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Fortitude Valley

IRRIGATION CONCEPT AND WATER USAGE REPORT

ISSUE: DA SUBMISSION

Document # LA-IR-DOC – 01 – 003

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DPoV

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Contents

1. Project report brief

This irrigation concept and water usage report aims to portray a clear and concise model that demonstrates the water conservation principles and practices of the proposed landscape irrigation network. Not only through the use of smart water irrigation products, but also through the science of plant / soil /water relationships in the fabricated environment of a high rise development.

2. Project overview

The proposed redevelopment at 36 WarryStreet Fortitude Valley Brisbane, will primarily consist of residential units with potential hospitality shops at ground level.
Harvesting of rainwater from roof structures, hard stand run off and general storm water redirection will be incorporated with rain water reuse collection tank/s and pump system/s.
Optimal sizing of harvesting tank/s and locations within the proposed building structure will be refined and optimised throughout detail design phase in coordination with other trade consultants.
However a clear and concise irrigation water usage model can be compiled at this early phase of the project by defining known factors such as planting pallets, crop coefficients, soil profiles, micro climates, and irrigation applications methods. These factors incorporated together will provide the irrigation water schedule required for a complete irrigation cycle with weekly and seasonal projections.
Water storage volumes can then be recommended and refined through detail design phase when site storage and infrastructure constraints are realised.

3. BCC RFI Response

Application Reference: A006963038
BCC RFI date: 27 March 2026

Revised Irrigation Strategy		
12) The proposal does not clearly demonstrate that adequate onsite water storage/non-potable water measures for the revised artificial growing environment/container planters can still be achieved for the development (e.g. location of storage tanks). It is noted that the previous approval did include an Irrigation Strategy Report and the 30,000L tank was approved to meet the non-potable irrigation requirement. Provide updated reporting and plans to reflect the proposed changes to the landscape design, outlining any changes to the proposed stormwater harvesting and water storage methods, as per the Landscape works code (PO12/AO's, PO13/AO's and PO15/AO's) and the Landscape design planning scheme policy. a. The proposed revised irrigation application rates for the onsite landscape areas within the development which is calculated using the methodology within Section 6.1 – Table 3 of the Landscape design planning scheme policy. b. Any revised stormwater harvesting capacity and water tank storage requirements to effectively irrigate the onsite landscape areas which is calculated using the methodology within Section 6.3 – Table 5 of the Landscape design planning scheme policy. c. The proposed size, capacity and location of the water storage tank devices to service the irrigation requirements of this development.	• Irrigation report to be submitted for review; • DPOV Consulting provided irrigation report for original approval – explore whether this can be amended and resubmitted? Vector Property to confirm preference.	Vector Property Arcadia DPOV Consulting? (TBC)

The following report provides to the following:

- Rainwater harvesting area
- Storage tank sizing
- Updated landscape planting areas and associated water usage for irrigation

4. Water source

As per BCC requirements for responsible use of water and sustainable irrigation, a target figure of 75% of landscape irrigation is to be sourced from a non-potable water source.

4.1. Harvesting availability / reliability / quality

Primary water source will be from harvested and reused rainwater collected from Rooftop.

Harvesting will from hardstand areas and planters with collected runoff diverted through stormwater drainage pipe network to a collection tank in the basement (to be confirmed) then transferred to the irrigation / rainwater holding tank on Rooftop level.

Water quality from harvesting areas such as roof structures and podium paving areas is considered to be low risk with minimum contaminants compared to carpark hardstand harvesting.

4.2. Alternate water source / fail safe backup

Rainwater / stormwater harvesting is only as reliable as the weather. During times of no rainfall, a potable water source will be required to maintain landscape health so as not to cause long term stress to foliage creating a potential fire risk.

A potable backup source is recommended as a fail safe measure for the water source, utilising a potable switch over valve system that is connected to a tank level control panel. If the storage tank has insufficient water volume prior to an irrigation event starting, the control panel will automatically switch to the potable source.

4.3. Water harvesting and storage criteria

Potential harvesting direct from Rooftop areas is approximately 95m²

Taking into account % efficiencies of catchment with surface finishes, obstructions such as planters and awnings, a conservative usable percentage would be approximately 90% of this area = 85.5m²

Final usable catchment area to be determined through detail design stage in coordination with hydraulics consultant.

In general: Potential stormwater harvest volume = median rainfall value x harvest area (in m2) x run-off coefficient (0.9)

With the potential monthly harvesting data set below, reliability of harvested water vs irrigation usage will be compare further down in this report.

RAINWATER HARVESTING -

BOM Rainfall data for Brisbane

Rainfall Statistic	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Units
Monthly Median (mm) (MMRF)	141.1	179.7	128.3	60.3	70.9	58.8	30.2	33.0	29.2	84.8	94.0	131.7	mm
Daily Median (DMRF)	4.6	5.8	4.1	1.9	2.3	1.9	1.0	1.1	0.9	2.7	3.0	4.2	mm
Roof catchment area details (usable area)	Area (m2)	95.50	Material	Steel	Absorption Loss		2.0	mm/month (B)		Efficiency	90.00%	(A)	
Roof catchment area breakup for table calculation	Roof Portions	1	Portion Area (m2)	95.50	Note: If total roof catchment area is divided into segments to suit Section 6.3 data table then that divided qty will equal the total number of tank								
Potential runoff harvest (litres) (RO) = (A) x (Rainfall MMRF - (B)) x Roof Area (m2)													
Monthly Ronoff / harvested usable catchment (RO)	11,956	15,273	10,855	5,011	5,922	4,882	2,424	2,664	2,338	7,117	7,907	11,148	L
Annual Volume = Sum all (RO)	*87,497*												

Tank Sizing

Step 1. *Determine the daily volume required by dividing the annual volume (calculated in Step 3 above) by 365 days per year*

Daily storage volume (average) = Annual Volume / 365 — *87,497* / 365 = **239.72** L / Day (average)

Step 2. *Determine the total tank storage required by using the roof area and volume of water required per day for the appropriate value shown in Table 5. For example, if 100L per day harvested from a roof area*

