Glen Waverley Uniting Church

Rain Water Harvesting Project

Part 1

System Details

WEST TANK SYSTEM

Rain Water Collection

On the Bogong Avenue side of the Church buildings, the rainwater is collected on the Church complex roof and directed into one of five downpipes, which in turn feed the water into the original underground stormwater piping. In addition water runoff from the brick paved loop driveway off Bogong Avenue also enters the underground stormwater piping via the two side entry pits.

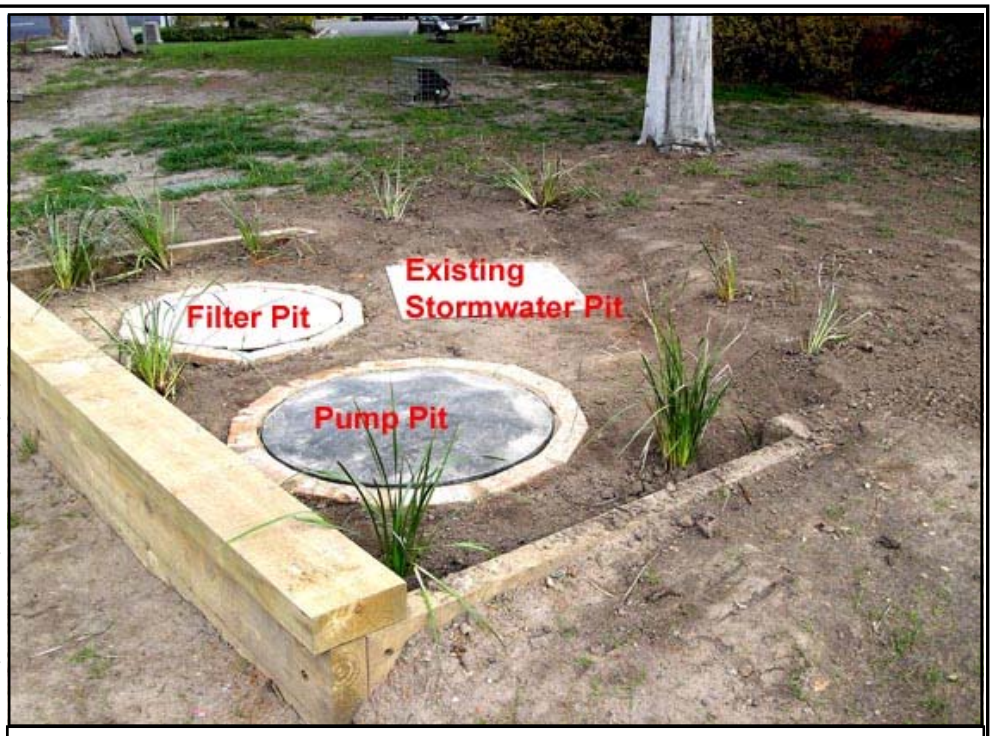

Fig 1.1 - Pits area

In the lawn near the corner of Bogong Avenue and Kingsway an **Existing** (concrete) **Stormwater Pit** changes the direction of the piping towards the main stormwater collection point at the bottom of the Church carpark.

A small weir added in this Pit now encourages water to flow via a (new) pipe connection into the (new) **Filter Pit**, and through the filters in the **Filter Pit** into the adjacent (new) **Pump Pit**.

The **Filter Pit** includes a removable "basket" filter plus fine filter lining around the inside.

Water passes through the **Filter Pit** filters and, via a short 100mm PVC pipe, into the **Pump Pit**.

The **Filter Fit** consists of a standard "Atlantis Large Filter Unit", plus an additional "empty" pit cut in half and the top half bolted and sealed to the other complete Filter Pit to provide the required depth of the overall unit.

Fig 1.2 - Filter Pit with basket removed

The lids on the Filter and Pump Pits are screwed down so that tools are required to remove them.

A submersible Sump Pump, with it's own, attached float level switch, pumps water from this **Pump Pit** through a pipe line to the **West Tank** at the rear (west side) of the Church.

The pipe line is 40mm diameter white PVC.

Note - *The Filter and Pump Pits cannot overflow as the existing stormwater pit outlet will allow excess water to pass to the stormwater drains (unless, in the abnormal event, the piping or drains are blocked downstream).*

Fig 1.3 - Pump Pit with Pump at lower RHS

Fig 1.4 - Trenching across the Bogong Avenue side Lawn

The pipe route (from the Pump Pit to the West Tank) is initially under the lawn and garden areas,.

Note *- The power supply cables to the Pump power outlet and the standard power outlet behind the Church brick sign are laid in this same trench below the water pipes.*

The pipe route then travels up the wall near the Office,

Fig 1.5 - Pipe route up Office wall

then across the metal decking roof attached to treated pine planks ↓,

Fig 1.6 - Pipe route across Foyer roof

around the north wall of the Hall →

Fig 1.7 - Pipe route around Hall north wall

and west wall of the Hall →,

Fig 1.8 - Pipe route around Hall west wall

across Store metal decking roof and down onto the Tank roof →.

The pipe has sheet metal covers (shown only in some of these photos) to protect it from the UV rays.

