



ALPHA PARK, CHANDLER'S FORD, EASTLEIGH

THE BUILDING MANUAL
(incorporating the Health & Safety File)

ATTENUATION CELLS

Subcontractor Details

Company: Alderburgh Group
Solutions House
Dane Street
Rochdale
OL11 4EZ

Tel: 01706 374 416



Installation Solutions for the Construction Industry

3rd July 2017

Catherine Hardcastle, Sales & Project Manager
SDS O&M Limited
18 Hamilton Way
New Milton, Hampshire
BH25 6TQ

Our ref: RP/10273

Email: Catherine@iagroup.co.uk

Dear Madam

RE: ATTENUATION TANKS, ALPHA PARK, CHANDLERS FORD

Further to your request for the release of relevant data appertaining to the above project, we have pleasure in providing extra information in order for you to compile your Building Manual.

The attenuation tank supplied is constructed from our Pluvial Cube and Pluvial Invicta systems, wrapped in Tuflex geomembrane and Geotex 300PP Protection Fleece. The installation includes pipe collars made from Tuflex geomembrane.

Our reference for the Alpha Park, Chandlers Ford job is RP/10273.

Please find the attached data for your O & M records:

- Pluvial Cube and Pluvial Invicta brochures
- Maintenance & Access brochure
- Tuflex brochure
- Geotex 300PP data sheet
- COSHH data for Geo-cellular tank
- COSHH data for Tuflex membrane
- COSHH data for Geotex membrane
- As built drawings

The manufacturer / supplier of the above materials is Alderburgh Ltd of Rochdale and your contact there is Bob Palmer (bob.palmer@alderburgh.com 01706 374416).

Solutek Environmental Ltd carried out the installation of the attenuation tank and your contact there is Daniel Di Rosa (daniel.dirosa@solutekenvironmental.co.uk 07969 038573).

The scope of the works undertaken by Solutek are outlined below:

- Supply and fix of Tuflex geomembrane and Geotex 300PP protection fleece to encapsulate Pluvial Cube and Pluvial Invicta modules;
- Installation of Pluvial Cube and Pluvial Invicta modules;
- Sealed to all inlets and outlets (pipe collars included);

We are certain that all of this information will suffice but if you require anything else then please contact the undersigned.

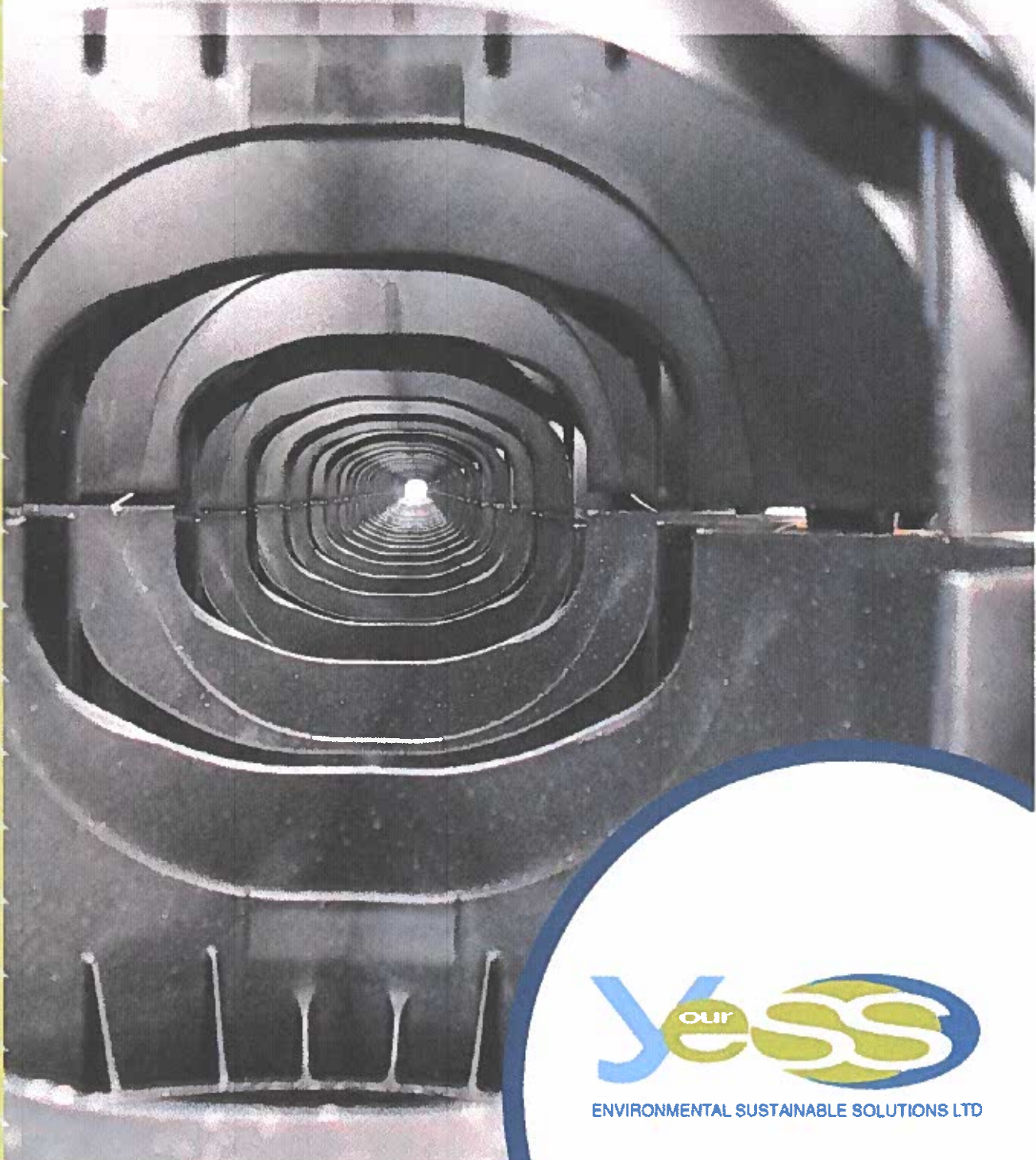
Yours faithfully,

 Daniel Di Rosa
for Solutek Environmental Ltd

Modular Geo-Void Systems

Total Water Management

Maintenance & Access



ENVIRONMENTAL SUSTAINABLE SOLUTIONS LTD

Contents

Maintenance

Pages 2 to 5

Versavoid

Pages 6 to 13

Versavoid & Pluvial Cube

Pages 14 to 17

Pluvial Cube

Pages 18 to 33

Low Flow

Pages 34 to 43

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,

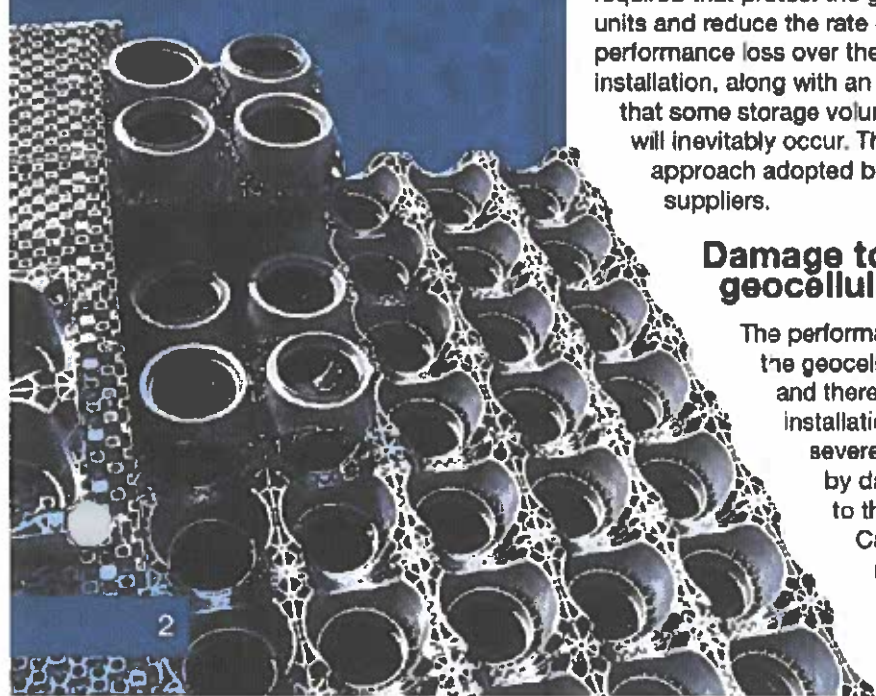
installation, back-filling and protection pre commissioning of the geocellular units. Damaged units should be discarded and replaced before installation.

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 Trees' 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 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.

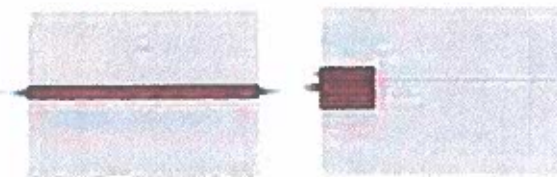
Silt loading levels and potential loss of storage

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	782	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.

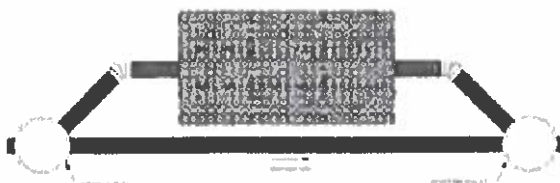
The general approach for siltation control is in the provision of external maintainable elements that prevent some materials entering the installation. An alternative approach is for low flow channels or sediment forebays to be provided. These can be regularly cleaned and maintained, thereby affording 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.

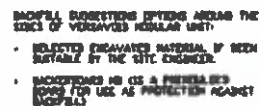
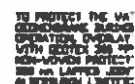
Recommended maintenance schedule

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.



TYPICAL IN-

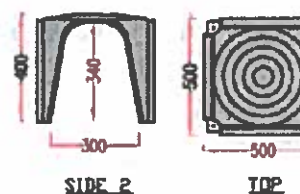
THE CONTRACTOR SHALL PROHIBIT THE MOVEMENT OF CONSTRUCTION PLANT ACROSS THE STORAGE TANKS AND WHERE NECESSARY PROVIDE ADDITIONAL SUPPORT AND PROTECTION TO THE STRUCTURE. PARTICULARLY POST CONSTRUCTION, TEMPORARY FENCING CAN BE USED TO PROHIBIT TRADE STOCKS, FILLING MATERIALS, HEAVY PLANTS ETC.

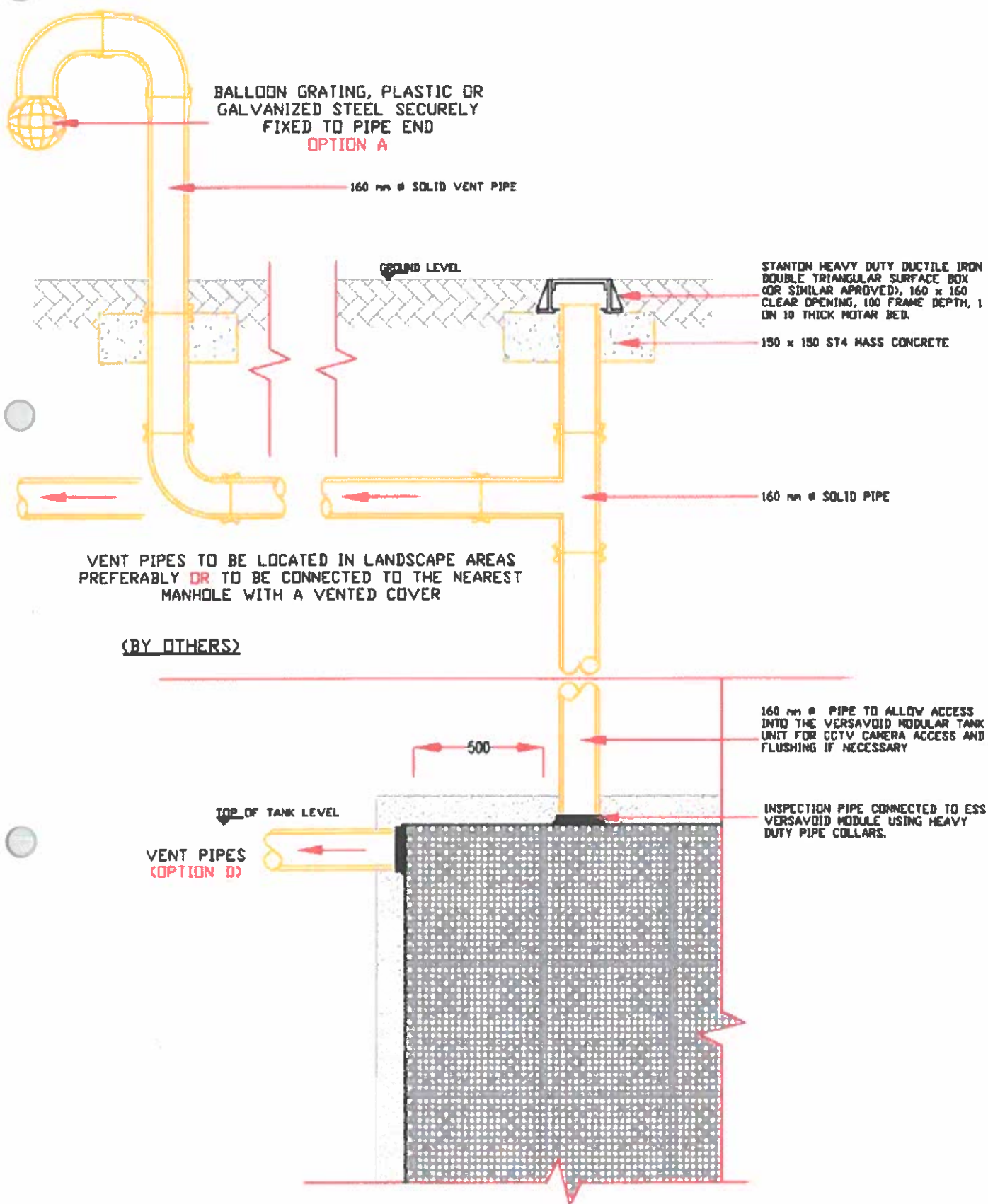
OPTIONAL



DIAGRAMATIC TANK LAYOUT

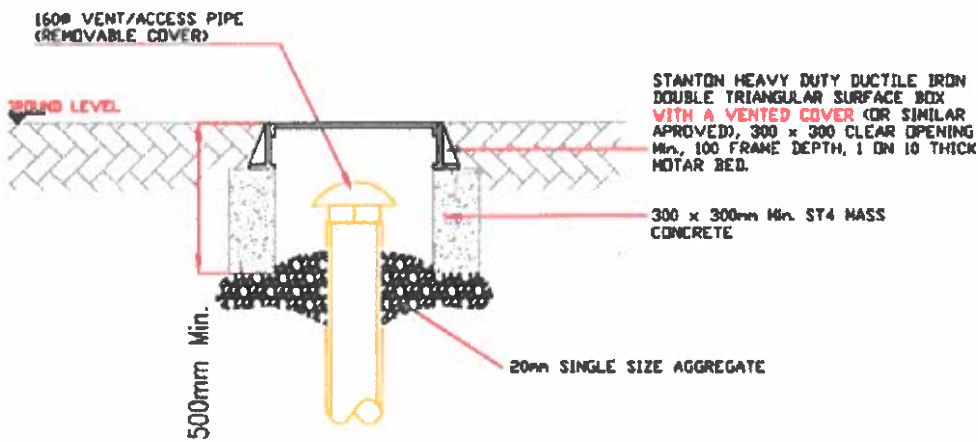
TYPICAL DETAILS OF ATTENUATION TANK USING
VERSADOID WITH 340x300 OPEN CHANNEL
MODULAR UNITS.



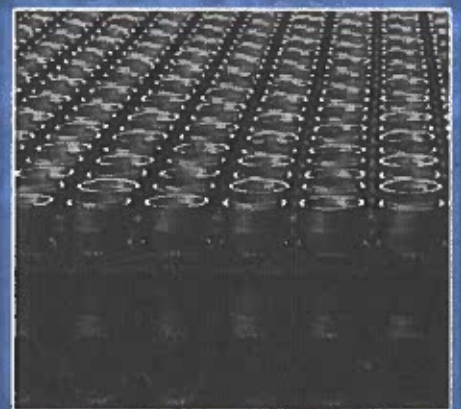
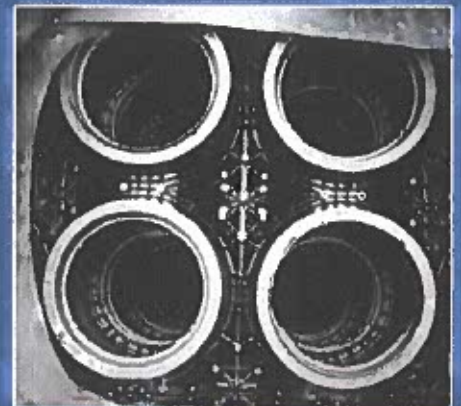
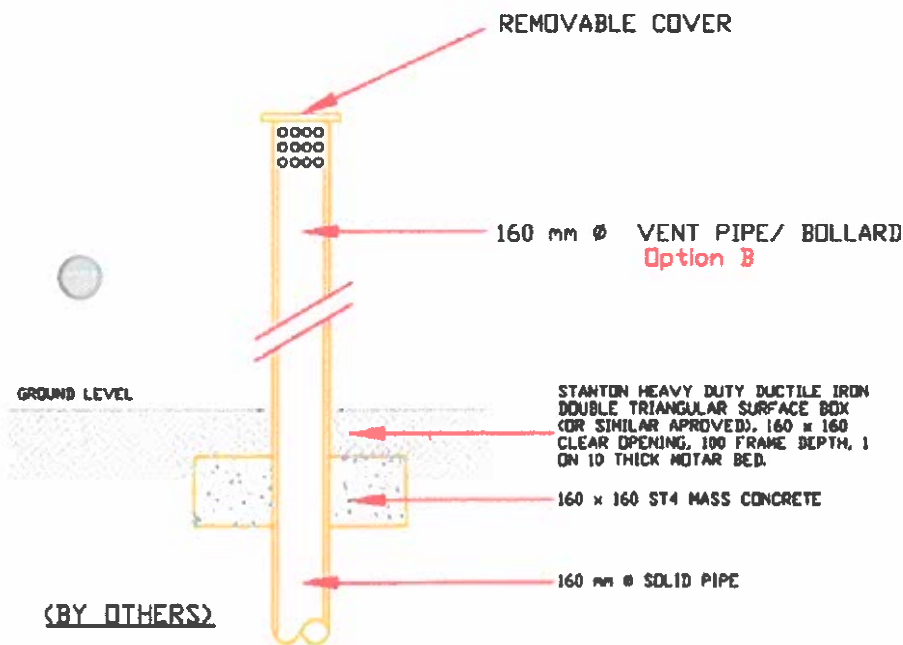


TYPICAL 160Ø VENT/INSPECTION PIPE CONNECTION

Versa Void



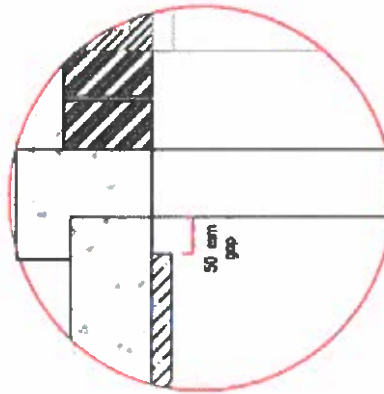
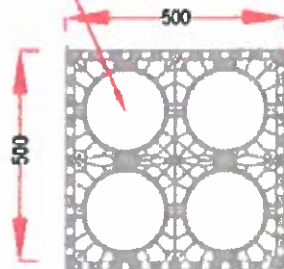
VENT BOX DETAIL
BY OTHERS
Option C



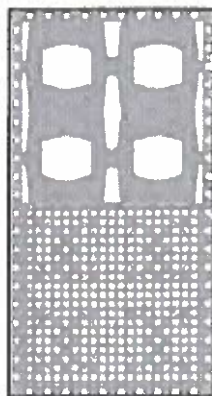
M.H. COVER AND FRAME BEDDED AND
HUNCHED IN 1:3 CEMENT MORTAR

REINFORCED CONCRETE COVER SLAB
BEDDED WITH MORTAR

INSPECTION CHAMBER



TOP OF TANK LEVEL



ESS VERSAVOID MODULAR UNIT TO BE WRAPPED
WITH TUFLEX IMPERMEABLE GEOMEMBRANE WITH
100 - 120 mm LAP HEAT WELDED JOINTS. (AS
SUPPLIED BY ALDERBURGH LIMITED).

TYPICAL 600 mm ϕ INSPECTII

NOTE:

- 1-CONCRETE SLAB FOR THE OPENING SHOULD NOT
BE IN TOUCH WITH PLASTIC CHAMBER.
- 2-MANHOLE COVER AND ALL THE CONCRETE WORKS
BY OTHERS.

COVER AND FRAME TO BE REF. D400 WITH
600 x 600 CLEAR OPENING

ENGINEERING OR SPECIAL PURPOSE CONCRETE BRICKWORK 4
COURSES (MAX), 2 COURSES (MIN) AND/OR PRECAST CONCRETE
COVER FRAME SEATING RINGS

GROUND LEVEL

150 mm CONCRETE SURROUND THE
CHAMBER (by others)

INSPECTION PIPE 600 mm Ø CONNECTED
TO ESS VERSA VOID MODULE FOR
INSPECTION / CCTV CAMERA ACCESS
AND FLUSHING IF NECESSARY.

