Humes
Water Solutions

Strength. Performance. Passion.

Stormwater harvesting and reuse

Issue 2

WSUD and stormwater reuse

For many years residents in urban areas of Australia have enjoyed cheap, high quality water from authority-owned pipe networks. But as climate and rainfall patterns have changed and populations expanded, dam levels have decreased and raw water quality has deteriorated. Authorities implemented action plans, investing billions of dollars into the construction of alternative water supply systems (e.g. desalination plants). These action plans have inevitably increased the cost of potable water to the consumer.

More recently there has been a shift towards water sustainable cities and Integrated Watercycle Management (IWM), implementing the rainwater capture and reuse aspects of Water Sensitive Urban Design (WSUD) to conserve potable supply.

Whether it is rainwater from the roof or stormwater from the catchment, water harvesting is integral to WSUD as it reduces the impact of pollution on water quality and stream flow, and helps developments meet water conservation objectives. Within the WSUD framework there are some clear objectives for the development of effective rainwater/stormwater harvesting systems:

- Reconnect communities to the natural water cycle through innovative urban design.
- Reduce potable water consumption by employing water efficient appliances and reusing grey/rainwater.
- Minimise wastewater and treat it to a standard that is suitable for reuse or release to waterways.
- Capture and treat urban stormwater for reuse or release to waterways during construction and operational stages of urban developments.
- Preserve the natural hydrologic regime of catchments.

Many authorities and research organisations have identified that by using rainwater tanks for non-potable applications, they can delay the need for expensive systems such as desalination and recycled wastewater. Multiple levels of government have encouraged support for tanks by offering grants, and changing legislation and building codes to require the installation of rainwater tanks for toilet flushing, irrigation and laundry uses. This could represent around 50% of typical domestic water usage. It is now almost commonplace across Australia for new domestic or commercial developments to include rainwater storage for non-potable reuse. Some authorities have taken this initiative even further by mandating a 25% water usage reduction by industry and commercial entities. In implementing larger scale harvesting and reuse systems, complying businesses will reap benefits long into the future.

In the driest inhabited continent on earth water is one of the most precious yet under-valued resources. Water shortages and the longer-term security of water supply for our communities are serious concerns for Australia, particularly in light of recent droughts which gripped large parts of the country. Research shows stormwater runoff from urban areas could provide more than 50% of the demand. The challenge is, how to efficiently capture and store this resource?

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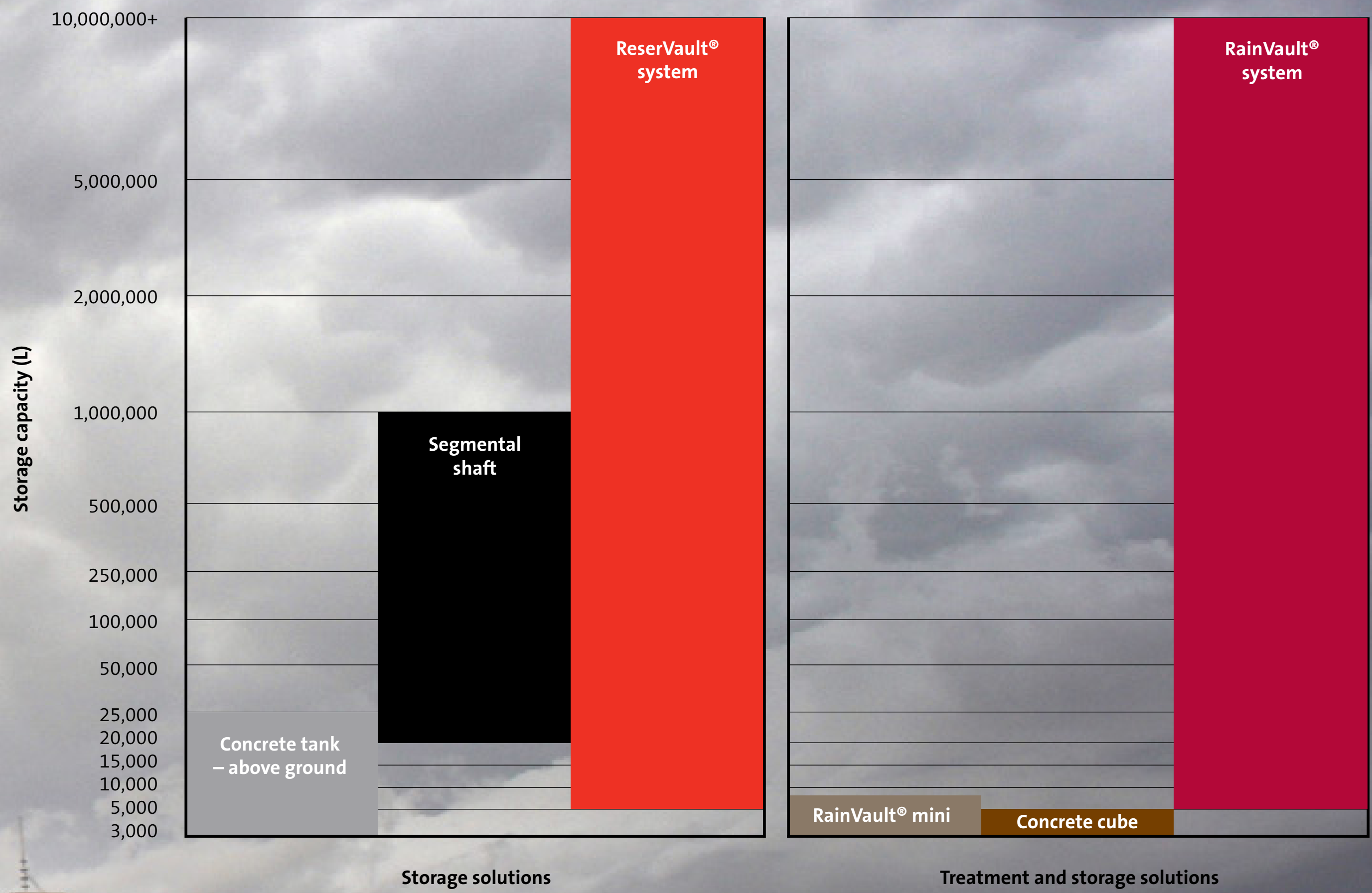
Stormwater harvesting and reuse solutions

Humes offer a range of solutions to assist with the collection, storage and reuse of water. From domestic scale to multi-megalitre systems, with or without treatment options, our harvesting solutions can be designed to meet your performance and budget requirements.

