HYDRAPROTECTOR FRP STORMWATER TREATMENT SYSTEM

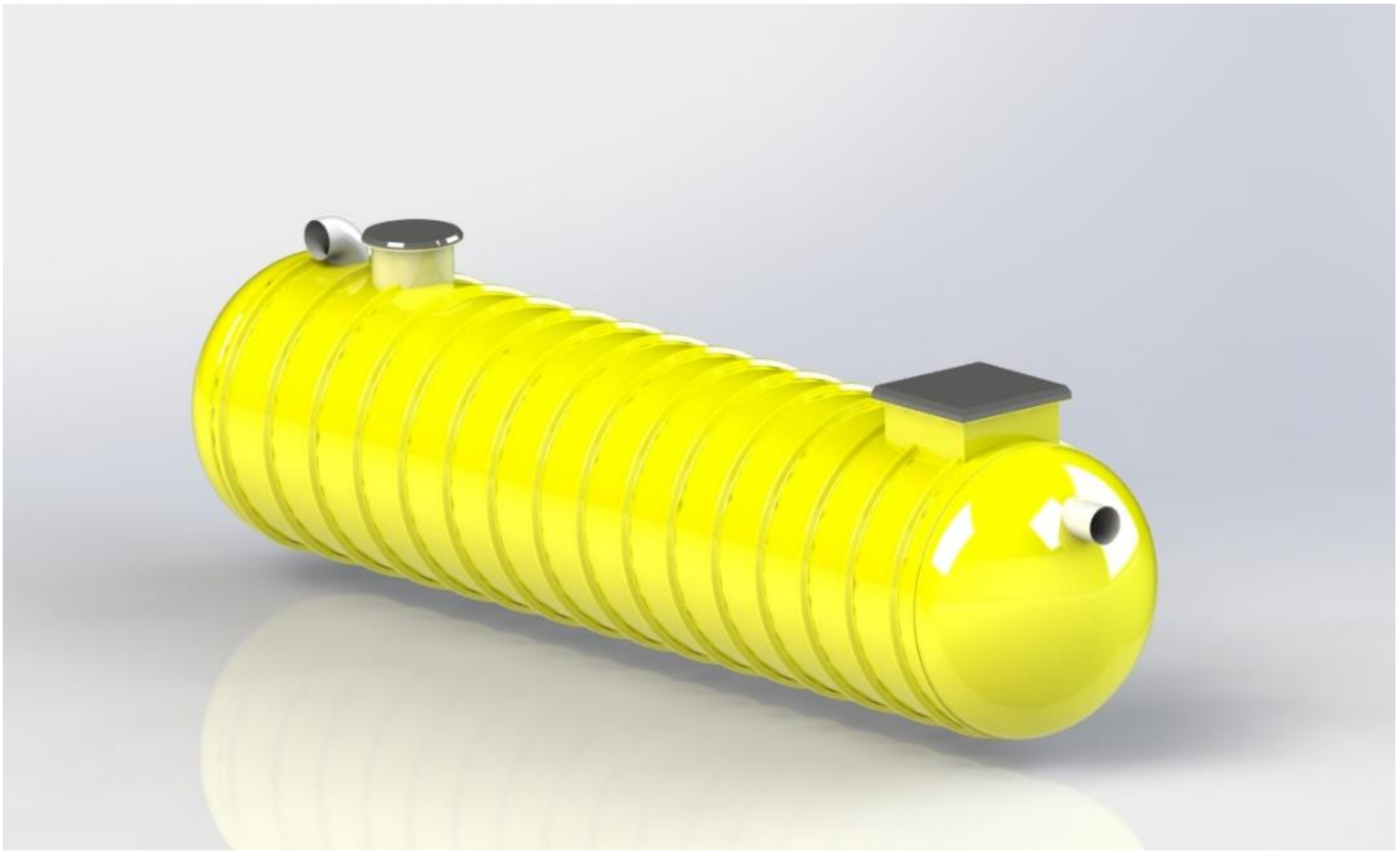
INSTALLATION AND MAINTENANCE MANUAL

PROTECTOR

1 Ropes Crossing Boulevard,

Ropes Crossing 2760

NSW, Australia



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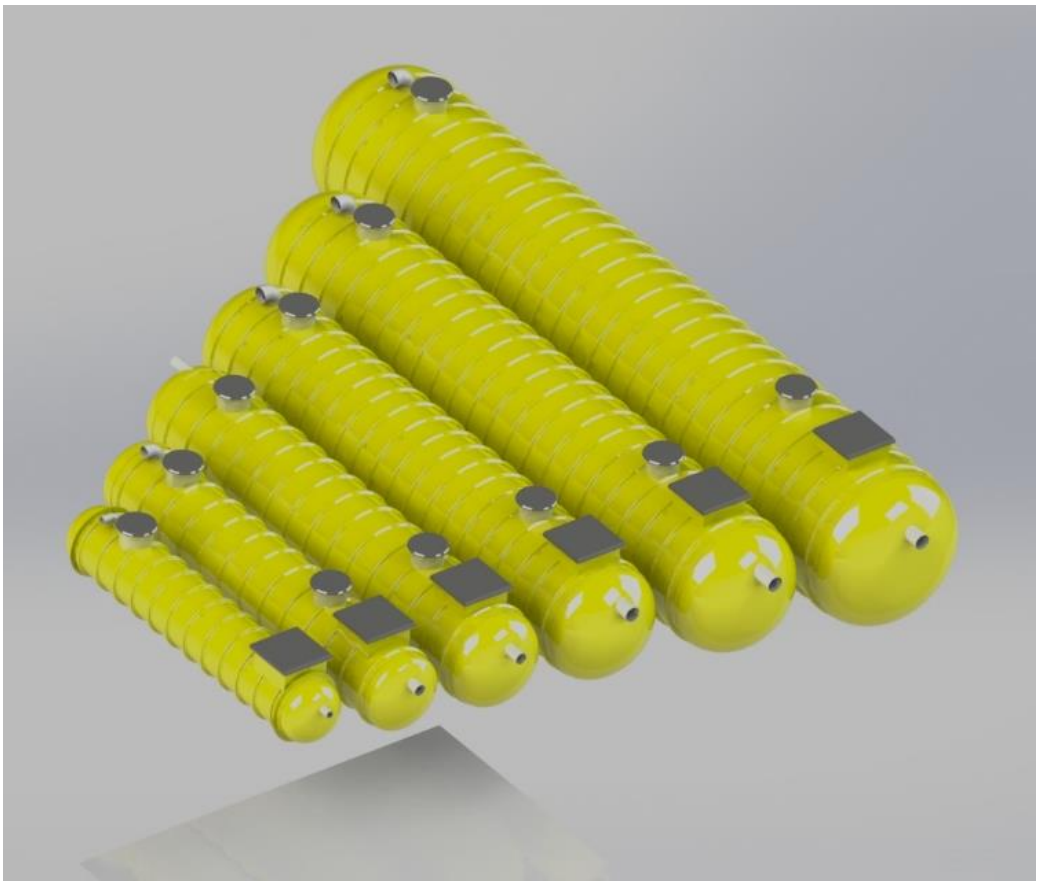
1. INTRODUCTION

Protector is a company excelling in the design, manufacture and production of fibreglass tanks to be utilised in stormwater treatment technologies. The newest development designed by Protector is the HYDRAPROTECTOR, a filtration device to be implemented into stormwater systems to remove large sediments, gross pollutants, hydrocarbons and oil from stormwater runoff. Once treated this water is then returned into the water system, efficiently keeping our water clean.



Protector is a company excelling in the design, manufacture and production of fibreglass tanks to be utilised in stormwater treatment technologies. The HYDRAPROTECTOR, a bypass separator, is an impeccably designed and manufactured high quality unit, designed and tested in accordance with the European standard BS EN 858-1and meets the requirements of the environment agency's pollution prevention guidelines (PPG3) and the construction products regulations. Once treated this water is then returned into the water system, efficiently keeping our water clean.

Protector separators are filament wound by an advanced patented chop hoop filament winding process. This process produces not only circumferential strength ads found in the helical wound tanks, but also high longitudinal strength. The interlinear shear strength permits tanks to be cut for manholes and pipework without undue loss in strength.

Leaks and spillages of oil and fuel are washed down drains every time it rains and, unless intercepted, in their way into water courses polluting reservoirs and rivers. This can have a disastrous effect on plants and wildlife. A substantial amount of oil pollution is collected in sites such as garage forecourts, large car parks and fuel storage depots and this must be intercepted to avoid the risk of prosecution.