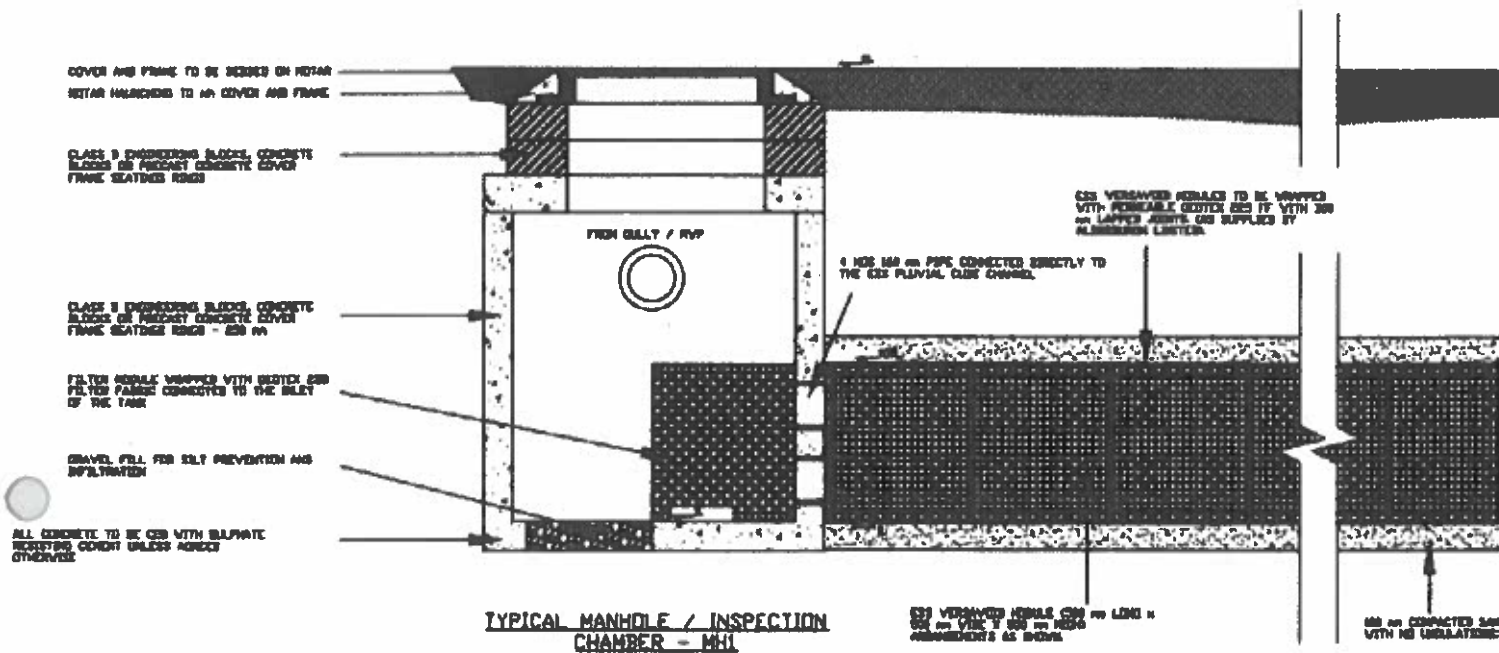
REINFORCED CONCRETE COVER SLAB
WITH MORTAR (by others)

INSPECTION PIPE CONNECTED TO ESS
VERSA VOID MODULE USING HEAVY
DUTY PIPE COLLARS.

IN PIPE CONNECTION

Versa Void

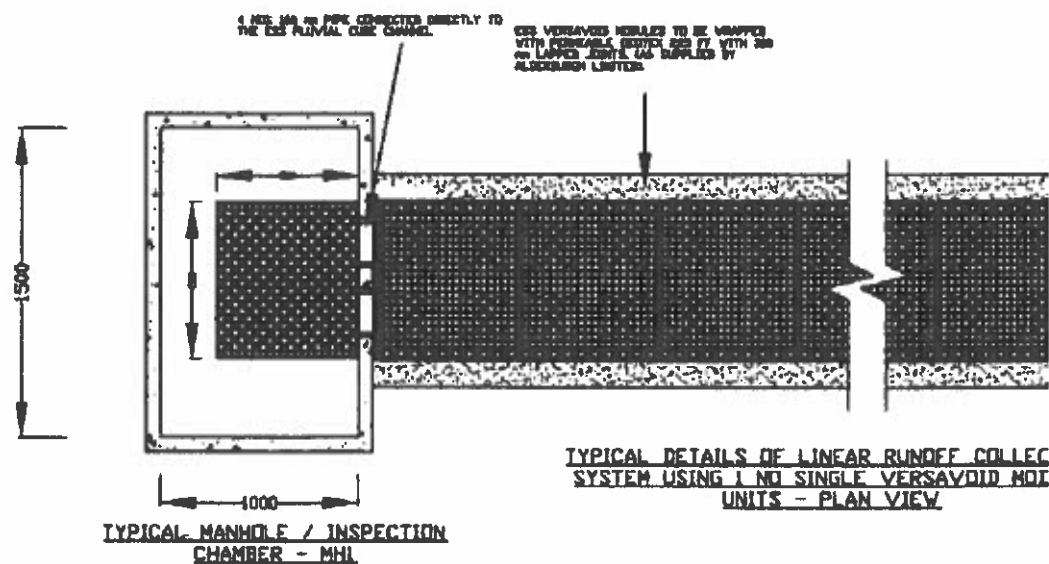




A 3 - 5% CBR HAS BEEN ASSUMED AT SUB-BASE
LEVEL SHOULD THE CBR BE TESTED AND FOUND TO
BE LESS THAN 3% THEN THE ENGINEER SHALL BE
NOTIFIED. ALSO, ANY SOFT SPOTS FOUND AT
SUB-BASE LEVEL SHALL BE REPORTED TO THE
ENGINEER

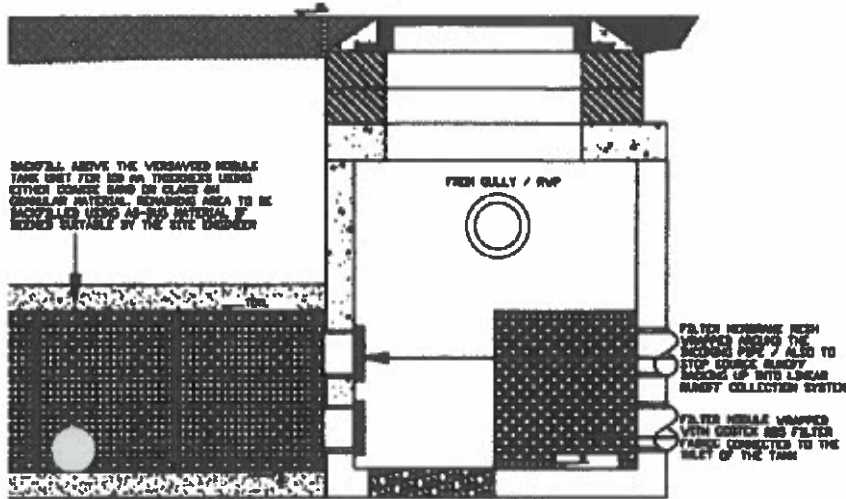
**TYPICAL DETAILS OF LINEAR RUNOFF COLLEC
SYSTEM USING 1 NO SINGLE VERSAVOID MOD
UNITS - CROSS SECTION VIEW**

CROSS SECTIONAL VIEW



PLAN VIEW

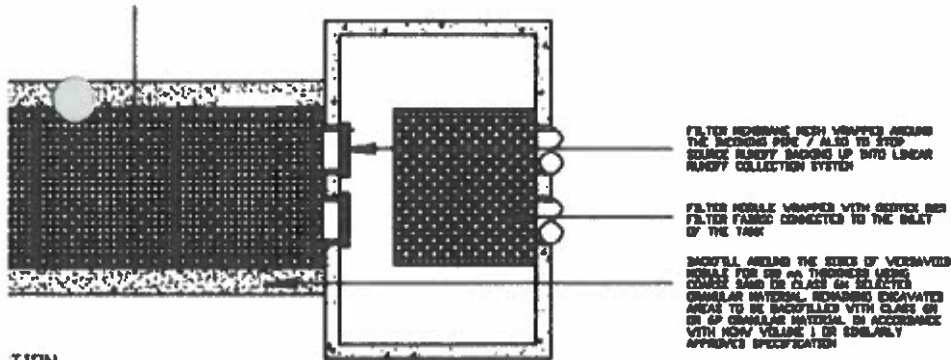
Versa Void



TYPICAL MANHOLE / INSPECTION CHAMBER - MH2

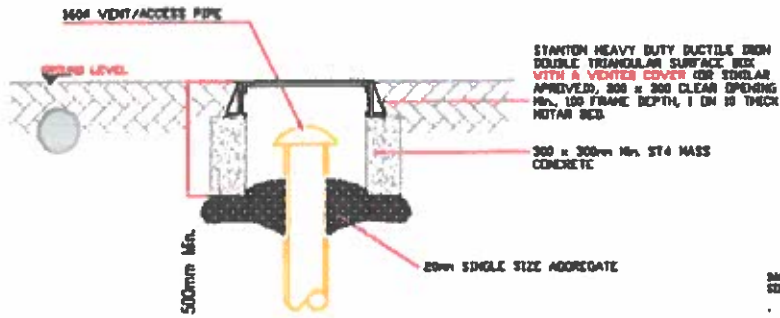
THE CONTRACTOR SHALL PROHIBIT THE MOVEMENT OF CONSTRUCTION PLANT ACROSS THE STORAGE TANK AND WHERE NECESSARY PROVIDE ADDITIONAL SUPPORT AND PROTECTION TO THE STRUCTURE. PARTICULARLY POST CONSTRUCTION TEMPORARY FENCING CAN BE USED TO PROHIBIT TRADE STOCKS, PILING MATERIALS, HEAVY PLANTS ETC.,

SEE VERSA VOID NOBILE (800 MM LONG x 800 MM WIDE x 800 MM HIGH) DIMENSIONS AS SHOWN



TYPICAL MANHOLE / INSPECTION CHAMBER - MH2





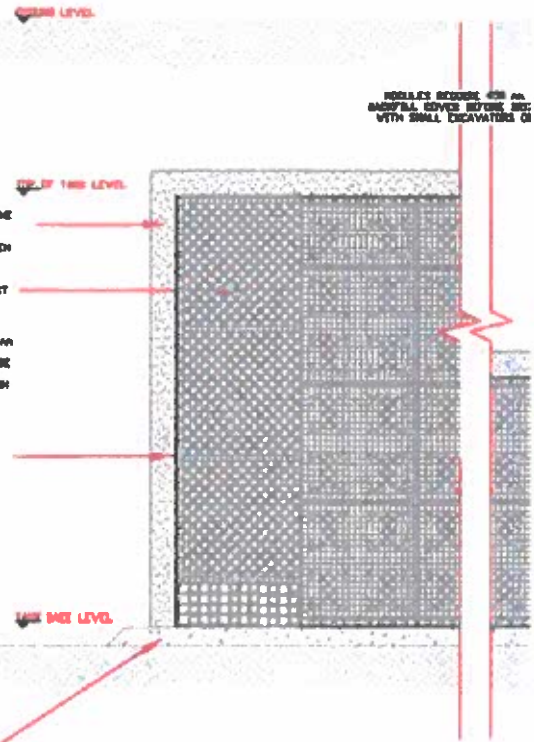
VENT BOX DETAIL BY OTHERS (OPTIONAL)

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, PILING MATERIALS, HEAVY PLANTS ETC.

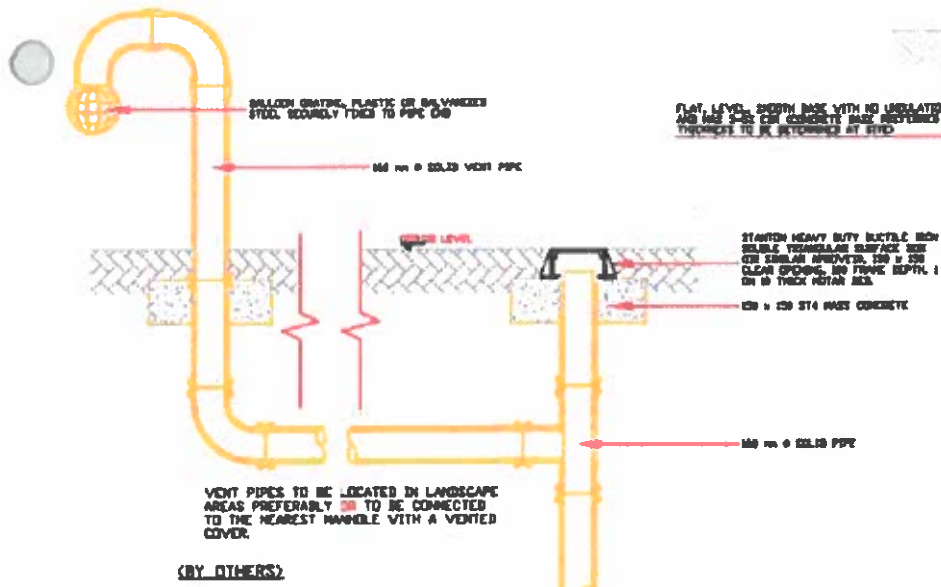
- SMOKELL SUGGESTIONS OPTIONS AROUND THE SIDES OF VERSAVOID MODULAR UNIT
- SELECTED EXCAVATED MATERIAL IF DEEMED SUITABLE BY THE SITE ENGINEER
 - BACKFILLING WITH A PROPOSED BENTONITE FOR USE AS PROTECTION AGAINST SMOKELL

SEE PLUVIAL CUBE MODULAR UNIT (200mm LONG x 300mm WIDE x 100mm HIGH) APPROVED AS SHOWN MODULAR TO BE BUILT IN ACCORDANCE WITH C33 SPECIFICATION SUPPLIED BY ALBION LINTAS

TO PROTECT THE WATERPROOF TUFLEX MEMBRANE DURING MODULAR OPERATION, OVERLAY THE TOP AND SIDES WITH 200mm PP FLEXIBLE PAVEMENT NON-MOVING PROTECTION SCOTCHTILE WITH 200mm LAYERS JOINTS ARE SUPPLIED BY ALBION LINTAS

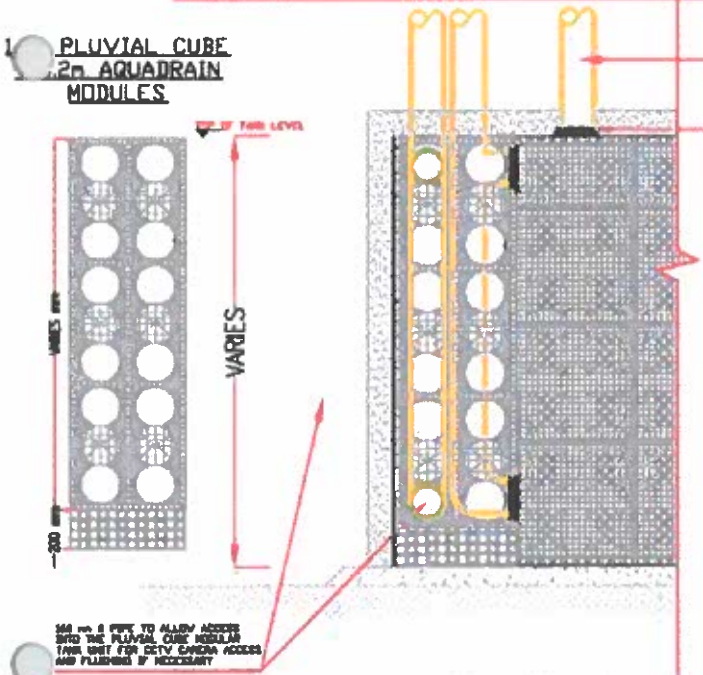


TYPICAL DETAILS OF AFTER-VERSAVOID AND PLUVIAL CUBE



AQUADRAIN MODULE

VERSAVOID MODULE



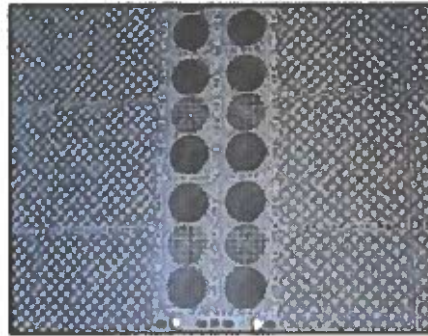
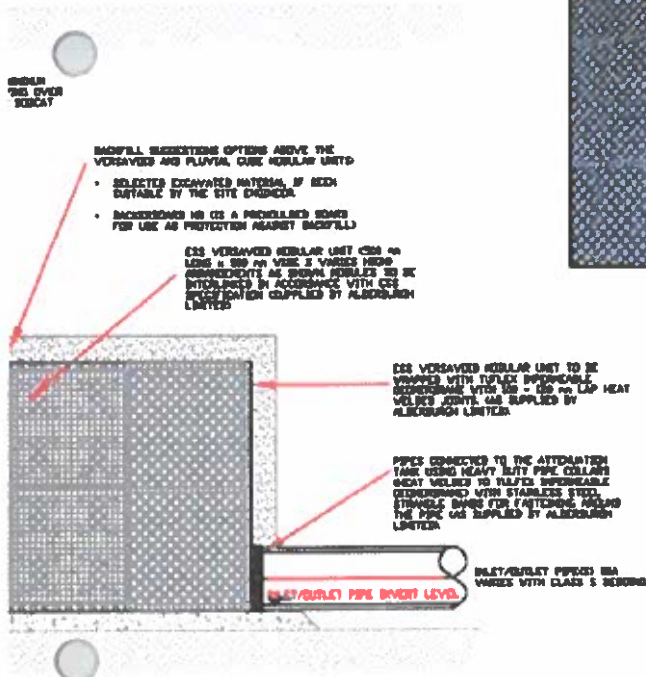
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- 2-MANHOLE COVER AND ALL THE CONCRETE WORKS BY OTHERS.

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SEE VERSAVOID MODULAR UNIT WITH TUFLEX IMPERMEABLE 100 - 150mm LAY HEAT VCL SUPPLIED BY ALBION LINTAS