** The tank sizes shown were determined from summarised data provided by the South Australian Water Corporation and the Department of Environment, Heritage and Aboriginal Affairs. The original data was calculated using a computer simulation based on averaged rainfalls and rainfall patterns and using a value of 0.8 for A and 2 mm per month for B.*

Volume required (L/day)	Roof area (m2) 100	150	200	300	400	500	600
100	10	8	7	7	7	7	7
200	34	23	19	16	14	14	14
400	-	-	-	47	39	34	31

Section 6.3 Table 5 - Landscape Policy Planning Scheme, Complimance with section PO4/AO4.1-AO4.3, PO12/AO12.1-AO12.4 and PO13/AO13.1-AO13.8 of Landscape Works Code

Step 3. *Recommended tank/s size and total capacity* — 34 KL — Roof portion splitting multiplication factor 1 — Total capacity = 34 KL

Note—Table adapted from Appendix 4 of Cunliffe, DA 1998, Guidance on the use of rainwater tanks, National Environmental Health Forum, Adelaide.

Recommended storage tank size to maximise the rain water harvesting = 34KL

4.4. Water treatment and specific project usage constraints

Water quality will require intervention prior to distributing to the irrigation network, this can be achieved through an auto backwash filtration unit at the pump station.

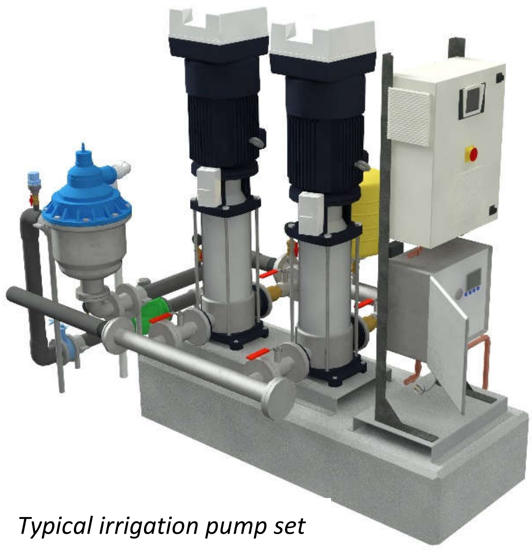
As there no turf areas requiring aerial spray irrigation, screen filtration is sufficient, higher levels of treatment such as UV sterilisation is not required.

Typical irrigation pump set

4.5. Water delivery method

With the water source being a tanked water source, a pressurising pump system will be required to operate the irrigation. However as the water storage tank is to be located on the rooftop, pump duty sizing can be efficiently minimised due to the assistance of gravity pressurising the supply main riser.

Drip irrigation zones typically required a head pressure of 300kPA at the supply solenoid valve. A typical floor level can be estimated to be 3m in elevation change. Pressure assistance through gravity can be calculated at 10kPa for every 1m drop, therefore each floor gains 30kPa in pressure buildup due to gravity.



Typical irrigation pump set

The first 3-4 floors below the tank will not achieve sufficient pressure buildup due to gravity, for this reason a pressure pump is required to make up the difference. The rooftop level required the highest pressure intervention which is 300kPa, after that each level accumulates 30kPa.

A typical pressure pump in this scenario would be recommended to have a pressure range of 320-250kPa depending where the pump is situated in relation to the landscape being irrigated on the Roof Top level. A typical flow rate of 60L/min would be expected from this pump source.

Harvested water is required to be transferred from the basement to Roof Top level tank. This water source is not required to be at pressure once Roof Top level is reached as it is only filling the tank as an open water pipe, not a closed pipe pressure system. For this reason the pump only is required to produce enough pressure to overcome the elevation difference between Basement level harvesting tank and the Roof Top tank.

Basement level 01 to Level 14 Roof Top is approximately 45m elevation change, pressure pump duty required in the order of 450-500kPa depending on final RLs.

5. Landscape Extents

Being a multi storey development, the planting pallet varies as the building progresses in height.

Ground

Planting = 18.0m^2

Upper Ground

Planting = 73.0m^2

Podium Level 1

Planting = 70.0m^2

Level 1

Planting = 30.0m^2

Levels 2-16

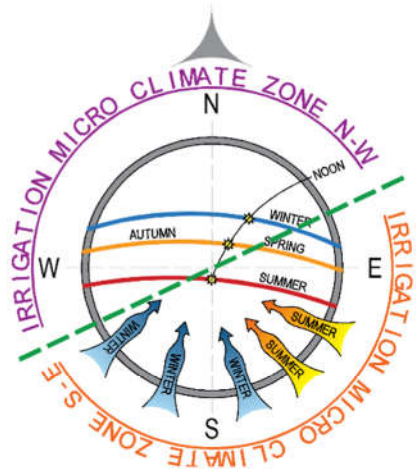
Planting = 5.0m^2 per floor = 75.0m^2

Rooftop

Planting = 104.0m^2

The planter pockets on Levels 2 to 16 as shown will have a higher degree of shading due to the building structure / façade creating rain shadows thus watering requirements will be potentially higher or more regular than larger planters on upper rooftop and lower ground levels that are exposed to the elements and can receive natural rainfall.

Level 2 to 14 planters irrigation zoning approach will be to combine 4 levels together on the same watering zone to maximise watering efficiencies whilst maintaining practical hydraulic flow rates.



The building will however be split with zoning to separate N-W and S-E facades to enable different watering schedules to suit the varying UV exposure and prevailing winds that each side of the building will be exposed to.

Ground Level will have a greenroof planter over the services cabinet which will required separate irrigation watering zone.

Typical over structure planters have shallow soil depths with drainage closer to the plants root structure.

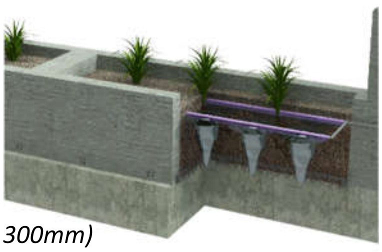
As a result more frequent shallower watering routines are required compared to other on grade or deeper planter areas within the same vicinity.

