OPEN CHANNEL MODULAR UNITS

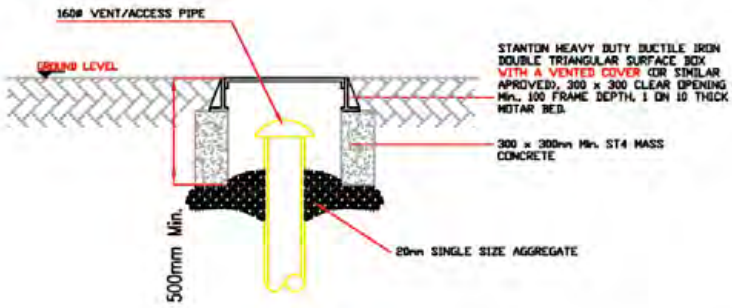


Ø 2No. 225Ø 400Ø 360Ø



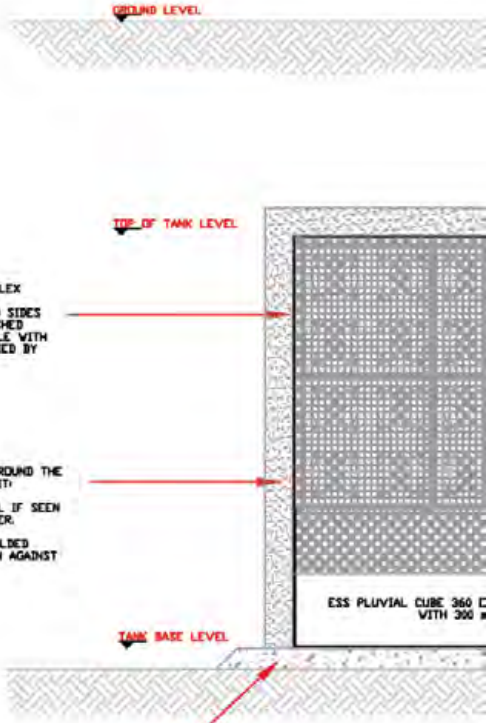






VENT BOX DETAIL
BY OTHERS
(OPTIONAL)

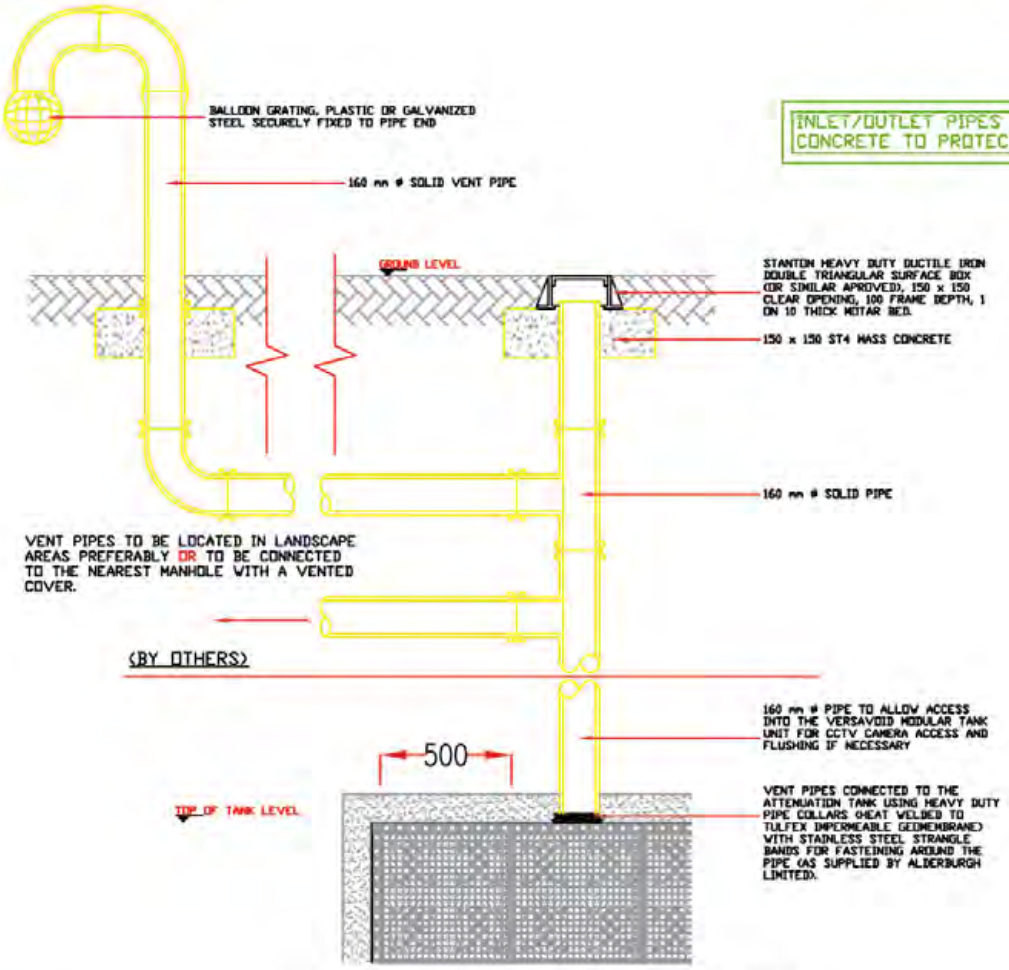
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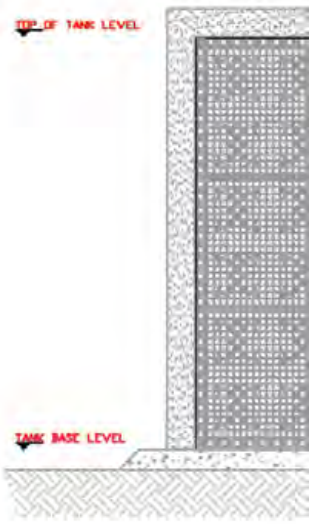
TYPICAL INLET PIPE CON