Versa Void & Pluvial Cube

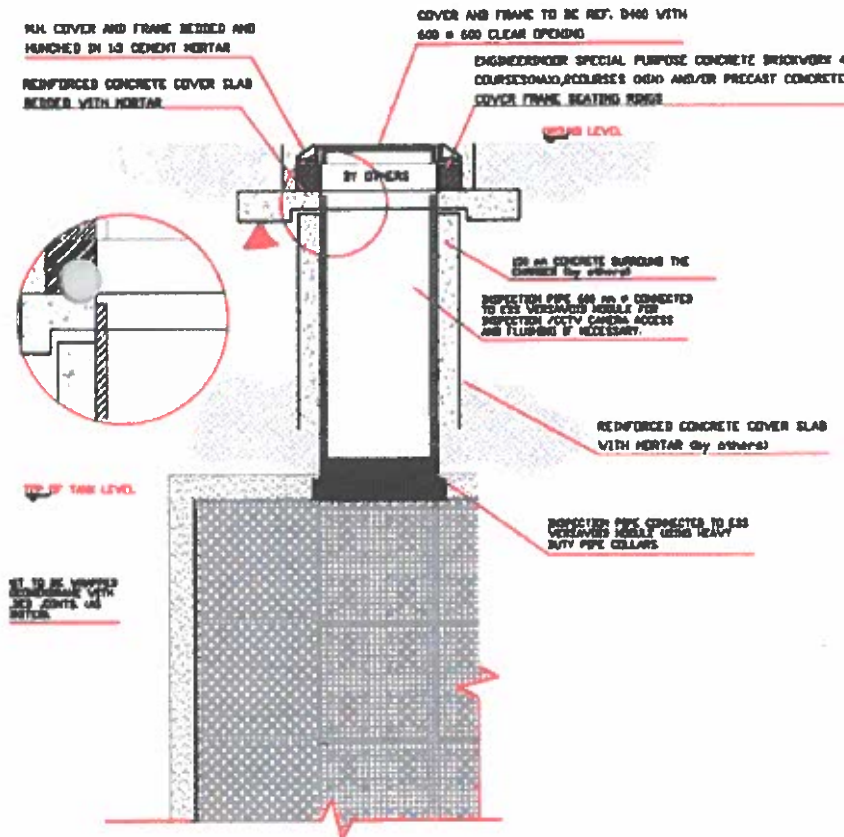


PLUVIAL CUBE
MODULE

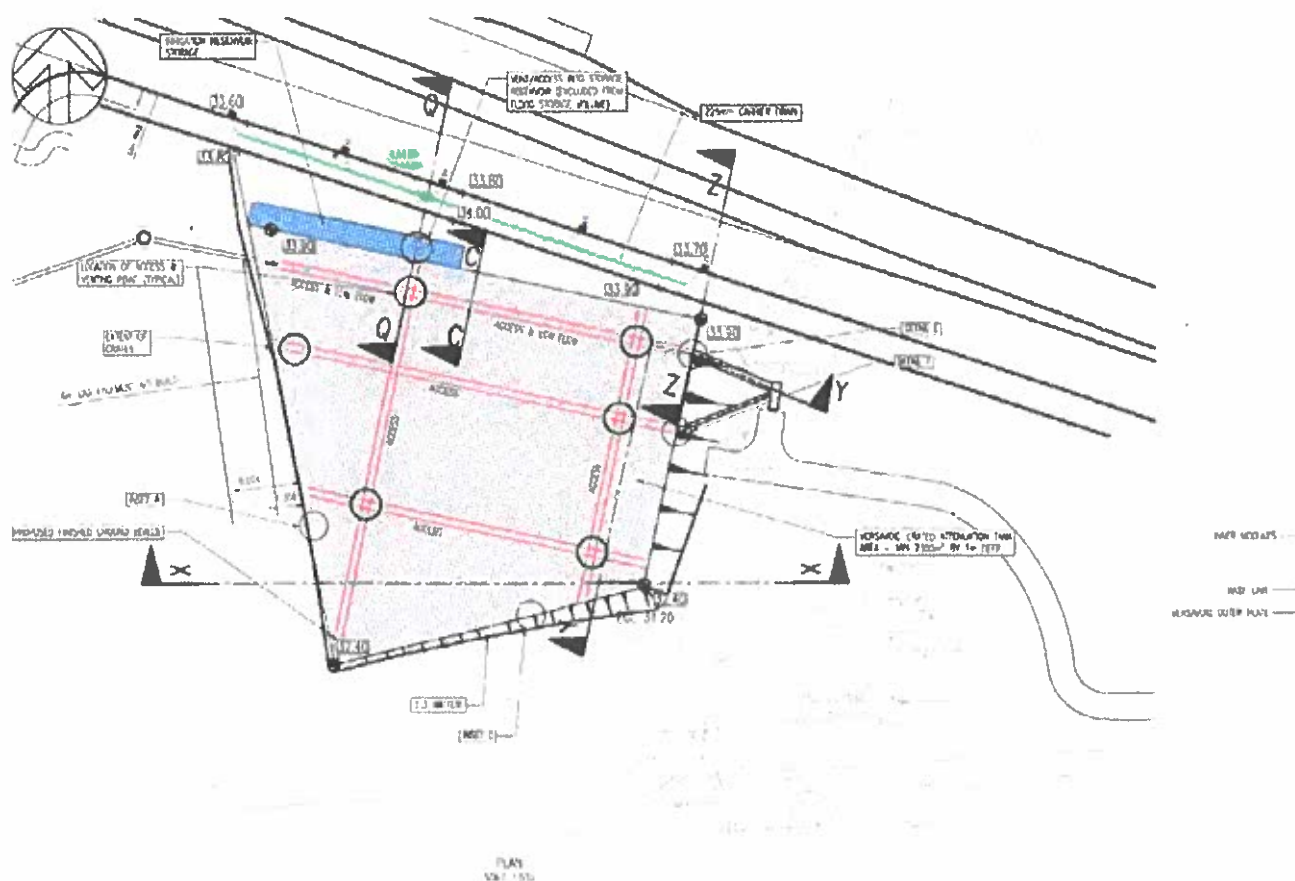
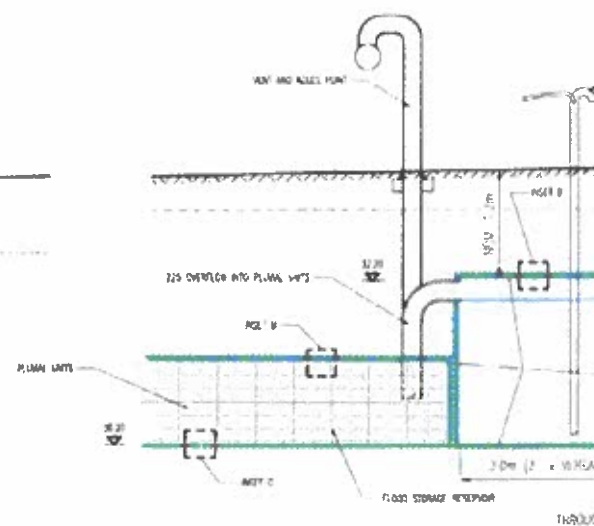
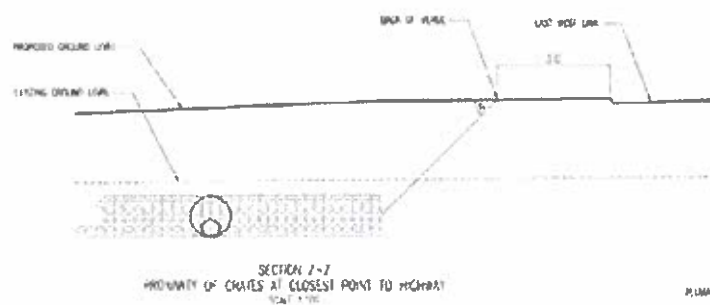
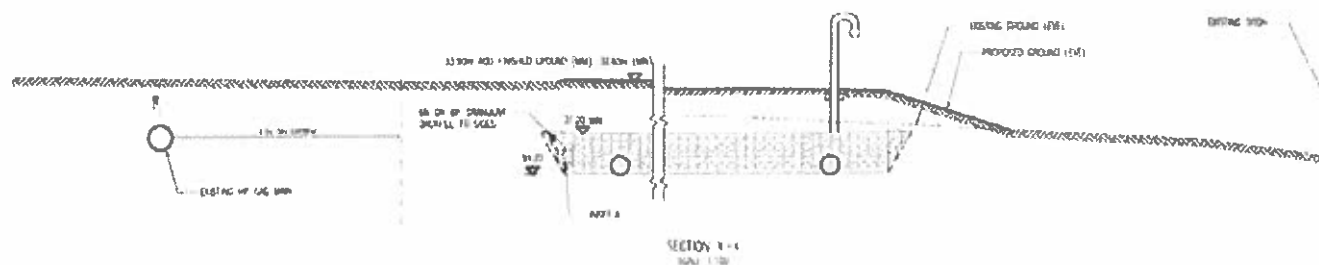
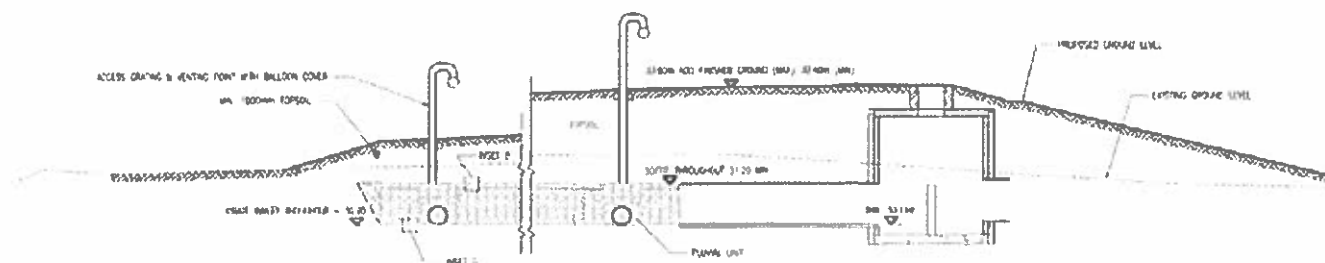
TYPICAL INLET/OUTLET PIPE CONNECTION

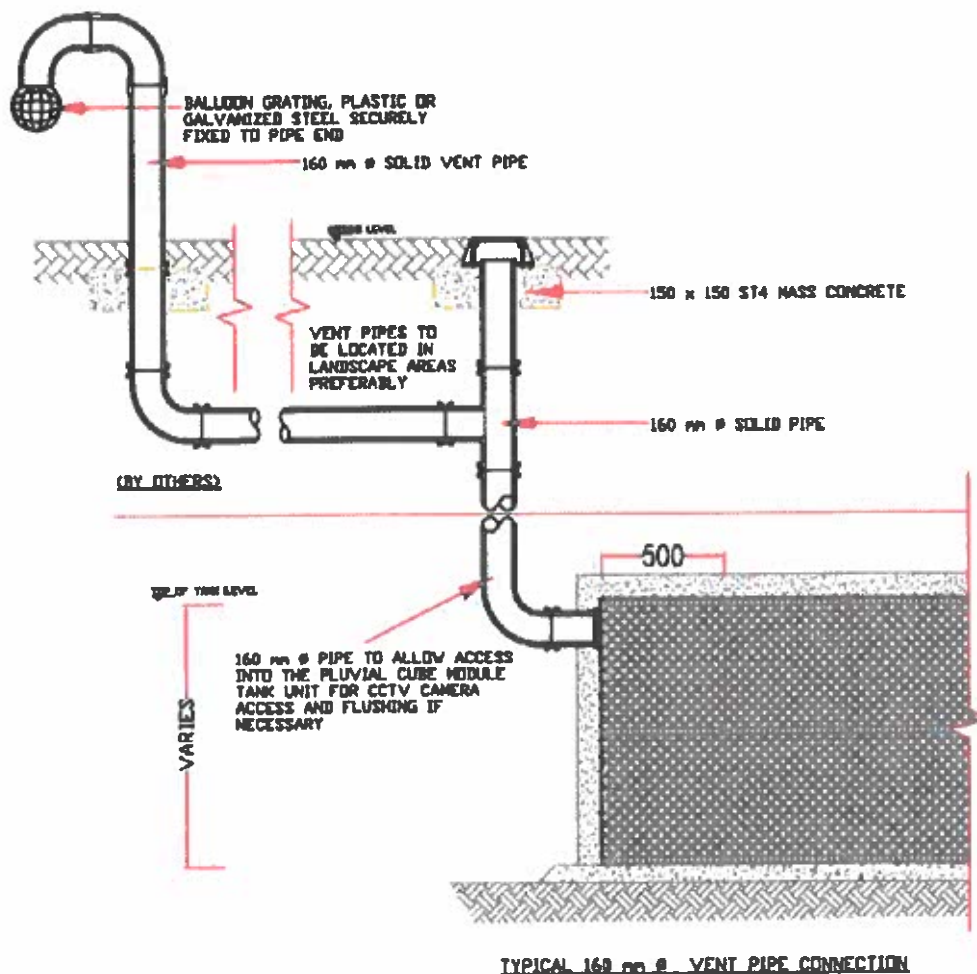
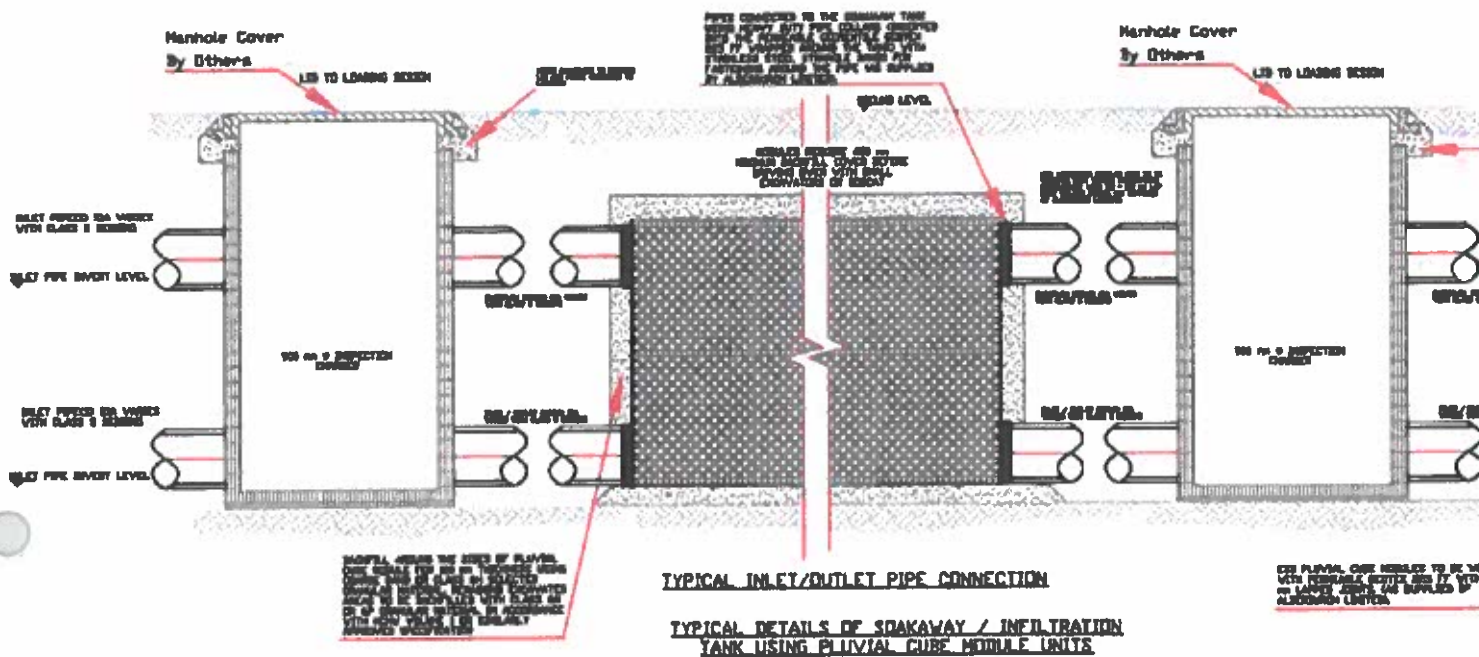
WATER TANK USING
VIBR MODULAR UNITS

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



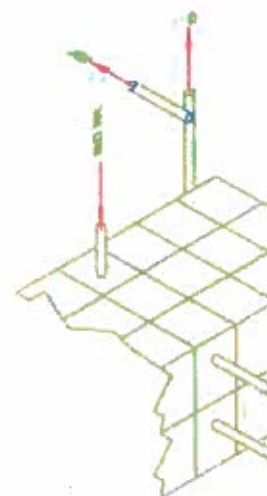
TYPICAL 600 mm Ø INSPECTION PIPE CONNECTION





A 3 - 5X C
LEVEL SHO
BE LESS T
NOTIFIED A
SUB-BASE L
ENGINEER

THE CONTRACTOR SHALL PROHIBIT THE
OF CONSTRUCTION PLANT ACROSS THE
TANK AND WHERE NECESSARY PROVIDE
SUPPORT AND PROTECTION TO THE STRU
PARTICULARLY POST CONSTRUCTION TEN
FENCING CAN BE USED TO PROHIBIT TRA
STOCKS, PILING MATERIALS, HEAVY PL



900x300x150 HALF
BATTERED PRECAST
CONCRETE KERB
(HYDRAULICALLY PRESSED)

10mm THICK CLASS 1
MORTAR BED

CONCRETE BACKING
GRADE SRC 20

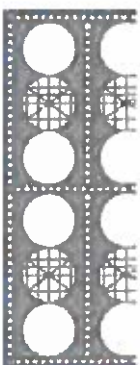
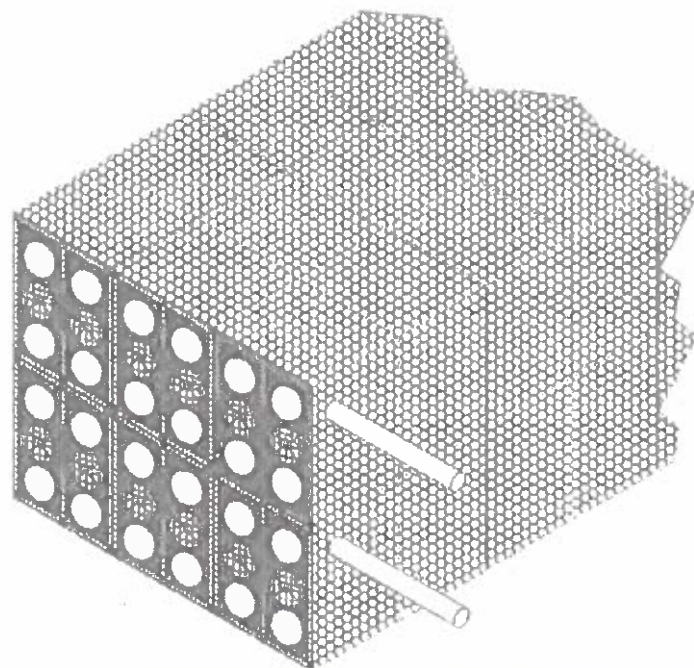
MINI 1:50 SLOPE

300 mm FILTER MEDIA

ESS PLUVIAL CUBE MODULAR UNIT (500 mm
LONG x 500 mm WIDE x 1075 mm HIGH)
ARRANGEMENTS AS SHOWN. MODULES TO BE
INTERLINKED IN ACCORDANCE WITH ESS
SPECIFICATION (SUPPLIED BY ALDERBURGH
LIMITED)

ESS PLUVIAL CUBE MODULAR UNIT TO BE
WRAPPED WITH PERMEABLE GEOTEX 225 FF
WITH 300 mm LAPPED JOINTS. (AS SUPPLIED
BY ALDERBURGH LIMITED).

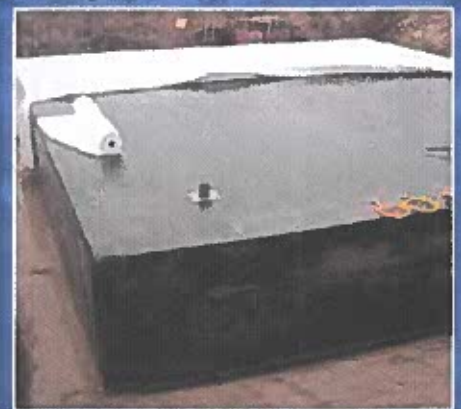
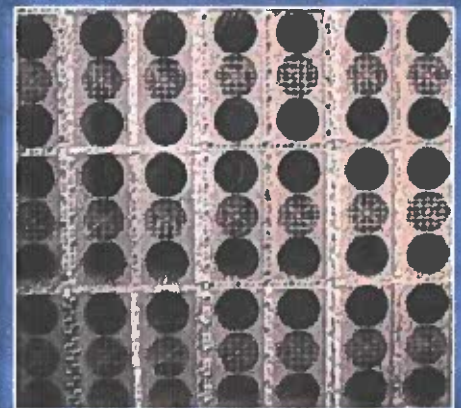
OPTION 1 INLET FROM THE TOP



OPTION 2

DIAGRAMATIC TANK LAYOUT

Pluvial Cube



TO BS EN 124 CLASS D400

150mm THICK PRECAST
CONCRETE COVER SLAB

ROAD SECTION

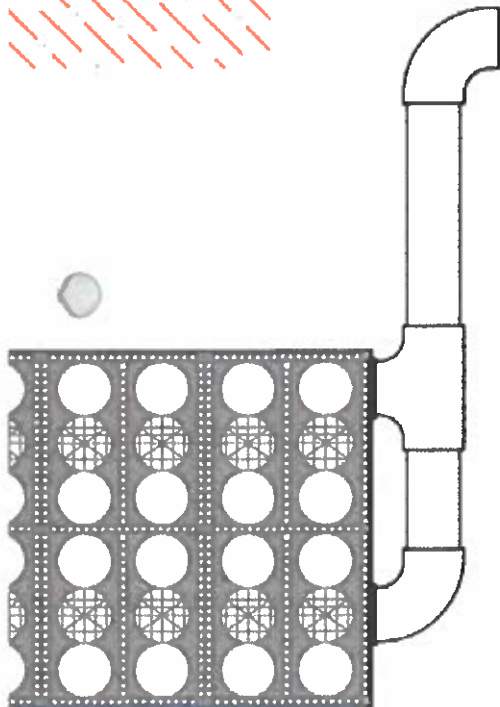
CONCRETE BACKING

PRECAST CONCRETE
BRICKS (SRC 30/20)
WITH CEMENT MORTAR
BEDDING BETWEEN EACH
COURSE. ALL AS APPROVED
BY THE ENGINEER

GRADE OPC 30 PRECAST
CONCRETE GULLY POT
TO BS 5911

150mm THICK CONCRETE
BED AND SURROUND SRC 20

SWP

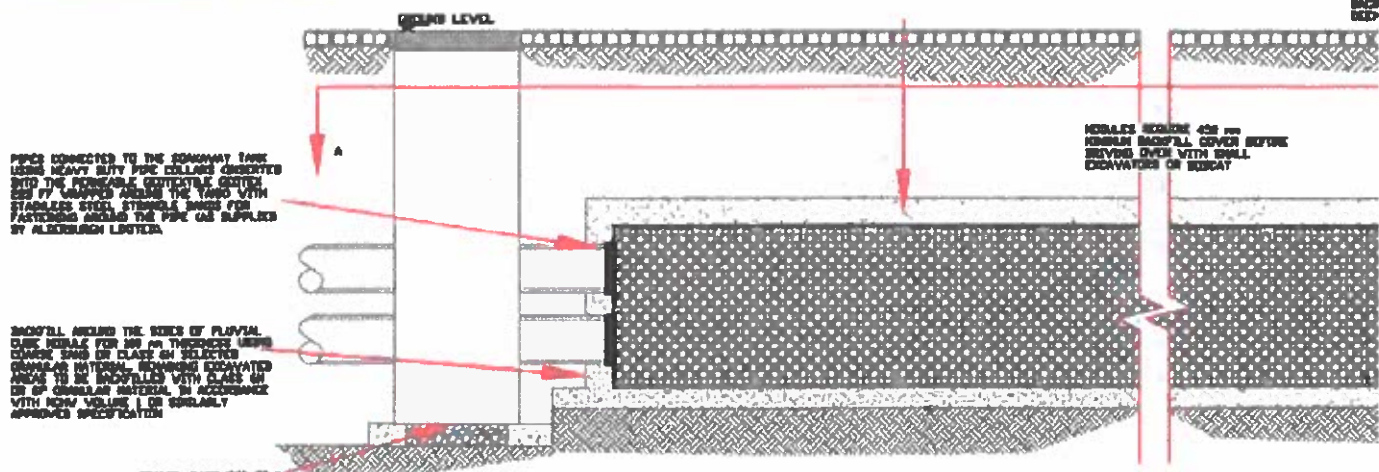


1.1 INLET FROM THE SIDE

THE CONTRACTOR SHALL PREVENT THE REVERSE OF CONSTRUCTION PLANT ACROSS THE STORAGE HOLE AND WHERE NECESSARY PROVIDE ADDITIONAL SUPPORT AND PROTECTION TO THE STRUCTURE. PARTICULARLY POST CONSTRUCTION, TEMPORARY FENCING CAN BE USED TO PREVENT TRUCKS, STOCKS, FILLING MATERIALS, HEAVY PLANTS ETC.

CRS PLUVIAL CURB MODULES TO BE WRAPPED WITH FLEXIBLE DUCTEX 225 FT WITH 200 MM LAPPED JOINTS. GAS SUPPLIED BY ALBIONHUR LIMITED.