Typical services cabinet overhead planter

Moving to the Roof Top level there are larger tree species with deep planting soil profiles, watering rates for these feature trees will be higher to maintain the soil water holding capacity.

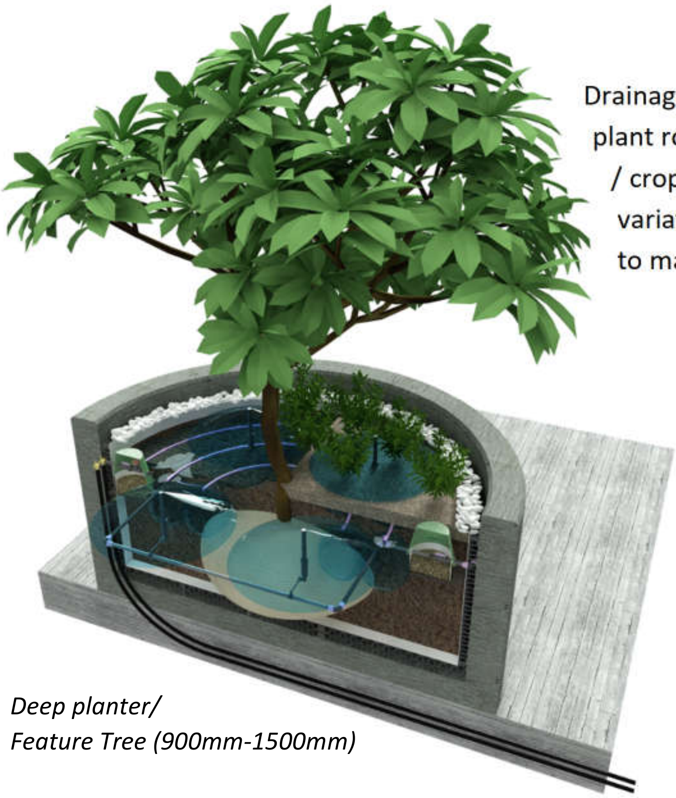
5.1. Landscape styles and construction details

Planter soil depth also affects watering requirements due to varying ET from heat exposure in shallow planters compared to deep soil planters.



Shallow depth planter (typical 300mm)

Drainage rates, soil mix water holding capacity and plant rootball size accommodation, plant water usage / crop coefficients all varies with planter depth variations, thus irrigation zoning must be segregated to maximise water use efficiencies.

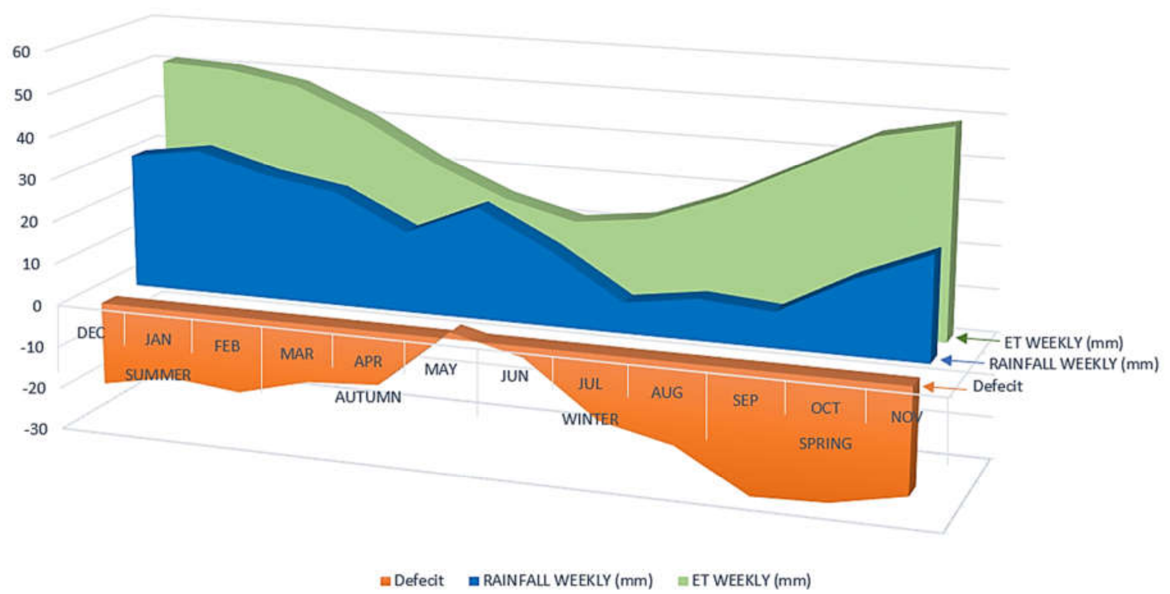


Deep planter/ Feature Tree (900mm-1500mm)

Medium depth planter (600-900mm)

5.2. Location and climatic conditions .

Brisbane average long term climate data 2005-2017



	SUMMER			AUTUMN			WINTER			SPRING		
	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV
Defecit	-19.52	-16.3	-18	-13.7	-12.55	1.55	-2.6	-15.2	-19.02	-28.77	-28.12	-24.57
RAINFALL WEEKLY (mm)	31.58	34.1	29.6	26.9	18.95	26.05	17.7	7.2	9.68	8.33	17.38	24.43
ET WEEKLY (mm)	51.1	50.4	47.6	40.6	31.5	24.5	20.3	22.4	28.7	37.1	45.5	49

Long term seasonal variations for South East Queensland is demonstrated in the graph above.

This data collated from the Australian Bureau of Meteorology over a 12 year period from 2005 to 2017 provides a true and accurate profile of the SE QLD climate as this time period covers drought conditions from 2004 through to 2007 and La Niña major rainfall events of 2011.

Even with these extreme weather event variations, the overall general trend of seasonal variations can be seen clearly.