TYPICAL

INLET/OUTLET PIPES MUST BE SUPPORTED WITH CONCRETE TO PROTECT IT DURING BACKFILLING

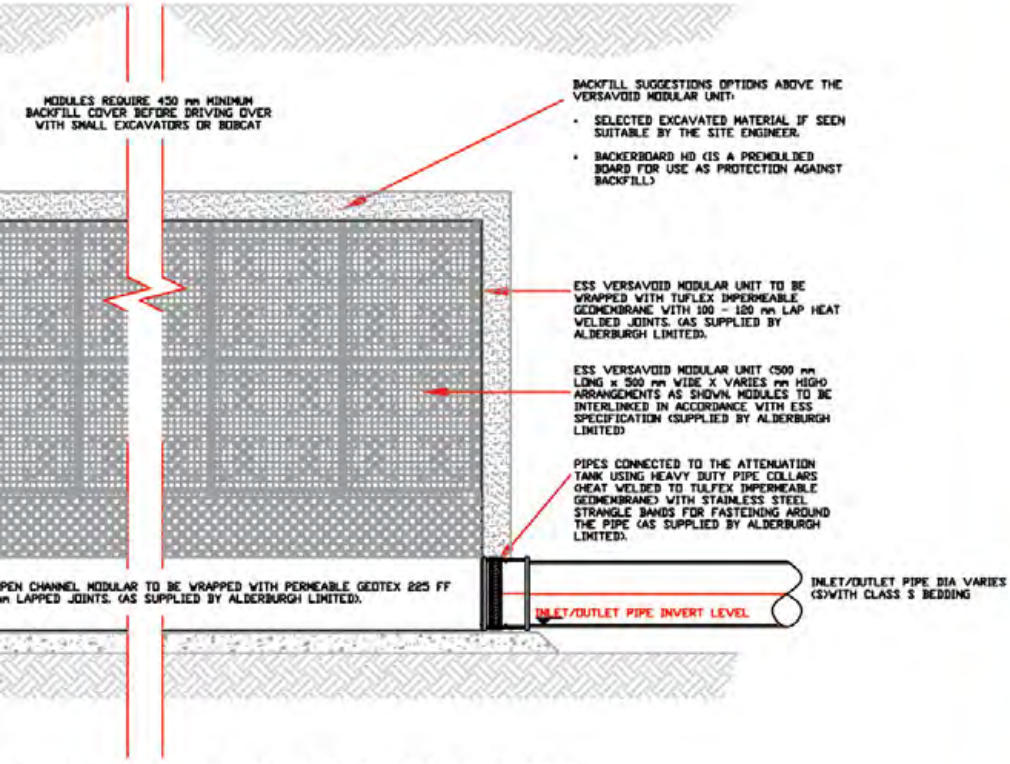


TYPICAL 160ø VENT/ACCESS PIPE CONNECTION



TYPICA
VERS

Low Flow

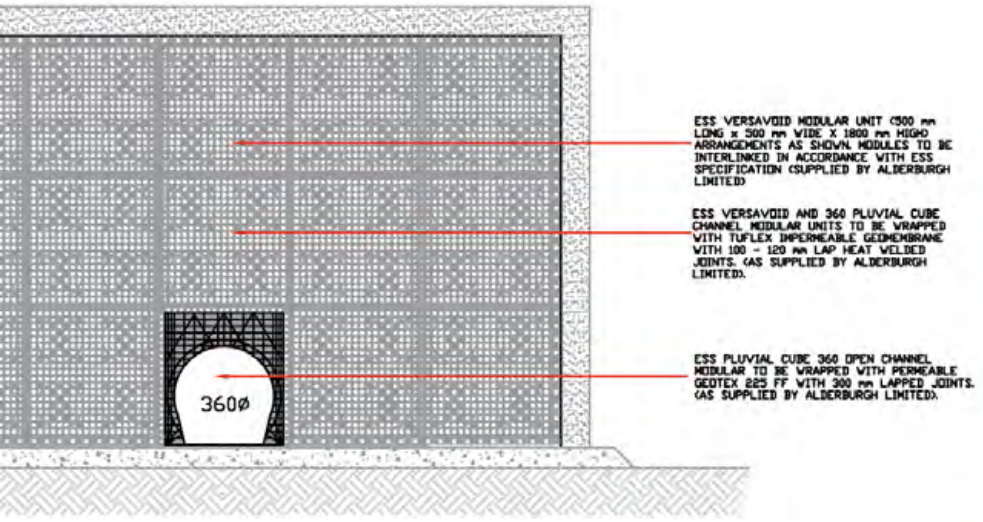


NECTION

TYPICAL OUTLET PIPE CONNECTION

DETAILS OF ATTENUATION TANK USING VERSAVOID MODULAR UNITS

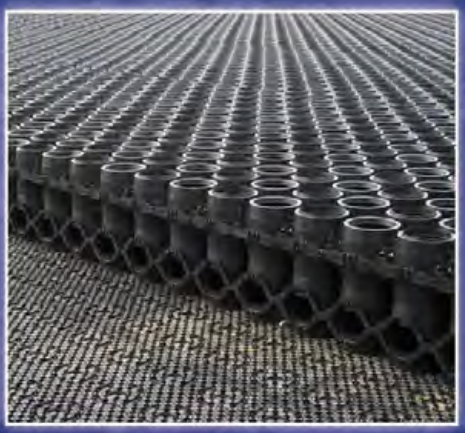
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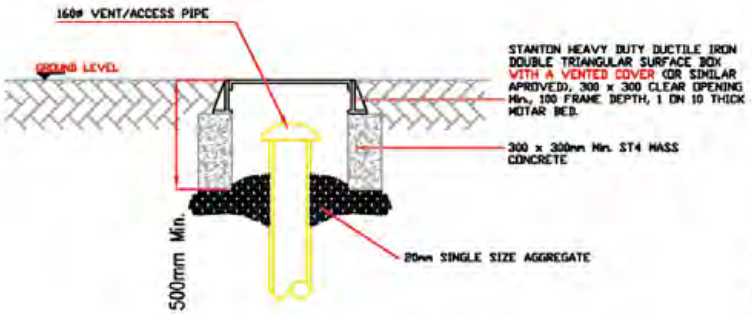