The figure below is a guide to identify the most appropriate harvesting solution for your project.

Figure 1 – Harvesting and reuse solutions



Treatment and storage solutions – Flexible volume

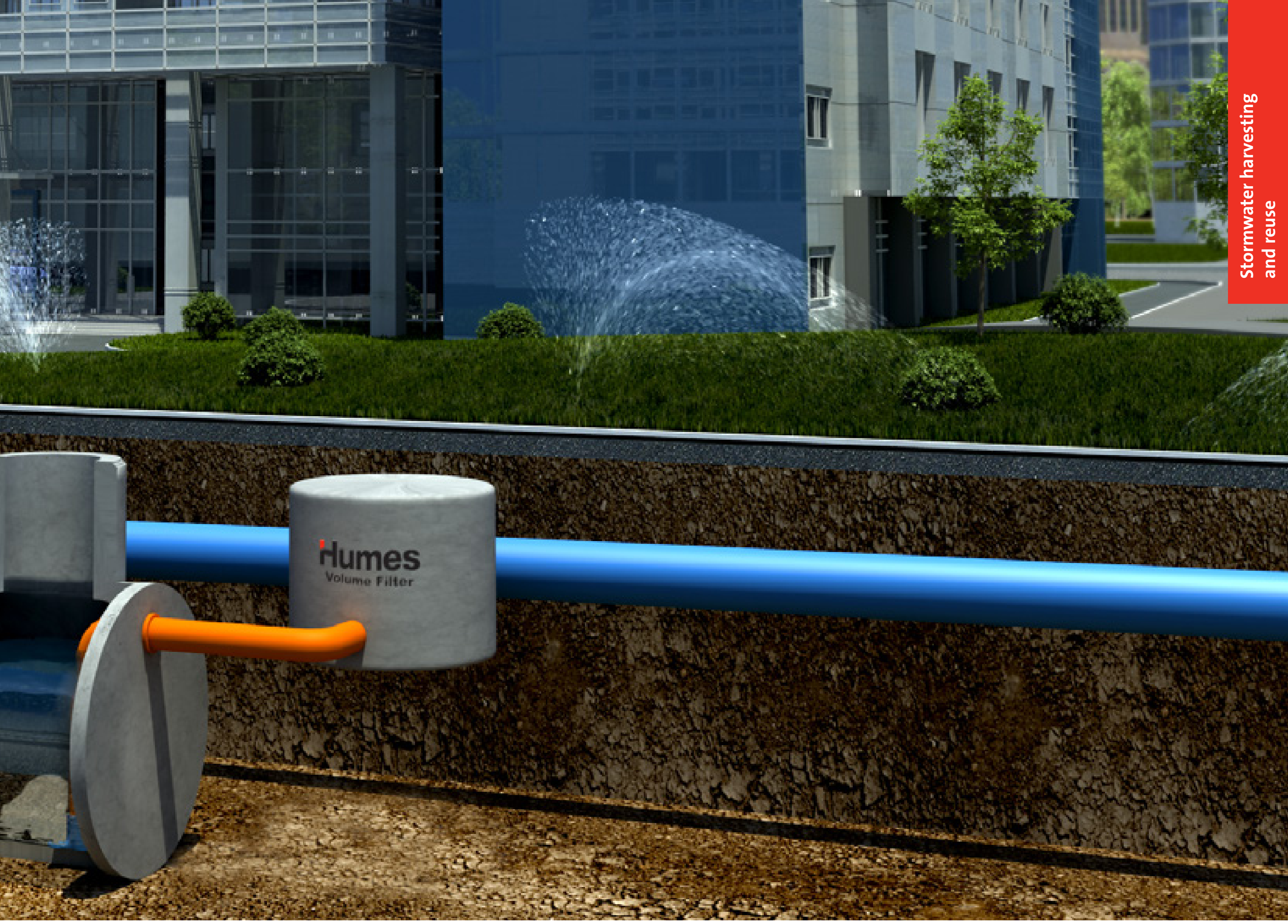
Top:
An illustration of a typical RainVault® system

RainVault® system

The RainVault® system is purpose-built to capture, treat, store and supply rainwater as an alternative to potable water for non-potable applications. This underground system offers great flexibility in its design with various configurations of its precast concrete barrels, and high performance pump and filtration systems. Its ability to retain above ground land use while storing water underground makes the RainVault® system a cost effective solution for commercial, industrial and large-scale residential projects.

The RainVault® system provides significant benefits throughout installation, ownership and maintenance:

1. It's a complete system – The system is a fully integrated harvesting and reuse solution, including a pre-treatment filter, components to maintain the stored water quality, flexible storage volume, and a pumping solution.
2. It maximises above ground land use – Manufactured from precast concrete, the system is fully trafficable, designed for the SM 1600 road traffic load as detailed in AS 5100. This makes it an ideal solution for installation under car parks, driveways, hardstands and open space areas.



3. It's watertight – Manufactured in monolithic concrete, the precast modules use a skid ring joint and a seal (rated to 90 kPa) to prevent water loss and ingress.
4. It can be custom designed to suit your project – The modular design can be configured to suit most footprints through interconnecting the storage components in multiple barrels.
5. It's easy to install – The precast concrete components means large systems are fast and simple to install.
6. It's accessible and maintainable – When required, it is possible to safely enter the RainVault® system for maintenance without completely excavating it. The access is secure against unwanted entry and vandalism.