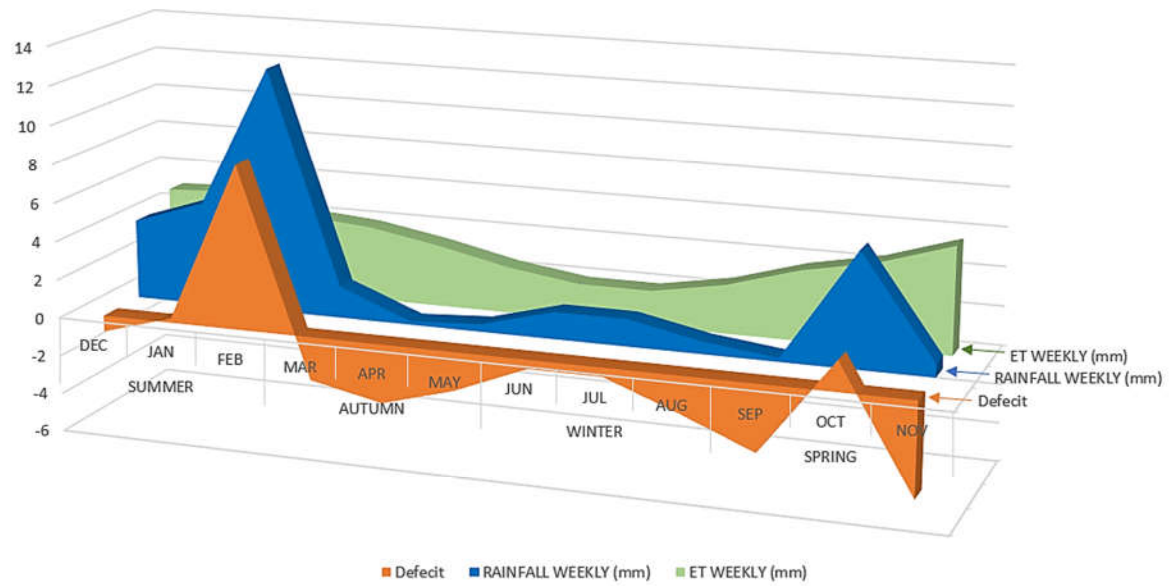
Summer = High evapotranspiration, relatively low shortfall in rain leaves a reduced deficit with ET resulting in 20-25mm per week of makeup irrigation.

Autumn = Reduced evapotranspiration and rainfall is proportional to summer but with lower deficit between rainfall and ET resulting in 10-15mm per week of makeup irrigation.

Winter = Low evapotranspiration, with relatively high rain and moisture leaves causes a slight surplus and mainly an equilibrium between rainfall and ET resulting in little irrigation required of around 0-10mm per week of makeup irrigation.

Spring = Very high evapotranspiration, low rainfall levels creating a high deficit between rain and ET resulting in 25-30mm per week of makeup irrigation.

Brisbane seasonal year climate data for 2020



	SUMMER			AUTUMN			WINTER			SPRING		
	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV
Defecit	-0.83	0.23	8.48	-2.23	-3.02	-1.98	-0.46	-0.46	-1.88	-3.42	1.56	-4.85
RAINFALL WEEKLY (mm)	4.1	5.34	12.61	1.61	0.17	0.39	1.39	1.39	0.63	0.19	5.9	0.67
ET WEEKLY (mm)	4.93	5.11	4.13	3.84	3.19	2.38	1.85	1.85	2.51	3.61	4.34	5.52

The graph above demonstrates the ET, rainfall and resulting deficit for 2020.

Although this data period indicates 2 noticeable spikes in February and October due to high level rainfall events, the general trend reflects the typical long term seasonal pattern as shown in the long term data set.

Summer = High evapotranspiration, relatively low shortfall in rain leaves a reduced deficit with ET resulting in 20-25mm per week of makeup irrigation. (Rain even negated from chart)

Autumn = Reduced evapotranspiration and rainfall is proportional to summer but with lower deficit between rainfall and ET resulting in 10-15mm per week of makeup irrigation.

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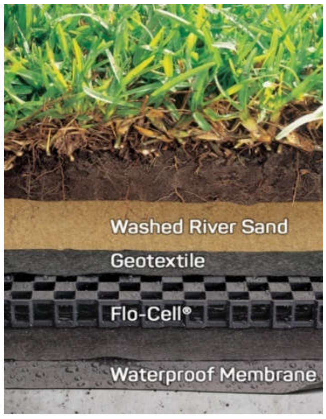
Spring = Very high evapotranspiration, low rainfall levels creating a high deficit between rain and ET resulting in 25-30mm per week of makeup irrigation. (Rain even negated from chart)

5.3. Irrigation zoning criteria set by development constraints

Soil profile variables and drainage rate factors will vary between each micro climates.

On ground gardens and constructed planter boxes will all have drainage systems intended to provide similar drainage ratios covering the micro climates, however larger open landscape gardens will have different soil drainage rates and holding capacities due to solar radiation and heat retention differences.

For this reason podium planting areas cannot be combined with on ground landscape areas.



Shallow podium soil horizon vs natural deep soil horizon

Typically irrigation zoning for building structures in SE QLD are segregated into S-E and N-W zones to accommodate the varying wind, solar radiation and directional rain trends. With close proximity to the Brisbane River, this hydro zoning is especially relevant.

5.4. Irrigation scheduling / operational times

Operational times of the irrigation are also not limited to the typical night water window hours as the sub surface drip does not impact on public presence.

Irrigation zone scheduling is not considered to be governed by public use of the facilities.

5.5. Safety in design / operational limitations

The irrigation system is considered to have a low risk factor for design and operation. Being primarily sub surface delivery, no over watering of hard surfaces resulting in trip hazards can occur.

6. Landscape specific attributes

All planting for all levels will be a form of containerised planting on podium.