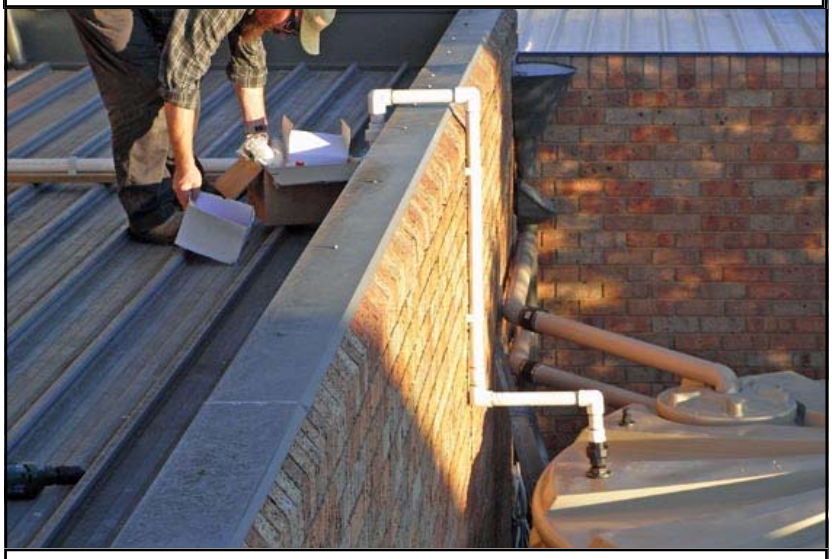

Fig 1.9 - Pipe route across Store roof and down to Tank

When the **West Tank** is nominally full a float level switch inside the Tank stops the submersible Pump.

Note - *In fact the float level switch is set to stop the Pump two rungs below the top of the Tank (to discourage tank overflow).*

Fig 1.20 - Float level switch with weight,

As well as water from the **Pump Pit**, water from the south west quarter of the Hall roof **(A)** and Store Roof **(B)** feeds into the West Tank via down pipe fittings .

The downpipe feeds into the open topped "Leaf Beater" **(C) downpipe filter** with coarse and fine stainless steel mesh filters.

The filter outlet feeds into the 1st Flush Filter pipe **(D)**. When this is full with the 1st flush of rain on the roof, the water "overflows" into the "Wet leg".

Fig 1.21 - Water from Hall and Store Roofs

Fig 1.22 - Downpipe Tank inlet, filters & Tank overflow West Tank

These fitting include a Downpipe Filter **(C)**, First Flush Filter **(D)**, as well as a Tank inlet filter (in the Tank top inlet).

Fig 1.23 - Downpipe Filter

Fig 1.24 - Tank overflow with 1st Flush Filter

West Tank

This tank is a 22,000 litre, corrugated plastic, cylindrical, beige coloured tank, manufactured by Team Poly, South Australia (a Hills company).

Fig 1.25 - West Tank, 22,000 Litres

The Tank foundation area was excavated down to clay, the area bounded with treated pine “sleepers” on three sides and by the Church foundations on the east side.

Slotted, 50mm, drainage pipe runs around the north, west and south sides of the enclosure and terminates in a covered rock pit **(A)**.

The Tank sits on a compacted base of “stone dust” or “crusher dust” which is the fines from rock crushing machines. It is a dense material and was compacted with a vibrating compacting machine. The dust tends to set hard after some rain but still drains through the compacted material.

Fig 1.26 - Preparation of Tank foundation

A simple float type level gauge with rotary indicator gives an indication of the Tank water level. The gauge calibration is linear with respect to the height of water in the Tank however the numbers do not equate with litres of water in storage.

The Tank overflow pipe drains to the stormwater system grate **(C)** and pit via the mozzie filter **(B)**. The stormwater system pipes run underground along the west, south, and east walls of the Hall Extension to eventually connect into the site stormwater system on the northern edge of the car park.

Fig 1.27 –Tank Level Gauge

Fig 1.28 - West Tank overflow & stormwater drain

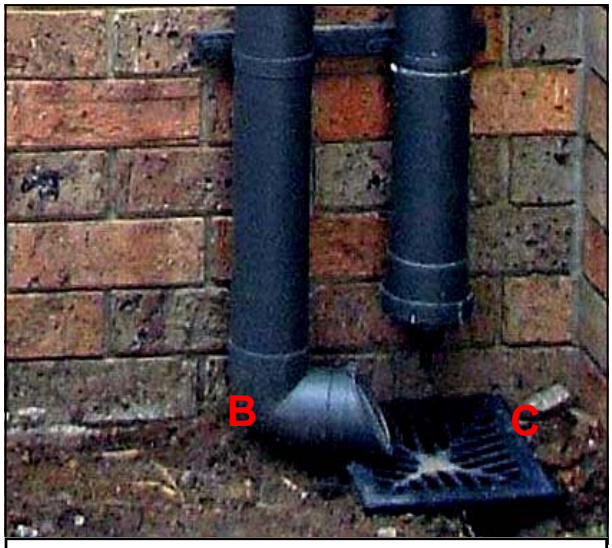

Fig 1.29 - Tank overflow with Mozzie filter into stormwater grate

Fail Safe Operation of West Tank

If the submersible Pump in the Pump Pit fails to stop when the Tank Float Level Switch indicates FULL, OR if it is raining and water continues to flow into the tank from the Hall and Store roofs,

then the Tank overflows to stormwater drain as described above.

West Pump

A pressure controlled pump, the **West Pump**, is contained within a "plastic" enclosure with a padlocked, removable lid **(A)**. The enclosure is bolted to the adjacent brick wall.