System overview

Operation of the RainVault® system starts once rain falls:

1. Runoff is captured by the site's drainage network.
2. It then passes through the pre-treatment filter, and into the storage barrels.
3. Water from the filter enters the RainVault® system via a calmed inlet device on the floor, directing water upwards and aerating the water column.
4. Particles that pass through the filter settle on the bottom in the sludge zone (refer Figure 2). Research has shown that this "living" environment is important in maintaining water quality.
5. Once full, the RainVault® system overflows back to the drainage system via a skimming siphon; this ensures that any floating films or pollens are skimmed off the upper layer of the harvested water, improving oxygen transfer from the air zone.
6. Submersible pumps are located at the outlet end of the system. The pump intake is suspended 150 mm below the water surface by a float, to ensure only the best quality water is drawn from the operational storage zone for use.
7. The pump control system can be programmed to draw on harvested water, or mains water supplies when storage levels are low, and can be connected to a building management system. The RainVault® system can provide water for a range of applications, including irrigation, vehicle wash down, toilets, and cooling towers.

Water quality zones

Research by Australian and European universities has shown that there are three key zones in rainwater tanks that contribute to the long-term quality of the captured water. The RainVault® system is designed and supplied with an operational storage zone, and two other water quality zones. The system uses world class European components to maintain the integrity of these three zones.

Air zone – A percentage of the storage volume is set aside to maintain an envelope of air above the water surface to facilitate oxygen exchange. The air zone is maintained through the use of a siphon outlet offset from the obvert of the tank.

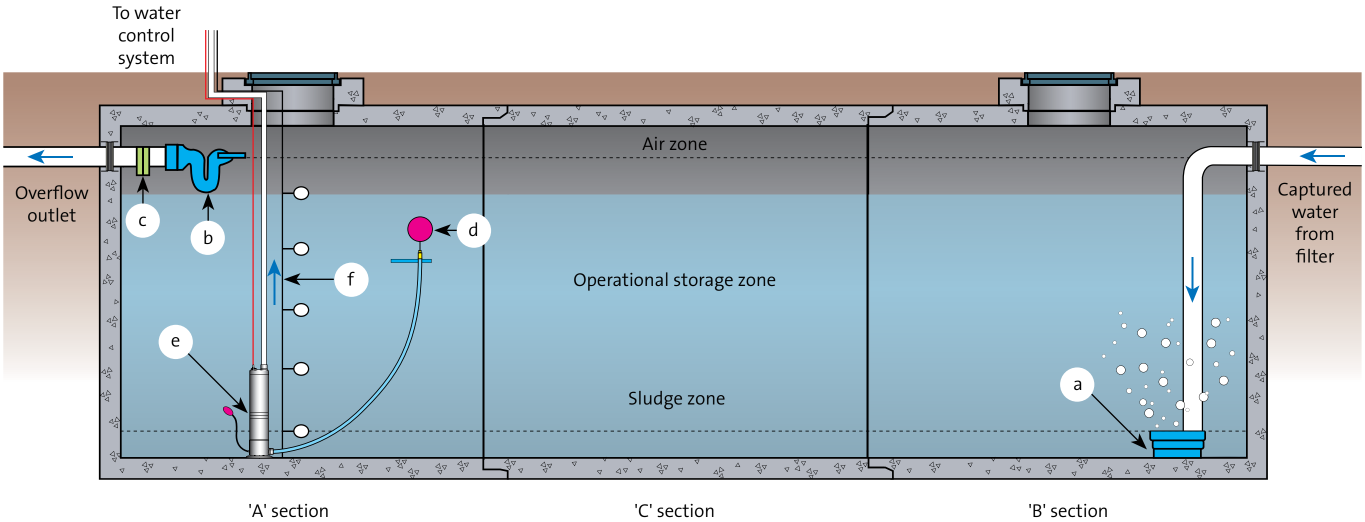
The specially-designed overflow siphon skims the water surface removing any floating films, scum or pollens that may accumulate on the water/air interface. The design of the siphon maintains a water seal against gases and odors and combined with a backflow prevention valve, prevents rodents and mosquitoes entering the tank.

Sludge zone – An allowance for additional volume is included at the base of the RainVault® system to allow for the settling of any fine materials or suspended solids. This forms a sludge layer that research has shown is vital for maintaining water quality throughout the water column. A calmed inlet device is fitted to the end of the inlet pipe to deliver inflows at the base of the water column while directing the water flow upwards. This transfers entrained oxygen through typically anaerobic (oxygen-low) water at the base. Sustaining oxygen levels through the water column has been shown to be important in keeping water fresh. The depth of material in the sludge zone should be monitored and removed only once it nears the height of the calmed inlet device (typically 100 mm deep).

Operational storage zone – The area between the sludge zone and the air zone is the operational storage zone. It is this volume that is presented in Table 1 as the storage capacity of the RainVault® system. A RainVault® system design with a long hydraulic retention time will produce higher quality water; therefore a long system or parallel barrels will give optimal results. However because the RainVault® system is modular in nature, it can easily be configured to suit any site constraints.

- **Calculating storage volumes**
  Estimating the volume of a system can be performed using the information in Table 1. As the system can vary in diameter, length, and the number of storage barrels please refer to Appendix 1 for an explanation on naming conventions and calculating storage volumes.