Typical planting depths will be:

- Trees - 1200mm;
- Large shrubs and palms - 800mm;
- Small shrubs and ground covers - 600mm

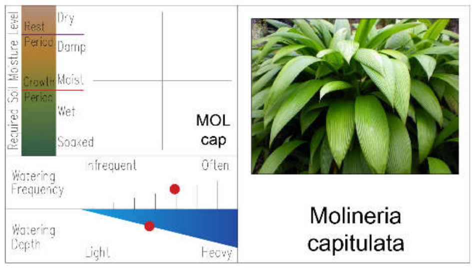
6.1. Planting pallet / Crop coefficient information

Plant type	Plant factor (PF)*/ Crop coefficient (K_c)†
Landscape plants with high water use	0.7–0.9*
Landscape plants with medium/moderate water use	0.4–0.6*
Landscape plants with low water use	0.1–0.3*
Landscape plants with very low water use	< 0.1*
Warm-season turfgrass (Bermudagrass, zoysiagrass, St. Augustinegrass, buffalograss)	0.6†
Cool-season turfgrass (tall fescue, Kentucky bluegrass, ryegrass, bentgrass)	0.8†

The planting pallet will generally be broken into 3 sections

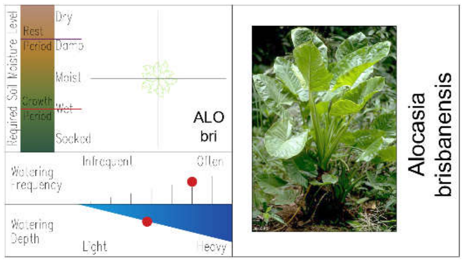
1. Ground Level planting

   Shade tolerant planting palette (typical crop coefficient = 0.3)



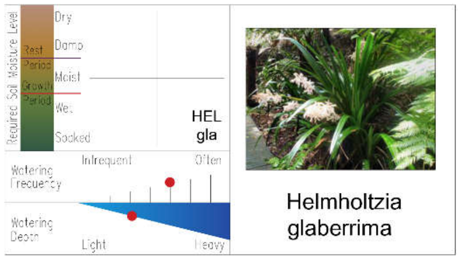
2. Residential balcony planting

   A planting palette proposed includes shade tolerant species that can be sustained in a partly shaded area (typical crop coefficient = 0.35)



3. Rooftop planting

   A part-shade tolerant planting palette with medium to large shade trees (typical crop coefficient = 0.4)

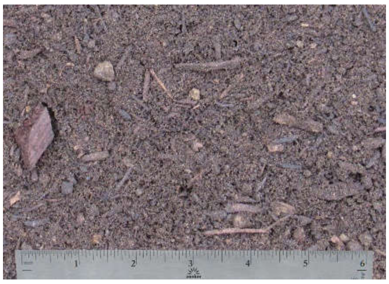


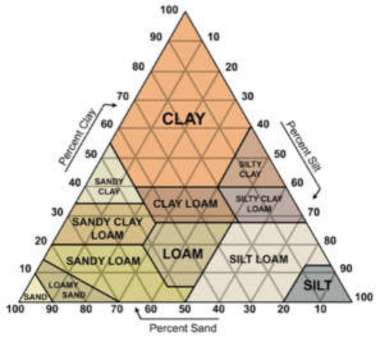
6.2. Soil profile data

6.2.1. Soil type/ texture

Typical soil profile for all containerised planters will be imported top soil with wetting agent.

Typical pH 7.3





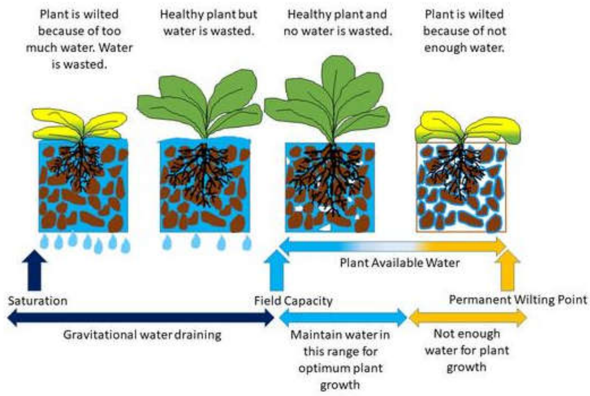
6.2.2. Infiltration Rates

Standard imported top soil for planter are free draining in nature but have a good water holding capacity. Wetting agents can be introduced to increase holding capacities for exposed planters.

Typical infiltration rate = 20-30mm/hr

6.2.3. Field capacity (FC) / Plant available water (PAW)

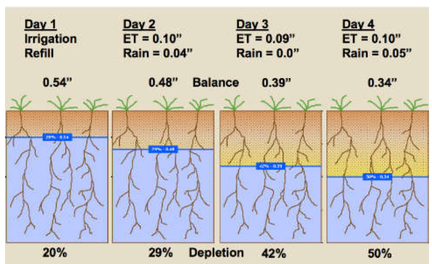
It is the amount of water that remains in the soil after all the excess water at saturation has been drained out. Usually, when sandy soils are allowed to drain for approximately 24 hours after saturation, field capacity is reached. In heavier textured soils that have more silt and clay, it take up to 2-3 days after saturation to reach FC



Typical field capacity for imported top soil = 110mm/1000mm depth of soil

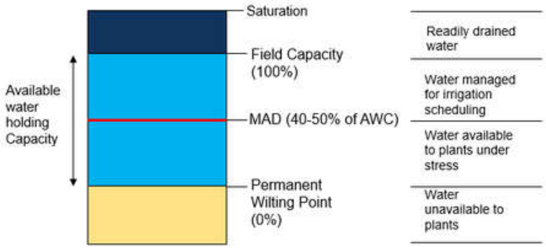
6.2.4. Allowable depletion rate (irrigation trigger point)

Management allowable depletion specifies the maximum amount of soil water the irrigation manager chooses to allow the crop to extract from the active rooting zone between irrigations.



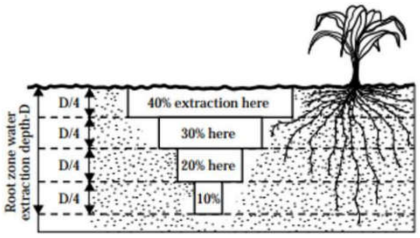
Only a portion of the available water holding capacity is easily used by the crop before crop water stress develops.