The Pump inlet is connected to a nearby outlet **(B)** on the Tank via an isolating valve. The Pump operates when water downstream of the Pump falls below a set pressure.

The Pump continues to operate until the pressure increases to a high set pressure, ie the water flow (in this case to the toilet cisterns) ceases allowing the pipe pressure to increase and shutdown the Pump.

A "test" valve **(C)** (ie to bleed or check water availability) is provided downstream of Pump enclosure.

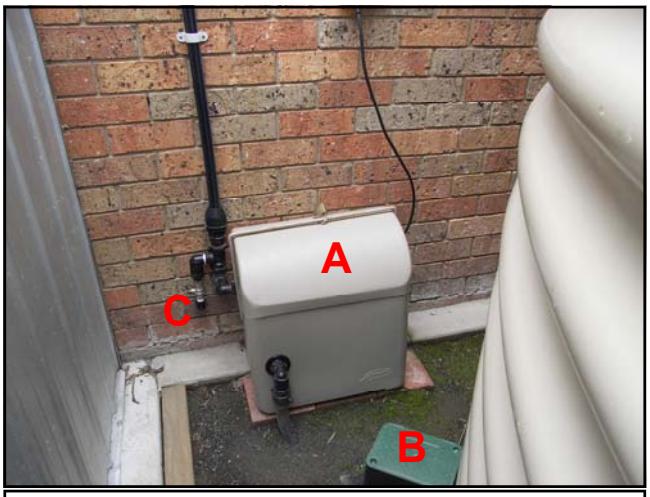

Fig 1.30 - West Pump in enclosure

A "Valve Train" is mounted on the Church wall external to the toilets.

The mains water enters the Church building complex at this location. After an isolating valve, **(D)** this pipe enters the cavity between the Male & Female toilets where it previously was connected to each toilet cistern. However a new Mains water pipe now bypasses all the cistern connections and is reconnected to the existing equipment within the Church including the toilet (rooms) hand basins and all equipments subsequent (ie Room 3 sink, the Hot Water Service, and the Kitchen).

Another mains water connection on this Valve Train, via a separate isolating valve **(E)**, goes via a Pressure Reducing Valve **(F)** then connects at a tee **(T)** to the Tank Water line **(G)**, also with an isolating valve **(H)**.

The pressure reducing valve **(F)** is set so that it's outlet pressure is lower than the Tank Water pressure produced by the **West Pump**.

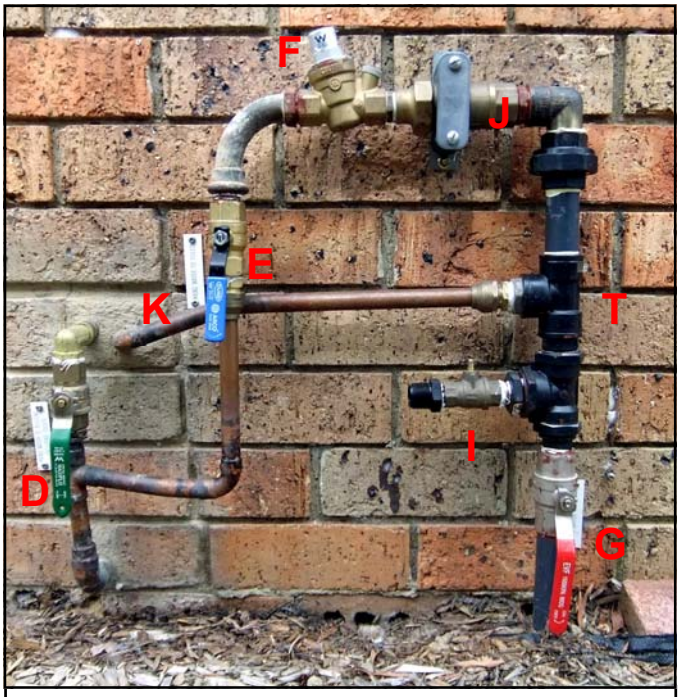

Fig 1.31 - Valve Train on West Wall outside Toilets

A dual non-return (or check valve) **(J)**, required by Regulation, prevents back flow of Tank Water into the mains water system.

The outlet from the tee **(T)** is connected to the pipe in the wall cavity **(K)** which connects with all the toilet cisterns.

Note that the Tank Water does NOT feed the toilet room washbasins.

Under normal conditions the Pump will supply Tank Water to the toilets. If the Tank water pressure is "low" for any reason (eg, no water in the Tank, Pump breaks down, pipe line fails, no power to run the Pump) the mains water will flow through the reducing valve into the tee **(T)** and to the toilet cisterns.

A "test" valve **(I)** is provided (ie to bleed or check water availability) on the Valve Train at the toilet cistern side of the Mains and Tank water inlets.

Another outlet, Fig 1.33 **(A)**, on the West Tank, with an isolating valve, connects to the "Gravity Feed" pipe to the Manse Tank. Under "normal" conditions this isolating valve will be left **Closed** as water for the Manse Tank comes from the Hall Extension roof.

This allows the Manse Tank to be "topped up" from the West Tank if needed,

Note –*The supply will be slow since the connecting pipe is of small diameter. A float (ball) valve on this line at about two-thirds height of the Manse Tank will shut when the water reaches this height in the Manse Tank thus preventing overfilling.*

(Refer to **Manse Tank System** for connections at Manse Tank.)