DETAILS OF ATTENUATION TANK USING AVOID WITH 360ø PLUVIAL CUBE OPEN CHANNEL MODULAR UNITS



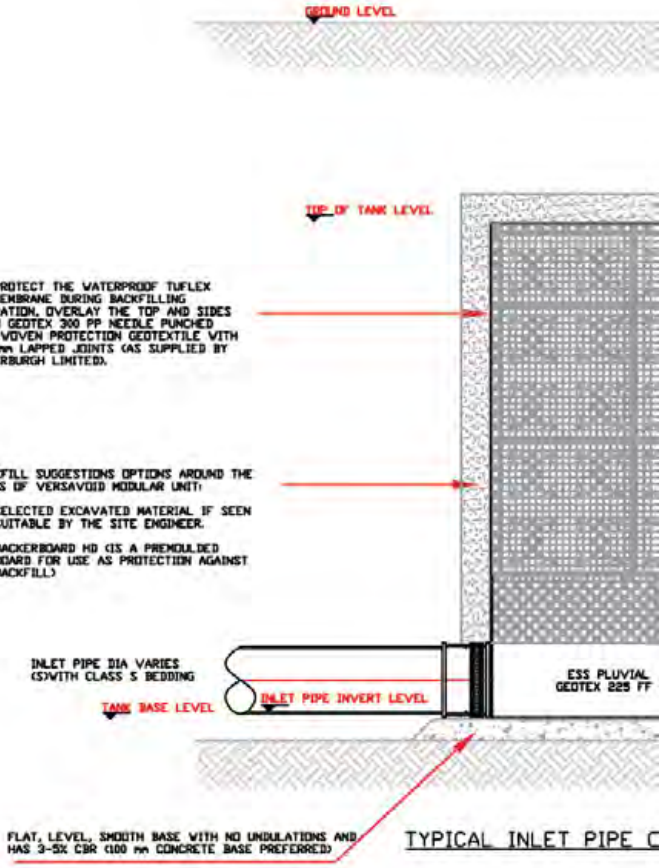






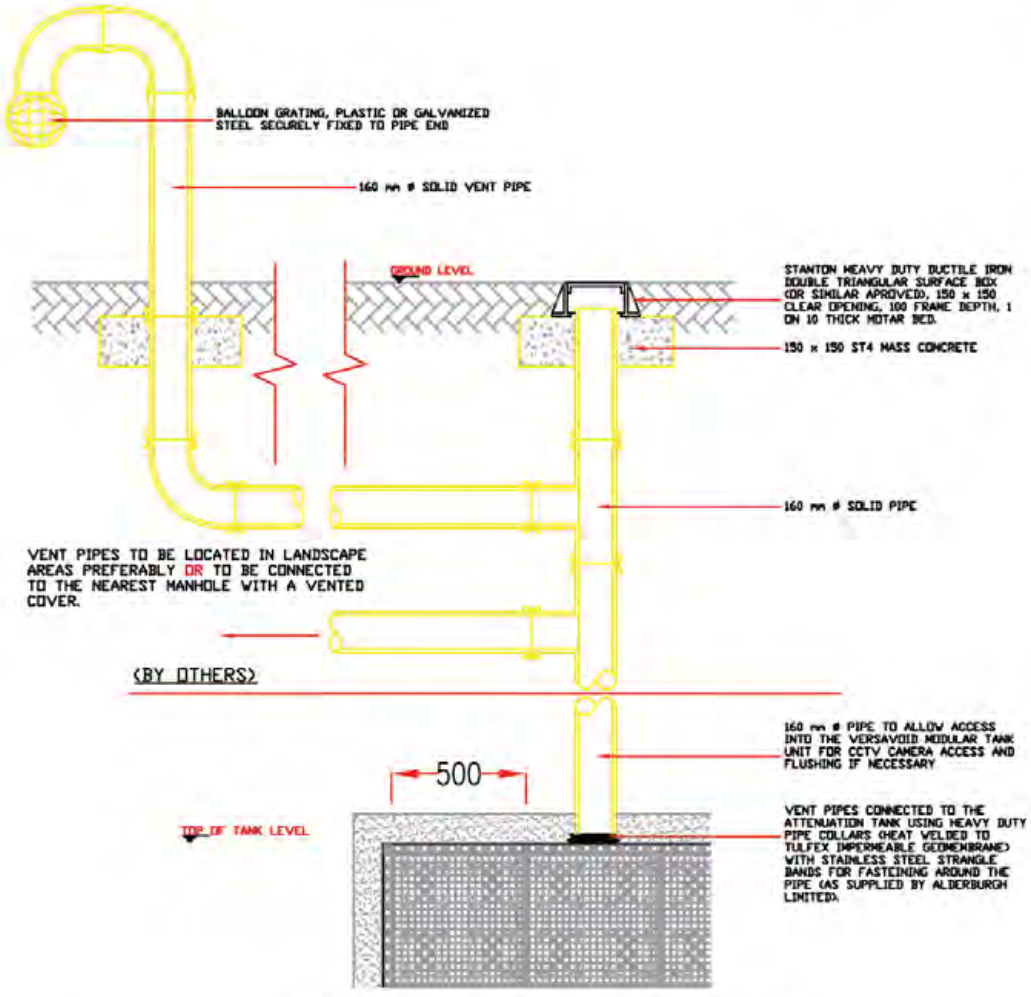
VENT BOX DETAIL
BY OTHERS
(OPTIONAL)

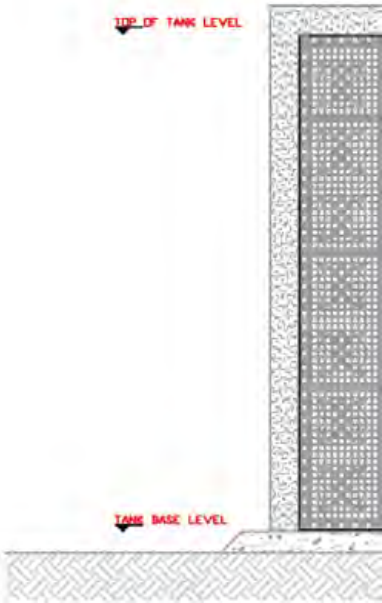
A 3 - 5% CBR HAS BEEN ASSUMED AT SUB-BASE LEVEL. SHOULD THE CBR BE TESTED AND FOUND TO BE LESS THAN 3% THEN THE ENGINEER SHALL BE NOTIFIED. ALSO, ANY SOFT SPOTS FOUND AT SUB-BASE LEVEL SHALL BE REPORTED TO THE ENGINEER