Typical allowable depletion = 50%



6.3. Crop effective root zone depth

Crop rooting depth determines how much soil water can be accessed by the crops. A shallow-rooted crop has less access to soil water as compared to a deep-rooted crop, most of a plant's roots are located in the upper portion of the root zone, irrigation water applications are generally managed to a shallower depth than the crop's full rooting depth.



Typical effective root zone depth

- Trees -500mm;
- Large shrubs and palms - 300mm;
- Small shrubs and ground covers - 200mm

7. Irrigation methodology and water usage data

The proposed irrigation system consists of a "Hybrid Irrigation Network" that being a permanent primary system and secondary supplemental irrigation system.

1. Primary irrigation system will be comprised of sub surface drip tube to all on grade planters and containerised planters as a permanent watering method for maximum watering efficiency, minimum water wastage and reduced long term maintenance.

2. Secondary irrigation system comprised of popup bubblers is intended for use only through establishment period for larger tree species where subsurface drip irrigation is not sufficient and does not provide heavy overhead watering that rootball structures require. This secondary system also has the benefit of providing a fail-safe supplemental watering method during times of plant heat stress.

7.1. Irrigation application methods

7.1.1. Primary irrigation system

36 WarryStreet development will consist of a primary watering system of sub surface drip irrigation to all gardens and podium planting.

From project experience of similar developments with containerised podium planters, a secondary irrigation system will be designed in for the establishment period.

7.1.2. Secondary irrigation system

The secondary will consist of overhead watering (non spray) via bubbler outlets place around mature plants and trees to provide the necessary deep watering and soil compaction for healthy and strong root growth during the establishment period.

The secondary irrigation system aids the subsurface irrigation system which alone cannot provide deep watering during establishment periods. Post establishment, this secondary overhead irrigation system can be shut off via isolation valves.

This secondary system will remain in place for future heavy/ deep watering if required under special landscape maintenance circumstances.

Palm crown watering will also be facilitated with micro misters temporarily installed direct to the drip zone beneath the tree during establishment period. Post establishment the micro mister will be removed.

Recommended product for the primary irrigation sub surface system is continuous length drip tube with integral pressure compensated inline drip emitters with anti syphon and anti drain feature to ensure to best water saving product is endorsed.

Recommended manufacturer's that supply this product with non treflan anti-root intrusion emitters are supplied by Rainbird and Netafim. High quality products with a proven industry track record.

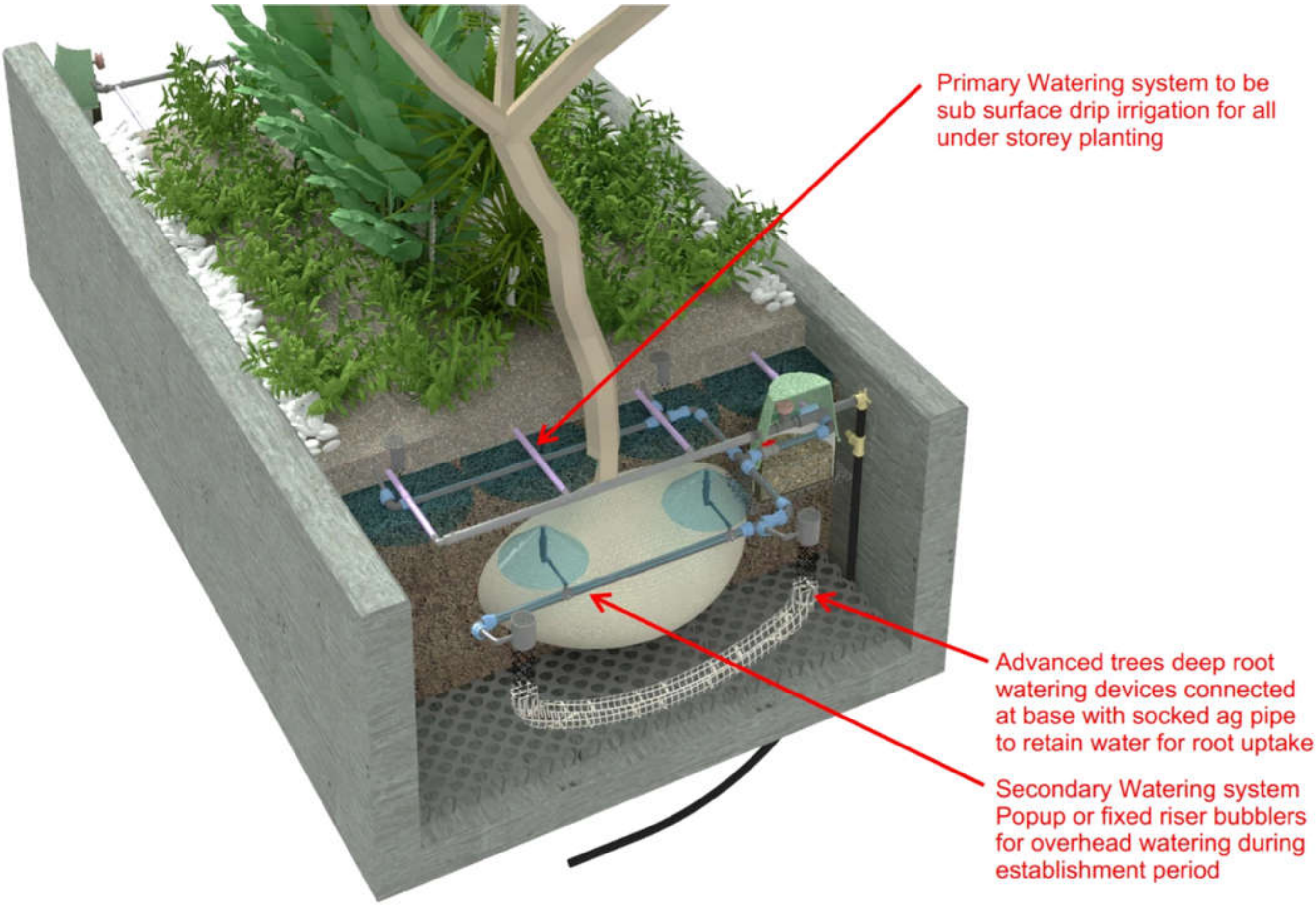
Copper Shield^{tm} (Rainbird) or Copper Oxide (Netafim) are the accepted and recommended methods for root intrusion protection, compared to products of the past that utilised dangerous Treflan chemicals for root intrusion protection.