PROTECTOR products, manufactured by the Australian-based manufacturer, PROTECTOR, provide high quality solutions for fast and efficient installation, needed for today's fast track building methods. Built to the highest specifications, the HYDRAPROTECTOR product is designed and built to BS4994-1987 and ASME RPT1. Popular with councils, municipal, water authorities, civil and construction customers and incorporating state-of-the-art technology, our stormwater treatment solutions provide simple solutions to some of the most complex problems in the water and waste water industry.

PROTECTOR products are designed to reduce operating costs and optimise operating efficiency. Above and below ground options can be used in a multitude of applications, in both domestic and commercial environments, from small, single pump units to dual pump systems, with capacities of up to 250,000 litres per unit. The entire range is easy to install, easy to handle, light and robust.

PROTECTOR's dynamic enterprise has roots in the industry that go back to over 40 years of engineering, design experience and product knowledge passed from generation to generation to where it is today. PROTECTOR products, known as the leading edge of composite manufacture here in Australia are renowned for their quality with painstaking attention to detail that has become the product and basis for the company's operation formed by years of experience and knowledge in the fibreglass and water industry.
Today PROTECTOR plant, based in Sydney, comprises of modern 'state of the art' filament winding and computerised robots to ensure fast operations and precision from concept to completion. The basis for the company's operation, with continuous success, both yours and ours!

Fibreglass Reinforced Polymer are composite materials made of a polymer matrix reinforced with fibres and are high strength, long life materials that are commonly used in aerospace, automotive and water industries. Our FRP products are coated with a final internal and external layer of C'veil and CSM to provide a higher resistance to corrosion which makes them ideal to be implemented in tank applications such as our stormwater treatment systems. They can be exposed to the water for years without being corrupted. Light weight, resistant to high temperature, strong in compression with our guarantee of easy on-site installation are some of the desirable features that FRP indicates. Furthermore, FRP plates have higher mechanical strength which enables them to carry higher loads compared to plastics. PROTECTOR has designed and manufactured stormwater treatment system utilizing FRP to provide a quality product. HYDRAPROTECTOR stormwater treatment system have a better durability, and highly resistant to any impact and corrosion whilst providing the best stormwater treatment available.

This document provides an in-depth and detailed collation of the technical information on the HYDRAPROTECTOR product including its installation practices, suitable usage, advantages and limitations. Information is also provided on the filtration system, its design and its maintenance.

2. Scope of Product

The HYDRAPROTECTOR is an underground installed horizontal stormwater treatment tank. The entire stormwater treatment system is made from FRP (fibre reinforced polymer) due to the materials reliable longevity and strength. It is most commonly used in high oil situations where run offs main pollutant is hydrocarbon based. Due to the installation of a coalesce unit, in any situation where the hydrocarbon requirement is less than 5ppm, the Hydraprotector is recommended and suitable. Fibreglass Reinforced Polymer are composite materials made of a polymer matrix reinforced with fibres and are high strength, long life materials that are commonly used in aerospace, automotive and water industries. Our FRP products are coated with a final internal and external layer of C'veil and CSM to provide a higher resistance to corrosion which makes them ideal to be implemented in tank applications such as our stormwater treatment systems. They can be exposed to the water for years without being corrupted. Light weight, resistant to high temperature, strong in compression with our guarantee of easy on-site installation are some of the desirable features that FRP indicates.

The Hydraprotector is commonly installed as the secondary part of a stormwater treatment and management system, usually followed by a tertiary treatment system. It is also capable of being able to be installed as a sole system with the inclusion of a pumping station either built in to the system or as a secondary part. Due to the high storage capacities available in the HYDRAPROTECTOR system, this system is able to double as a horizontal storage and retention system and hence is a viable system to be installed in any number of applications or scopes.

2.1. Applications

The HYDRAPROTECTOR is suitable for many applications. Its high filtration rate and large array of configurations and sizes allows for this system to be suitable in almost all situations. Its ability to also be combined with other filtration systems, such as the HYDRAPROTECTOR, as a combined system ensure that this system can be used in a wide range of applications. The most common applications are listed below:

- Power Stations
- Substations & Switchyards
- Mining & Heavy Vehicle
- Windfarms
- Waste Transfer Depots
- Re-fuelling Areas
- Service Stations
- Asphalt Plants

3. HYDRAPROTECTOR STORMWATER TREATMENT SYSTEM SPECIFICATIONS

PROTEC WATER products are Quality Assured under BS EN ISO 9001:2000 - manufactured in a modern manufacturing plant ensuring the highest standard of quality control. Protector separators are filament wound by an advanced, patented, chop hoop filament winding process. This process produces not only circumferential strength as found in helical wound tanks, but also high longitudinal strength. The interlaminar shear strength permits tanks to be cut for manholes and pipework without undue loss in strength. The dished ends are incorporated during the filament winding process, enabling tanks to be moulded and completed as virtually 'one piece' units.

The manufacturing process is carefully monitored with a digital read out system. Chopping glass, winding glass, the resin-rich inner layer and main laminate resins are kept within specification parameters, thus minimising human error. Quality control procedures require each tank to be carefully inspected and tested.

All the Protector range have been individually engineered to handle the toughest environmental situations and proven in the toughest environments such as high-water tables and volcanic soils. Problems in these areas have been solved with the installation of the HYDRAPROTECTOR.

The Packaged Hydraprotectors are engineered to the following Standards:BS4994 – 1987, AS/NZS 1546.1:1998. Hydraulic and civil engineering can also be provided to your requirements.

Protector separators are filament wound by an advanced, patented, chop hoop filament winding process. This process produces not only circumferential strength as found in helical wound tanks, but also high longitudinal strength. The interlaminar shear strength permits tanks to be cut for manholes and pipework without undue loss in strength. The dished ends are incorporated during the filament winding process, enabling tanks to be moulded and completed as virtually one-piece units. The manufacturing process is carefully monitored with a digital read out system. Chopping glass, winding glass, the resin-rich inner layer and main laminate resins are kept within specification parameters, thus minimising human error. Quality control procedures require each tank to be carefully inspected and tested. Ultrasonic thickness readings, Barcol hardness readings and material content weights are checked and recorded against the tanks unique serial number.

3.1. Design and Construction Standards

- AS1546 - Underground tank design
- AS1170 - Loading code

3.2. Design Methodology

The underground tank Design Methodology is based on the use of the above standards as described, where applicable:

- AS1546 is used to formulae the design load of soil/groundwater and use for the testing methods applied.
- AS1170 is used to formulae the design loads from active loads that the stations are subject to, including the required roof slab design. This standard is also used to formulae the ballast requirements for ant floatation.

3.3. Materials of construction

3.3.1. Corrosion

- Internal
    - Internal Corrosion Barrier, moulded with a resin rich C'veil and CSM layers
    - Resin rich Corrosion barrier constructed from Hetron 922 Vinyl Ester Resin
    - C'veil will be Regina 80gsm Surface Tissue
    - The Internal Corrosion Barrier is manufactured in accordance with AS2634
- External
    - External layer will a resin rich CSM layer and C-Glass veil finished with ISO/NPG Flow coat layer for external finish to required colour

3.3.2. Reinforcement

- Manufactured using Chop / Hoop Construction, on a computer-controlled Filament Winding machine.
- Shell Thickness are in accordance to the design requirements set out in the methodology. o Structural layers are constructed from Polyplex Isophthalic Resin with CSM & Hoop in accordance with Ratio's as specified by the design.
- Fiberglass 'E' glass is used for both chopped and continuous strands.

3.3.3. Tank

- The Stormwater treatment system Battered base is circumferentially benched to WSA04—2005
- FRP Flanged fittings are made in accordance with AS2634, and flanges are installed as per AS2634. Both the internal and external FRP attachment laminates are in accordance with AS2634

4. SAFETY

These instructions should not be interpreted in any way to put one's health at risk, or to harm property and/or the environment. The following definitions will serve as a guide when reading this manual:

4.1. Warning

Indicates a potentially hazardous situation, which if not avoided could result in death or serious injury.

4.2. Caution

Indicates a potentially hazardous situation, which if not avoided may result in minor or moderate injury. A caution without the safety alert symbol indicates a potentially hazardous situation, which if not avoided may result in property damage.

4.3. Important Information

Proper installation of each HYDRAPROTECTOR is essential:

• To ensure the safety of all the individuals involved in the installation.

• To prevent HYDRAPROTECTOR damage and/or failure, which could lead to product loss and environmental contamination.

• To validate the HYDRAPROTECTOR warranty.

4.4. General Information

WARNING HYDRAPROTECTORs are a confined space per OHS guidelines. Follow proper confined space safety procedures.