TYPICAL INLET PIPE C

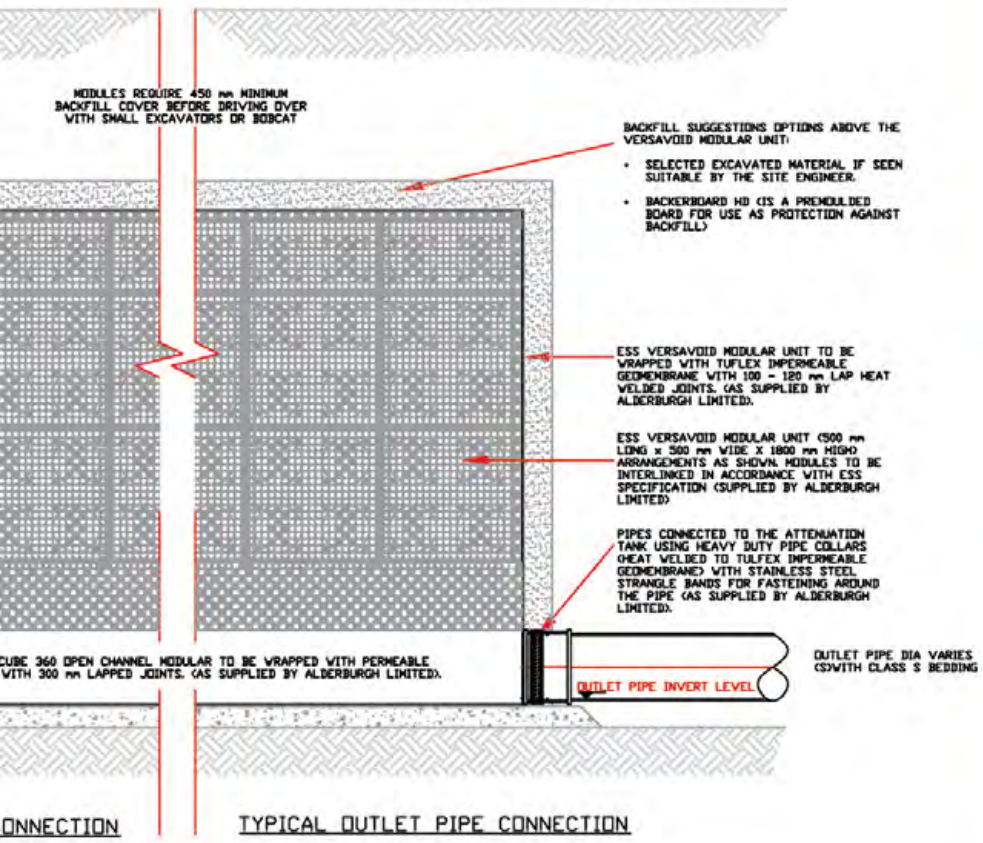
TYPICA





TYPICAL 160ø VENT/ACCESS PIPE CONNECTION

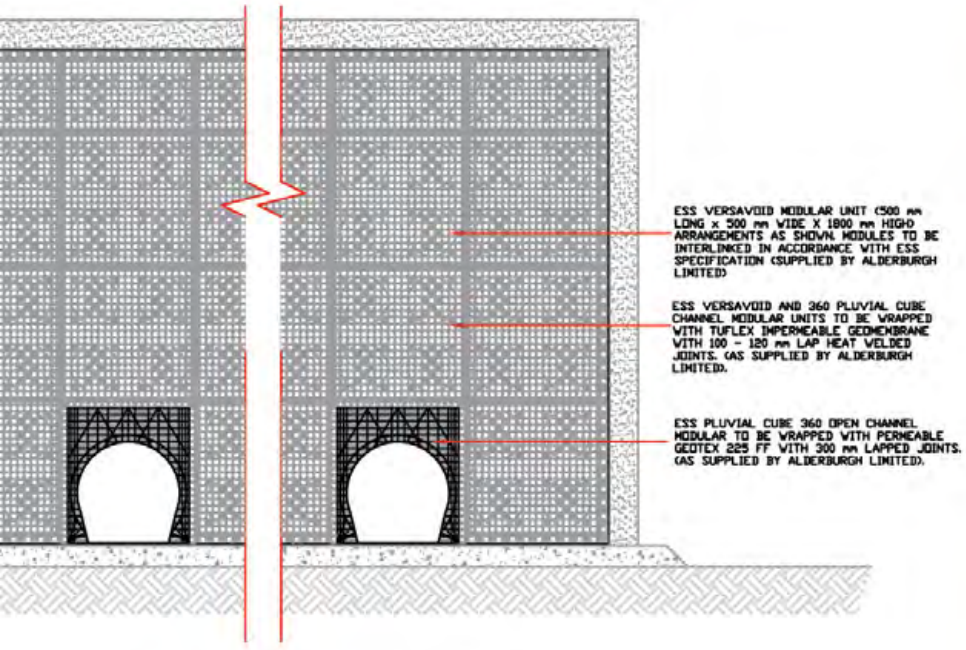
Low Flow



ONNECTION TYPICAL OUTLET PIPE CONNECTION

L DETAILS OF ATTENUATION TANK USING VERSAVOID MODULAR UNITS

THE CONTRACTOR SHALL PROHIBIT THE MOVEMENT OF CONSTRUCTION PLANT ACROSS THE STORAGE TANK AND WHERE NECESSARY PROVIDE ADDITIONAL SUPPORT AND PROTECTION TO THE STRUCTURE, PARTICULARLY POST CONSTRUCTION. TEMPORARY FENCING CAN BE USED TO PROHIBIT TRADE STOCKS, PILLING MATERIALS, HEAVY PLANTS ETC.,