7.1.3. Feature Tree Planters Irrigation Concept

Irrigation to feature trees are to be controlled automatically and separately from ground floor and podium level understorey landscaping.

Multiple floors can be combined on a common irrigation zone to provide a cost efficient solution, whilst tailoring water application for the specific planting media.
Similarly to the ground level landscaping, inline drip tube will be used for watering of the understorey landscape in each of the feature treee planter boxes. In addition to the drip tube, deep root watering devices will also be used which provide watering and aeration direct to the feature trees rootball.

The drip line and deep root watering device will be controlled on separate solenoid valves for total separation, providing flexible run times and application rates to be adopted.



The "hybrid" irrigation system for contained planters and podium planted areas is highly recommended to provide the flexibility of additional overhead watering for fast plant establishment

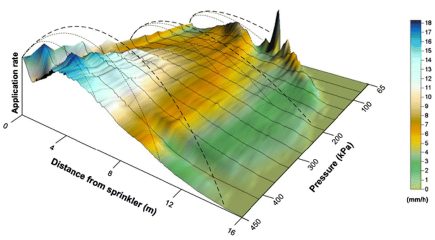
7.2. Irrigation profile data

7.2.1. Sprinkler / emitter / outlet application rates

Subsurface drip tube

2.3 L/hr emitters@ 0.3x0.3 grid = 25.5mm/hr

7.2.2. Irrigation efficiency



Subsurface drip irrigation is to be utilised as the primary irrigation method

Watering efficiency is considered to be 90%

8. Water usage and storage

8.1. Irrigation area summary

IRRIGATION WATER USE SUMMARY FOR PLANTER DEPTH TYPES

Peak Watering (Establishment / Summer)	Application per irrigation event (mm)	6.00	Application per irrigation event (post establishment (mm)	7.50
	Planter on Podium	Water Usage	Planter on Podium	Water Usage
	Subsurface Drip	SSDI	Subsurface Drip	SSDI
Soil/Planter Depth	400.00	mm	600.00	mm
Root zone depth	100.00	mm	175.00	mm
	m2	L	m2	L
Rooftop	0.00	0.00	104.00	780.00
Level 16	0.00	0.00	5.00	37.50
Level 15	0.00	0.00	5.00	37.50
Level 14	0.00	0.00	5.00	37.50
Level 13	0.00	0.00	5.00	37.50
Level 12	0.00	0.00	5.00	37.50
Level 11	0.00	0.00	5.00	37.50
Level 10	0.00	0.00	5.00	37.50
Level 9	0.00	0.00	5.00	37.50
Level 8	0.00	0.00	5.00	37.50
Level 7	0.00	0.00	5.00	37.50
Level 6	0.00	0.00	5.00	37.50
Level 5	0.00	0.00	5.00	37.50
Level 4	0.00	0.00	5.00	37.50
Level 3	0.00	0.00	5.00	37.50
Level 2	0.00	0.00	5.00	37.50
Level 1	0.00	0.00	30.00	225.00
Level 1 Podium	0.00	0.00	70.00	525.00
Upper Ground	73.00	438.00	0.00	0.00
Ground Floor	18.00	108.00	0.00	0.00
TOTALS	91.00 m2	546.00 L	279.00 m2	2,092.50 L

Total average water usgae per irrigation session during peak watering period	1,896.00	L
Total Landscape landscape area on podium (Artificial Growing Environments)	271.00	m2

8.2. Irrigation water usage vs potential harvesting / storage sustainability

IRRIGATION SCHEDULING

BOM Rainfall data for Brisbane

Rainfall Statistic	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Units
Rainfall Monthly Mean (mm) (MMRF)	141.10	179.70	128.30	60.30	70.90	58.80	30.20	33.00	29.20	84.80	94.00	131.70	mm
Rainfall Daily Mean (DMRF)	4.55	5.80	4.14	2.95	2.29	1.90	0.97	1.06	0.94	2.74	3.03	4.25	mm

BOM ET data for Brisbane

ET Statistic	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Units
ET Daily Mean (ET)	5.62	4.14	4.62	4.27	3.27	2.86	2.69	3.40	4.32	5.52	5.08	6.15	mm
ET Weekly	39.36	28.98	32.31	29.87	22.92	20.02	18.83	23.78	30.26	38.61	35.58	43.04	mm
ET Monthly	174.30	115.90	143.10	128.00	101.50	85.80	83.40	105.30	129.70	171.00	152.50	190.60	mm

Irrigation events per week / seasonaly adjusted

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Units
Daily difference (DEF) = (DMRF) - (ET) *(-ve value = no irrigation required)*	1.07	-1.66	0.48	1.32	0.99	0.96	1.72	2.33	3.38	2.78	2.05	1.90	mm
Irrigation supplement per week (AR) = (DEF) x 7	7.50	-11.60	3.34	9.22	6.91	6.74	12.01	16.33	23.67	19.46	14.36	13.30	mm

Irrigation methodology

Peak Watering Application Rates

Shallow Planter - upto 400mm 600mm depth	SSDI	6.00	mm / m2 per event	Shallow Planter 400 Total	91.00	m2
Medium Planter - upto 600mm - 1000mm dpeth	SSDI	7.50	mm / m2 per event	Medium Planter 600 Total	180.00	m2

Total irrigated landscape area	271.0	m2	
Peak watering average usage per single irrigation event	1,896.0	L	average per event