PROTECTOR fibreglass HYDRAPROTECTORs are designed for installation with concrete top pad and bottom slabs. The following instructions reflect the approved methods for installing HYDRAPROTECTORs. Follow all OHS, Federal, State or Local, safety and environmental codes and regulations

4.5. Before you Begin

• Read, understand and follow these instructions.

• Barricade the work area.

• Review and prepare to complete the installation checklist as the installation progresses. If you have questions on other HYDRAPROTECTOR installation details, call Technical Support at 02 8006 4229

5. Prior To Installation

Our Products are Suitable for almost all locations, from an industrial Car Park to Residential Catchment areas, from mining areas to Airports, our large range of products will provide the solution you need. Our FRP designs will strive to keep our streams, waterways and our environment clean.

5.1. Design Considerations

Important considerations must be taken when deciding on which Protector product is suitable for your needs. With the assistance of our team of experienced staff we can offer endless assistance and advice in this matter. The most important aspects we consider helping solve your needs are:

- Physical Locale and rainfall conditions
- Catchment Size
- Contaminant types
- Flow Rate
- Risk Analysis

All our products ensure clean, treated water to flow back into the environment.

5.2. Location

Location is vital for design considerations for PROTECTOR to provide the best possible HYDRAPROTECTOR FRP tank for you site demands. Information shall need to be supplied to our team depicting all information necessary for us to select the perfect HYDRAPROTECTOR tank for you. Rainfall data, flow rates, storm conditions and other aspects of the surrounding area are recommended to be provided or detailed.

For optimal installation and transport of the HYDRAPROTECTOR FRP tanks, clear and safe access to the stormwater treatment system, stormwater treatment system installation site and control panels must be considered to facilitate ease of installation, maintenance and servicing. The access manways built into our HYDRAPROTECTOR tanks must be accessible at all times and well-sealed to prevent foreign contaminants from entering the stormwater treatment system. Access roads must be available for delivery of the tanks, with no intrusion or obstacles that may cause damage to the FRP tank upon delivery and installation.

5.3. Wide/Long Loads

Where the tank is of such size that police/ private escort is required delivery, times given are estimates only. In the event of delays outside the control of PROTECTOR the extra charges that result will be forwarded to the contractor.

5.4. Installation Procedures

The alternative methods of installation depend on the ground conditions, water table, the tank locations and whether the tank is fitted with feet or not. Installation should be carried out by a competent contractor in accordance with the above procedures, Health and Safety at Work legislations and good building practices. It is not possible to

cover every condition in the instructions, therefore if in doubt please don't hesitate to contact us.

5.5. Tank Dimensions

Dimensions given on drawings and literature shall be subject to manufacturing tolerances and should be checked physically prior to installation.

5.6. Storage

Set tank on smooth ground free of bricks and sharp objects. Chock/tie down to prevent movement in high winds. If tanks have to be stored temporarily prior to installation they should be located:

- In an area where the chance of accidental damage or vandalism will be minimized
- On a flat surface free from small or sharp objects
- With efficient temporary anchorage to prevent high winds causing damage

5.7. Tank Specification

Check that you have received the correct specification tank. PROTEC underground tanks are available in specifications to suit invert depths, concrete or pea gravel surround and water conditions: standard heavy, extra heavy and special. For most applications the standard of heavy specifications is adequate. If the tank invert depth and/or water table depth is outside the range, we shall be pleased to advise accordingly.

5.8. Extension Access shafts

Check if extension shafts are required. These are available in increments of 600mm. Note: where there are the need for coalesce units or pumps are incorporated that require guide rails, fitted ladders, the height of the extension access shafts should be measured accurately before ordering.

6. PRE-INSTALLATION

6.1. General

The construction method used in the manufacture of FRP HYDRAPROTECTOR stormwater treatment system utilises high strength Composite Laminar of Resin and Glass
These materials are extremely strong as well as corrosion resistant. But, like all engineered products, care must be taken during installation to ensure that long, trouble free operation can be expected.

6.2. Pre-Installation Checks

1. After unloading inspect the tank skin for any damage during transportation and crane slinging. Should any minor surface damage be evident, this must be reported to your supplier and inspected before proceeding with the installation.
2. Check walls, floor and roof for any surface damage. If minor repairs are required, report as outlined in above.
3. Check all pipe penetrations through wall, ensure that no damage has occurred and that the surfaces are clean for later joining to incoming and outgoing pipes and vents.
4. Check hold down bolts on pedestals and tighten if necessary.

6.3. Handling and Preparation

WARNING Do not stand on or under HYDRAPROTECTOR while it is being lifted. This could result in personal injury or death.

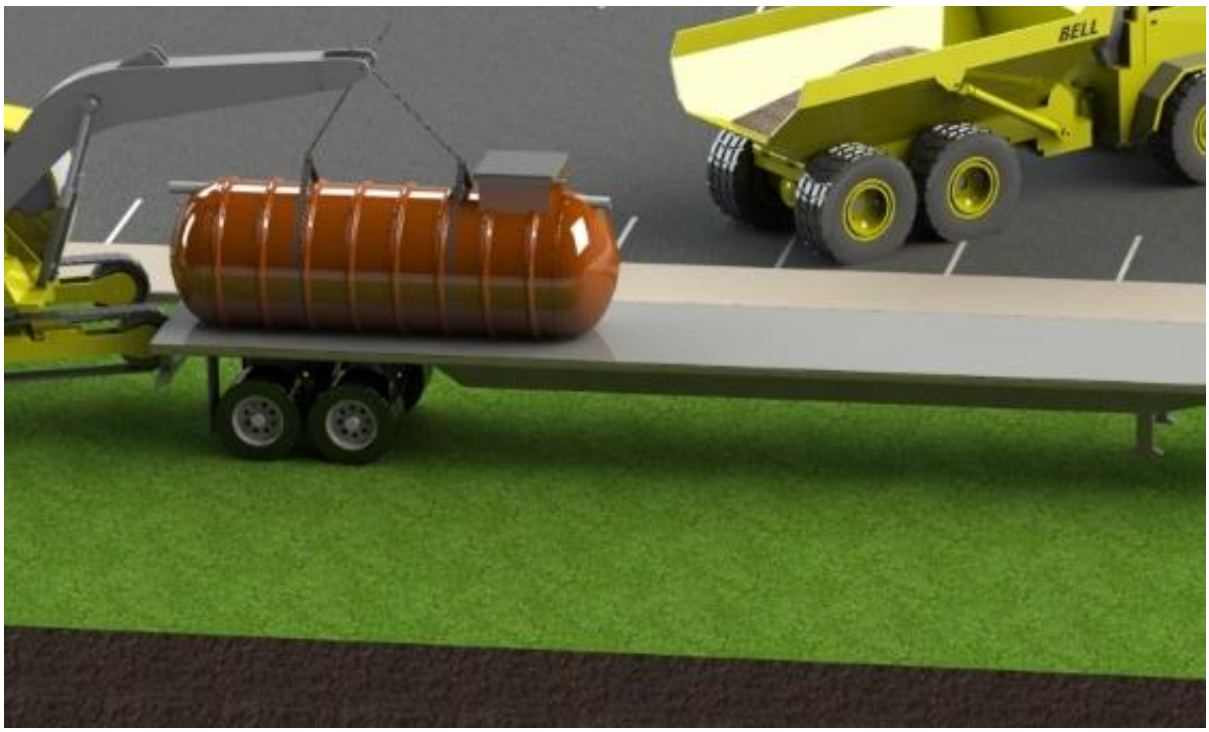
• Do not drop or impact the HYDRAPROTECTOR.
• HYDRAPROTECTORs should be stored horizontally and chocked, using only appropriate materials such as sandbags, tires, or other soft or pliable materials.
• Upon HYDRAPROTECTOR delivery and when lifting HYDRAPROTECTOR, visually inspect entire exterior surface of the HYDRAPROTECTOR for shipping or handling damage.
• If the HYDRAPROTECTOR must be moved by rolling, ensure that ground to be traversed is smooth and free of rocks, debris, or other hard objects.
• Do not roll or set the HYDRAPROTECTOR on any pipe stub out, accessory or appurtenance installed on the HYDRAPROTECTOR.
• The contractor is responsible for rigging, unloading and securing the HYDRAPROTECTOR.
• When lifting the HYDRAPROTECTOR in the horizontal position, use two slings with a spreader bar.
• Use a minimum of two lift lugs when pivoting the HYDRAPROTECTOR from horizontal to vertical.
• Utilize all lift lugs provided at the HYDRAPROTECTOR top for vertical lifting.
• Only a pliable strap or rope should contact the HYDRAPROTECTOR, do not use chains, steel cables or hard metallic slings.