TYPICAL DETAILS OF ATTENUATION TANK USING VERSAVOID WITH 360Ø PLUVIAL CUBE OPEN CHANNEL MODULAR UNITS

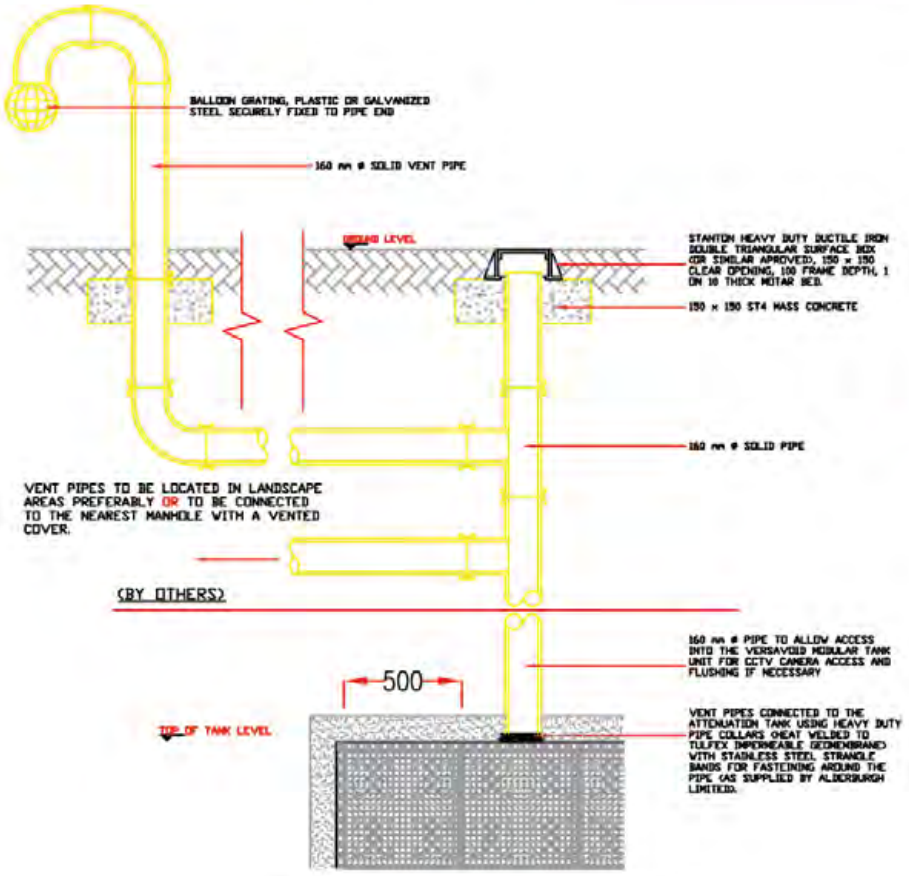






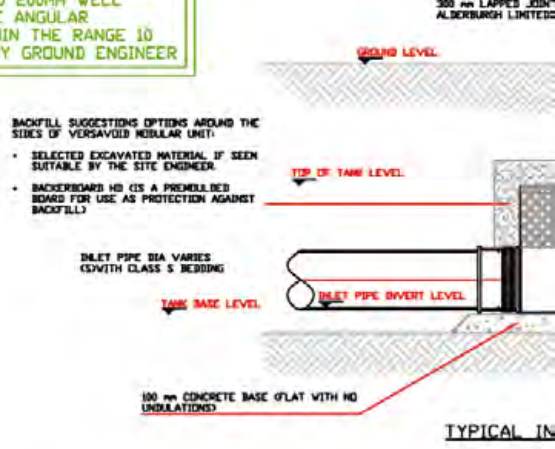
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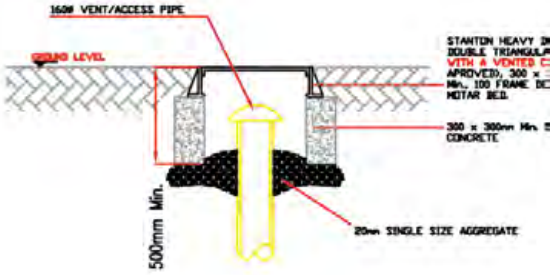


TYPICAL 160 mm ø VENT PIPE CONNECTION

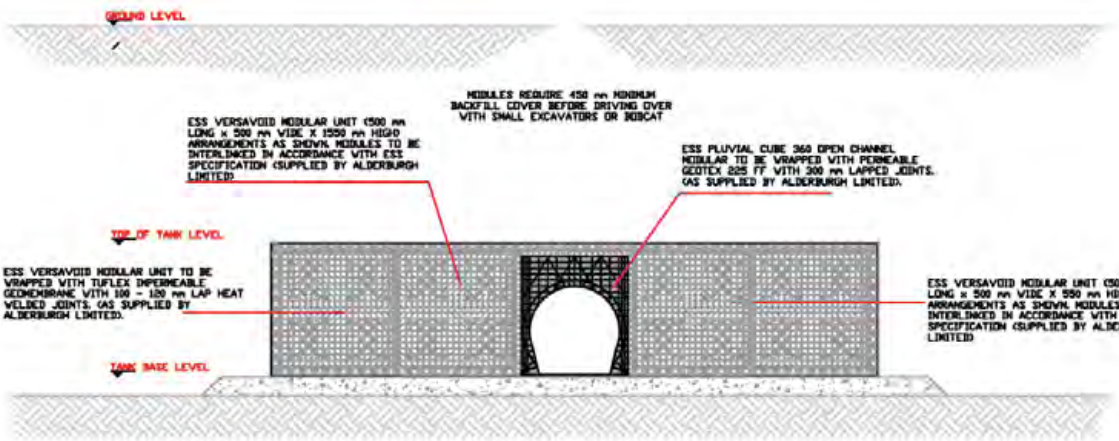
OPTIONAL



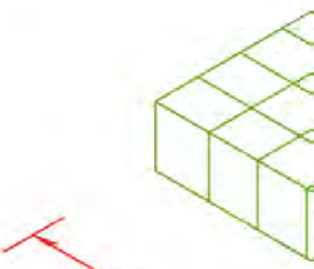
TYPICAL IN



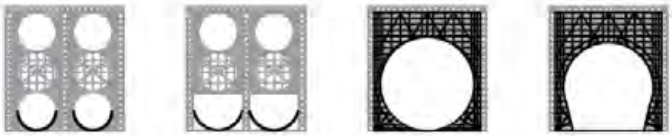
VENT BOX DETAIL
BY OTHERS
(OPTIONAL)