Fig 1.32 - Valve train with cover in place

Fig 1.33 - Gravity Line from West Tank

Fig 1.34 - Tank Isolating Valve (on West Tank) to

Loose covers Fig 1.31 & 34 **(B)** are placed over the Tank outlet valves to protect the valves and connections to the Tank and to lessen the "trip-hazard".

Manse Tank System

Rain Water Collection

The rain water collected on the Hall Extension roof exits via a rainhead **(A)** and a small length of downpipe, at both the east and west walls adjacent to the south wall.

The downpipe feeds into the open topped "Leaf Beater" **(B)** with coarse and fine stainless steel mesh filters.

The filter outlet feeds into the 1st Flush Filter pipe **(C)**. When this is full with the 1st flush of rain from the roof, the water "overflows" into the "Wet leg".

The "Wet Legs" from the south east and south west end walls join together underground and connect **(D)** into the manhole cover over the inlet filter of the **Manse Tank** via a 90mm PVC pipe.

Fig 1.36 - "Wet leg" pipe (D) connecting into Manse Tank

Fig 1.35 - Hall extension rainhead at south – east corner, downpipe & filter, 1st Flush, drain & grate, & Wet Leg

Fig 1.37 - Wet Leg drain

The "Wet Leg" is so called as it always contains water in the pipe section that is below the outlet into the Tank.

A "drain" outlet on the "Wet Leg" via a screwed cap **(E)** is provided on the "Wet Leg" at the south east end of the hall extension.

Note *- This does not drain the underground section of the "Wet Leg".*

Fig 1.38 - Gravity line connection to Ball valve inside Manse Tank

The gravity line from the **West Tank** (see **Fig 1.33 (A)**) is connected to the **Manse Tank** at about two-thirds of the Tank height **(F)** and enters via a ball (float) valve inside the Tank. The intent of this line is to allow partial filling of the **Manse Tank** in the unlikely event that little or no water is available but there being substantial water in the **West Tank**.

The water flow is initiated manually by turning ON the isolation valve at the **West Tank**. The flow is stopped either by turning OFF the isolation valve at the **West Tank** or by the Ball Valve if the water height in the **Manse Tank** reaches the valve height. The ball valve provides for overflow protection as the elevation of the top of the **Manse Tank** is substantially lower than that of the **West Tank**.

Manse Tank

This tank is an 8,000 litre, corrugated, plastic, cylindrical, beige coloured, tank, manufactured by **Team Poly, South Australia** (a Hills company).

A simple float type level gauge **(A)** with rotary indicator gives an indication of the Tank water level. The gauge calibration is linear with respect to the height of water in the Tank however the numbers do not equate with litres of water in storage.

Fig 1.40 - Manse Tank, 8,000 litres

The Tank foundation area was excavated approx 500mm below surrounding ground level so that the Tank top would not protrude above the adjacent Manse fences.

The area is bounded with treated pine "sleepers" on all sides and is drained via a grate into the stormwater system. A slotted, 50mm, drainage pipe runs around the sides of the enclosure and drains into the stormwater system of 17 Southdown.

The Tank overflow piping is brought out into the carpark kerb **(B)**, allowing any overflow to be observed .

Fig 1.41 - Manse Tank Overflow

Fig 1.42 - Part of Manse enclosure

The Tank sits on a compacted base of "stone dust" or "crusher dust" which is the fines from rock crushing machines. It is a dense material and has been compacted with a vibrating compacting machine. The dust tends to set hard after some rain but still drains through the compacted material.

The area has been enclosed within a paling fence matching the Manse boundary fences due to Monash Council requirements and the desire of some Church members.

A wooden gate **(C)** provides entry into the enclosure, complete with a step **(D)** inside to allow safe entry and exit into/from the enclosure.

A stormwater pit **(E)** is provided within the Tank enclosure as it is below local ground level. The piping is connected to the stormwater piping of 17 Southdown Avenue.

Fig 1.39 - Storm Water Pit, Manse Tank area

Fail Safe Operation of Manse Tank

If it continues to rain when the Tank is full then the Tank overflows via the overflow pipe, south side, which is piped directly into carpark kerb **(C)** as described above.

Manse Pump

This pump-motor set is the same brand, type and size as the other two Tank pumps but has a different control system and therefore a different arrangement.

Tank water from the Tank Outlet isolation valve **(A)** (with cover) if fed to the Pump via a filter **(B)**. The Pump pressurises the delivery pipe **(C)** as well as a small tank **(D)** under the Pump (the accumulator) to a set point high pressure on the pressure switch **(E)**.

When a toilet is flushed the accumulator provides the first few litres of water until the set point low pressure triggers to restart the Pump to again provide water to the delivery pipe and recharge the accumulator.

Fig 1.43 - Entry into the Manse Tank enclosure, and Tank Outlet

The physical arrangement, with the accumulator below and electric motor and pump above, provides protection for the "electrics" in the abnormal situation of water filling the base of the enclosure .

This Pump feeds water to the toilets in No.15 (2 toilets) and No.17 (three toilets) Southdown Avenue Manses and to the sole toilet in the Hall Extension.