Lifting and Tank Handling from Truck
Once the truck arrives:

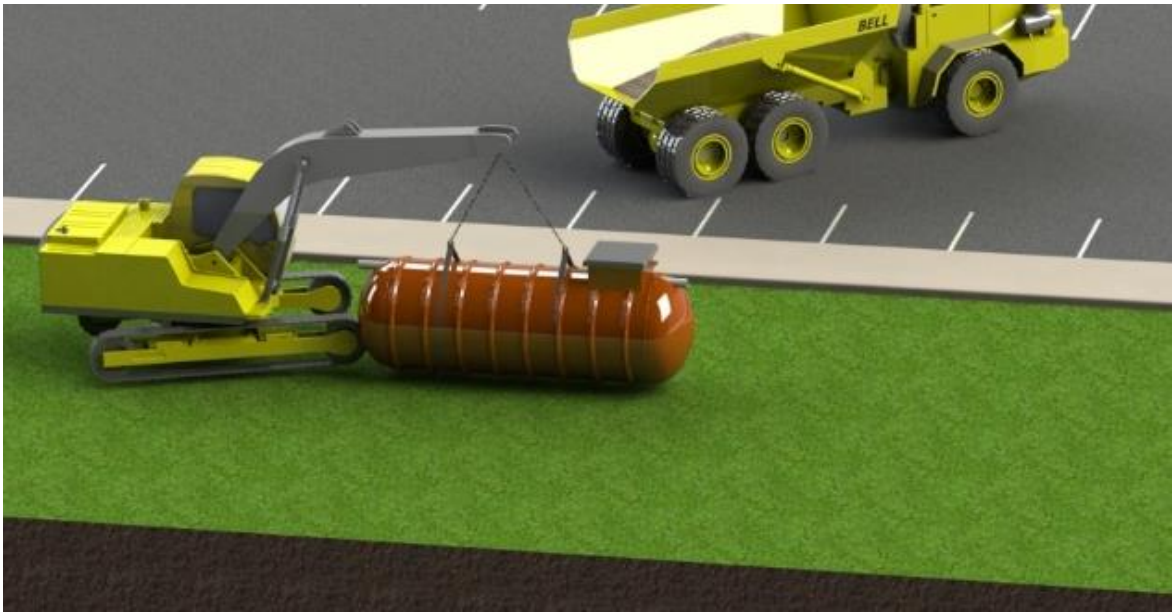
1. check condition of tank to ensure no damage has incurred in Transport. All issues must be photographed and sent to PROTEC FRP for verification.

Lifting procedure:

2. Place Soft Slings around the body of the station
3. Slings to be ¼ from each end



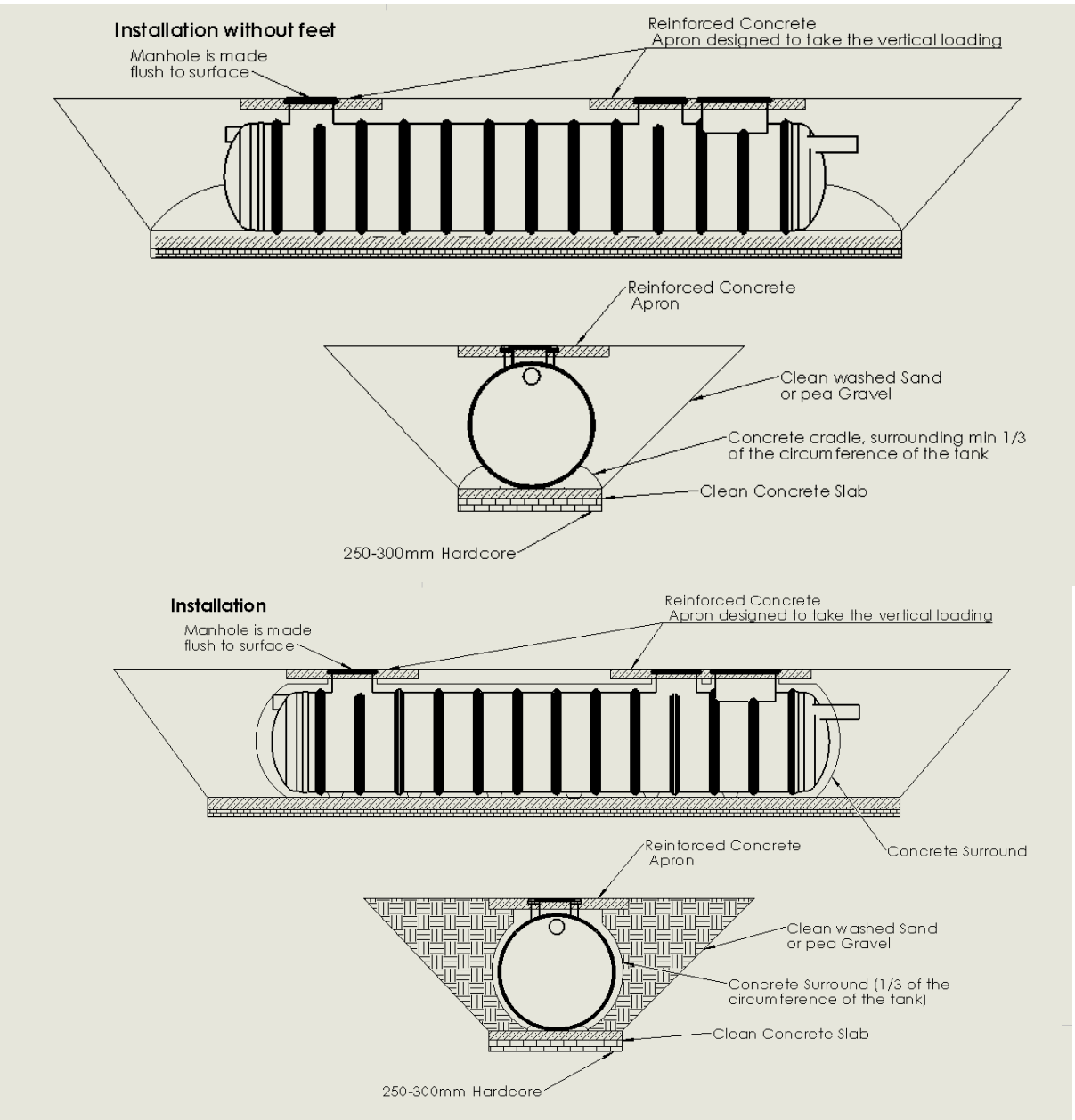
4. Connect two leg chains to slings
5. Ensure that angle of lifting is no less than 60 degrees.
6. Lift and Place on Ground
7. Place tank on ground as the same Position of the truck
8. Ensure that the tank is resting on supports. Ensure that the flanges do not come in to contact with the ground.
9. Ensure that the base of the tank is on soft ground (I.E. grass)



7. CONCRETE SURROUND INSTALLATIONS

7.1. Typical Installation With Feet

7.1.1. With concrete base and Concrete/ Pea Gravel Surround



7.1.2. Procedure with Feet

Feet can be provided during manufacture to enable the tank to be placed on a flat concrete base and levels checked prior to surrounding with concrete. Feet are not load bearing and minimal water should be placed in the tank prior to placing backfil concrete.

1. Pour concrete base to correct depth and level off. Base to be reinforced as necessary
2. When this concrete has set sufficiently, place the tank into position, check for levels including outlet and inlet inverts and fill with water in accordance to the details given. Ensure concrete slab is clean and ready for placing concrete surround. Ensure placement of surround within 48hrs of casting the base slab.

Excavation Details for Concrete Surround			1000, 1200, 1500	1850, 2200	2500, 3000
Maximum burial depths	Standard	Dry excavation	4	5	5.7
	Heavy	Dry excavation	5.6	6	7.25
		High water table	3	3.75	5
	Extra Heavy	Dry excavation	6.5	7	8
	Special	Dry excavation	7.3	8	9.2
Minimum hardcore			200	250	300
Concrete base slab thickness			150	220-240	240-300
Concrete Surround			150	220-250	250-300
Max water initial fill depths			300	400	500

7.2. Typical Installation Without Feet

7.2.1. Preliminary

Determine the size of the excavation from the dimensions of the tank and the incoming drain invert depth allowing for a minimum of 200-250mm of concrete around the tank. Where difficult ground conditions of the possibility of external loading exist, the concrete surround should be designed accordingly, for example with extra thickness and the use pf reinforcing.