BACK FILL
200 MM
LAYER
200 MM
LAYER
200 MM
LAYER



**TYPICAL MANHOLE / INSPECTION CHAMBER
(TO ENGINEERS SPECIFICATION)**

TYPICAL DETAILS OF LINEAR RUNOFF COLLEC SYSTEM USING PLUVIAL CURB MODULE UNIT

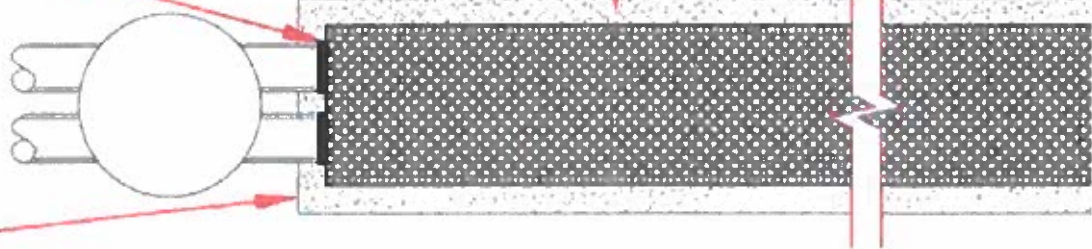
CROSS SECTION

PIPES CONNECTED TO THE ROADWAY TAKE USING HEAVY DUTY PIPE COLLARS INSERTED WITH THE FLEXIBLE DUCTEX 225 FT WRAPPED AROUND THE TAKE WITH STAINLESS STEEL STRAPLES BARS FOR FASTENING AROUND THE PIPE GAS SUPPLIED BY ALBIONHUR LIMITED.

CRS PLUVIAL CURB MODULES TO BE WRAPPED WITH FLEXIBLE DUCTEX 225 FT WITH 200 MM LAPPED JOINTS. GAS SUPPLIED BY ALBIONHUR LIMITED.

BACK FILL
200 MM
LAYER
200 MM
LAYER
200 MM
LAYER

SHOULDER AROUND THE SIDES OF PLUVIAL CURB MODULE FOR 200 MM THICKNESS USING COARSE SAND OR GRAVEL OR SELECTED GRANULAR MATERIAL. REMAINING EXCAVATED AREA TO BE BACKFILLED WITH CLASS 6H OR 6P GRANULAR MATERIAL IN ACCORDANCE WITH NEW VOLUME 1 OR SIMILARLY APPROVED SPECIFICATION.



**TYPICAL MANHOLE / INSPECTION CHAMBER
(TO ENGINEERS SPECIFICATION)**

TYPICAL DETAILS OF LINEAR RUNOFF COLLEC SYSTEM USING PLUVIAL CURB MODULE UNIT

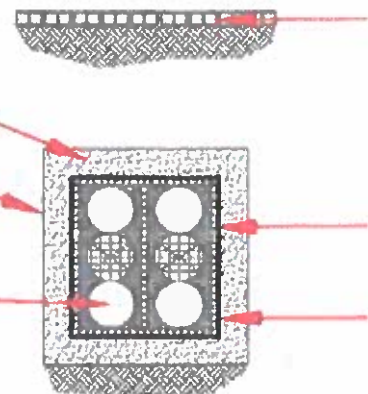
SECTION VIEW A - A (PLAN)

A 3' x 3' CH HAS BEEN ASSIGNED AT SUB-BASE LEVEL. SHOULD THE CAR BE TESTED AND FOUND TO BE LEAKY THEN THE ENGINEER SHALL BE NOTIFIED. ALSO, ANY RPT. SPOTS FOUND AT SUB-BASE LEVEL SHALL BE REPORTED TO THE ENGINEER.

BACKFILL ABOVE THE PLUVIAL CURB MODULE TAKE UNIT FOR 200 MM THICKNESS USING EITHER COARSE SAND OR CLASS 6H GRANULAR MATERIAL. REMAINING AREA TO BE BACKFILLED USING 6P-200 MATERIAL IF SITES SUITABLE BY THE SITE ENGINEER.

SHOULDER AROUND THE SIDES OF PLUVIAL CURB MODULE FOR 200 MM THICKNESS USING COARSE SAND OR CLASS 6H GRANULAR MATERIAL. REMAINING EXCAVATED AREA TO BE BACKFILLED WITH CLASS 6H OR 6P GRANULAR MATERIAL IN ACCORDANCE WITH NEW VOLUME 1 OR SIMILARLY APPROVED SPECIFICATION.

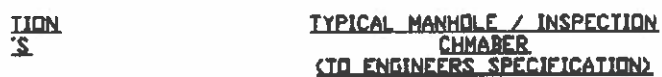
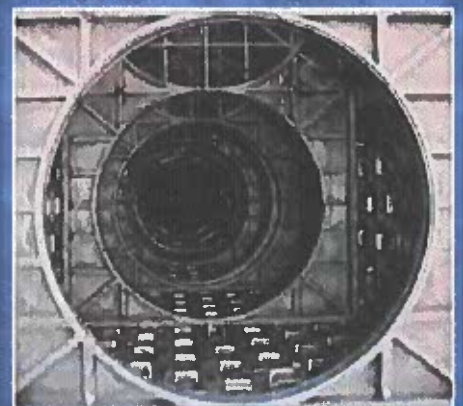
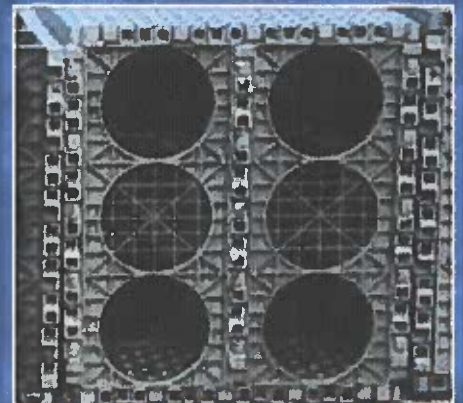
PIPE CONNECTED TO MANHOLE FOR DISPECTION IF NECESSARY



TYPICAL DETAILS OF LINEAR RUNOFF COLLEC SYSTEM USING PLUVIAL CURB MODULE UNIT

SIDE VIEW

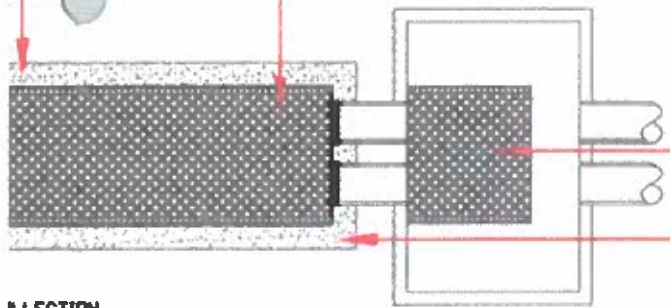
A photograph of a large industrial shredder machine. The machine has a heavy metal frame and multiple horizontal rollers. A large roll of orange material, likely a type of geotextile or fabric, is being fed into the machine from the right side. The machine is mounted on a concrete base.



Pluvial Cube

1. PLUVIAL CUBE
FOR USE IN
COLLECTING
PRECIPITATION
AT THE SITE

2. PLUVIAL CUBE SHOULD BE 100 IN LONG &
100 IN WIDE & 100 IN HIGH
UNLESS OTHERWISE SPECIFIED. IT SHOULD BE
CONSTRUCTED AS A TIGHT, WEATHER-RESISTANT
WITH PLASTIC PROPERTY CABLE TIES.



3. FILTER SHOULD BE WRAPPED WITH GEOTEXTILE AND
1/2-INCH FABRIC CONNECTED TO THE INLET
OF THE TANK

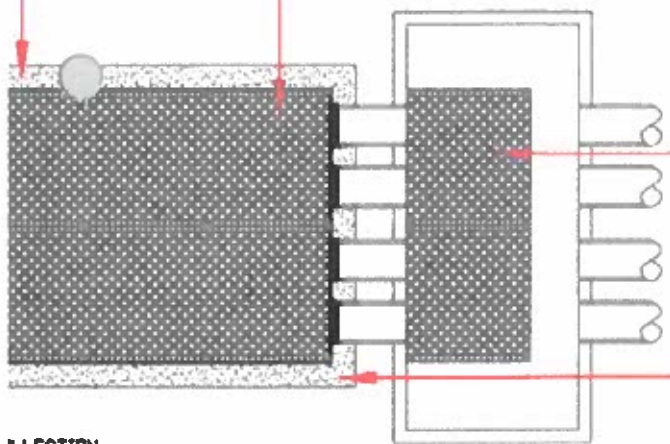
4. BACKFILL AROUND THE SIDES OF PLUVIAL
CUBE SHOULD BE 100 IN THICKNESS LAYER
COURSE SAND OR GRAVEL OR SELECTED
SAND OR GRAVEL. BACKFILL SHOULD
BEAD TO BE SUBSTITUTED WITH CLAY OR
SILT OR SILT-LIKE MATERIAL IN ACCORDANCE
WITH NEW YORK STATE (OR FEDERAL)
APPROVED SPECIFICATION

COLLECTION
CUBE

TYPICAL MANHOLE / INSPECTION
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OF THE TANK

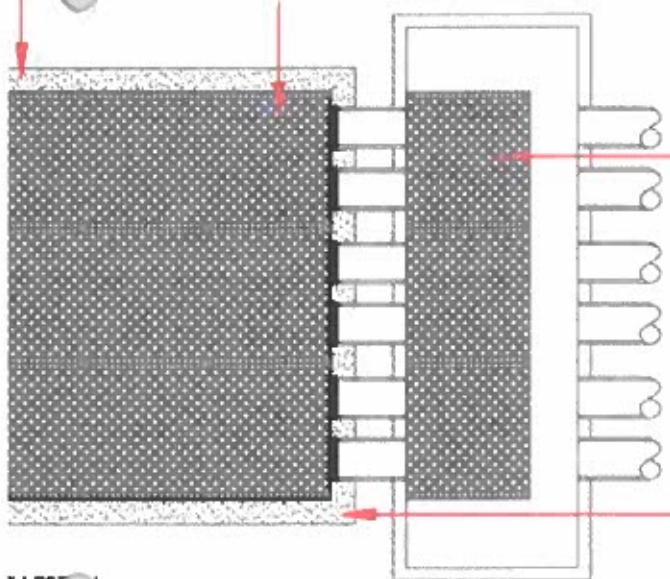
4. BACKFILL AROUND THE SIDES OF PLUVIAL
CUBE SHOULD BE 100 IN THICKNESS LAYER
COURSE SAND OR GRAVEL OR SELECTED
SAND OR GRAVEL. BACKFILL SHOULD
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SILT OR SILT-LIKE MATERIAL IN ACCORDANCE
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APPROVED SPECIFICATION

COLLECTION
CUBE

TYPICAL MANHOLE / INSPECTION
CHAMBER



100 mm DEEP ESS COARSE MIXTURE
FILTRATION MEDIA AND SUPPLIED BY
ALBION LINTAS

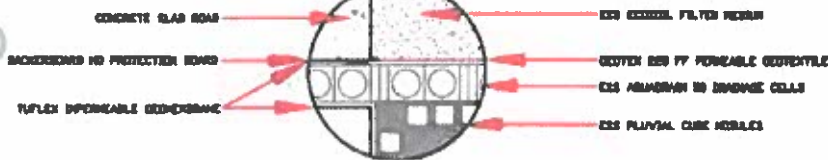
ESS PLUVIAL CUBE MODULARS WRAPPED WITH
TUFLEX IMPERMEABLE GEOTEXTILE ON
THE SIDES WITH 250 - 300 mm LAP JOINT
FOR IMPERMEATION AND SUPPLIED BY
ALBION LINTAS

ESS PLUVIAL CUBE MODULARS TO BE WRAPPED
WITH TUFLEX IMPERMEABLE GEOTEXTILE
WITH 250 - 300 mm LAP HEAT WELDED
JOINTS AND SUPPLIED BY ALBION LINTAS

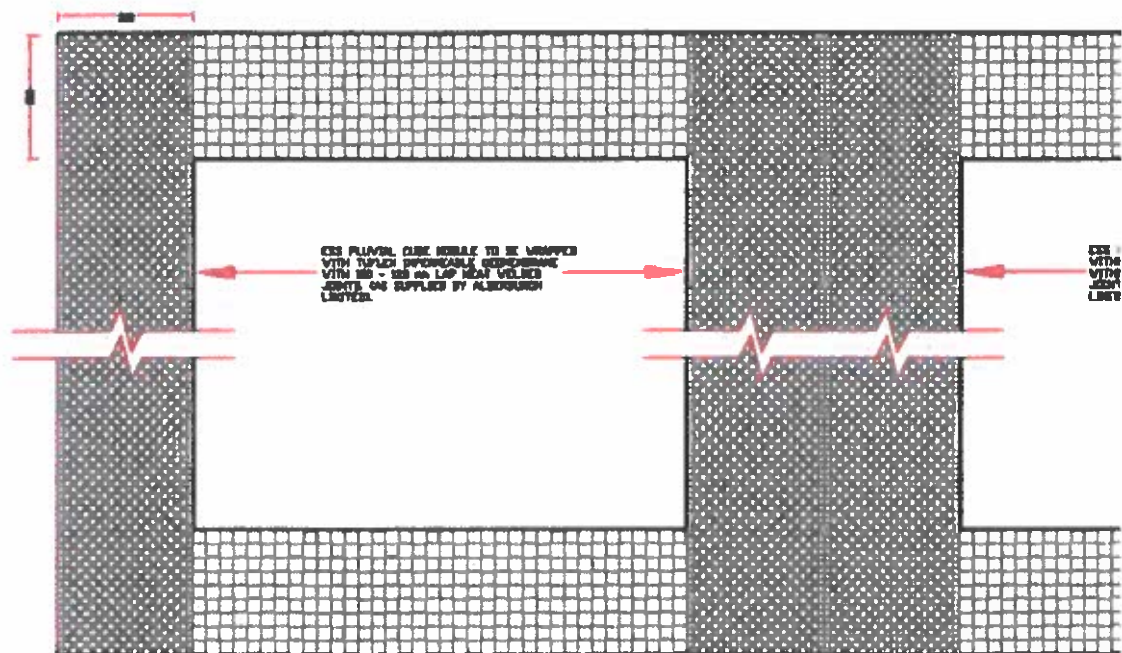
ESS
WITH
WITH
JOINT
LINTAS

A

TYPICAL DETAILS OF ESS ROADSIDE DRAINAGE USING PLUVIAL CUBE MODULAR UNITS



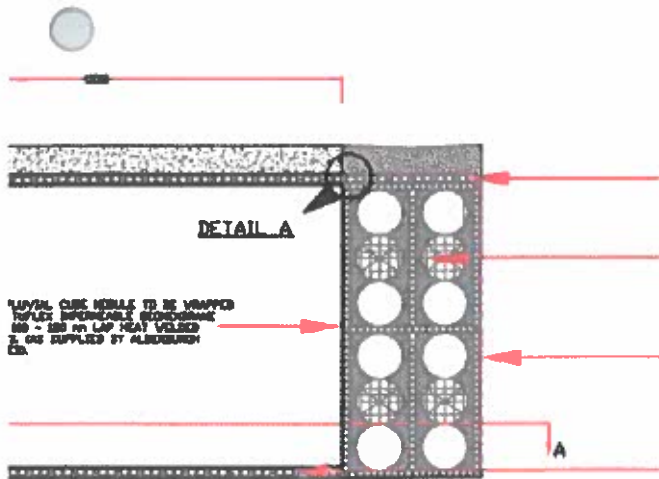
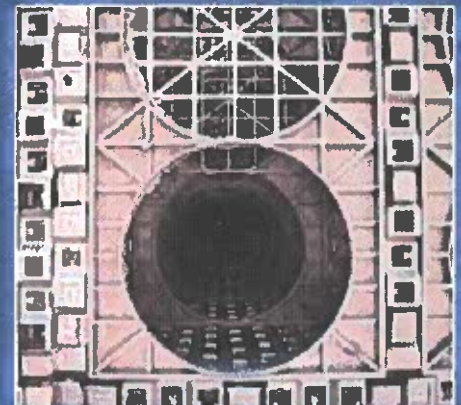
DETAIL A



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

A 2 - ON ONE HAS BEEN ASSIGNED AT SUB-ROAD
LEVEL SHALL THE C/P BE TESTED AND FOUND TO
BE LESS THAN 50 THEN THE DRAINAGE SHALL BE
NOTIFIED ALSO, BUT NOT SPOTS FROM A1
SUB-ROAD LEVEL SHALL BE REPORTED TO THE
ENGINEER

Pluvial Cube



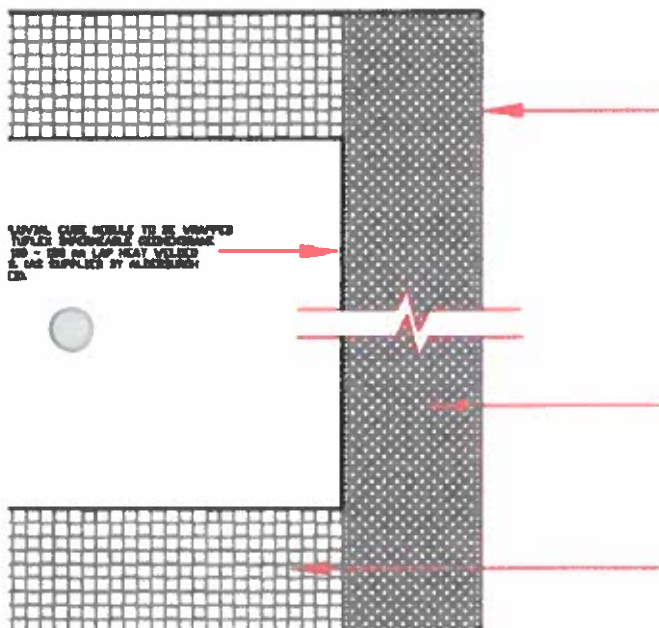
ESS MATERIALS IN BRASSING CELLS TO BE WRAPPED WITH TYPLEX IMPERMEABLE GEOTEXTURE ON THE SIDE WITH 200 - 200 mm LAP JOINTS UNDER THE COVER. JOINTS ARE WRAPPED WITH TYPLEX IMPERMEABLE GEOTEXTURE IN OTHER AREAS AS SUPPLIED BY ALBION LIMITED

ESS PLUVIAL CUBE MOBILE 600 mm LONG x 200 mm WIDE x 200 mm HIGH. JOINTS ARE WRAPPED WITH TYPLEX IMPERMEABLE GEOTEXTURE ON THE SIDE WITH 200 - 200 mm LAP JOINT FOR INFILTRATION GAS SUPPLIED BY ALBION LIMITED

ESS PLUVIAL CUBE MOBILE 600 mm LONG x 200 mm WIDE x 200 mm HIGH. JOINTS ARE WRAPPED WITH TYPLEX IMPERMEABLE GEOTEXTURE ON THE SIDE WITH 200 - 200 mm LAP JOINT FOR INFILTRATION GAS SUPPLIED BY ALBION LIMITED

ESS MATERIALS IN BRASSING CELLS TO BE WRAPPED WITH TYPLEX IMPERMEABLE GEOTEXTURE WITH 200 - 200 mm LAP HEAT WELDED JOINTS INSTALLED AT 90° C/C CONNECTING PLUVIAL CUBE MOBILE ROAD BRASSING GAS SUPPLIED BY ALBION LIMITED

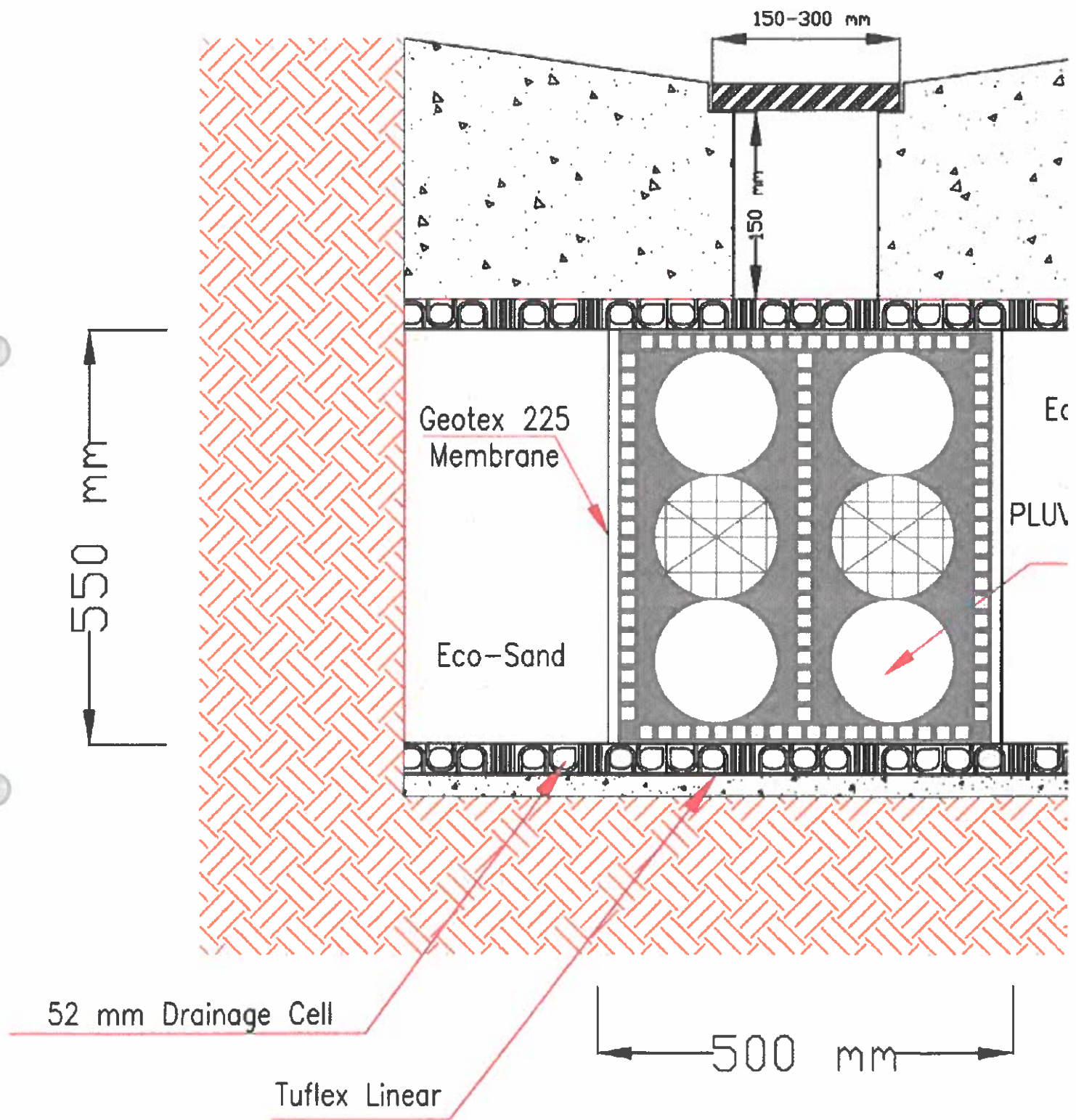
THE CONTRACTOR SHALL PREVENT THE MOVEMENT OF CONSTRUCTION PLANT ACROSS THE STORAGE TANK AND WHERE NECESSARY PROVIDE ADDITIONAL SUPPORT AND PROTECTION TO THE STRUCTURE. PARTICULARLY POST CONSTRUCTION TOPPERING TOWERING CAN BE USED TO PREVENT TANK SETTLING, FILLING MATERIALS, HEAVY PLANTS ETC.