Figure 2 – RainVault® system configuration



Legend

a	Calmed inlet
b	Overflow siphon
c	Backflow prevention valve
d	Floating pump intake
e	Pump
f	Water level gauge

Table 1 – RainVault® system configuration guide

RainVault® model	Inside diameter (mm)	Outside diameter (mm)	Storage volume combined 'A' + 'B' sections* (L)	Additional 'C' section volume each (L)	Combined 'A' + 'B' sections mass† (kg)	Additional 'C' section mass each‡ (kg)
RV1200 - 01 - 00	1,280	1,500	5,000	2,500	8,200	3,300
RV1950 - 01 - 00	1,950	2,220	10,000	6,300	16,000	6,000
RV2100 - 01 - 00	2,100	2,388	12,000	7,500	17,700	6,800
RV2250 - 01 - 00§	2,250	2,550	14,000	8,700	20,200	7,500
RV2400 - 01 - 00	2,438	2,742	19,000	10,000	21,200	8,000
RV2700 - 01 - 00	2,700	3,030	23,000	12,000	25,500	9,500
RV3000 - 01 - 00	3,060	3,410	30,000	16,000	32,000	12,000

Notes:
* Volume excludes sludge zone and air zone.
† Mass comprises both end sections plus saddle for risers, but excludes risers.
‡ Mass is for class 2 'C' sections - contact Humes for masses of heavier class sections.
§ RV2250 currently available in Western Australia only.

Bottom:
Volume filter – VF6

Pre-treatment

In order to maintain good water quality and ensure a long life for the pump system, it is necessary to perform suitable pre-treatment on the inlet pipe. The selection of the appropriate treatment unit will depend upon the type of catchment feeding the RainVault® system:

- **Roof runoff**
  Roof runoff is relatively clean when compared with urban residential catchments, roads and hardstands. For this reason, the pre-treatment methods for roof runoff focus on coarse leaf litter and other material greater than 0.55 mm that may be deposited on the roof. Stainless steel volume filters are typically recommended for this purpose.

  Table 2 details the appropriate sized filter units for different roof catchments up to 2,350 m^2. These filters require minimal maintenance, are self-cleaning, and can be easily removed or replaced if necessary. The design includes a 0.55 mm screen that prevents mosquito entry into the storage components.

- **Hardstand or road catchments**
  Hardstand or road catchments typically observed in commercial or industrial sites have large impervious areas that collect sediment, hydrocarbons and heavy metals from vehicles that use them. Some catchments may also experience high litter loads or leaf fall. For these catchment types, a combination of larger-scale primary and secondary treatment systems may be recommended.

The primary treatment process typically includes a Gross Pollutant Trap (GPT) such as a HumeGard® unit. This level of treatment is designed to remove debris and solids down to 150 µm.

The secondary treatment process may involve a HumeCeptor® unit or filtration product depending upon the level of treatment required, and the end use of the captured water. A HumeCeptor® hydrodynamic separator can reliably remove suspended solids down to 10 µm, whereas a media filtration device can remove finer particles.

An effectively maintained pre-treatment system will minimise the amount of pollutants carried over into the RainVault® storage, and therefore maintain better water quality over a longer period. Please consult product brochures for further information on these devices or consult your local Humes representative.

Note – All filtration systems incorporate a bypass for cleansing and excess flow volumes which must be plumbed around the storage system, and then discharged to the downstream stormwater drainage network to protect the longevity of the RainVault® system.

Table 2 – Volume filter selection

Pre-treatment filter	Filter location	Max. roof area (m^2)	Inlet/outlet diameter (mm)
Downpipe x 4	On downpipe	350	100
VF1	Plastic pit	300	100
Twin VF1	Plastic pit	600	2 x 100
VF2	Precast pit	850	150
VF3	Precast pit	1,100	2 x 150
VF6	Precast pit	2,350	2 x 225

Pump and water delivery kits

There are six standard options available for supplying water from the storage to non-potable uses, these are separated into two groups; a) constant pressure, variable speed pumps; and b) variable pressure, constant speed pumps. Your specific project requirements should be used as a guide to select the appropriate system.

All standard kits utilise a floating intake with a mesh screen and separation collar, suspended from an air-filled float. This ensures that water is drawn from approximately 150 mm below the water surface in normal conditions, but prevents sludge entering the pump when water levels are low.

All standard pump kits utilise submersible pumps, though above ground pumps are available upon request. Standard kits are designed to utilise a potable supply back-up to ensure the supply of water to toilets and other essential non-potable uses is maintained; this option can be disabled for areas without access to a potable supply.

Water level gauges are incorporated into the pump control panel to provide real time confirmation of the stored volume and indicate whether rainwater or town water is in use.

Pump and water delivery kits, and treatment options are available separately upon request. If the pump kits in Table 3 do not meet the needs of your project, your local Humes Water Solutions representative is able to help source a configuration that will.

Trafficability

Because the standard RainVault® system is designed for SM 1600 traffic loads, as specified in AS 5100.2, it is an ideal solution for car parks, roadways, commercial and industrial projects, and it can carry any unexpected loads that may occur in open space areas (e.g. slashers, fire tenders).

In these applications the system will require a minimum of 200 mm cover over the top of the tanks, to a maximum of 2 m, for a standard installation. If greater levels of fill are present, or the system is required to take heavier loads, contact your local Humes Water Solutions representative for assistance. The RainVault® system can be designed to accommodate most load criteria and has been designed to resist buoyancy.

Table 3 – Pump kit selection

Pump parameters	Kit 1	Kit 2	Kit 3	Kit 4	Kit 5	Kit 6
Discharge port (mm)	32	32	32	40	40	40
Full load current (Amps)	5.9	7.3	9.1	8.4	11.2	12.0
Power rating (kW)	0.75	1.00	1.20	1.15	1.68	1.80
Voltage (single phase)	240	240	240	240	240	240
Nominal duty flow (L/min)	50	50	90	6 - 60	10 - 90	12 - 120
Nominal duty head (m)	32	45	40	45	45	40
Nominal duty pressure (psi)	45	64	57	64	64	57

Designing a RainVault® system

Preliminary design stage

1. Collect project information

The modular nature of the system maximises design flexibility for every project. To ensure the system reflects your project requirements and site constraints, the following information should be supplied at the preliminary design stage. Once this information is received Humes will provide you with a concept drawing of the proposed solution (PDF or CAD format):

A. Contact information of design engineer/ civil designer.

B. Project title or name.

C. Project site address.

D. Required storage volume – The precast units add volume in specific increments, so solutions may be slightly larger or smaller in capacity. If a minimum volume is required please let us know.