TYPICAL DETAILS OF ATTENUATION TANK USING VERSAVOID WITH 300ø PLUVIAL CUBE CHANNEL MODULAR UNITS



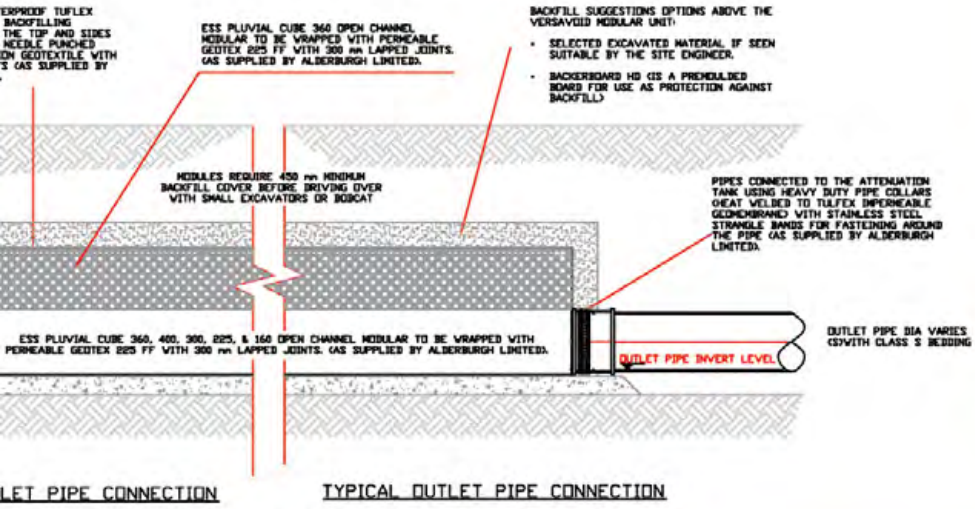
DIAGRAMATIC TANK LAYOU



2No. 160ø 2No. 225ø 400ø 360ø



Low Flow

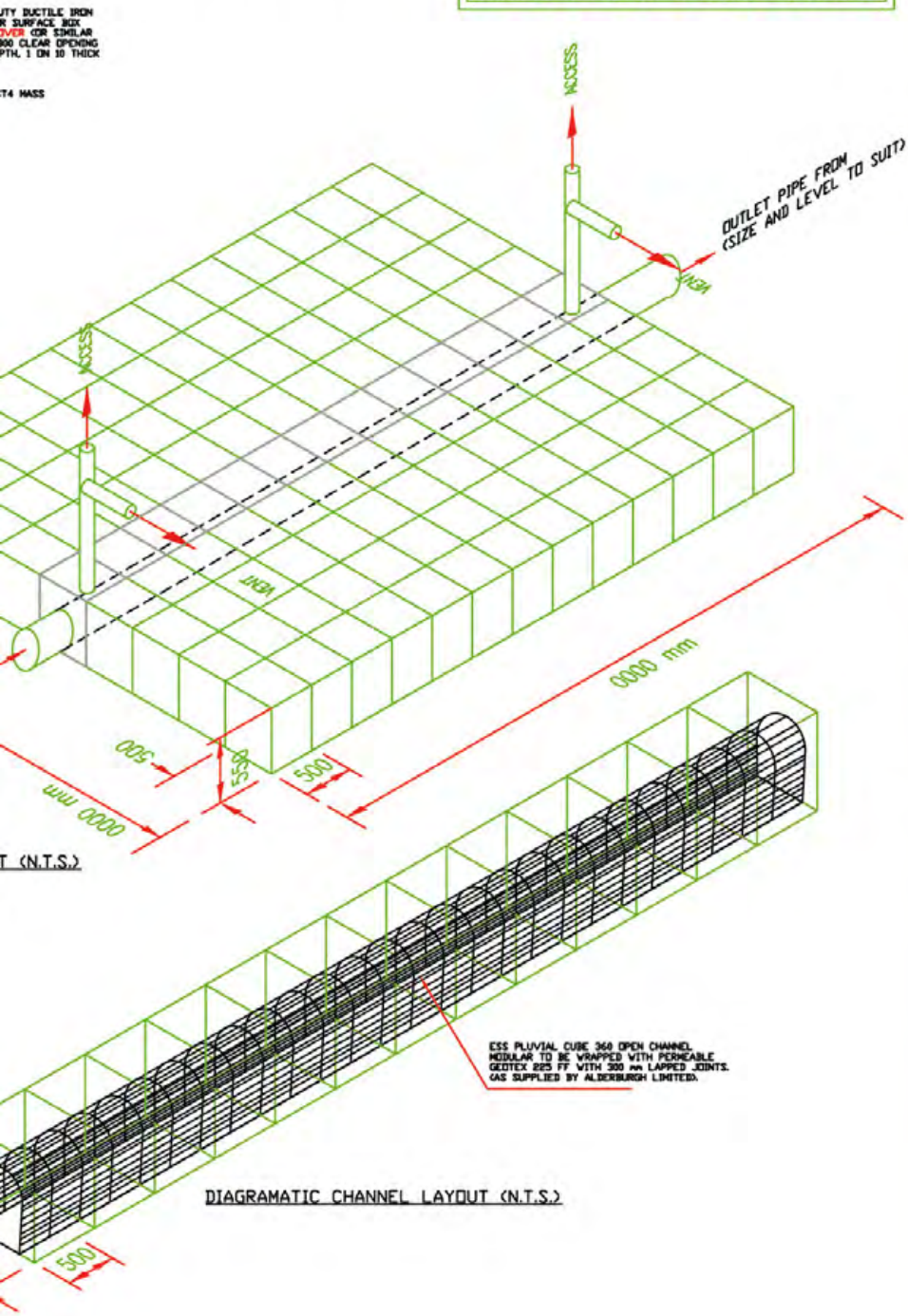


LET PIPE CONNECTION

TYPICAL OUTLET PIPE CONNECTION

TYPICAL DETAILS OF ATTENUATION TANK USING VERSAVOID MODULAR UNITS