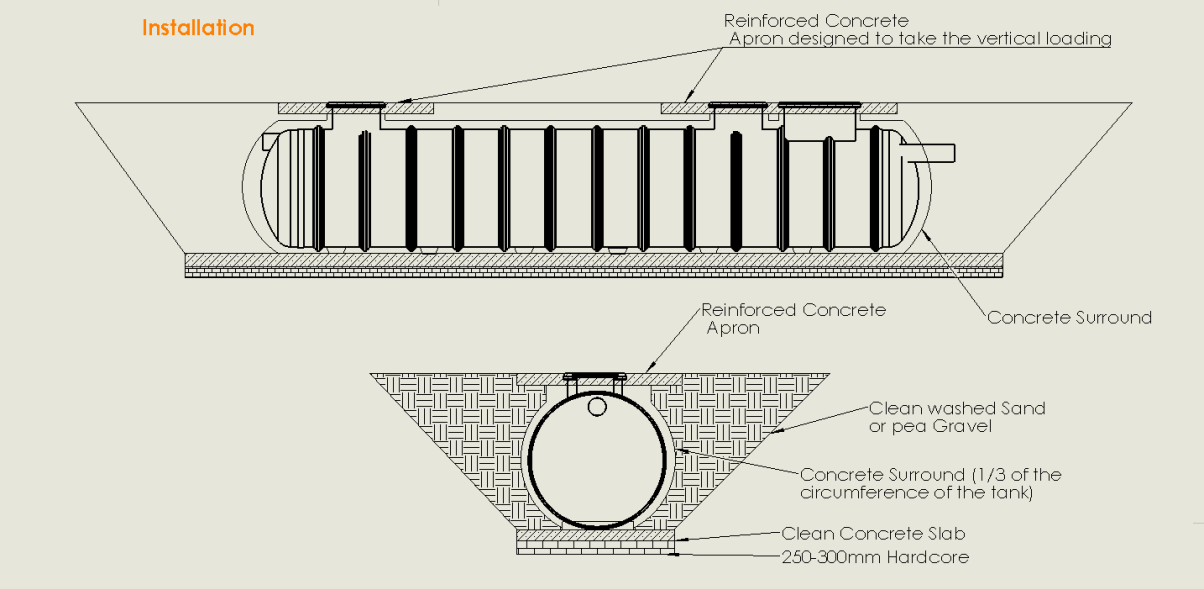
7.2.2. Excavation

Excavate allowing for easy placing of the tank and concrete and for consolidating concrete around the bottom half of the tank when backfilling. Allowance should be made for any timbering or sheeting that may be required.

If the bade of the excavation is of unstable ground – loose gravel, running sand, landfill type areas, peat, swamp or clay areas subject to swelling – excavate to allow for 250-300mm of hardcore and cover with a polythene membrane prior to placing concrete.

7.2.3. Procedure Without Feet

1. Place concrete along the centre of the excavation vase and lower the tank into position 'puddling' it into the concrete to form a cradle. Consolidate under the tank to prevent voids by hand, do not use vibrating pokers.
2. Check that the tank is truly vertical and level and that the inlet and outlet levels are correct
3. After the concrete has reached its initial set, fill with water according to the given data
4. Continue by placing concrete around the tank at the same time filling with water to equalise pressure and resist flotation. Where the tank is divided into chamber ensure all chambers are equally filled.
5. Connect up pipework, seat access shaft into socket and apply waterproof mastic and adhesive, or as applicable.
6. Top up the tank with water to the invert level and place the remained of the concrete to a depth of approximately 250mm above the top of the tank. Where extension shafts are fitted these can be surrounded in concrete once the main tank surround concrete has been set. IMPORTANT: Before surrounding circular or rectangular shafts with concrete, shutter internal to support the sides and safeguard against distortion.
7. Where the concrete slav over the tank is to take the vehicle loading, it should be reinforced, in accordance with good practice to take the maximum load. The reinforcing should be extended onto unexcavated ground. It is important that vehicle loading is not transferred to the tank itself.



7.3.4. Venting

Adequate ventilation of the septic tank and the inlet pipework shall be provided to prevent the accumulation of gases. All Protector products should be vented to Australian Standards, subject to local authority requirements. In multiple chamber separators, vent pipework must not be combined into a common stack below a point where the pollutants contained could be transferred into other containers.

8. Pea Gravel Backfill Installations

NB: Ensure only properly trained and experienced contractors perform this method of installation.

8.1. Backfill Material

Pea gravel or crushed rock is preferred as backfill material. Clean washed sand may be used, but it must be compact in 300mm lifts to above tank top. Requirements of the backfill material include:

- Clean and washed
- Non-cohesive, inert materials
- Pea gravel or crushed rock
- Particle no greater than 20mm
- Material free from rocks, ice, snow or organic materials.

8.2. Excavation

Excavate allowing for easy placing of the tank and backfill for consolidating backfill around the bottom half of the tank. Allowance should be made for any timbering or sheeting that may be required.

8.2.1. Stable Ground Conditions

Determine the size of the excavation from the dimensions of the tank and the incoming drain invert depth, allowing for a minimum of 450mm of backfill between the tank sides and the ends of the excavation.

8.2.2. Unstable Ground conditions

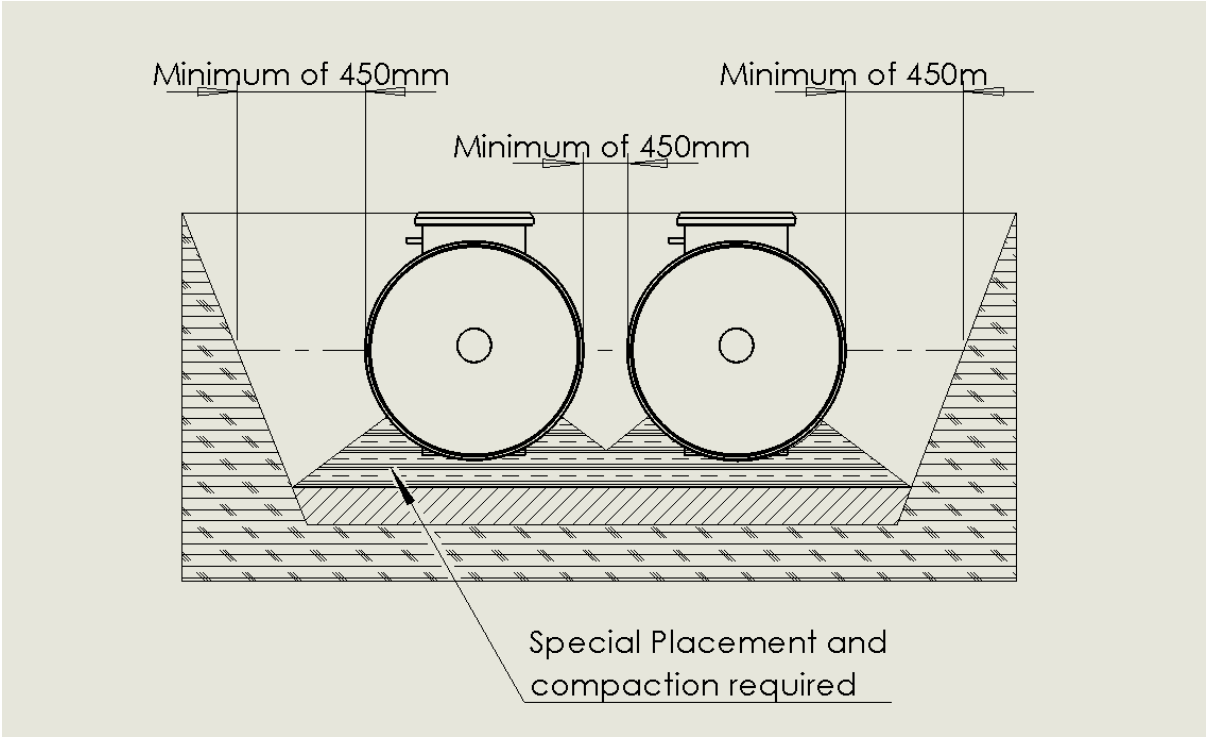
Where the ground is unstable, for instance landfill areas, peat, swamp or in clay areas subject to swelling or shrinking, the width of the backfill must be increased to a minimum of half the tank diameter between the tank sides and the ends of the excavation. If the base of the excavation is also of unstable ground, allow for 250-300mm of hardcore. After placing the hardcore, consolidate to ensure a firm base for the backfill.

8.3. Filter Fabric

Where there is a risk of the migration of pea gravel with the native soil, an approved filter fabric/geotextile is recommended.

8.4. Filling tanks

Do not fill tanks until backfill is to the top of the tank. Where the tank is divided into chambers, ensure all chambers are filed evenly.