E. Any footprint constraints in terms of overall system length and width – Where length is constrained, a design will utilise multiple barrels. Information on the maximum width will help determine the maximum number of barrels possible.

F. Maximum system depth/diameter that can be accommodated – Naturally, larger diameter systems provide greater storage volumes for each unit. Shallow rock or groundwater may limit the maximum diameter that can be used.

G. End use for harvested water – What level of water quality is needed to service the end use?

H. Pipe inverts - The invert of both the inlet and outlet pipes, their approximate locations, finished surface levels, and anticipated cover over the system (if known).

I. Inlet and outlet pipe details – The RainVault® system can accommodate 100 mm, 150 mm and 225 mm diameter uPVC inlet and outlet pipes.

J. Traffic loads and any information necessary to confirm the applicability of SM 1600 design criteria (which will generally be suitable for most applications).

The RainVault® and ReserVault® (see page 16) systems both follow similar design methodology, with the addition of the following information for the ReserVault® system:

Note D – The ReserVault® system is designed without an air zone and sludge zone.
Note I – The ReserVault® system may accommodate larger diameter inlet and outlet pipes as required.

Bottom:
A twin barrel RainVault® system with access chambers

2. Optimise storage volumes

To optimise the volume of a harvesting system a water balance should be performed; this will also provide a payback period for the system. Humes Water Solutions offers this service to designers and customers, for which we utilise the following information:

- Historic rainfall data – Sourced from the Bureau of Meteorology (BOM).
- Daily water demands – How much captured rainwater/stormwater can be utilised for non-potable water use?
- Catchment area – What is the total available area from which water will be harvested and what is the catchment type?

Historic rainfall data – Daily rainfall data is sourced from the BOM. The maximum number of available data is used to provide the greatest level of confidence in the optimisation results.

Daily water demands – The daily water demands are estimated on both current and projected water consumption for non-potable uses. There are many industry standard metrics that can be used to determine these usage rates some of which include:

- tap flow rates - AS/NZS 6400:2005 Water Efficient Products – Rating and Labelling
- toilet flush volumes - AS/NZS 6400:2005 Water Efficient Products – Rating and Labelling
- industry standard irrigation rates – will vary for plant species and location
- pump flow curves
- supplier brochures etc.

The first step in determining the daily water demand is to assess the types of water usages that can be met through harvesting. These might include toilet flushing, outdoor taps used for wash-down purposes, irrigation systems, cooling tower make-up water, etc. Once the usage types are determined, the individual demands can be estimated. A worked example is shown in Table 4 below.

Catchment area – The catchment area can be roof area, hardstand areas, or a combination of both. The catchment area can also consist of natural or pervious surfaces where water may be in the form of overland flow. The key to optimising a harvesting system is to maximise the catchment area available.

Once the area has been decided, it is necessary to determine how much water can be captured from the catchment. In other words, a catchment that is 100% impervious will result in runoff from most rainfall events, whereas a catchment with a permeable portion will require more rainfall to produce runoff.

Table 4 – Daily water demands example

Activity	Usage calculation rate	Daily total (L)
Toilet flushing	120 staff x 3.6 L flush, twice per day	864
Pressure washing of vehicles	120 minutes at 12 L per minute	1,440
Irrigation of 250 sqm landscaping	25 mm per sqm weekly	893
Daily demands that could be provided through harvesting		**3,197**

The historic rainfall data combined with the catchment area (multiplied by its capture efficiency rate) is the input into the harvesting system, and the daily water demand is the output from the system. The optimisation balances the amount of water captured with the demand on the tank.

This optimisation provides a range of storage sizes and their demand satisfied. Figure 3 below is a water balance model for the four largest capital cities in Australia. It has used the above daily water demand figures of 3,200 L/day, and a roof catchment area of 1000 m^2, with a catchment efficiency rate of 95%.

It can be seen below that the climatic conditions significantly affect the frequency that the demand is satisfied by the tank. It can also be seen by the curves in the graph, that there will be a point at which there are diminishing returns on the investment - the point where the gradient of the line changes. Beyond these volumes a cost-benefit analysis of installing larger volumes is required.

Contact your local Humes Water Solutions representative to take advantage of our optimisation design service and quantify potential savings and payback periods.

References

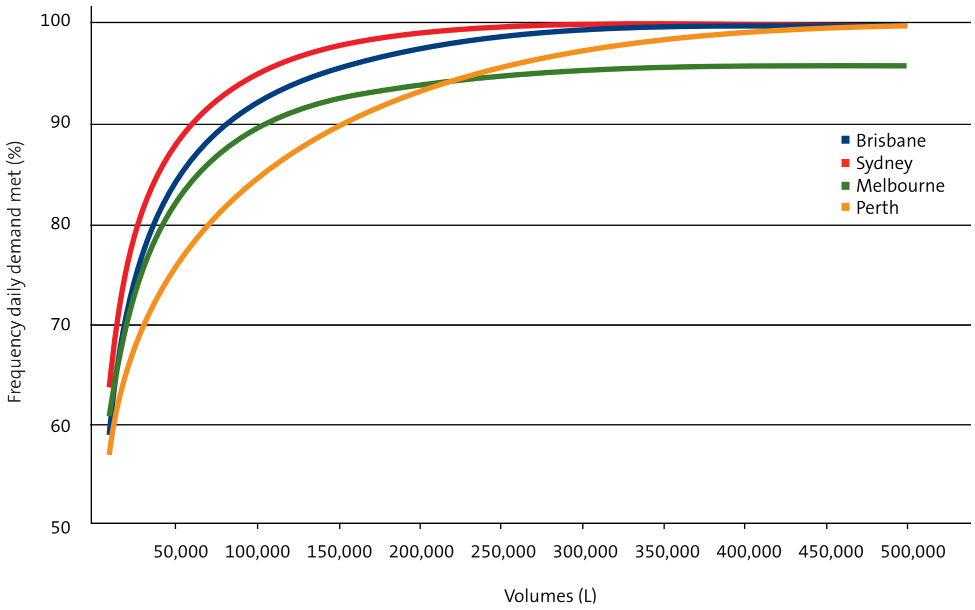
Some useful references for more detail regarding optimising stormwater harvesting systems, as well as other system requirements include:

- Water by Design (2009), Draft Stormwater Harvesting Guidelines, South East Queensland Healthy Waterways Partnership.
- Natural Resource Management and Ministerial Council (NRMMC), Environmental Protection and Heritage Council (EPHC) & Australian Health Ministers' Conference (AHMC) (2006), Australian Guidelines for Water Recycling: Managing Health and Environmental Risks (Phase 1), NHMRC and NRMMC, Canberra.
- Environmental Protection and Heritage Council (EPHC), National Health and Medical Research Council (NHMRC) and Natural Resource Management and Ministerial Council (NRMMC) (2009), Australian Guidelines for Water Recycling: Managing Health and Environmental Risks: Stormwater Harvesting and Reuse (Phase 2), Biotext, Canberra.

Operational works approval/tender stage

Our preliminary design will be revised prior to submission for operational works approval and/or tender to include any minor amendments, finished surface levels, pipe invert levels, diameters etc. This can be provided in CAD format for overlaying onto engineering drawings if required.

Figure 3 – RainVault® volumes for a 1,000 m^2 catchment and 3,200 L/day demand



Installing a RainVault® system

The precast concrete units can be laid quickly and efficiently with a combination of mobile crane, excavator and readily available hand tools. It has already been installed in many locations around Australia, and in a wide variety of configurations, including multiple barrels, various diameters, and volumes.

The system is to be installed in accordance with the documents in the following list. These references should be detailed in tender contract specifications:

- AS/NZS 3725 – Design for Installation of Buried Concrete Pipes
- AS 1546.1 – On-site Domestic Wastewater Treatment Units - Septic Tanks
- AS 3735 – Concrete Structures Retaining Liquids
- AS 4198 – Precast Concrete Access Chambers for Sewerage Applications
- HB230 – Rainwater Tank Design and Installation Handbook
- WSA 128 – Industry Standard for Buried Rainwater Tanks for Storage of Roof Water, Issue 1
- Humes' Concrete Pipe Manual.

Bedding

RainVault® systems must be installed with H2 bedding in accordance with AS/NZS 3725. The bedding must be correctly prepared to ensure optimal operation of the system and seal formation. Refer to Section 9: Pipe Support and Bedding Factors from AS/NZS 3725 for specific details.

Lifting and joining the sections

Each of the RainVault® sections is lifted from the four 5 tonne lifting points (arteons) on the top. Another two arteons are located on opposite sides of the barrel for joining the sections together.

Each of the 'C' sections will have a socket at one end and a spigot at the other. A rubber ring is stretched onto the spigot end of the section and lubricated prior to the sections being joined. The lubricant supplied with the RainVault® system should also be applied liberally to the socket at the other end of the section.

The first piece, typically an end unit, should be installed in the required position. The second piece should be lifted in to meet the first, but held slightly suspended. Two endless chain blocks, or "come alongs" are fixed to the two opposite 5 tonne arteons on the first two pieces. Tension is gradually increased until the gap at the joint is no greater than 10 mm. The second piece can then be released from the crane.

After the first two sections have been joined, the third section is connected in the same manner except that the come alongs connect between the arteons of the first and third section. This is to ensure that the weight of one section cannot cause separation of a previously installed section. This process is carried out for all of the sections until installation is complete. The risers for the access openings at each end of the RainVault® system are then installed. Multiple barrels are then interconnected with uPVC fittings, pipe and solvent.

Upon completion of each of the RainVault® barrels, and prior to backfilling, they should be vacuum tested separately to ensure water tightness, in accordance with WSA 128 and AS 1546.1

The pump and control panels should be connected by a plumber and electrician on-site, in accordance with the installation guidelines. Please refer to our 'Information for Contractors' reference material for further details on the installation process.

Backfill

Backfilling requirements are detailed in AS/NZS 3725, Section 9: Pipe Support and Bedding Factors.

Treatment and storage solutions – Fixed volume

The advent of inner city infill development often means that a harvesting and reuse system is required, but land constraints limit the viability of an above ground system. Humes have developed a fully trafficable solution for these small scale applications, that offer all the benefits of larger-scale designs.

RainVault® mini system

The RainVault® mini system is a fully integrated harvesting and reuse solution, ideal for small scale commercial and domestic systems that need to maximise above ground land use.

The combination of precast concrete barrels and European components provides a robust, high performance system with a minimum service life of 50 years (in most ground conditions). Its unique design incorporates proven technology for optimising water quality, including inlet and outlet devices, floating pump intake and the filtration of organics and solids down to 0.5 mm.

Filtration process

1. Rainwater flows into the filter cartridge.
2. The self cleaning drum screen separates solids, leaf litter and contaminants and diverts the cleansed water into the RainVault® mini storage facility. An automatic timed backwash device further eliminates filter maintenance (where required).
3. Separated solids, leaf litter and contaminants are flushed past the screen and continue to the downstream stormwater network.

Refer to Figure 4 for RainVault® mini configuration.

The modular nature of the system means it is easily customised to meet the needs of each project, with systems of 3000 L, 5000 L, and 7000 L capacities (refer to Table 5). The use of precast concrete provides a mass to resist floatation in high ground water areas, while also being vandal and fire proof.