INLET/OUTLET PIPES MUST BE SUPPORTED WITH CONCRETE TO PROTECT IT DURING BACKFILLING

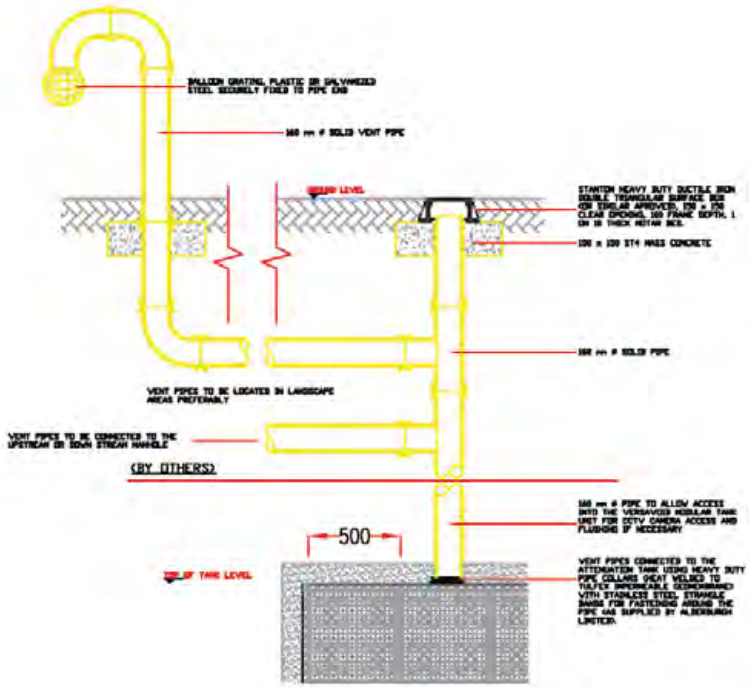


DIAGRAMATIC CHANNEL LAYOUT (N.T.S.)



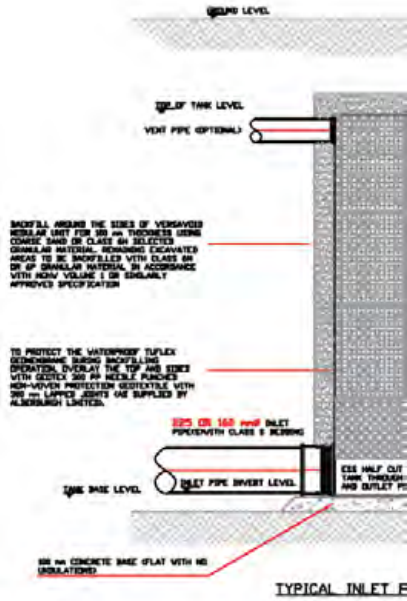






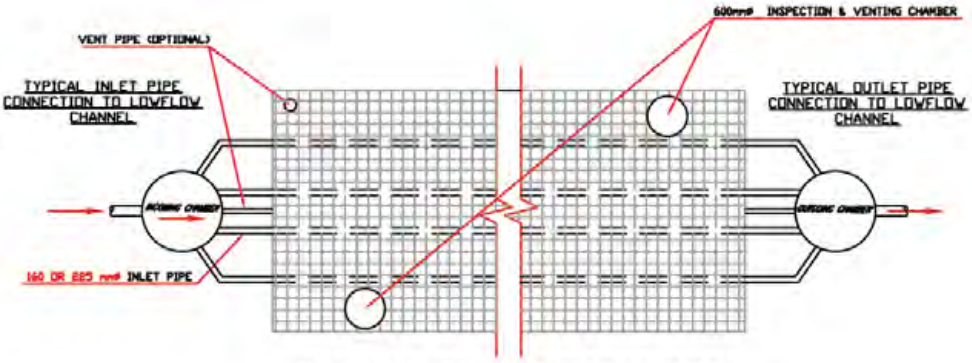
TYPICAL 160 mm ø VENT PIPE CONNECTION

OPTIONAL



TYPICAL INLET P

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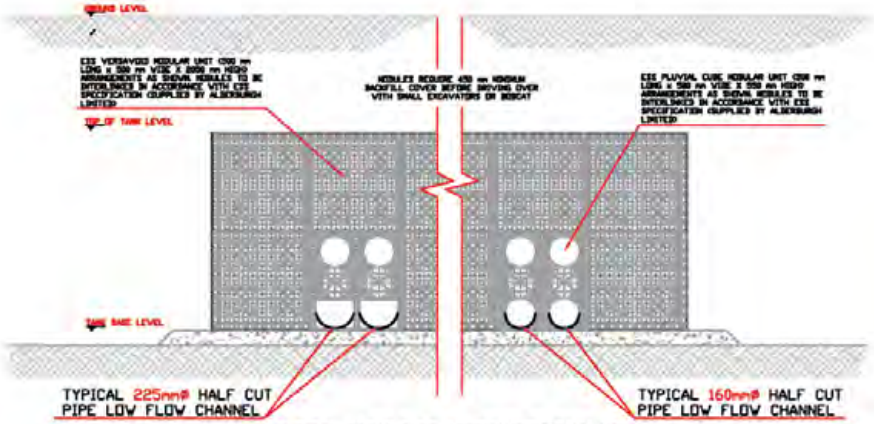