8.5. Dry Hole Procedure

1. Place a minimum of 150mm-300mm of approved backfill over the excavation bottom.
2. Position the tank carefully onto backfill bed and check for levels including inlet/outlet inverts
3. Place first 300mm lift of backfill evenly around the tank by shovelling and pushing beneath the tank bottom, between ribs and end domes to ensure complete support and to eliminate voids. Place and compact further 300mm lifts as above to a minimum depth of 1/3rd tank diameter. The reminder of the backfill can be poured without consolidation except where required to support a cover slab.
4. Connect up the inlet, outlet and vent pipework, seat access shaft into the socket and apply waterproof mastic or adhesive
5. Where a concrete slab is to be constructed over the tank to take vehicle loading, it should be reinforced according to good practice to take the maximum load and should be extended onto unexcavated ground. It is important that the vehicle loadings are not transferred to the tank itself. Ensure the sides have been shuttering to work against distortion forces.

8.6. Wet Hole Procedure

Where there is water entering the excavation, the water level should be maintained below the foundation level by pumping. If the water level cannot be lowered, you will need to ballast the tank very carefully. Place the tank in the excavation adding only enough water ballast to sink it. The water level in the tank must never exceed the water level in the excavation. While adding ballast use only lifting straps to keep the tank in position.

It is essential the backfill is distributed evenly around the base of the tank and thoroughly consolidated with the aid of long handled probes to eliminate any voids as set out in point three of the dry hole procedure.

8.6.1. Backfill Bed

This table describes the minimum amount of approved backfill required to be used over the excavation bottom.

Tank	Min Backfill Bed (mm)
1000, 1200, 1500 diameter	200
1850 and 2200 diameter	250
2500 and 3000 diameter	300

9. Wet Concrete Cradle with Pea Gravel Installation

This method of installation combines the safety of the concrete cradle system with the economy of the pea gravel backfill, this being a safer option for a less experienced contractor than providing a bedding of purely pea gravel.

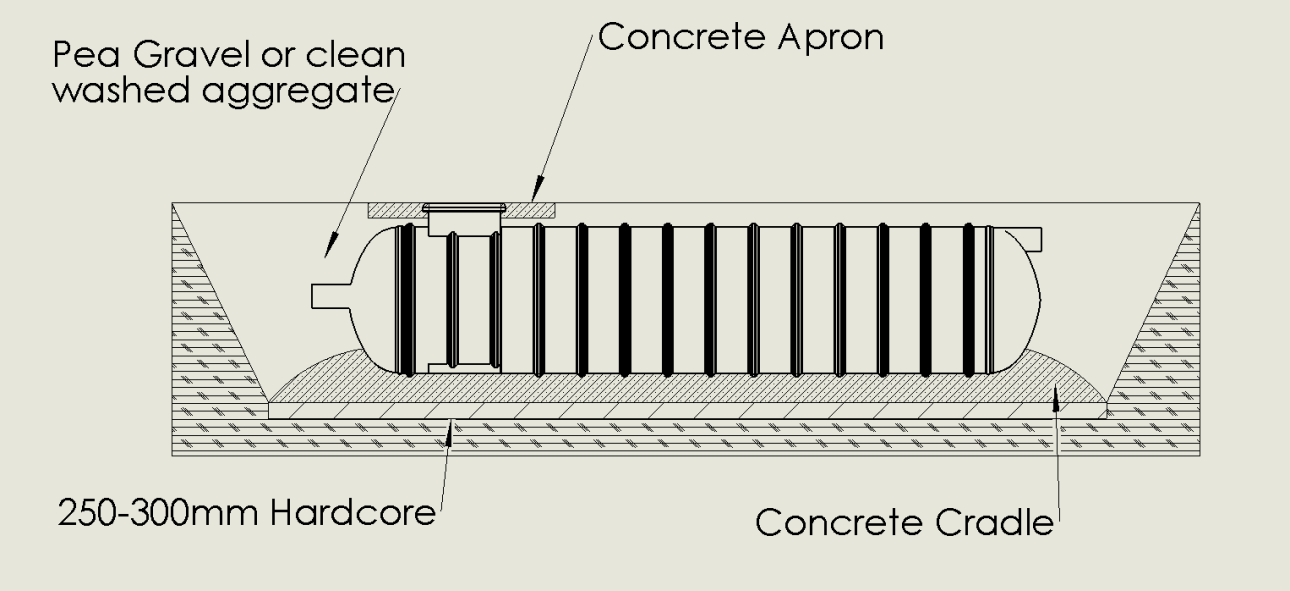
9.1. Installation Details

Excavation for Stable ground conditions

Determine the size of the excavation from the dimensions of the tank and the incoming drain invert depth, allowing for a minimum of 200-250mm (ST4 mix) concrete and for a minimum of 450mm between the tank and the excavation

9.1.1. Excavation of unstable ground conditions

Where the ground is unstable, for instance landfill type areas, peat, swamp or in clay areas subject to swelling or shrinking, the width of the backfill must be increased to a minimum of half the tank diameter between the tank sides and the ends of the excavation. If the base of the excavation is also of unstable ground, allow for 250-300mm of hardcore. After placing the hardcore, consolidate and cover with a polythene membrane prior to placing the concrete.



9.2. Procedure

1. Place concrete along the centre of the excavation base and lower the tank into position ‘puddling’ it into the concrete to form cradle. Consolidate under the tank to prevent voids. Consolidate by hand – do not use vibrating pokers.
2. Check the tank is truly vertical, level and inlet/outlet invert levels are correct.
3. Place first 300mm lift of backfill evenly around the tank by shovelling and pushing around the tank sides, between ribs and end domes to ensure complete support and to eliminate voids. (Where access is confined long handled probes, curved to enable reaching the

underside of the tank, can be used). After placing first lift of backfill the remainder of the backfill can be poured without further consolidation by hand.

4. Connect inlet, outlet and vent pipework, seat access shaft into socket and apply waterproof mastic/adhesive, or as applicable.

5. Where the concrete slab is to be constructed over the tank to take vehicle loading it should be reinforced in accordance with good practice to take the maximum load and should be extended into unexcavated ground. It is important that vehicle loading is not transferred to the tank itself.

Where the tank is divided into chambers ensure all chambers are filled equally. Where the chambers may require to be separated by load bearing partitions to accommodate different liquid levels the tank must be surrounded in concrete.

10. INSTALLATION OF EXTRAS

10.1. Mechanical Anchoring

Mechanical anchoring is required where the tank is to be surrounded in pea gravel and where water would enter into the excavation, or where the tank is to be surrounded in concrete and it is imperative the tank does not shift during the placement of this concrete. Protector mechanical anchoring straps are available for all tanks. These are located over the designated ribs and held in position by locator's position over the said ribs. Cables or straps should not be used between the ribs on the tank.

It is the responsibility of the tank owner or his technical representative to determine if mechanical anchoring is required for a specific installation.

If water could enter the excavation (underground water table, rainwater run off etc.) we recommend the tank is mechanically anchored unless the minimum depth from tank top is, as in table shown below. The weight of over burden on top of the concrete anchor pad provides the anchoring force. The pad is to prevent buoyancy but should be designed taking into account soil conditions such as thickness and reinforcement.

Straps must not be placed between the ribs or passed over from one side to the other as stress will be transferred to the weakest part of the tank wall. Unless the Protector system is used and position correctly to the instructions given the warrant will be nullified.

Anchor points should be spaced equal to the tank diameter plus 3oomm each side of the tank regardless of tank diameter. The anchor points must be aligned with accordance with the designated ribs plus or minus 25mm. All anchor straps must be uniformly tightened with the ratchets. Straps should be a tight, snug fit to the ribs but most not cause the tank to deflect. It is recommended that the ratchets are positioned on alternate sides of the tank to ensure the tank remains vertical during tensioning. Check the tanks internal diameter before and after to ensure against deflection.