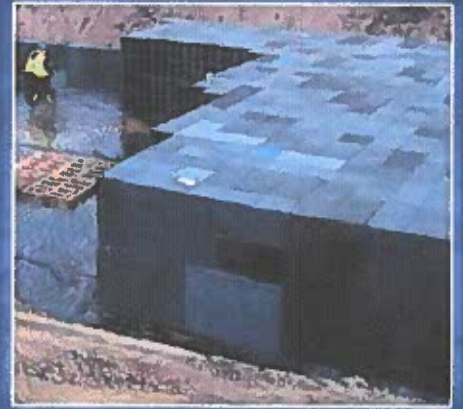
ESS PLUVIAL CUBE MOBILE 600 mm LONG x 200 mm WIDE x 200 mm HIGH. JOINTS ARE WRAPPED WITH TYPLEX IMPERMEABLE GEOTEXTURE ON THE SIDE WITH 200 - 200 mm LAP JOINT FOR INFILTRATION GAS SUPPLIED BY ALBION LIMITED

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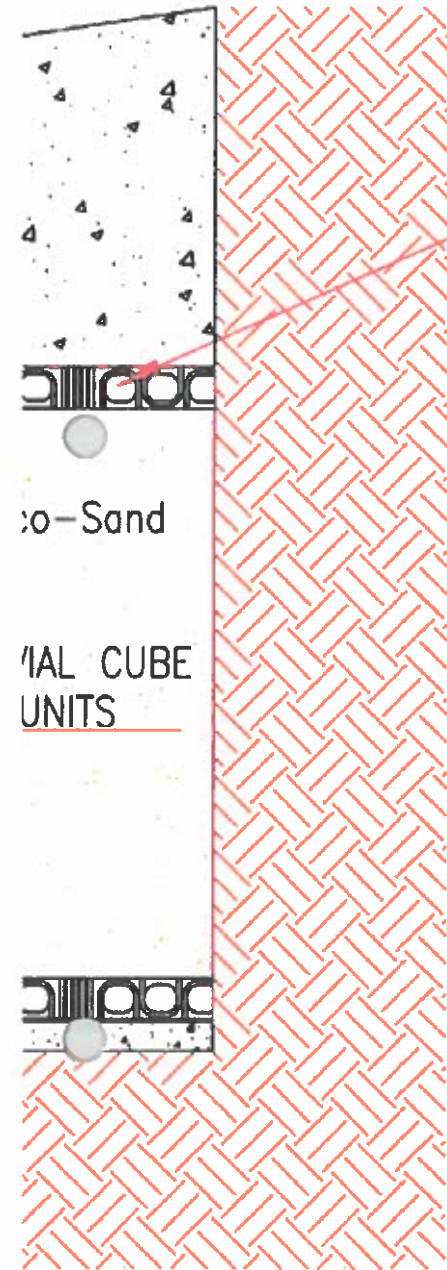
ESS MATERIALS IN BRASSING CELLS TO BE WRAPPED WITH TYPLEX IMPERMEABLE GEOTEXTURE WITH 200 - 200 mm LAP HEAT WELDED JOINTS INSTALLED AT 90° C/C CONNECTING PLUVIAL CUBE MOBILE ROAD BRASSING GAS SUPPLIED BY ALBION LIMITED



Pluvial Cube

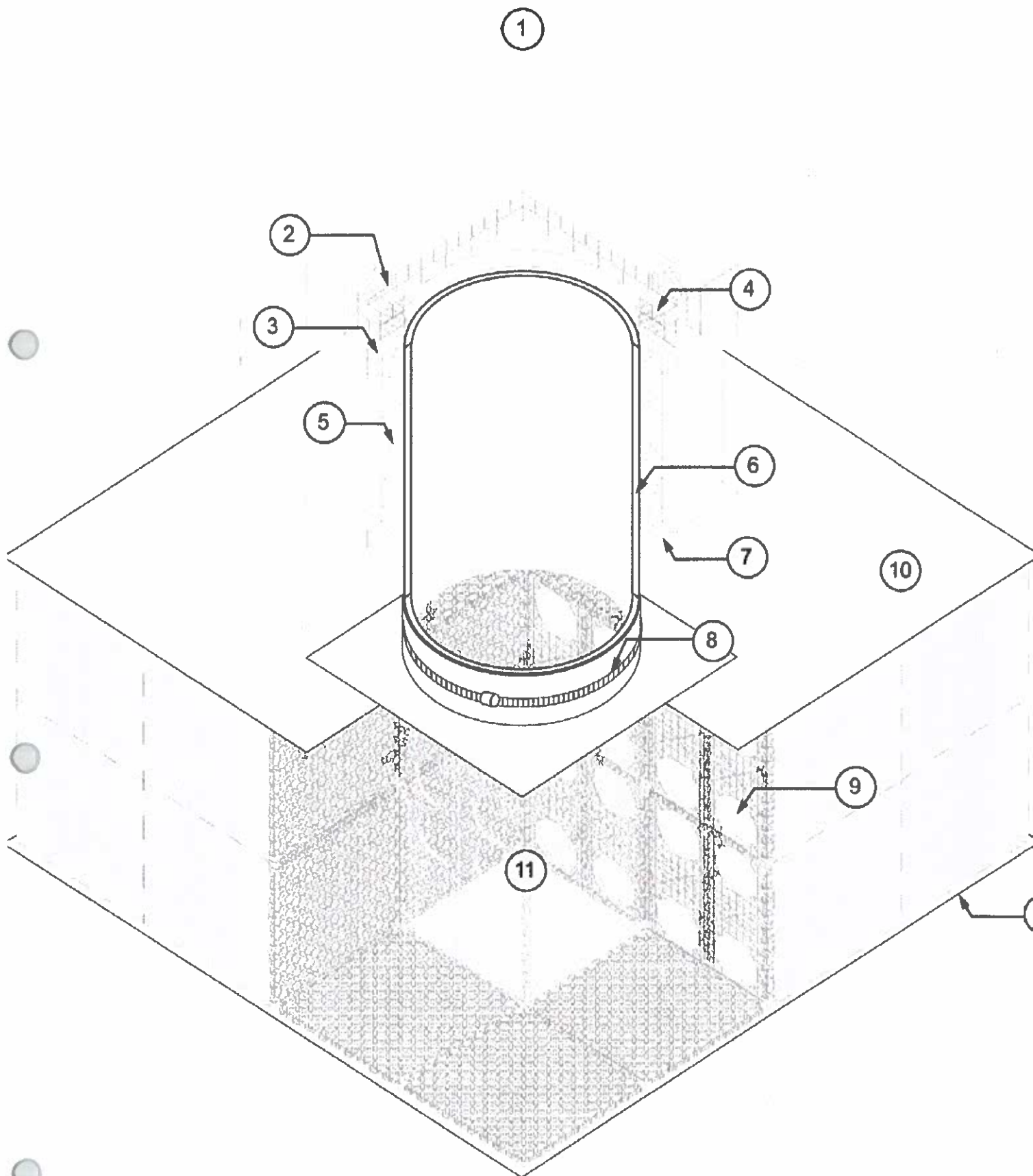


52 mm Drainage Cell



50-Sand

PLUVIAL CUBE
UNITS

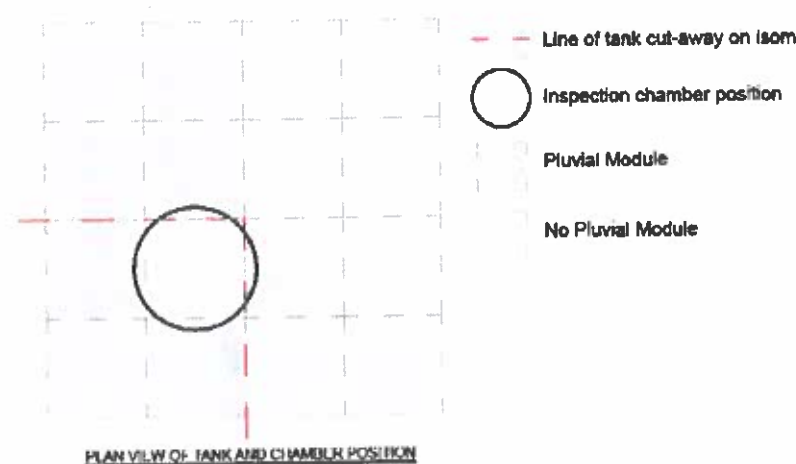


KEY:

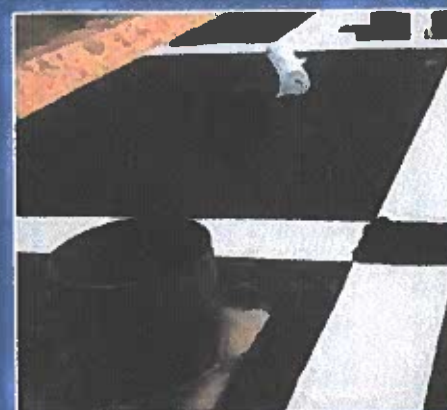
- 1 Finished Ground Level
- 2 M.H. Cover and Frame bedded and haunched in 1:3 cement mortar
- 3 Reinforce Concrete Cover Slab bedded with mortar
- 4 Engineering or Special Purpose Concrete Brickwork: 4 courses max, 2 courses min and/or precast concrete cover frame seating rings
- 5 150mm Concrete Surround (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).

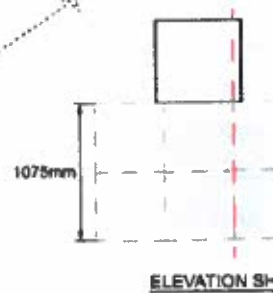
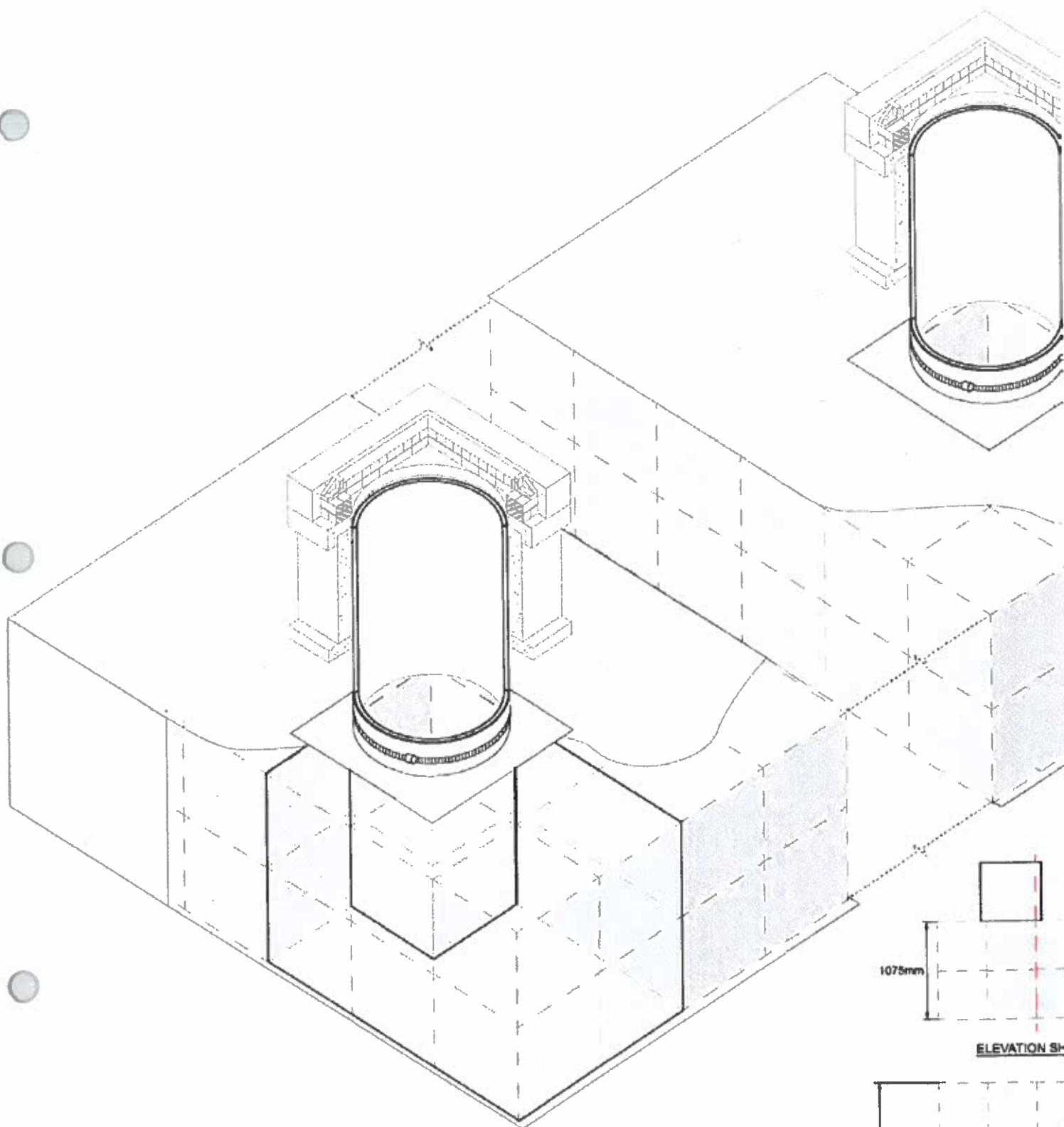
NOTE:

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

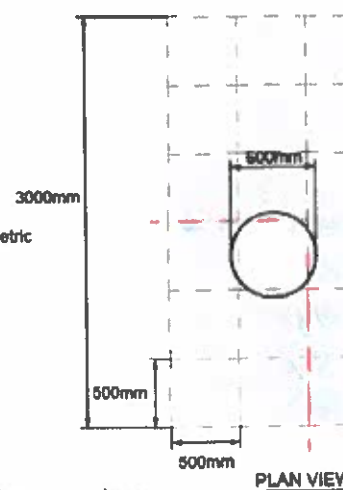


Pluvial Cube





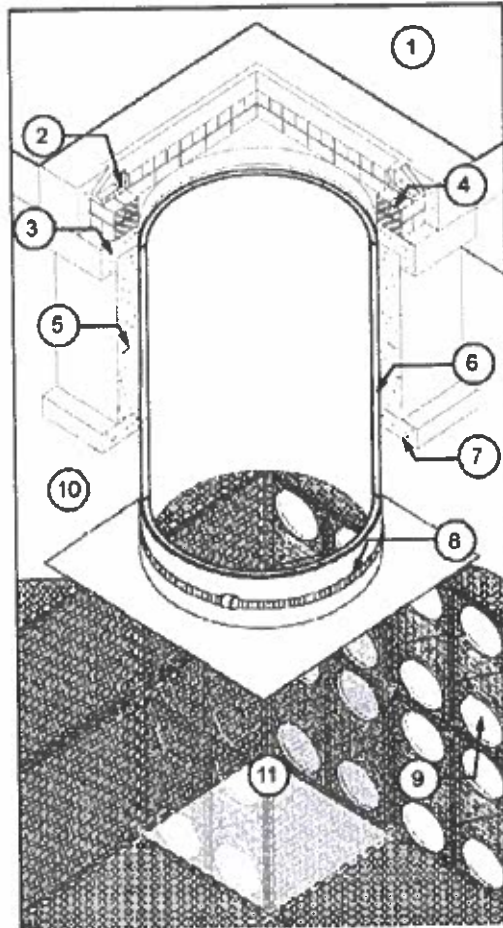
- Line of tank cut-away on Isometric
- ○ Inspection chamber position
- Pluvial Module
- No Pluvial Module



NOTE:

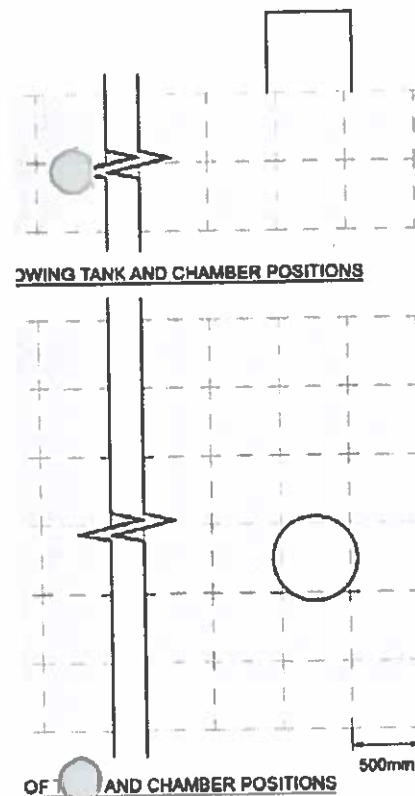
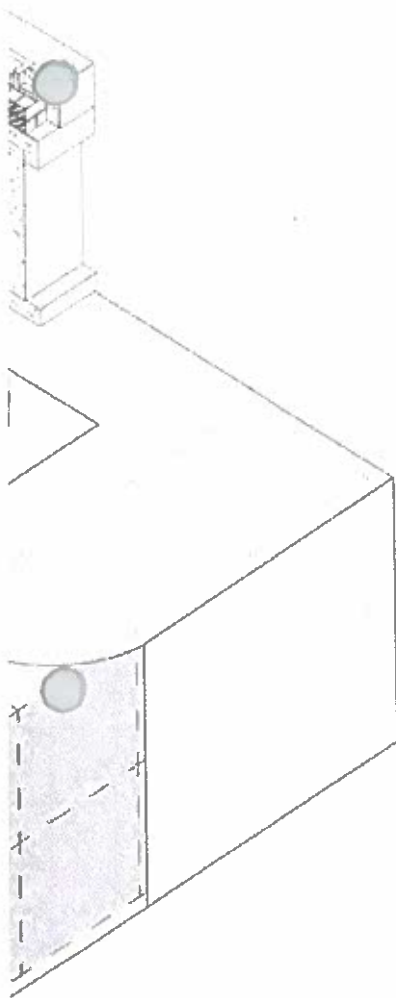
Cortex 300PP Protection Fleece not shown, but should be installed to cover the entire tank and protect Tuflex impermeable membrane from tears or punctures.

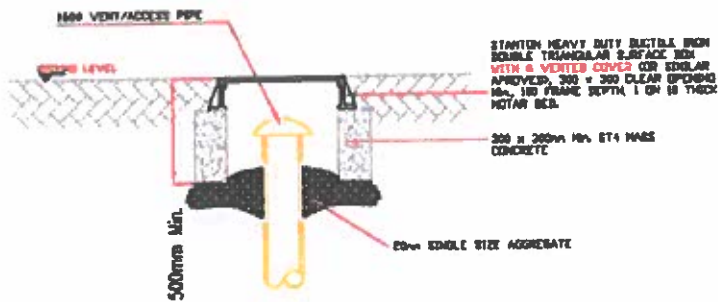
Pluvial Cube



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 Engineering 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 800mm 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 180mm 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).





**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, PILING MATERIALS, HEAVY PLANTS ETC.

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 GEOTECH ENGINEER

TO PROTECT THE WATERPROOF TUPLEX GEOMERBRANE DURING BACKFILLING OPERATIONS OVERLAY THE TOP AND SIDES WITH GEOTEX 500 MP NEEDLE PUNCHED NON-WOVEN PROTECTION GEOTEXTILE WITH 200mm LAPPED JOINTS (AS SUPPLIED BY ALBERKURH LIMITED).

- BACKFILL SUGGESTIONS OPTIONS AROUND THE SIDES OF VERSAPOSED MODULAR UNIT:
- SELECTED EXCAVATED MATERIAL IF DEEMED SUITABLE BY THE SITE ENGINEER.
- BACKFILLING 100mm IS A PROHIBITED ROAD FOR USE AS PROTECTION AGAINST BACKFILL.