The system complies with all relevant Australian Standards, codes and guidelines, including:

- AS 3600 – Concrete Structures
- WSA 128 – Buried Rainwater Tanks for Storage of Roofwater
- HB 230 – Rainwater Tank Design and Installation Handbook
- relevant municipal requirements.

Precast concrete cubes

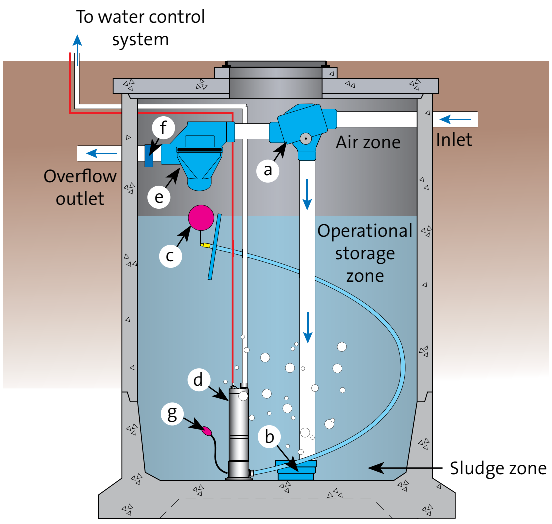
Humes manufacture a range of precast concrete cubes for water harvesting and reuse. The cubes provide a safe and secure water source for activities such as car washing, laundry, hot water systems and irrigation, where high quality potable is not required.

The cubes are available in 3,000 L or 5,000 L modules and are designed for structural loads, which helps to maximise above ground land use.

The precast cubes can also be configured with several key components for maintaining water quality. It relies on an air zone for maintaining aerobic conditions, an active storage zone, and a sludge zone which collects the fine sediments and chemical/microbiological contaminants contained in roofwater runoff.

The cubes incorporate the same filtration and pumping options discussed in our RainVault® and RainVault® mini systems, which provide seamless switching between storage and town supply.

Figure 4 – RainVault® mini configuration



Legend

a	Cartridge filter
b	Calmed inlet
c	Floating pump intake
d	Pump
e	Overflow siphon
f	Backflow prevention valve
g	Water level gauge

Table 5 – RainVault® mini configuration guide

RainVault® mini model	Useable storage volume* (L)	Height (mm)	Maximum mass (kg)
RB3000	3,000	2,227	2,500
RB5000	5,000	2,927	3,000
RB7000	7,000	3,747	3,500

Note:
* Volume excludes sludge zone and air zone.

Left:
RainVault® mini system

Right:
Precast concrete cubes

Storage solutions

ReserVault® system

Top:
A multiple barrel ReserVault® system

The ReserVault® system is an ideal solution where a high quality of water is not required, (e.g. irrigation applications). This 'no frills' model is similar to the RainVault® system, using the same seals and storage components, but excludes the filters, water quality measures and pump kits. As the design and installation process for the ReserVault® and RainVault® systems are similar, please refer to page 8 for further information.

Contact your local Humes Water Solutions representative to discuss whether your project is serviced best by a RainVault® or ReserVault® solution.

Note – The ReserVault® volumes presented in Table 6 are absolute volumes based on the maximum total storage capacity for each of the models.

Table 6 – ReserVault® system configuration guide

ReserVault® model	Inside diameter (mm)	Outside diameter (mm)	Storage volume combined 'A' + 'B' sections* (L)	Additional 'C' section volume each (L)	Combined 'A' + 'B' sections mass† (kg)	Additional 'C' section mass each‡ (kg)
RSV1200 - 01 - 00	1,280	1,500	5,500	3,000	8,200	3,300
RSV1950 - 01 - 00	1,950	2,220	11,550	7,300	16,000	6,000
RSV2100 - 01 - 00	2,100	2,388	13,400	8,500	17,700	6,800
RSV2250 - 01 - 00§	2,250	2,550	15,450	9,700	20,200	7,500
RSV2400 - 01 - 00	2,438	2,742	19,900	10,500	21,200	8,000
RSV2700 - 01 - 00	2,700	3,030	24,700	12,900	25,500	9,500
RSV3000 - 01 - 00	3,060	3,410	31,600	16,600	32,000	12,000

Notes:
* No volume allowance for sludge zone and air zone.
† Mass comprises both end sections plus saddle for risers, but excludes risers.
‡ Mass is for class 2 'C' sections - contact Humes for masses of heavier class sections.
§ RSV2250 currently available in Western Australia only.

Precast concrete tanks – above ground

The Humes range of concrete water tanks is ideal for the storage of water in rural conditions.

The standard concrete water tank holds 5,000 gallons or 22,700 L and is provided with standard inlet and outlet fittings (these can be tailored to meet your requirements). The concrete walling provides insulation and resistance from UV light to keep the water temperature cool, and the strength, weight and durability of the concrete provides greater resistance to vandalism and accidental damage. The tanks are easy to install and maintain, and have a long service life.

Top:
5,000 gallon concrete tank

Bottom:
Segmental shaft

Segmental shafts

Segmental shafts provide a viable solution for water storage structures where there is a limited footprint but unlimited depth. Segmental linings have proven very successful in both temporary and permanent conditions due to their ease of installation, enabling shafts to be sunk in difficult ground conditions economically and safely. The shaft construction method is dependant on geological and hydrological conditions together with a preference for certain techniques.

Humes cast these segmental linings in 4.5 m, 6 m, 7.5 m, 9 m, 12.5 m, and 15 m diameters and they are available throughout Australia. Structures must be designed by a suitably qualified design engineer. Contact Humes for specific information on applications requiring this solution.

Humes Water Solutions

Humes Water Solutions is a specialist division within the Humes business, dedicated to the provision of stormwater treatment, harvesting and reuse, and detention solutions.