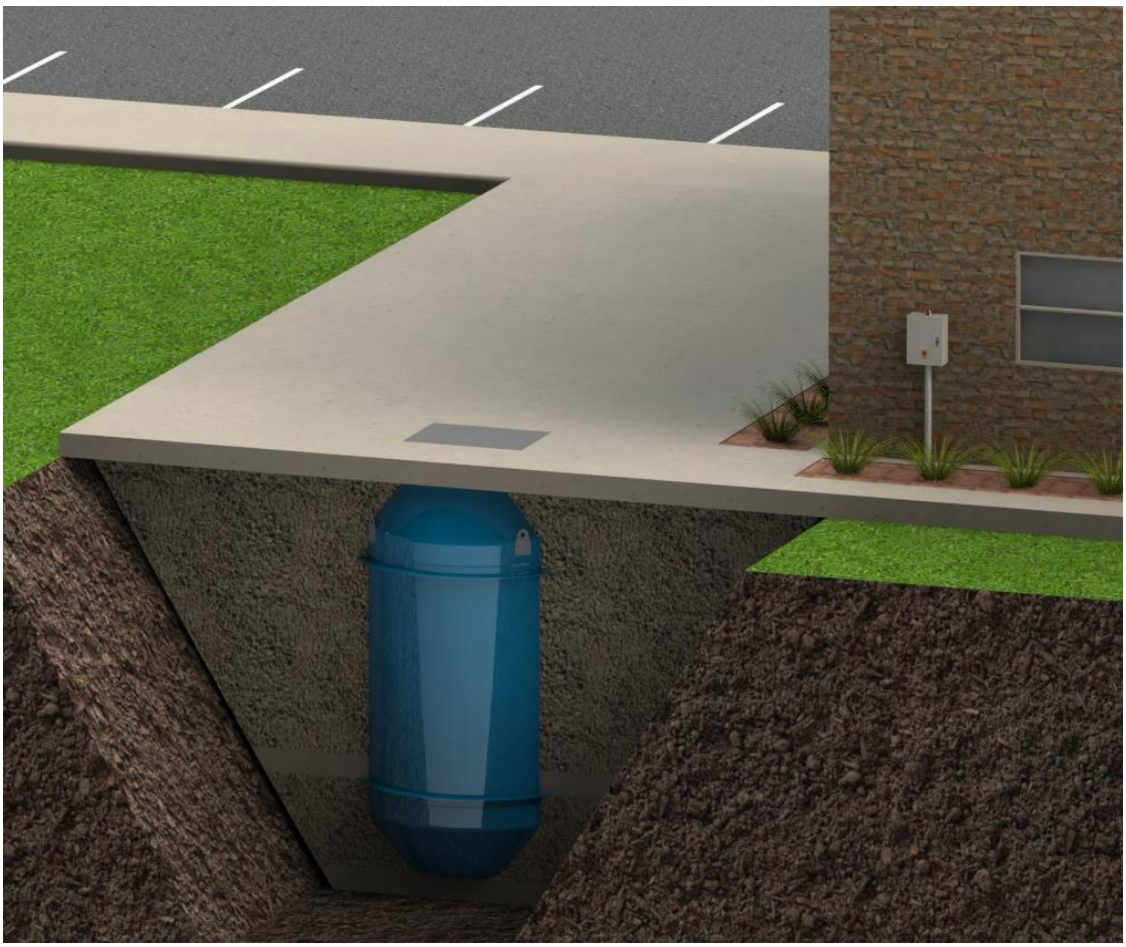
10.1.1. Anchoring Procedure

1. Check the contents of the kit are all present

2. Install the galvanized sinker into the pre-case pockets of the concrete base. These must line up with the ribs of the tank. The 'holding down' ribs are indicated on the tank by a strap label
3. Using the short length of webbing, pass the look of the webbing through the sinker bringing it back on itself, then pass the remaining webbing through the loop and pull tight.
4. Taking the ratchet, remove the bolt. Place the top look of the short length of webbing between the opening for where the bolt has been removed and replace the bolt.
5. Attach the long length of the webbing to the opposite galvanised sinker in a similar way to that described in stage 2. Then throw the remaining length of webbing over the tank, making sure that the webbing is not twisted.
6. Slide the GRP strap locators on to the long length of the webbing and position the locators as shown in the drawing.
7. Taking the end of the long length of webbing, thread it through the slot of the ratchet and tighten up using the ratchet arm to give required tension.
8. On completion of the ratchet tensioners should be well wrapped in DENSO or similar tape for long term protection if the tank is surrounded in pea gravel or similar backfill.

10.2. PROTECTOR Automatic Alarm and Monitoring System

Various options are available for installing the control panel. They can be mounted on eternal or internal walls or on a freestanding post. The control panel can also be installed in a freestanding Solar powered unit, making it independent of mains electricity.



1. Control panel for PROTECTOR automatic alarm and monitoring system. Can be placed up to 300m from the prove
2. Access covers shaft in accordance to EN:124. Access covers with ventilation openings or those which can be bolted down are not permitted
3. Venting into grassed area – not manifolded if permitted by local authority otherwise see below.
4. Alarm Probe

10.3. Venting systems

Each chamber of any tank should be vented. Vent pipes should extend to greater than 2.4 m above ground level, and should not be less than 75mm in diameter and of robust construction, being manifolded above ground.

11. UNDERGROUND TANKS

11.1. Wellpoint Dewatering

Where sandy, permeable ground is saturated with water, well point dewatering is a technique that lowers the ground level over a defined area. This is achieved by simultaneously pumping from a number of well points inserted into the water table.

Without well point dewatering the contractor would be trying to work or dig in ground that is virtually quicksand. The sides of the excavated hole would keep collapsing and any sand removed would be replaced by more sand running in, filling the hole. This can result in unnecessary danger to workers, other site locations, infrastructure nearby etc. Once the well points have been installed and the system has been running for some time, the contract can the excavate in stable conditions. The system must be run 24 hours a day.

11.2. Long Excavation

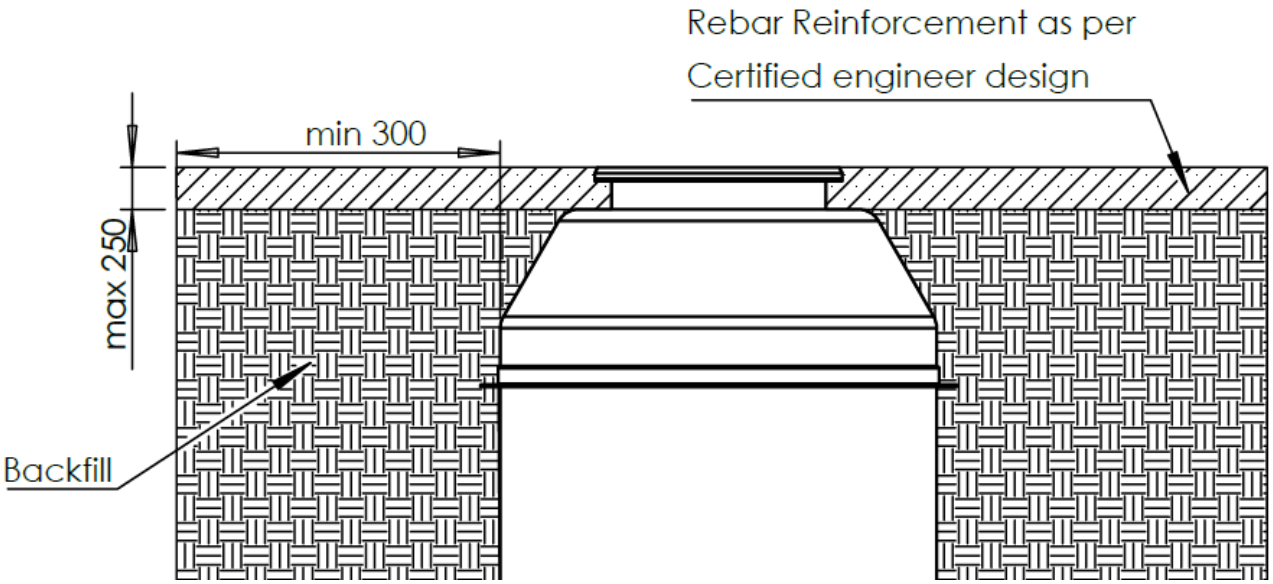
Where excavations exceed 4m and extend to up to 22m, a proprietary bracing system, where little or no cross bracing internally is required, should be used. Systems available compromise telescopic, hydraulic and rough adjustment walling modules connected to fixed length extension beams designed to provide support to interlocking sheet piling. Where excavations are 20m or more in length a goal post is required to be arranged to provide cross bracing support at the central point. This arrangement enables the PROTECTOR tank to be passed under and into the excavation.

To allow for the central goal post, the PROTECTOR tank must be slung sufficiently off centre to ensure clearance when finally positioning. Just sufficient angle of repose of the suspended tank can be achieved by using carefull calculated length slings. Care must be exercised when the lower suspended end of the PROTECTOR tank reaches the concrete base slab. It is recommended the first point of contact is protected. A vehicle type is effective in cushioning a load point.