INLET PIPE DIA VARIES (WITHIN CLASS 3 REDBOND)

100mm BASE LEVEL

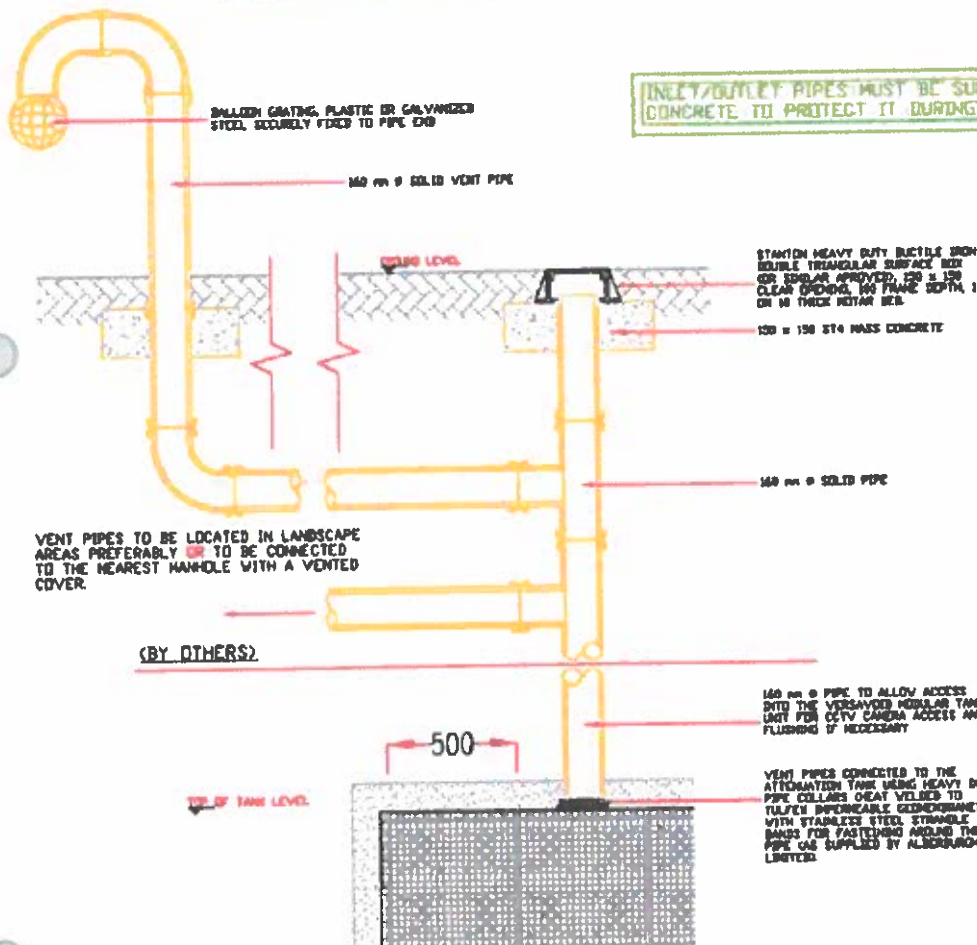
INLET PIPE INVERT LEVEL

CS3 FLUVAL CURB PERMEABLE GEOTEX E

FLAT LEVEL, SMOOTH BASE WITH NO UNDULATIONS AND HAS 3-5% CBR 100mm CONCRETE BASE PREPARED

TYPICAL INLET PIPE - 1

TYPICAL



(BY OTHERS)

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

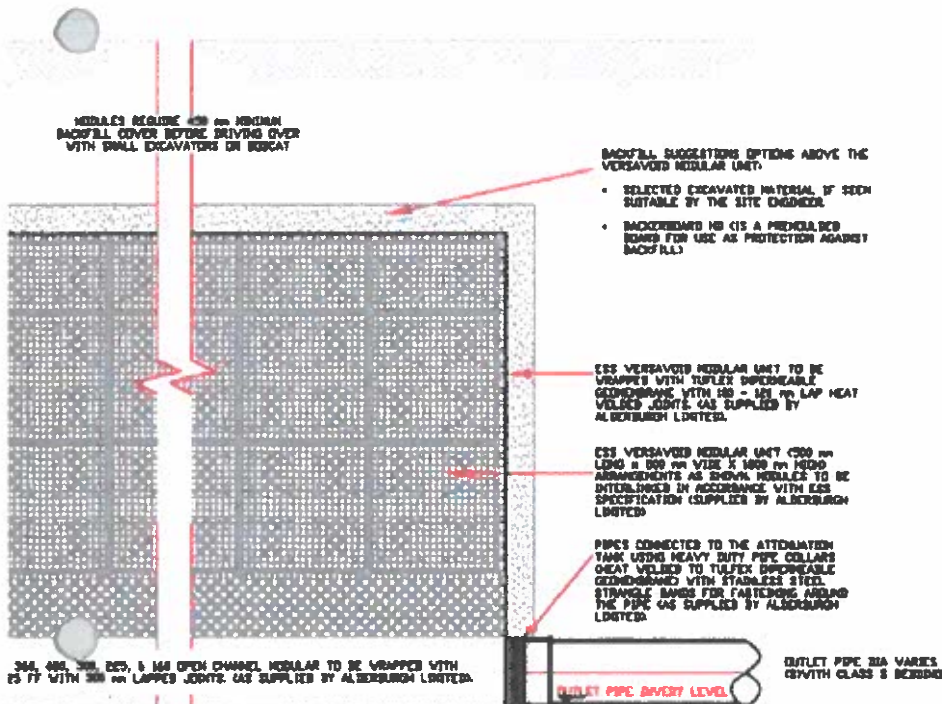
TOP OF TANK LEVEL

TANK BASE LEVEL

TYPICAL 1600mm VENT/ACCESS PIPE CONNECTION

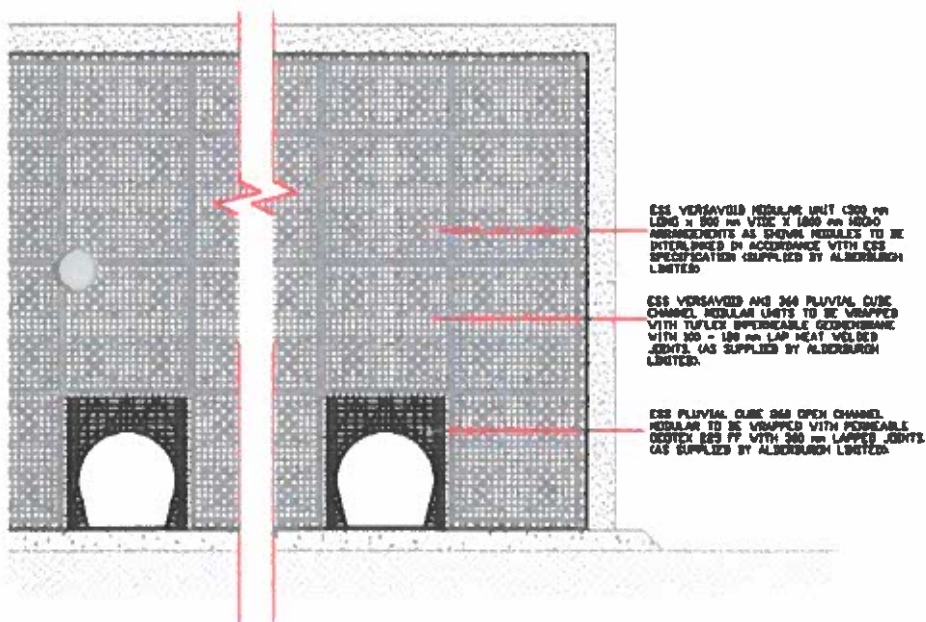
2No. 16

Low Flow

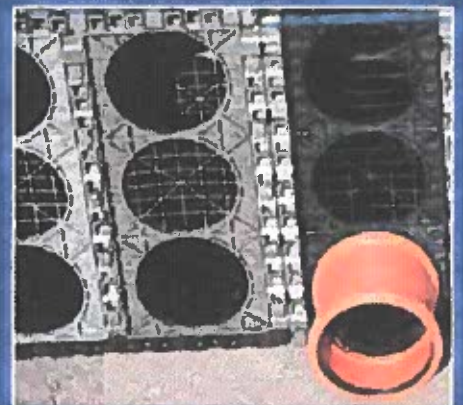
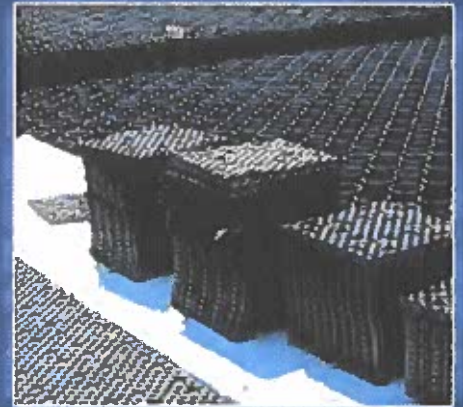
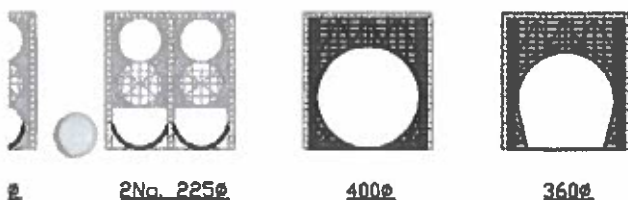


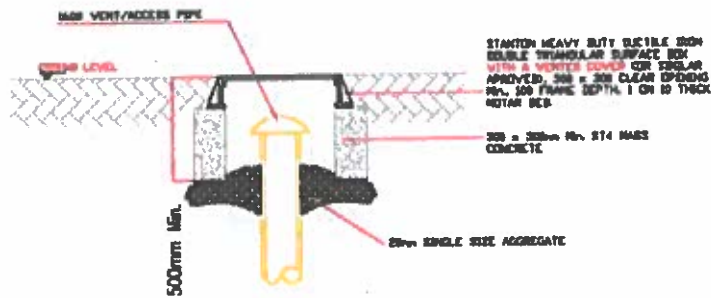
INJECTION TYPICAL OUTLET PIPE CONNECTION

DETAILS OF ATTENUATION TANK USING VERSAVOID MODULAR UNITS



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





**VENT BOX DETAIL
BY OTHERS
(OPTIONAL)**

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TO PROTECT THE WATERPROOF TUFLEX GEOMEMBRANE DURING BACKFILLING OPERATION, OVERLAY THE TOP AND SIDES WITH GEOTEXT 300 MM NEEDLE PUNCHED NON-WOVEN PROTECTION GEOTEXTILE WITH 200 MM LAP JOINTS (AS SUPPLIED BY ALDERBURGH LIMITED)

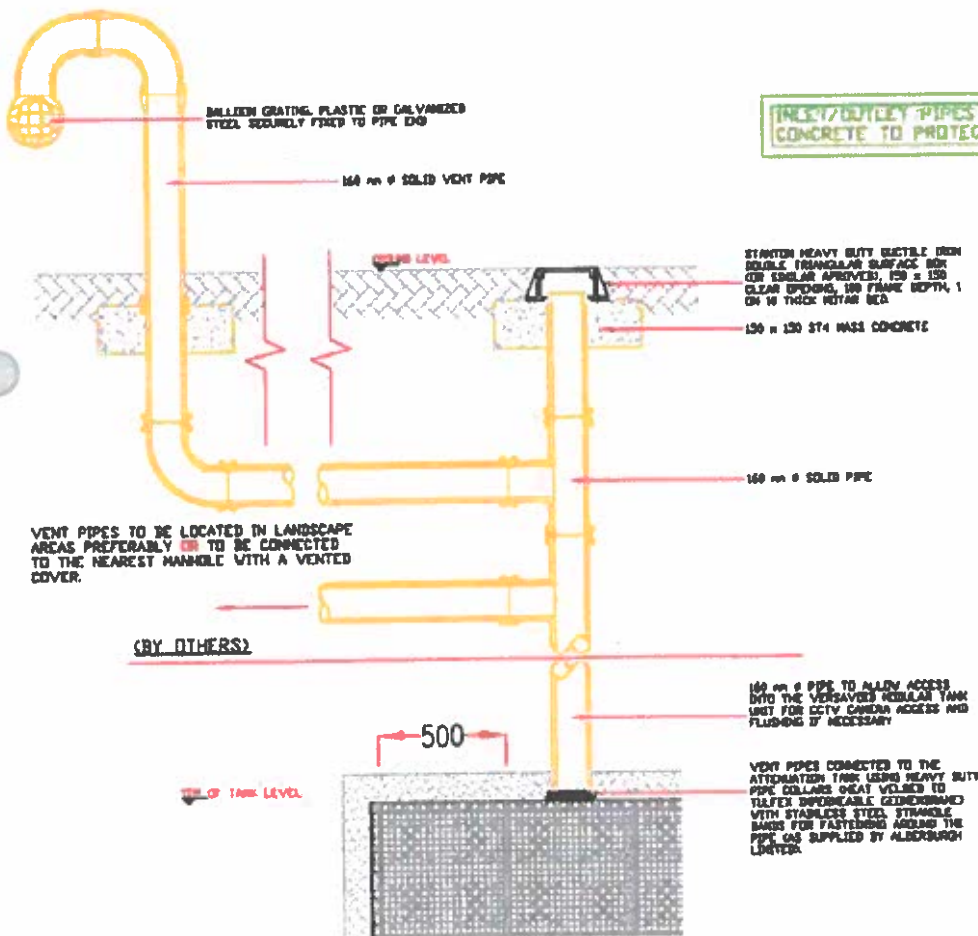
BACKFILL SUGGESTIONS OPTIONS AROUND THE SIDES OF VERSAVERS MODULAR UNIT

- SELECTED EXCAVATED MATERIAL IF SOON SUITABLE BY THE SITE CHIEF
- BACKFILLING NO. 125 & PROBABLY 125mm FOR USE AS PROTECTION AGAINST BACKFILL

FLAT, LEVEL, SMOOTH BASE WITH NO UNDULATIONS AND HAS 5-22 CM 100 MM CONCRETE BASE PREPARED

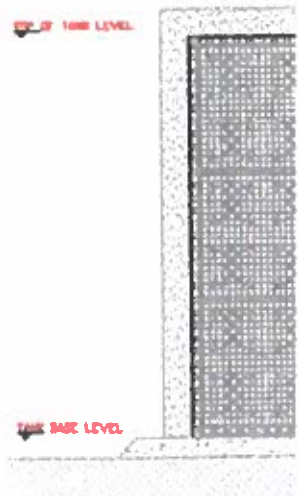
TYPICAL INLET PIPE CON

TYPICAL



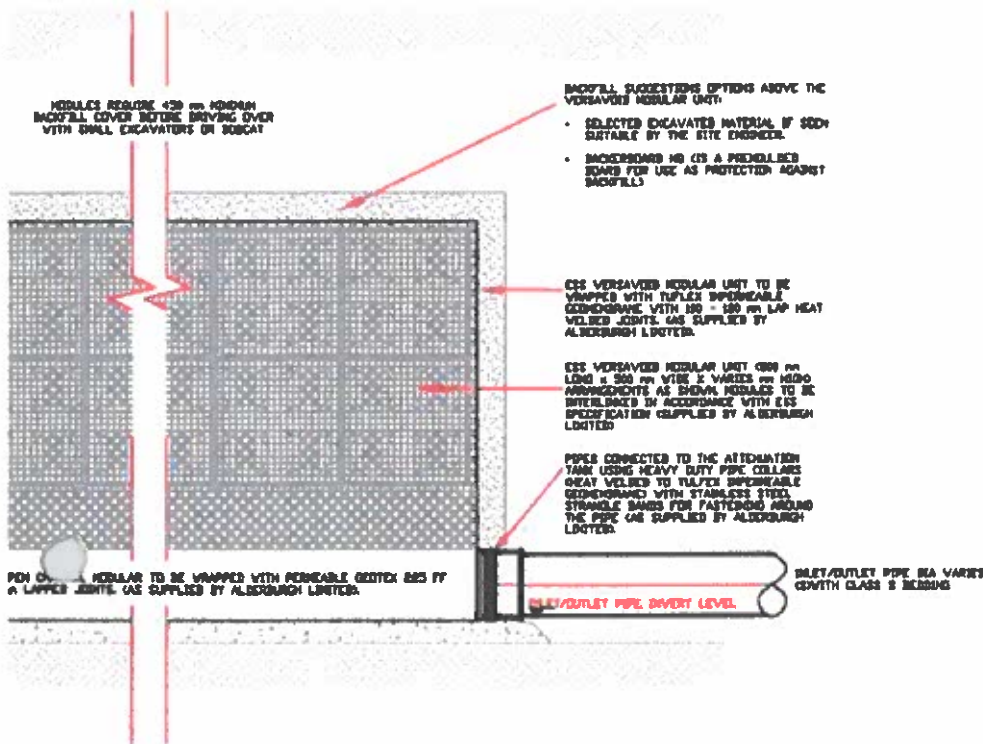
TYPICAL 160mm VENT/ACCESS PIPE CONNECTION

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



**TYPICAL
VERS**

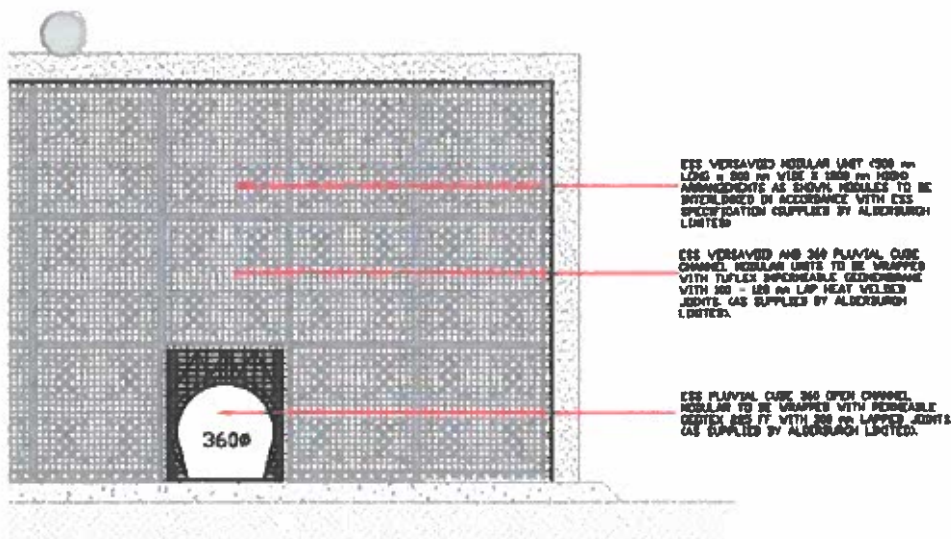
Low Flow



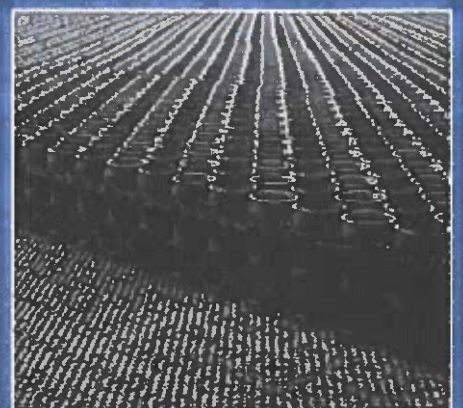
SECTION TYPICAL OUTLET PIPE CONNECTION

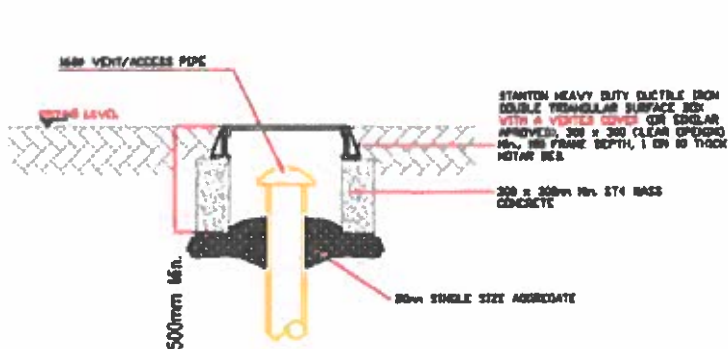
DETAILS OF ATTENUATION TANK USING VERSAVOID MODULAR UNITS

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



DETAILS OF ATTENUATION TANK USING SVI WITH 3600 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

TO PROTECT THE WATERPROOF TUFLEX GEOMEMBRANE DURING BACKFILLING OPERATIONS, OVERLAY THE TOP AND SIDES WITH GEOTEX 200 PP FIBRE PLACED NON-WOVEN PROTECTION GEOTEXTILE WITH 200mm LAPPED JOINTS (AS SUPPLIED BY ALDERBURN LIMITED).