Our team has been developed to provide an unparalleled depth of knowledge and experience for our customers, which takes Humes Water Solutions beyond the traditional barriers of company-based solutions.
A combination of graduate and post graduate personnel with working backgrounds in the private and public sector ensures the delivery of well-measured and practical advice for our customers.

We are dedicated to the development and protection of our water resources and to this end we undertake rigorous research and development of our products, stay abreast of stormwater issues and solutions around the world, and publish peer-reviewed technical papers on issues relevant to the stormwater industry.

As a part of the Humes business, Humes Water Solutions has access to a national infrastructure, a dedicated engineering design team, and over 100 years design, manufacturing and construction experience.

Humes now operates 16 accredited plants (ISO9001) and 20 sales offices to provide a truly national footprint and meet the needs of our customers irrespective of their location.

Our range of stormwater solutions also includes our multi-award winning* RainVault® harvesting and reuse system, and the new StormTrap® detention system.

For Humes and its parent company, Holcim Ltd, sustainable development is a key priority. Our stormwater treatment products demonstrate our commitment to protecting the environment.

For more information on any of our products, or for a selection of technical papers published by Humes Water Solutions, please visit us at humeswatersolutions.com.au.

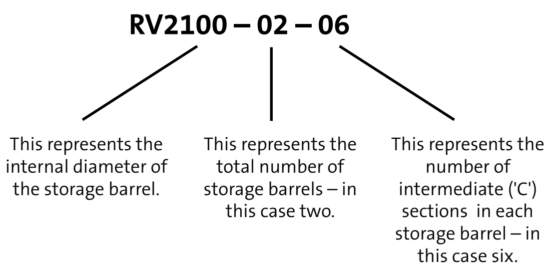
*
- 2008 Winner - Excellence in Stormwater Harvest & Reuse for the Riverstone Crossing RainVault from the Stormwater Industry Association.
- 2008 Fieldforce Environmental Product of the Year Award from the Master Plumbers and Mechanical Services Association of Australia.
- 2006 CivEnEx - Most Innovative Product.

Appendix 1 – Configuring RainVault® and ReserVault® systems

The RainVault® and ReserVault® systems can vary in diameter, length, and number of storage barrels therefore it is important to understand the model numbering system, and how to use the configuration guide.

The RainVault® and ReserVault® systems use the same naming conventions for model numbers – 'RV' precedes the RainVault® model numbers, and 'RSV' precedes the ReserVault® model numbers.

A typical RainVault® system might have a model number as follows:



All systems will have an 'A' section and a 'B' section, as these constitute the ends for access, pipe inlets and outlets. 'C' sections are the middle modules inserted to provide additional volume. Refer Figure 2 on page 5 for details.

Using the figures from Table 1 below, a RainVault® model RV2100 - 02 - 06 would have a total usable volume of 114,000 L. A worked example is shown in Table 7 below.

Table 7 – RV2100 - 02- 06 usable volume example

Components per barrel	Volume each (L)	Quantity	Total volume (L)
RV2100 'A' + 'B' sections	12,000	1	12,000
RV2100 additional 'C' sections	7,500	6	45,000
Volume per barrel	-	-	57,000
Total volume for 2 barrel system	57,000	2	114,000

Table 1 – RainVault® system configuration guide (from page 5)

RainVault® model	Inside diameter (mm)	Outside diameter (mm)	Storage volume combined 'A' + 'B' sections* (L)	Additional 'C' section volume each (L)	Combined 'A' + 'B' sections mass† (kg)	Additional 'C' section mass each‡ (kg)
RV1200 - 01 - 00	1,280	1,500	5,000	2,500	8,200	3,300
RV1950 - 01 - 00	1,950	2,220	10,000	6,300	16,000	6,000
RV2100 - 01 - 00	2,100	2,388	12,000	7,500	17,700	6,800
RV2250 - 01 - 00§	2,250	2,550	14,000	8,700	20,200	7,500
RV2400 - 01 - 00	2,438	2,742	19,000	10,000	21,200	8,000
RV2700 - 01 - 00	2,700	3,030	23,000	12,000	25,500	9,500
RV3000 - 01 - 00	3,060	3,410	30,000	16,000	32,000	12,000

Notes:
* Volume excludes sludge zone and air zone.
† Mass comprises both end sections plus saddle for risers, but excludes risers.
‡ Mass is for class 2 'C' sections - contact Humes for masses of heavier class sections.
§ RV2250 currently available in Western Australia only.

Humes
Water Solutions

Appendix 2 – RainVault® system - preliminary bid/design request

Humes
Holcim (Australia) Pty Ltd
ABN 87 099 732 297
humeswatersolutions.com.au

Consultant/project engineer information					
First name		Last name			
Position					
Company					
Address					
City		State		Post code	
Phone		Fax			
Mobile		Email			

Project information					
Project name					
Site address					
Project city		State		Post code	

Consultant/project engineer information							
RainVault® model		Class of access cover		Inlet/outlet diameter (mm)		Required volume (L)	
'A' unit access shafts		'B' unit access shafts		Reducers		PVC pipe	
Quantity	Type	Quantity	Type	Quantity	Type	Length (mm)	Diameter (mm)
						FSL	
Pump kit		Filter volume		Outlet IL	Inlet IL	Outlet RL	Inlet RL

Layout

Indicate number of 'C' units for each row of barrels in the side column

Number of 'C' units

System size (m)		System volume (L)
Length	Width	

For office use only			
Requested by		Date	
Phone		Date required	
Fax		Signature	
Plant			
Cost center			

Contact information

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info@humeswatersolutions.com.au

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Canberra
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Grafton
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Fax: (02) 6644 7313

Kempsey
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Lismore
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Fax: (02) 6622 1342

Newcastle
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Sydney
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Tamworth
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Tasmania

Launceston
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Western Australia

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Fax: (08) 9309 1625

Perth
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