12. TRAFFIC AND NON-TRAFFIC LOAD COVERS

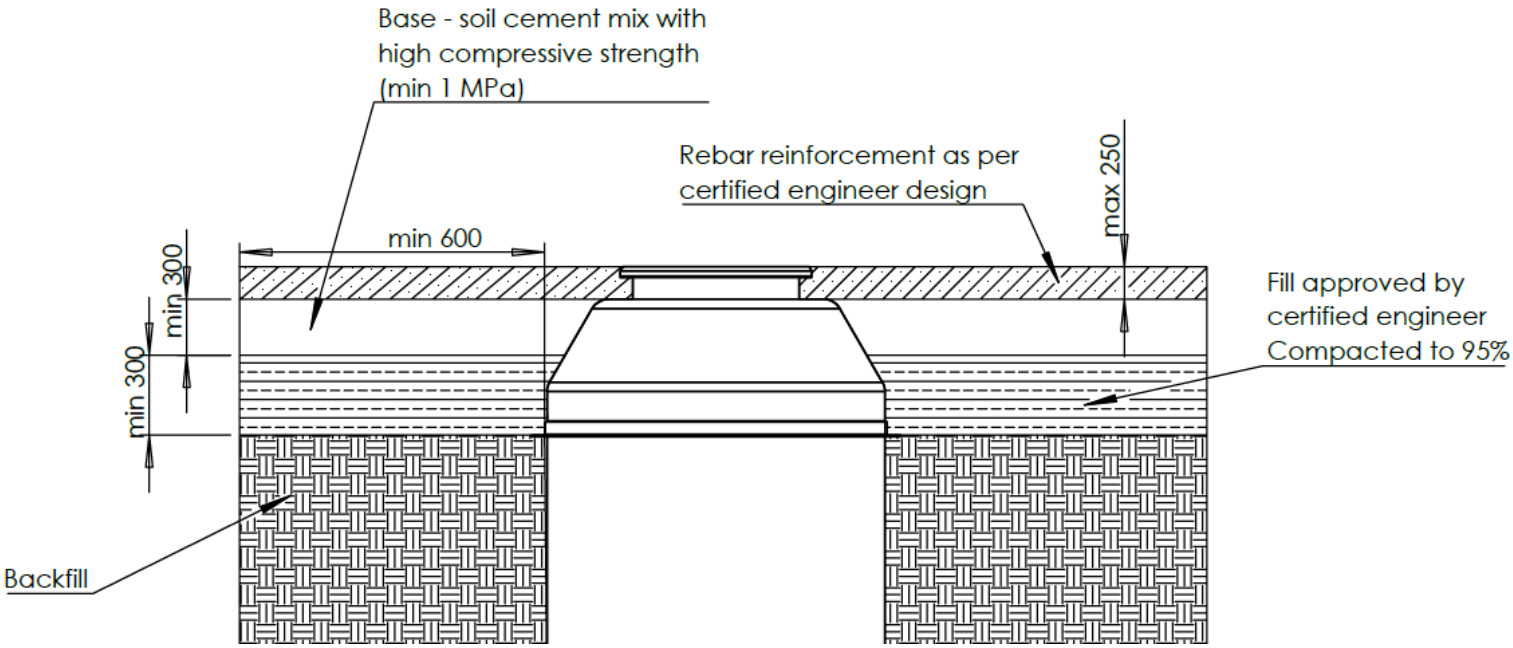
12.1. Fibreglass Flat Tops Without Traffic Loads

- The pad must be larger than the HYDRAPROTECTOR a minimum of 300mm in all directions.
- Maximum 200mm concrete pad thickness.



12.2. Fibreglass Flat Tops with Traffic Load

- The pad must be larger than the HYDRAPROTECTOR a minimum of 600mm in all directions.
- The Certified Engineer shall specify the pad strength and reinforcement so that the static weight of an 200mm thick square pad (no more than 600mm larger than the diameter of the HYDRAPROTECTOR centred on the HYDRAPROTECTOR) along with a dynamic T-44 traffic load must be distributed on the HYDRAPROTECTOR perimeter and not on the interior of the lid.
- If either the static pad load or the dynamic traffic load is exceeded, all of the pad and / or traffic loads must be supported by the soil around the HYDRAPROTECTOR and not by the HYDRAPROTECTOR itself.


Base - soil cement mix with
high compressive strength
(min 1 MPa)
Rebar reinforcement as per
certified engineer design
max 250
min 600
min 300
min 300
Fill approved by
certified engineer
Compacted to 95%
Backfill

13. AFTER INSTALLATION

After the installation procedure has been followed and the HYDRAPROTECTOR system is secured in place, a few final steps must be adhered to, to maximise the lifespan of the FRP Underground tank.

It must be ensured that the tank will have no contact from outside environmental conditions and protection from contact with moving factors. These include motor vehicles, farm equipment, construction and any animal interference. If not installed completely underground, fencing must be included on site to ensure no contact by environmental conditions from high wind, and existing fauna interactions. The lids must be designed to be able to take the impact of any contact from motor vehicles or animals, and alternatively must not cause damage to any vehicles or and animals that walk or drive upon the lid. Hence the surroundings must be carefully cordoned off and the lid designed for the sites demands.

13.1. Live Surface Loads

Light duty Fibreglass or aluminium access covers are not suitable for vehicular traffic. If a package stormwater treatment system is to be positioned in a location subject to vehicular traffic, then a certified cast iron cover must be used. Either Class B or Class D covers may be selected to suit the appropriate wheel loading. Special design consideration must be given to the surface slab, which must provide a frill re-enforced bridge support to transmit slab loads to virgin ground. In this case, the services of a qualified civil engineer should be engaged to provide adequate slab designs.

14. MAINTENANCE

A necessary requirement of the use of the Hydraprotector is the need for regular inspection, maintenance and cleaning. This regularity is defined by the catchment area that it is in and the features and properties of the surroundings. Regardless of the catchment area features, it is recommended by PROTECTOR that there is a mandatory inspection after 1 month of use after installation to determine the amount of capture of gross pollutants and sediments and determination of regularity of maintenance can be taken from this.

As previously stated, any form of weather conditions outside the norm of which the specific HYDRAPROTECTOR is design fall, be it high rainfall or heavy storm conditions, an immediate inspection is recommended.

NB: when maintenance is conducted on the HYDRAPROTECTOR system, ensure that all Workplace health and Safety precautions and directions are adhered to and the Confined Space Regulations are carefully followed when required.

The cleaning and maintenance procedure is simple, requiring removal of the access cover and inserting a suction hose into the chamber, recommended use of a vacuum loader truck. Remove all forms of refuse and debris before entering the chamber. Always ensure cleaning is begun from the inlet side of the chamber and ensure carefully resecuring of the access cover when completed.

Specific maintenance procedures of each aspect of the stormwater treatment system is outlined below. All maintenance must be carried out by some authorised personnel and all OH and S regulations and confined space regulations must be strictly followed.

14.1. HYDRAPROTECTOR Chamber Maintenance

1. Remove access manway carefully and safely.
2. The Hydraprotector is equipped with a coalescing filter system which will require removal and maintenance. Using a Crane or lifting apparatus, carefully remove each filter from its position in the filter floor.
3. Replace the coalescing filter system with a new system filter
4. Using a vacuum or hose truck, insert a suction hose into the chamber. Remove all forms of refuse, silt and debris before entering the chamber. Always ensure cleaning is begun from the inlet side of the chamber and ensure carefully resecuring of the access cover when completed.
5. Replace each the filter.
6. Ensure no damage to any part of the system, or if any replacements need to be made for the system to resume full operation.
7. Restart operation

14.2. Interior Maintenance

1. Silt and sediment Chamber - Remove all sediment, gross pollutants and anything other trash that can restrict water flow.
2. Central Bypass Riser – ensure that all clogging is removed, and that water can flow without obstacle through the bypass

3. Clean all inlet dropper, outlet pipe and vent of any possible blockages or debris
4. Ensure no structure damage has occurred on the filter floor

15. WARRANTY AND EXPECTED LIFESPAN

The quality assurance of our FRP products ensures that the HYDRAPROTECTOR range of FRP underground packaged tanks has an expected lifespan of 50 years. There is also a guarantee of our HYDRAPROTECTOR products to be free of defects in material and workmanship for one (1) year from the date of shipment form our manufacturing factory. The obligation of this warranty, statutory or otherwise, is limited to replacement or repair at factory or at a point designated by PROTECTOR, of such part as shall appear to us, upon inspection at such point, to have been defective in material or workmanship. This warranty does not obligate PROTECTOR to bear the cost of labour or transportation charges in connection with replacement or repair of defective part; nor shall it apply to a pump upon which repairs, or alterations have been made unless authorised by PROTECTOR in writing. No Warranty is made in respect to electrical control panels, pumps, motors or trade accessories, such being subject to warranties of their respective manufacturers. No express, limited or statutory warranty, other than herein set forth is made or authorised to be made by PROTECTOR. in no event shall PROTECTOR be liable for consequential damages or contingent liabilities arising out of failure of any Packaged Stormwater treatment system or parts thereof to operate properly. Packaged Stormwater treatment system must be installed by licensed tradesmen. Failure to do so voids all Warranty.

16. FIBREGLASS HYDRAPROTECTOR INSTALLATION NOTES