BACKFILL SUGGESTIONS (OPTING AROUND THE SILES OF VERSAVOID REGULAR UNIT)

- SELECTED EXCAVATED MATERIAL IF SEEN SUITABLE BY THE SITE ENGINEER
- BACKFILLING NO. 12 A PREMOULDED BOARD FOR USE AS PROTECTION AGAINST BACKFILL

INLET PIPE DIA VARIES (WITH CLASS 5 BEDDING)

TOP OF TANK LEVEL

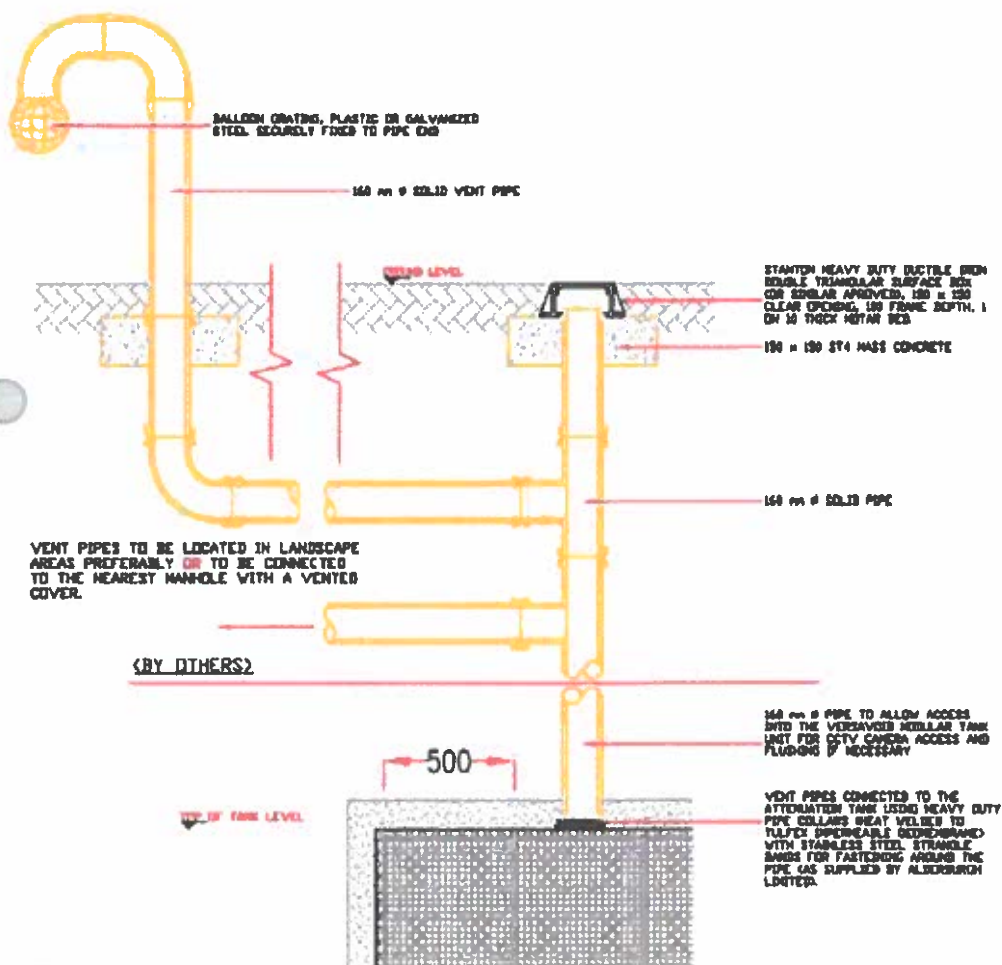
INLET PIPE DIVER? LEVEL

100mm BASE LEVEL

FLAT, LEVEL, SMOOTH BASE WITH NO IMBULATIONS AND HAS 3-5% CBR (100mm CONCRETE BASE PREFERRED)

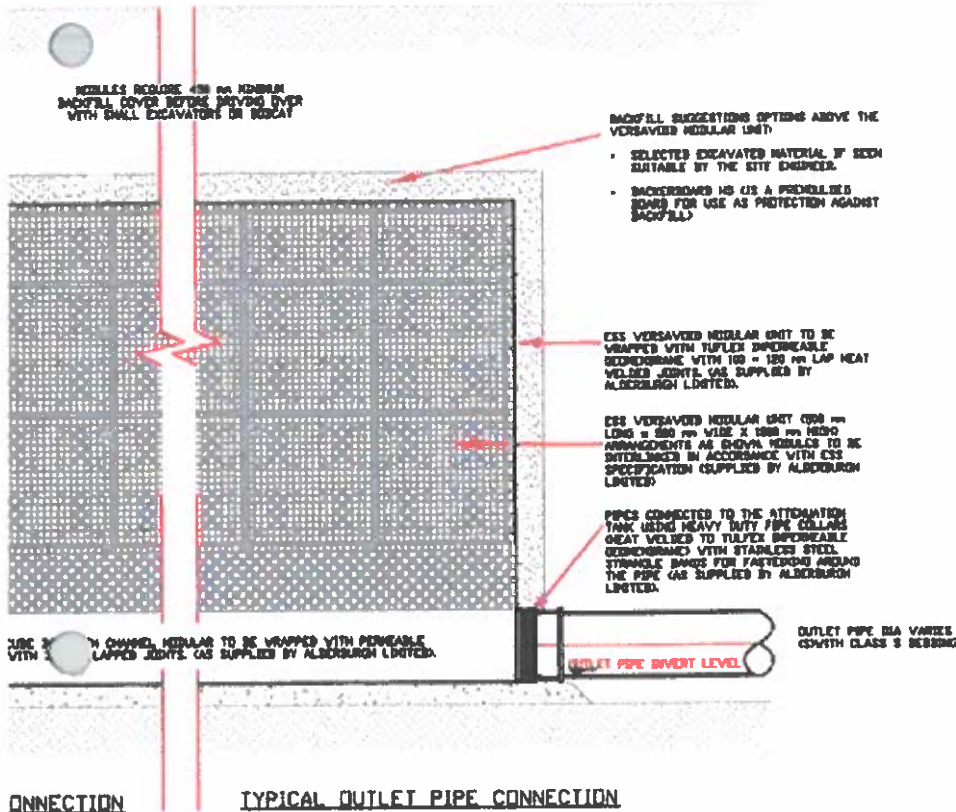
TYPICAL INLET PIPE C

TYPICAL



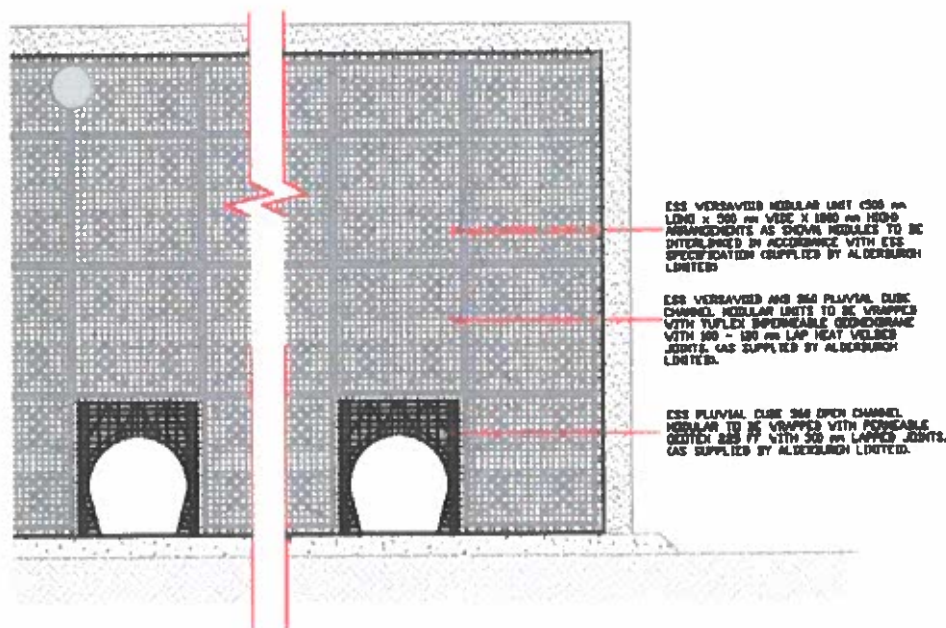
TYPICAL 160mm VENT/ACCESS PIPE CONNECTION

Low Flow

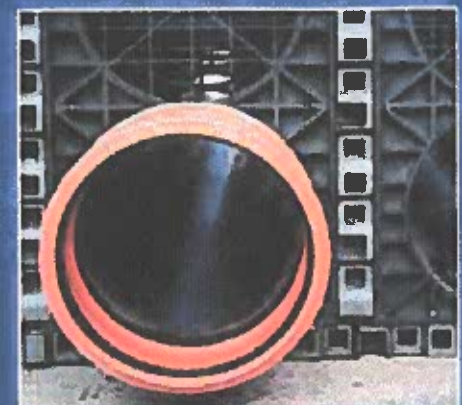


DETAILS OF ATTENUATION TANK USING VERSAVID MODULAR UNITS

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, PILING MATERIALS, HEAVY PLANTS ETC.,



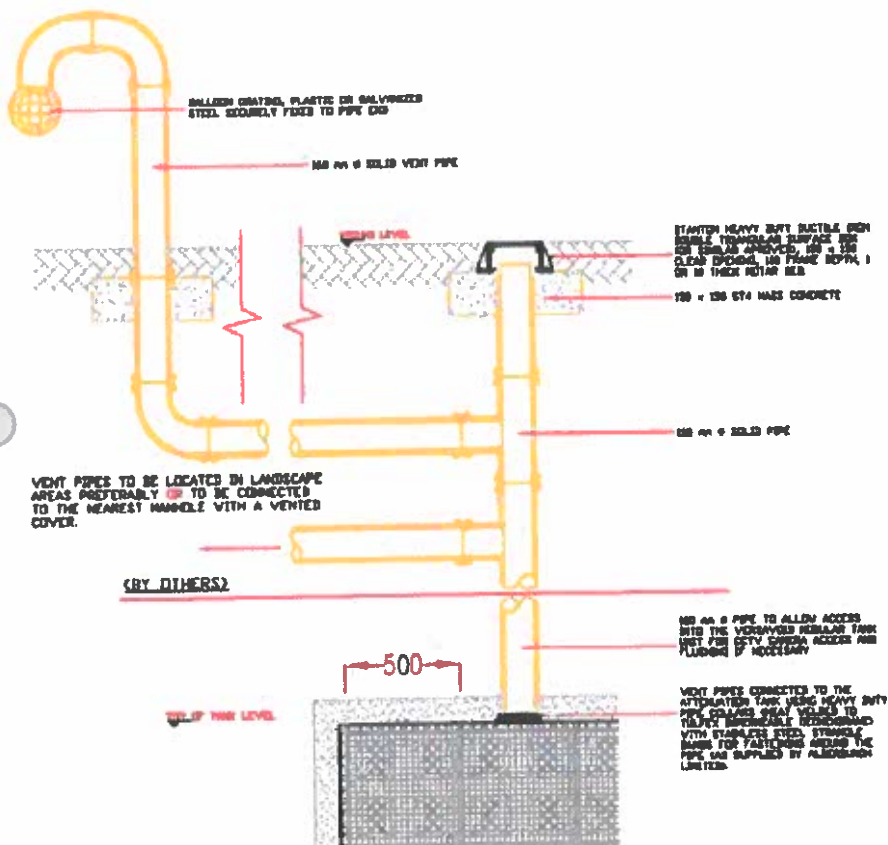
DETAILS OF ATTENUATION TANK USING VERSAVID WITH 3600 PLUVIAL CUBE OPEN CHANNEL MODULAR UNITS



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

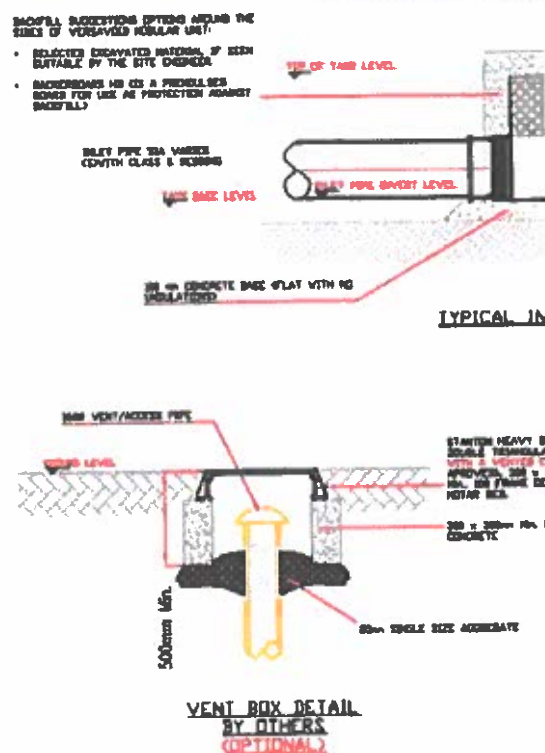
A 3 - 5X CBR HAS BEEN ASSUMED AT SUB-BASE LEVEL. SHOULD THE CBR BE TESTED AND FOUND TO BE LESS THAN 3X THEN WE SUGGEST USING A LAYER OF COMBINGED 40/40 AND 200MM WELL COMPACTED CLEAN, SINGLE SIZE ANGULAR GRANULAR MATERIAL FROM WITHIN THE RANGE 10 TO 20MM - TO BE VERIFIED BY GROUND ENGINEER.

TO PROTECT THE VA
EXPERIENCE SURGEON
OPERATION, OVERLAY
WITH OFFICE 300 40
NON-MOVEN PROTECT
300 40 LATTER JUNE
ALERT, NON LATTER

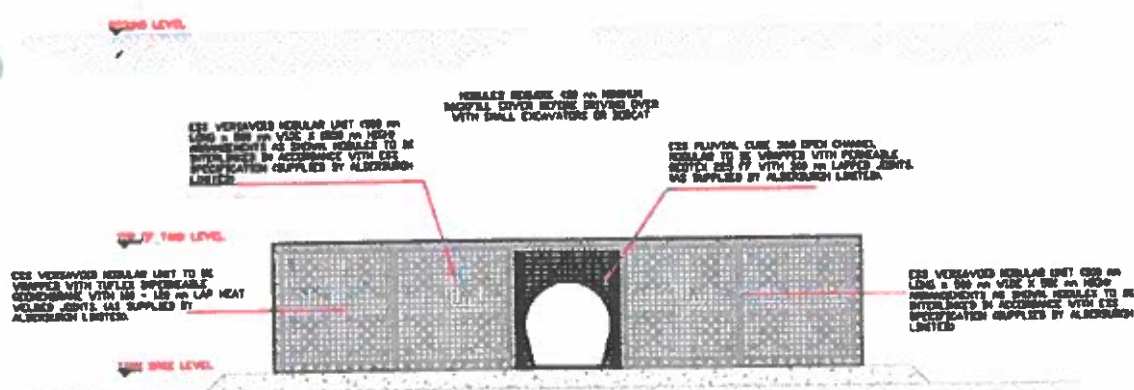


TYPICAL 160 mm Ø VENT PIPE CONNECTION

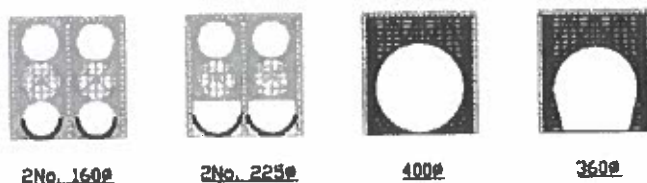
OPTIONAL



VENT BOX DETAIL
BY OTHERS
(OPTIONAL)



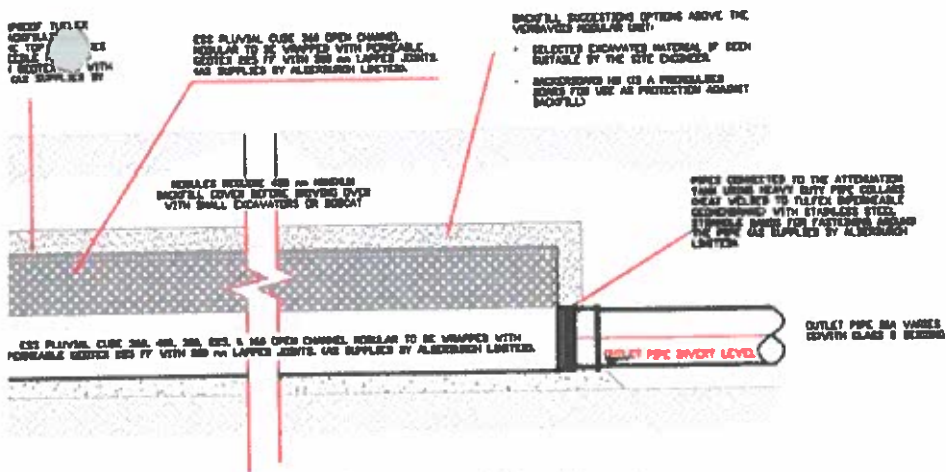
TYPICAL DETAILS OF ATTENUATION TANK USING
VERSAVOID WITH 3000 PLUVIAL CUBE CHANNEL
MODULAR UNITS.



DIAGRAMATIC TANK LAYOUT



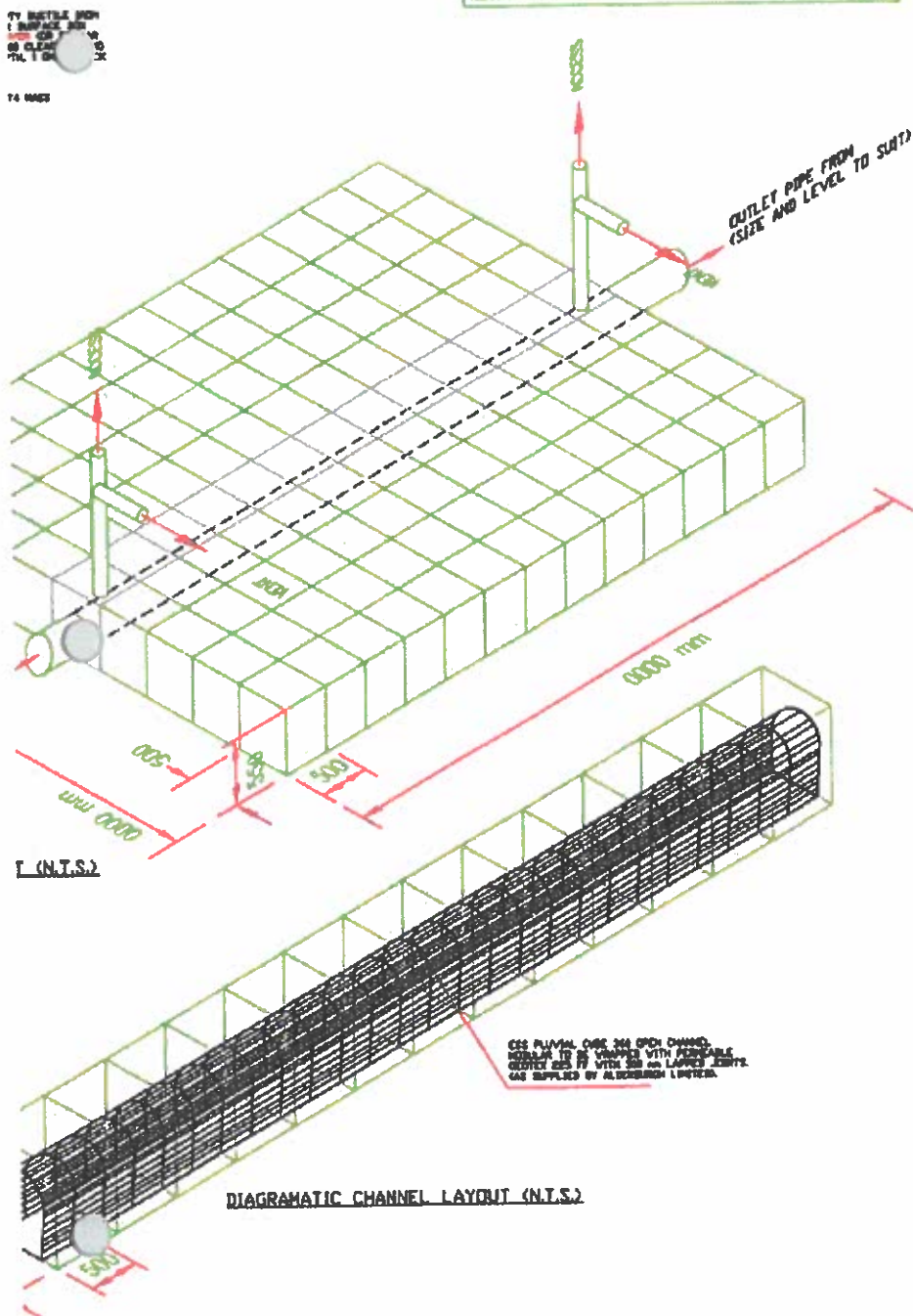
Low Flow



TYPICAL OUTLET PIPE CONNECTION

TYPICAL DETAILS OF ATTENUATION TANK USING VERSA VOID MODULAR UNITS

THIRTYFOUR INCH DIAMETER PIPES MUST BE SUPPORTED WITH CONCRETE TO PROTECT IT DURING BACKFILLING.



[illegible]

TYPICAL DETAILS OF ATTENUATION TANK USING
VERSAYOID MODULAR UNITS

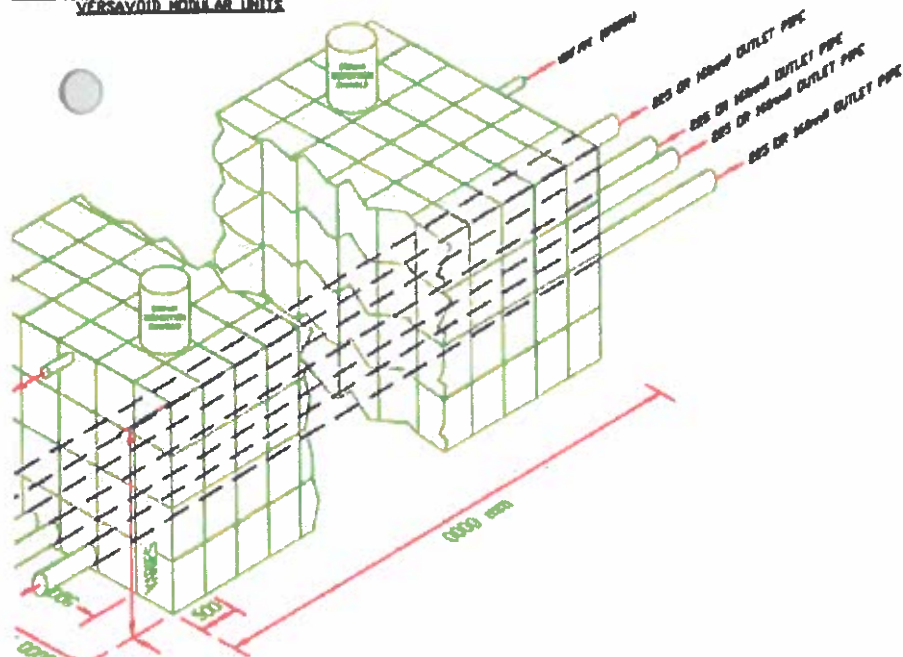
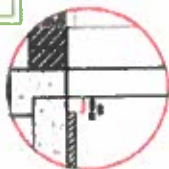
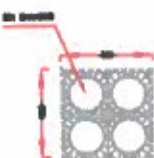
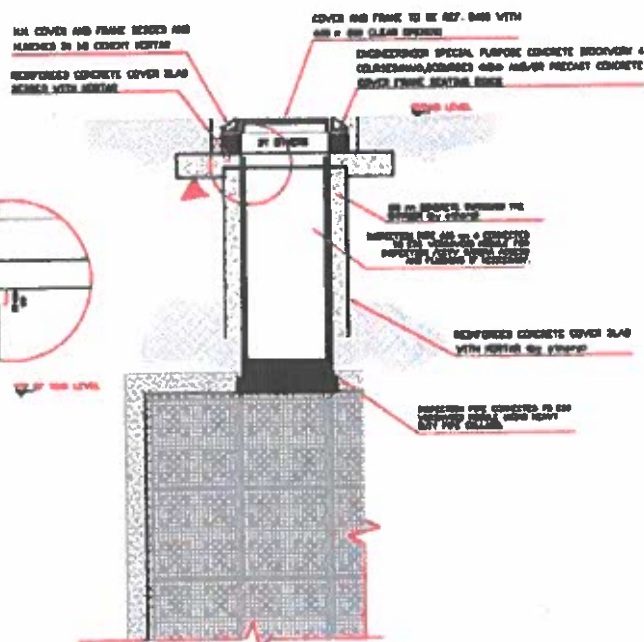


DIAGRAM C TANK LAYOUT

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



ALL INFORMATION CONTAINED HEREIN IS UNCLASSIFIED
DATE 08-10-2001 BY 60322 UCBAW



TYPICAL 600 mm ID 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



Environmental Sustainable Solutions Ltd

Dane Street, Rochdale, OL12 8XB
tel: 01706 374416, fax: 01706 376785

email: technical@y-ess.com
<http://www.y-ess.com>

E&OE. Without Guarantee.