PLAN VIEW OF ATTENUATION TANK SHOWING LOWFLOW CHANNEL AND INLET / OUTLET CONNECTIONS



INLET/OUTLET PIPES MUST BE SUPPORTED WITH CONCRETE TO PROTECT IT DURING BACKFILLING

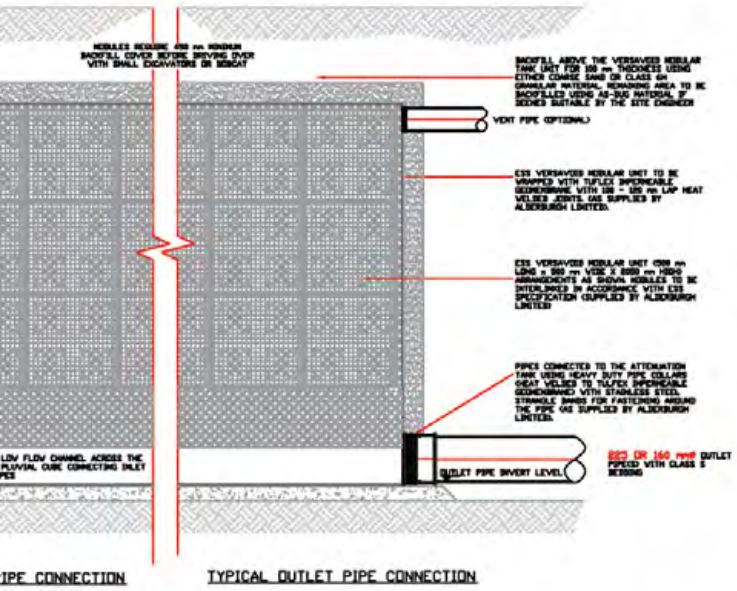
NOTE:
1-CONCRETE SLAB FOR
BE IN TOUCH WITH PL
2-MANHOLE COVER AN
BY OTHERS.



TYPICAL DETAILS OF ATTENUATION TANK USING VERSAVOID MODULAR UNITS

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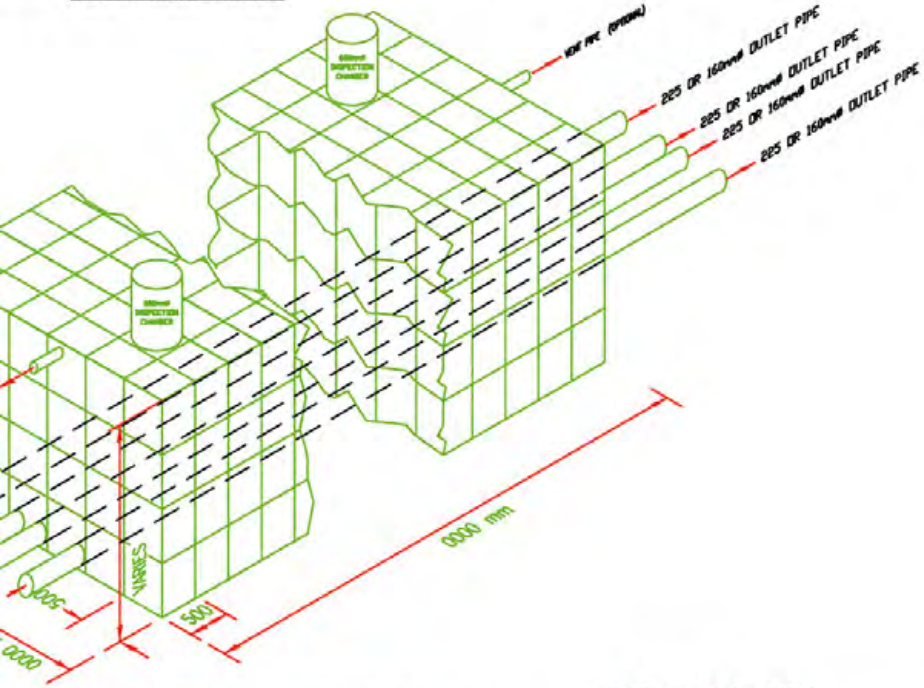
Low Flow



IPE CONNECTION

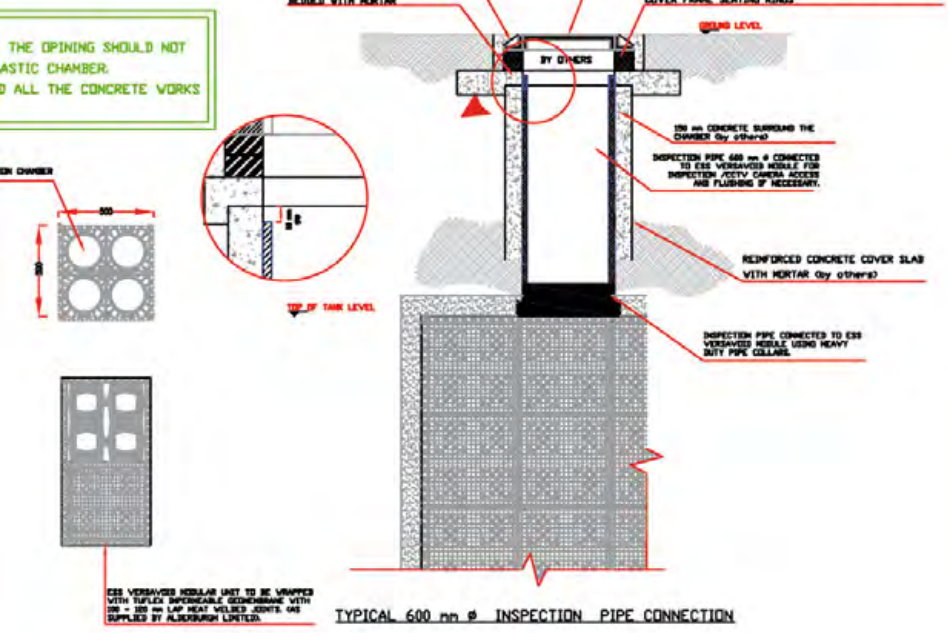
TYPICAL OUTLET PIPE CONNECTION

YPICAL DETAILS OF ATTENUATION TANK USING VERSAVOID MODULAR UNITS



DIAGRAMATIC TANK LAYOUT

THE OPINING SHOULD NOT
ASTIC CHAMBER.
D ALL THE CONCRETE WORKS



TYPICAL 600 mm ø INSPECTION PIPE CONNECTION







- Sustainable Drainage Systems
- Roof Gardens
- Water Recycling
- ECOSOIL - Filtration
- Attenuation
- Flood Protection
- Porous Surfacing
- Solar Power
- Geo-Thermal Systems
- Contaminated Land Remediation



All products are manufactured to the highest quality, being subject to rigid quality control. However, the company cannot control conditions of application and use of its products, thus any warranty, written or implied, is given in good faith for materials only. ESS Ltd will not accept any responsibility for damage or injury arising from storage handling, misapplication or misuse of its products. All transactions are subject to our standard condition of sale, copies of which are available on request.

To find out more about these systems and products please contact us

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