A "Valve Train" at each building provides the control and changeover to mains water (supplied to that particular building). Mains water enters the Valve Train via isolating valve **(F)** (blue handle). The pressure reducing valve **(G)** reduces the water pressure to below that delivered by the West Pump. The dual non return valve **(H)** prevents back flow of Tank water into the mains.

Tank water enters the Valve Train via isolating valve **(I)** to the tee **(T)**. As it is at a higher pressure

Fig 1.44 - Manse Pump

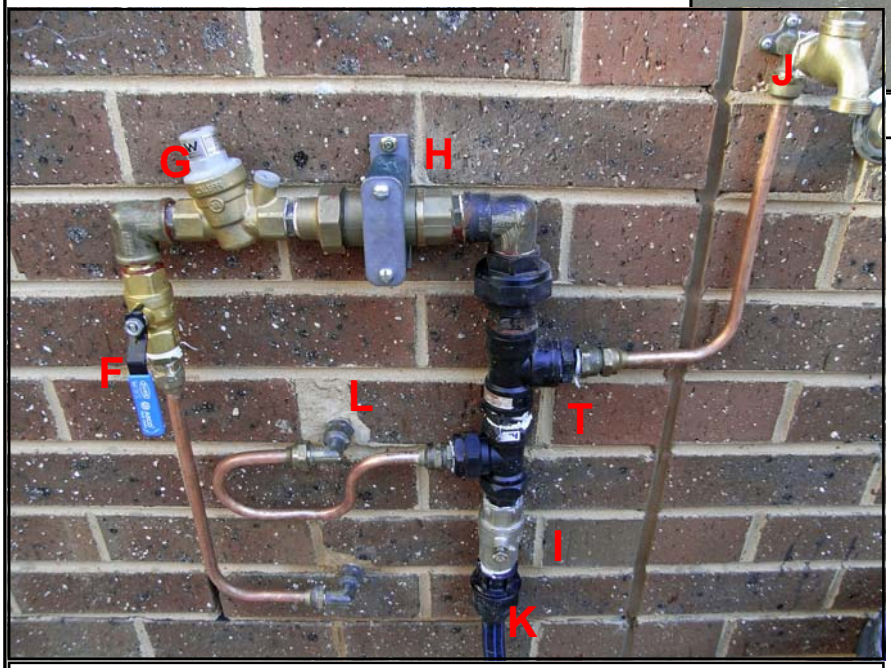

Fig 1.45 - Valve Train at Manse, cover removed;

than the mains water it supplies the toilets when the toilet line **(L)** pressure drops due to pressing the flush button on a cistern.

If the Tank water pressure is "low" for any reason (eg, no water in the Tank, Pump breaks down, pipe line fails, no power to run the Pump) the mains water will flow through the reducing valve **(G)** into the tee **(T)** to the toilet line to the cisterns.

Non return valve **(K)** prevents back flow of mains water from the other two Valve Trains (Manse and Hall Extension).

Fig 1.46 Valve Train with cover in position and adjacent "test" Tap

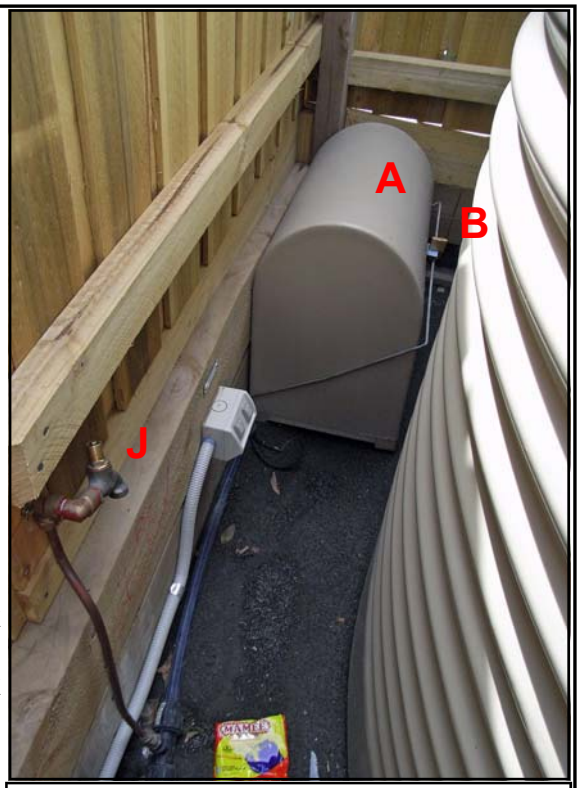

Fig 1.47 - Manse Pump with cover; Test tap in left foreground

"Test" valves are provided within the Manse Tank Enclosure **(J) Fig 1.47**, and adjacent to the Valve Trains **(J) Fig 1.45 & 46**. For the two Manses and Manse Tank enclosure these valves have "Vandal proof" removable tap handles.

The pumpset is protected by a completely lift-off enclosure **(A)** (four sides, top and no base) padlocked via hinged bar **(B)** to the sleeper wall.

Fail Safe Operation of Manse Tank

The Manse Tank will not normally overfill via the gravity line from the West Tank due to the float (ball) valve. However if the float valve was to fail the Manse Tank could fill (depending on the height of water in the West Tank) and overflow into the carpark kerb and be noticed. Investigation would soon reveal that the water wasn't coming from the wet leg ie open the Wet Leg drain (see Fig 1.37) preventing any rain water flowing into the Tank.