GEOTEX 300 PP

DESCRIPTION

A needle punched non woven geotextile made from 100% virgin polypropylene staple fibres, UV resistant, produced without the addition of chemical binders and without thermal bonding of the filaments.

PRIMARY FUNCTIONS

Fabric used for ground stabilisation and membrane protection.
Enclosing granular layers in formed drainage systems.

TECHNICAL DATA

Roll Size:	Width	6 m	
	Length	50m, 100m	
Weight:	300g/m ²		
Fabric Thickness:	4.0mm nom.		BS 2544 AS
Tensile strength:	MD	13KN/M	BSEN ISO 10319
	CD	21KN/M	BSEN ISO 1996
Extension:	MD	103%	BSEN ISO 1996
	CD	80%	BSEN ISO 1996
Water Transmittivity	@ 100mm head	140 lt/m/sec	BSEN ISO 10319
Apparent Opening size	90% finer	90 microns	BS6906 PE2 1989
CBR (Puncture):	Part 4	2400N	
Displacement (mm)		70	
Cone PropTest (mm)		17mm	

The above are typical mean values of 5 samples taken at random for test purposes, as defined in BSEN ISO standard.

SPECIFICATION

The Geotex 300PP filter fabric should be specified by name with specific reference to the technical requirements of its use

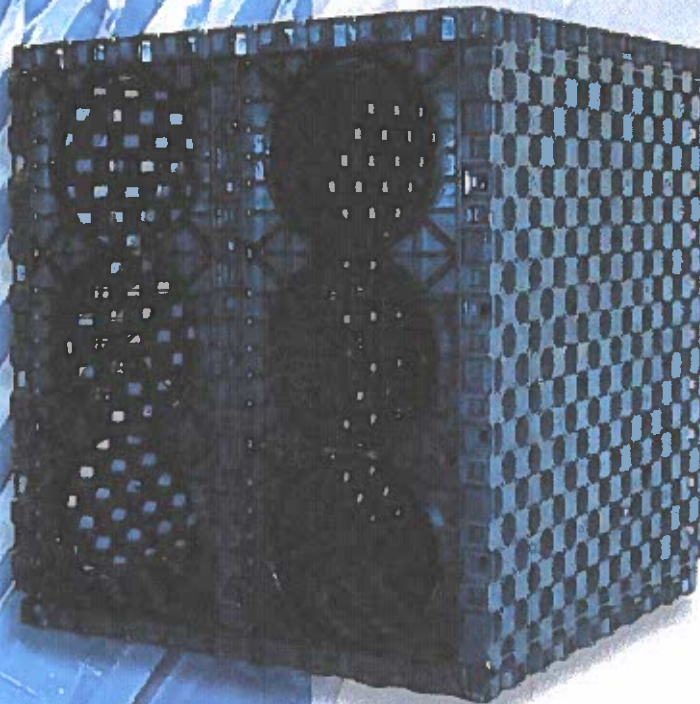


Modular Geo-Void Systems

Total Water Management

Pluvial Cube

**Total Linear Access
Precipitation Collection System**



**Unique Low Flow
Channel System**

Modular Geo-Cell Tank System

Infiltration, Detention and Re-use made easy...

Total Stormwater Management

E.S.S. Geo-Cell Modular Tank systems use surface and sub-surface infiltration techniques, resulting in clean water that can be re-used or allowed to re-enter the natural water system. E.S.S. Geo-Cell Modular Systems offer a highly efficient option for Stormwater Management in any kind of soils.

Water Quality

E.S.S. Geo-Cell Modular Tank Systems excel when there is a requirement to achieve a high water quality, particularly in the effective removal of nutrients and gross pollutants. In addition to the obvious environmental benefits, the sub-surface location of the tank system provides more usable space and an enhanced aesthetic setting compared to above ground concrete or plastic tanks.

The Modular Advantage

E.S.S. Geo-Cell Modular Tank System performance supersedes outdated aggregate trenches. The E.S.S. System provides a void space of over 90% compared to less than 20% in typical aggregate trenches. Consequently, the E.S.S. System offers a smaller footprint to achieve the same storage capacity as an aggregate trench. This saves time and money in installation and civil works costs. The lightweight design of E.S.S. Modular Tank Modules also make installation quicker, safer and cheaper. No sediment build up occurs in the E.S.S. System, unlike the clogging that is characteristic of aggregate based approaches.

System Components

Pluvial Cube Geo-Cell Tank Modules

EcoSand biologically engineered soils

E.S.S. Filtration Unit

Geotex Filtration Fabric

Tuflex Waterproofing Membrane

Geotex Protection Fleece

Ventilation Units

Preformed Pipe Connection Covers

Aquabrake Flow Control Devices and Chambers

Refer to separate data sheets

Benefits...

Complete Linear Access

Quick

Reduce site access delays

Lightweight

No cranes required

Strong

Designed for car loadings

Modular

Easily create any shape

Economical

Cheaper than concrete

Maintenance Free Tank

All debris and sediment is pre-filtered

Determinate Volume

One cubic metre of Pluvial Cube modules contain 950 litres of water

Cost Effective

Reduces excavation and disposal by two thirds compared with conventional soak wells

High Infiltration

90% void surface area

Structurally Designed

Supports shear loadings

Unique Low Flow Channels

Ensuring complete removal of any silts

Permeable Paving

Single Module



Size: 50cms x 50cms x 55cms
Units / m³: 0.1375m³
7.27 per m³

Double Module



Size: 50cms x 50cms x 107.5cms
Units / m³: 0.269m³
3.72 per m³

Triple Module



Size: 50cms x 50cms x 160cms
Units / m³: 0.40m³
2.50 per m³

Clear Linear Access Through Open Subterranean Channels

Water sensitive Urban Channels

The Channel Systems are based on permeable sub-surface waterways that restore water quality and recharge the natural environment. The sub-surface E.S.S. Channel System provides a unique way of working with nature to solve the enormous problems currently associated with open concrete channels and swales.

Traditional Concrete Channels

Open concrete channels and swales are currently one of the main methods of transporting large quantities of Stormwater for discharge into streams, rivers and oceans. Open channels are used widely in the urban landscape even though they are considered unsafe. Channels are also a breeding ground for vermin and vector that endangers human health. In addition to the health and safety problem, large concrete channels take up vast areas of land and have a negative impact on the amenity of the area.

Pluvial Cube Module Dimensions* (mm)	Module Configuration	Units per m ³	Module Volume (m ³)
500 (L) x 500 (W) x 550 (D)	Single	7.27	0.1375
500 (L) x 500 (W) x 1075 (D)	Double	3.72	0.2688
500 (L) x 500 (W) x 1600 (D)	Triple	2.5	0.4

Product Data	Standard Pluvial Cube Module	Heavy Duty Pluvial Cube Module
Application	Stormwater Management	Stormwater Management
Average Weight (kg) - single module	6.05	7.05
Compressive Strength* (kN/m ²)	240	400
lateral Strength* (kN/m ²)	120	200
Long Term Creep Testing** (kN/m ²)	90	120
Void Ratio (%)	96	96
Surface Void Ratio (%)	Greater than 90	Greater than 90
Minimum Backfill Cover [†] (mm)	450	450
Maximum Backfill Cover (mm)	3000	4750
Material	Propylene	Propylene
Chemical Resistance	Good	Good
Bacterial Resistance	Good	Good
UV Resistance	Good	Good

Note: Other Modules with Compressive Strength more than 1500 kN/m² available

* Modules tested using UKAS calibrated test machine, range 0 - 60 Tons, UDL, loading rate 0.2 kN/m²

** Modules tested for long term creep testing for 90 and 180 days

[†] Any cover less than 450 mm - contact ESS design department



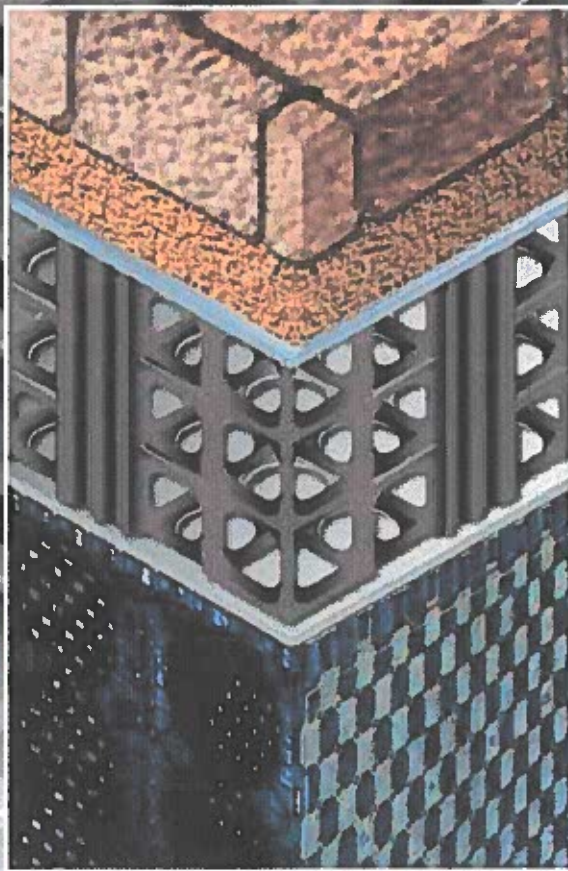
Modular Geo-Void Systems

Total Water Management

Pluvial Invicta

**Total Linear Access
Precipitation Collection System**

"The strongest most versatile system available"



**Can be installed directly under
sub-base surface**

**Fully compliant and
tested to the latest
CIRIA 737 guidelines**



ENVIRONMENTAL SUSTAINABLE SOLUTIONS LTD

GEOMEMBRANES

ALDERPRUFE **TUFLEX**

Features

- Excellent Barrier Properties**
- High Puncture Resistance**
- Exceptional Multiaxial Stress and Strain Properties**
- Good Tear Resistance**
- High Surface Friction**
- Good Low Temperature Behaviour**
- Low Coefficient of Thermal Expansion**
- Very Good Chemical Resistance**
- Very Good UV Resistance**
- Excellent Environmental Stress Crack Resistance (ESCR)**
- Excellent Welding Properties - Wide Seaming Temperature Window**



Infiltration, Retention and Re-use made easy...

Total Stormwater Management

E.S.S. Invicta Modular Tank systems use surface and sub-surface infiltration techniques, resulting in clean water that can be re-used or allowed to re-enter the natural water system.

E.S.S. Invicta Modular Systems offer a highly efficient option for Stormwater Management in any kind of soils.

The Modular Advantage

E.S.S. Invicta Modular Tank System performance supersedes outdated aggregate trenches. The E.S.S. System provides a void space of over 90% compared to less than 20% in typical aggregate trenches. Consequently, the E.S.S. System offers a smaller footprint to achieve the same storage capacity as an aggregate trench. This saves time and money in installation and civil works costs. The lightweight design of E.S.S. Modular Tank Modules also make installation quicker, safer and cheaper. No sediment build up occurs in the E.S.S. System, unlike the clogging that is characteristic of aggregate based approaches.

System Components

Pluvial Invicta Geo-Cell Tank Modules

EcoSoil biologically engineered soils

E.S.S. Filtration Unit

Geotex Filtration Fabric

Tuflex Waterproofing Membrane

Geotex Protection Fleece

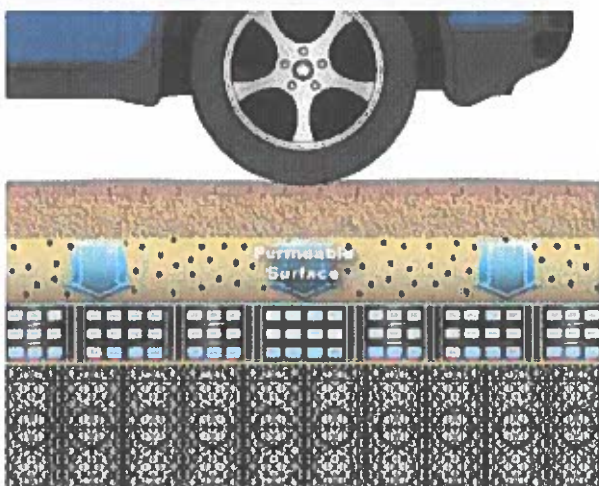
Ventilation Units

Preformed Pipe Connection Covers

Aquabrake Flow Control Devices and Chambers

Refer to separate data sheets

Geotex OF3000 Oil Filtration Fabric



Benefits...

Complete Linear Access

Quick

Reduce site access delays

Lightweight

No cranes required

Strong HGV-EE Tonnes

Designed for 120 Tonnes/M²

Modular

Easily create any shape

Economical

More cost effective than concrete

Maintenance Free Tank

All debris and sediment is pre-filtered

Determinate Volume

One cubic metre of Pluvial Invicta modules contain 950 litres of water

Cost Effective

Reduces excavation and disposal by two thirds compared with conventional soak wells

High Infiltration

90% void surface area

Structurally Designed

Supports shear loadings

Unique Low Flow Channels

Ensuring complete removal of any silts

General Description

Alderprufe Tuflex is a single layer cold applied geomembrane suitable for environmental protection to structures, containments and cut-off trenches.

Alderprufe Tuflex combines excellent chemical resistance with low flexural modulus to provide a malleable, flexible membrane suitable for non-smooth surfaces and factory prefabrication to optimise on-site installation.

Alderprufe Tuflex is the ideal membrane for building protection systems and cut-off trench containment particularly on contaminated sites which would otherwise prove too difficult or costly to develop.

Building Protection Membrane

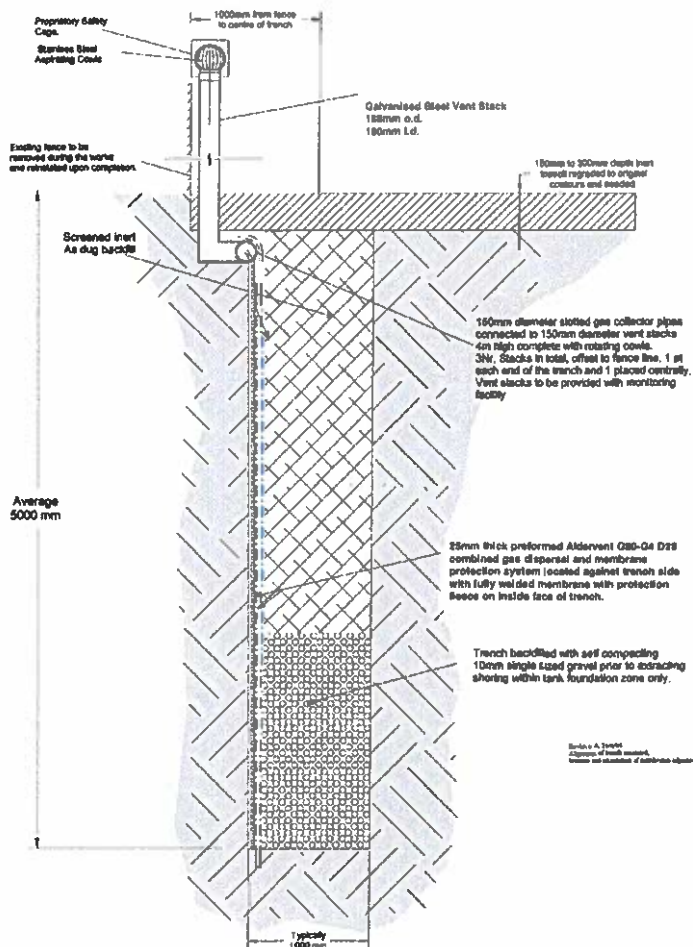
Applied as a Gas Barrier Membrane to protect the building against the ingress of all land borne gases - Methane, Carbon Dioxide and Radon. Tuflex is laid in a single layer over a prepared site. Due to its inherent weldability and on site quality assurance monitoring, the membrane is recommended to be laid by trained operatives certified for the purpose. On smaller sites factory fabricated panels can be supplied for application by others. Applied to cover the whole of the slab area above Aldervent gas ventilation system if required.

All membrane penetrations (i.e. steel stanchions and service entry points) to be sealed with factory formed units welded to the membrane on site.

At all points where the membrane passes through load bearing walls, Aldercourse Tuflex DPC or GRA DPC is installed and welded to the overlying Tuflex membrane.



Pressure testing of welded joints
(part of standard CQA procedures)



Membrane Protection

Protect finished membrane with Geotex or Alderway protection mats if following trades are erecting steel fabrication for slab reinforcement.

All punctures to be repaired by a minimum overlap of 150mm.

Cut-off Trench Containment

Alderprufe Tuflex has been successfully installed up to 8 metres deep as a vertical barrier to contain contaminants and gases on brown fields sites and around landfill.

Installed by accredited contractors.

Bespoke systems have been designed to suit site specific parameters.

Trilaminate membranes with exceptionally high puncture resistance are available.

Cut-off trenches for contaminant control, with large volume gas and liquid dispersal properties, are possible, utilising Aldervent Geogrid, Geovoid, or Geocell systems. (see separate data sheets.)



In-service performance

The demands made on Alderprufe Tuflex in landfill, water containment or pollution control are considerable. The flexibility of Alderprufe Tuflex is due to the polymeric structure of the resin. There are no plasticisers in the Alderprufe Tuflex formulation that can be leached out by exposure to chemicals or sunlight causing the membrane to become brittle.

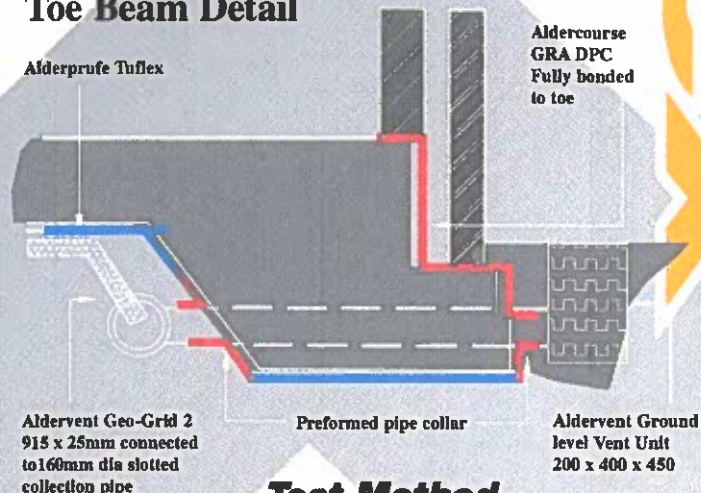
Design and Specification

All Alderprufe Tuflex systems carry Product Guarantee Insurance including efficacy cover. Bespoke system designs with third party accreditation including P.I. cover are available to the developer to offer full security and warranties.



This product satisfies the criteria set out in BS 6920: Part 1: 1996 "Specification" and thus complies with the requirements of the Water Bylaws Scheme Tests of Effect on Water Quality (BS 6920: 1996). It is suitable for use with cold but not hot water.

Toe Beam Detail



Test Method

Thickness mm +/- 10%	0.75	1.0	1.5	ASTM D - 751
Density g/cm ³	0.9	0.9	0.9	ASTM D - 792
Tensile Stress @ break Min N/mm ²	13	18	26	ASTM D - 638
Elongation @ Break %	>700	>700	>750	ASTM D - 638
Puncture Resistance Min N	120	150	200	FTMS 101C Method 2065
Tear Resistance Min N	45	60	90	ASTM D - 1004
Dimensional Stability	+/-2%	+/- 2.0	+/-2%	ASTM D - 1204
% Change Max				1 Hr @ 1000C
Stress Crack Resistance	100%	100%	100%	ASTM 5397
Volatile Loss 5%	0.2	0.2	0.2	ASTM D - 1203
Loss Max				Method A
Ozone Resistance	No cracks	No Cracks	No Cracks	ASTM D - 1149
Carbon Black Content	2-3%	2 - 3%	2-3%	ASTM 1063
Moisture Vapour g/m ² /day	<0.01	< 0.1	<0.01	ASTM E96
Friction Angle (Non Woven Geotextile)		21°		Shear Box
Methane Permeability	0.14	0.11	0.007	European standard g/m ² /day/atm
Methane Transmission Rate		1.8 x 10 ⁻⁹ m ³ /m ² /s/atm		BRE
Permeability Coefficient		1.8 x 10 ⁻¹²		