If there is large rainfall the Tank may fill and then overflow into the carpark as it is designed to do, and it would be accepted that the overflow was due to the rainfall.

Halfway down the carpark (southern side) is a side entry stormwater pit so Tank overflow water will end up in the stormwater drain.

Fernery Tank System

Rain Water Collection

The rain water collected on the southern half of the Church Worship Centre and the Foyer roofs exits via a rainhead and 150mm diameter, Vestry and Roof column downpipes.

The downpipes feed into a GWUC Tank Group designed **Downpipe Filter**.

The filter initially included course and fine stainless steel mesh filters placed at a steep angle to allow leaves and other debris to fall or be blown off by the wind.

In practise it was found that a substantial amount of the falling rainwater created “bubbles” across the filter mesh by surface tension and much water splashed/dribbled of the outside off the filter (causing a nuisance).

Fig 1.48 - Vestry Downpipe Filter

After much experimentation, the course filter was removed and the fine filter was lowered to almost horizontal resulting in collection of the all rainwater.

The **Downpipe Filter** consists of two chambers, one inside the other.

The filtered water passes through the fine filter into the inner chamber and exits via the 90mm horizontal outlet.

The outer chamber collects the run-off and overflow from the inner chamber and the debris from the top of the (fine) filter. If the fine mesh filter becomes blocked the water overflows into the outer chamber which is designed for the same capacity as the incoming downpipe. The water passes through the outer chamber and is released through the bottom opening into a downpipe (of same capacity as the incoming downpipe) to the ground **(A)**. The bottom of this downpipe finishes at a grate allowing the water to enter the stormwater piping. A vertically sliding sleeve discourages splashing and allows easy cleaning of the grate.

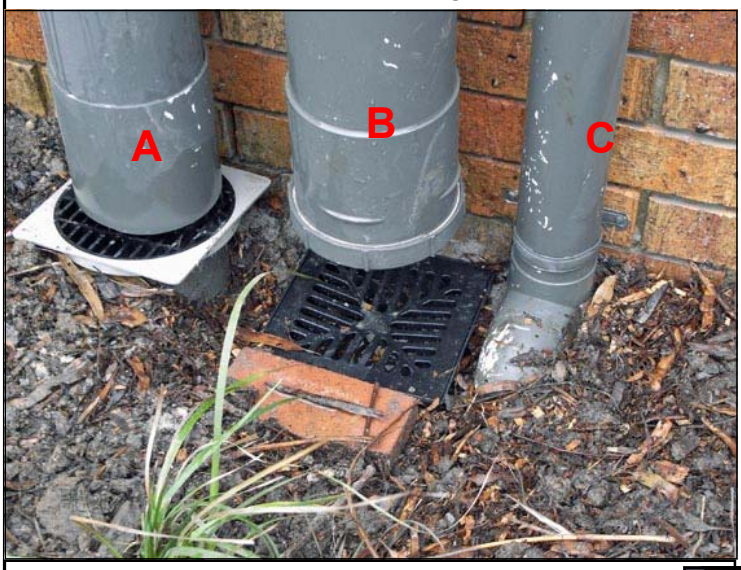

Fig 1.49 - Outlets from Downpipe Filter

The filtered water exits the inner chamber of the **Downpipe Filter** and then fills the 150mm diameter **1st Flush Filter (B)**. This collects the first amount of rain on the roof and allows the separation of the dust and fine particles which pass through the previous **Downpipe Filter**.

The base of the **1st Flush Filter** comprises a 150mm screwed cap a fine filter fitted on the side, and a tap nut fitted under the outlet hole of the filter.

The tap nut has a small hole and allows the water to slowly and “automatically” drain out of the whole height of the filter and present an empty filter to the next 1st flush of rain.

Fig 1.50 Column Filters, Overflow and Wet Leg

This tap nut and the 150mm screwed pipe cap need to be removed regularly to clean the accumulated sludge from the **1st Flush Filter**.

When the 1st Flush Filter (vertical pipe) is full of rain water it "overflows" into the 90mm diameter "Wet Leg" (see **Fig 1.49 (C))** and feeds into the Fernery Tank.

There are two of the above sets of filters and Wet Legs feeding the Fernery Tank.

The downpipe on the south side of the Hall →, from the south east corner of the roof has been rerouted onto the Foyer roof. This rain water adds to the water collected directly from the south half of the Worship Centre and Foyer.

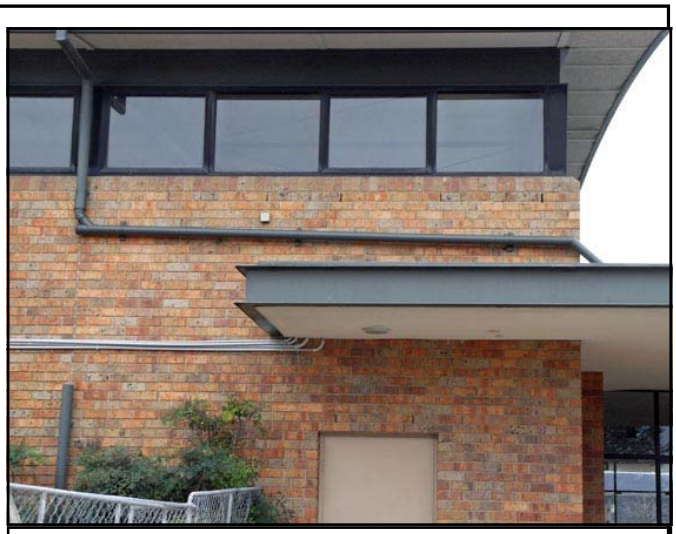

Fig 1.51 - Rerouted downpipe on Hall

Fernery Tank

This Tank is an 15,064 litre, corrugated, plastic, cylindrical, beige coloured, tank, manufactured by **Bushmans Group Pty Ltd**, Terang VIC. This tank is designed to be sited in-ground (up to one third of its height) and backfilled around the Tank.

A simple float type level gauge **(A)** with rotary indicator gives an indication of the Tank water level. The gauge calibration is linear with respect to the height of water in the Tank however the numbers do not equate with litres of water in storage.

The standard inlet Filter **(B)** has been modified on site to increase the height of the vertical sides with filter mesh therefore increasing filter area.

Fig 1.52 - Fernery Tank, 15,064 litres

The filter/manhole cover **(C)** has been cut in two to provide access to view the filter without having to remove the two Wet Leg inlets.

Fig 1.53 - Excavation & compacting, Fernery Tank

The Tank foundation area was machine excavated approx 500mm below surrounding ground level. Prior to excavation, careful hand digging exposed the main power line and Telstra phone lines into the Church building directly under the Tank foundation.

A slotted, 50mm, drainage pipe runs around the sides of the enclosure and drains into a pit **(D)** at the east adjacent to the footpath.

The Tank sits on a compacted base of “stone dust” or “crusher dust” which is the fines from rock crushing machines. It is a dense material and has been compacted with a vibrating compacting machine.

The dust tends to set hard after some rain but still drains through the compacted material.

Water is piped by the Wet Legs from the Vestry wall and the Roof Column into the tank inlet.

The Tank overflow is piped directly into the underground stormwater drain at the base of the Roof Column.

Fig 1.54 - Valve Train with adjacent Tank Water Tap

Fail Safe Operation of Fernery Tank

Fig 1.55 - Fernery Tank Overflow

If it continues to rain when the Tank is full then the Tank overflows via the overflow pipe, east side, which is piped directly into the stormwater drain at the base of the roof column

Fernery Pump

A pressure controlled pump, the **Fernery Pump,** is contained within a “plastic” enclosure **(A)** with a removable lid padlocked by a hinged bar, **(B)**. The enclosure is bolted to the adjacent brick wall.

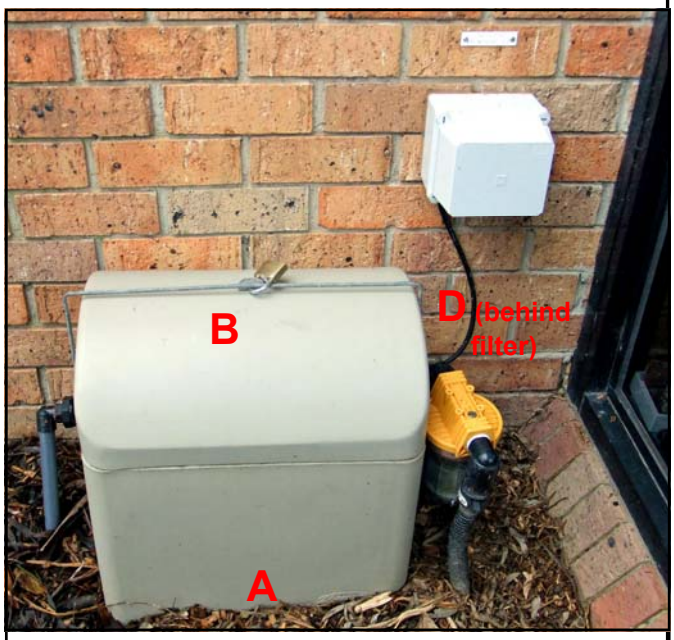

Fig 1.56 - Fernery Pump

The Pump inlet is connected to an “underground” outlet on the Tank via an isolating valve **(C)** protected by a PVC pipe and cap.

Fig 1.57 - Tank outlet

The Pump operates when water downstream of the Pump falls below a set pressure ie the watering system comes on or someone turns on the one garden tap connected to the pump output.

The Pump continues to operate until the pressure increases to the high set pressure, ie the water flow ceases allowing the pipe pressure to increase to the pump turn OFF high set point.

A “test” valve **(D)** (ie to bleed or check water availability) is provided just outside Pump enclosure.

The mains water supply to the Pump enclosure is piped from the water tap up-stand near the carpark entrance to the Church, compete with an isolation valve **(E)** and cover.

Fig 1.58 - Water Tap upstand & Mains Water to Fernery Pump, without & with valve cover

A “Valve Train” mounted within the Pump enclosure provides the control and changeover to mains water.

The “Valve Train” includes:

- Mains water isolation valve **(A),**
- Pressure reducing valve **(B),**
- Dual non return valve - unseen, behind pressure controller,
- Motor Pump set **(C)**

Tank water inlet to the enclosure and Pump is at **(D)** via a filter **(E)**.

A “Test” valve **(F)** is provided on the Pump set outlet. The valve handle has been removed (to prevent unauthorised operation as it is outside the Pump enclosure).

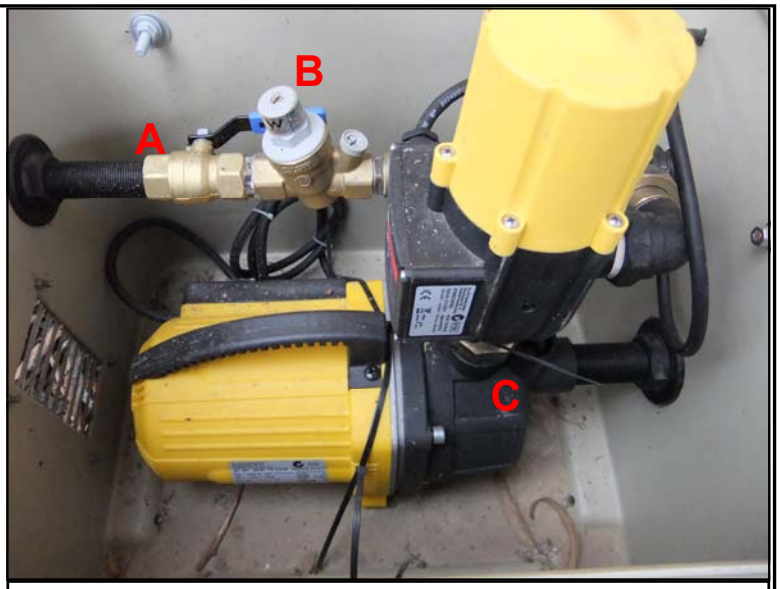

Fig 1.59 - Fernery Pump with cover removed

Fig 1.60 - Fernery Pump with cover removed

Fig 1.61 - Pipe route from Pump

The outgoing piping **(G)** (black Poly) is routed underground in front of the Church south windows then above ground against the Church wall behind the garden foliage.

The piping delivers the outlet water to the manual garden water tap **(H)** with “Vandal proof” removable tap handle, somewhat hidden in the garden on the Church east wall, and to the existing Garden Watering System.

Fig 1.62 - Garden watering tap

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GWUC, RAIN WATER HARVESTING SYSTEM

The mains water connection to the Garden Watering System previously originated just after the site Water Meter in pit **(A).**

Pit **(B)** contained this connection, the isolating valve and the Garden Watering System Main Solenoid.

The Main Solenoid has been removed and the now redundant isolating valve outlet capped **(C)**.

Fig 1.64 - Pit B Solenoid Valve removed

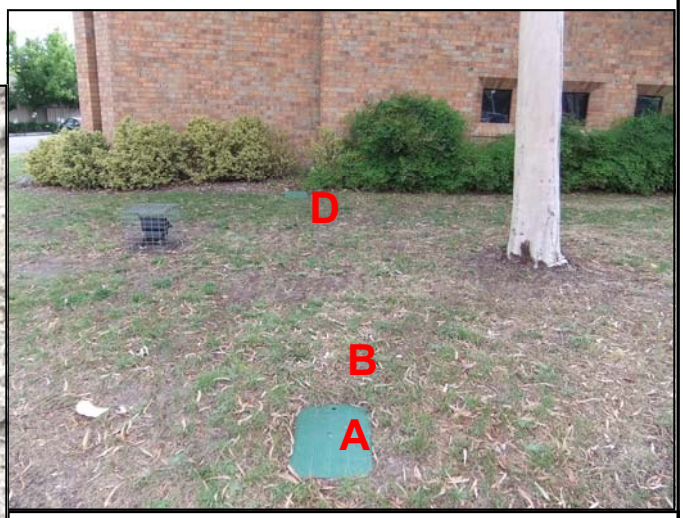

Fig 1.63 - Garden Water Tap

A new pit **(D)** has been installed in the lawn. The Fernery System Water supply (pipe **(G)** see Figs 1.59 & 60) is fed to the Main Solenoid Valve now contained within pit **(D)**. This carries Tank water backed-up by the mains water via the Valve Train.

The outlet **(E)** of the Main Solenoid Valve is fed to the existing, nearby Garden Watering east Solenoid Pit (containing four solenoid valves).

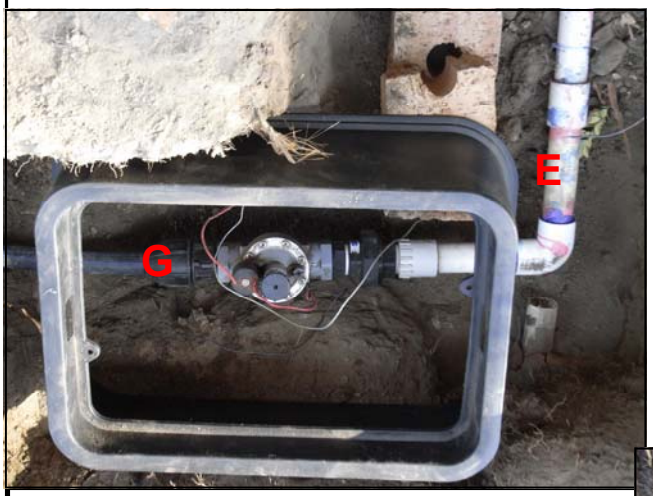

Fig 1.65 - Garden Watering Main Solenoid Pit C

For further information on the Garden Watering System see document **GWUC Garden Watering Equipment Locations 130308.pdf.**

Fig 1.66 - Garden Watering East , 4 Solenoid Valve Pit