Irrigation events per week / seasonaly adjusted

Number of irrigation events per week to achieve (AR)		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Units
		Summer	Summer	Autumn	Autumn	Autumn	Winter	Winter	Winter	Spring	Spring	Spring	Summer	
Shallow Planter - upto 400mm 600mm depth	SSDI	4	4	2	2	2	1	1	1	2	3	3	4	days /week
Medium Planter - upto 600mm - 1000mm dpeth	SSDI	4	4	2	2	2	1	1	1	3	3	3	4	days /week
Weekly irrigation total usage		7,584	7,584	3,792	3,792	3,792	1,896	1,896	1,896	5,142	5,688	5,688	7,584	L
Monthly irrigation total usage		30,336	30,336	15,168	15,168	15,168	7,584	7,584	7,584	20,568	22,752	22,752	30,336	L
Highest irrigation weekly water usage		7,584 L												L
Highest irrigation monthly water usage (peak 4 weeks)		30,336 KL												L

8.3. Irrigation seasonal water budgets

Seasonal water usage for irrigation

Tank level at beginning of month, initial month filled	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	Summer	Autumn	Autumn	Autumn	Winter	Winter	Winter	Spring	Spring	Spring	Summer	Summer	
Week 1 irrigation usage	7,584	7,584	3,792	3,792	3,792	1,896	1,896	1,896	5,142	5,688	5,688	7,584	L
Week 2 irrigation usage	7,584	7,584	3,792	3,792	3,792	1,896	1,896	1,896	5,142	5,688	5,688	7,584	L
Week 3 irrigation usage	7,584	7,584	3,792	3,792	3,792	1,896	1,896	1,896	5,142	5,688	5,688	7,584	L
Week 4 irrigation usage	7,584	7,584	3,792	3,792	3,792	1,896	1,896	1,896	5,142	5,688	5,688	7,584	L
Monthly Irrigation total usage	**30,336**	**30,336**	**15,168**	**15,168**	**15,168**	**7,584**	**7,584**	**7,584**	**20,568**	**22,752**	**22,752**	**30,336**	L
Yearly Irrigation total usage	**225,336**												L
4 week water usage volume / storage requirements	22,752	22,752	11,376	11,376	11,376	5,688	5,688	5,688	15,426	17,064	17,064	22,752	L

Storage tank summary irrigation vs rainwater harvesting

Water storage tank sizing based on roof catchment area	34	KL	L
Water storage tank sizing based on 4 weeks of irrigation	30	KL	L
Revised storage volume to reflect 75% non-potable factor	23	KL	L
Reliability % of storage capacity vs irrigation peak 4 week	149.4%		L
Does tank sizing meet BCC 75% minimum non potable clause	Yes		L

Taking into account average seasonal rainfall, a typical minimum recommended storage capacity would accommodate for 4 weeks worth of irrigation water usage during peak watering periods. Peak monthly water usage = **30,336L**

Also taking into consideration potential harvesting from Roof Top Level, and accommodating a 4 week storage capacity for peak period watering, this would storage tank of **34,000L.**

Alternate fill backup to tank is always recommended for periods of low or no rainfall as irrigation will still be required. Options can included town water backup via automated switching valves and tank level sensors, and/or external fill point to tank via water truck.

9. Power supply & controls

The irrigation controls system utilises a 240VAC controller unit typically wall mounted with pump equipment.
Low voltage 24V solenoid valves are used in field to automate irrigation operation.

9.1. Automation, control and monitoring sensors

Every irrigation system is only as good as the application method and its application rate.

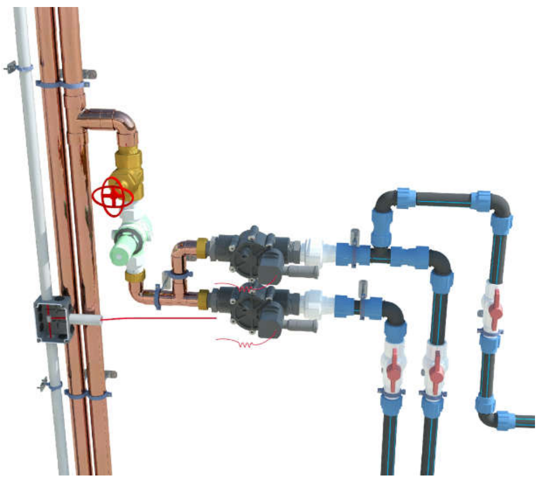
Example of flow sensors

Precise water delivery control and real time monitoring is a vital part of a complex irrigation system.

Example of irrigation controller

Pressure and Flow sensors located at the water source and at various locations along the delivery mainline will monitor the performance of the irrigation and adjust or over-ride the irrigation operating if conditions vary outside of preset limits.

Coupled with a water smart and wifi enable controller, and master control solenoid valve, the entire irrigation system can be monitored and interacted with in real time from any computer and any location around the world via web based software.



Example of irrigation solenoid valve assembly within hydraulic / water meter

The primary flow sensor located at the pump source connected to the irrigation controller has the ability to "learn" the expected flows for each zone of irrigation for the feature tree planters.

When an irrigation event occurs and a flow range is monitored to not be within the "learned" range then an alarm is reported and communicated to the nominated maintenance staff by txt msg.

As the flow per irrigation zone is know from the design, and with the irrigation controller programmed with the applicable operating time periods for each zone, the controller's "learned" flow range will confirm that the correct volume of water has been delivered to each zone.

This method of monitored delivery of water is recommended over moistures sensors as it is a more reliable and accurate method of measuring and monitoring delivered water to landscapes. Moisture sensors however will also be incorporated into the irrigation system as a remote monitoring system but not used as an overriding device for the irrigation controller.

The recommend method of moisture sensing is using devices that allow off site monitoring which allows maintenance staff to check moisture levels and irrigation performance then make adjustments to the irrigation controller themselves.

Pressure regulation devices upstream of all solenoid valves will also be installed on each level to ensure to exact flow and pressure is supplied on every level.

10. Maintenance, proactive and reactive

10.1. Typical maintenance program during establishment period

Frequency	Type of inspection	What to look for:
Daily	Visual inspection	Look for obvious broken sprinklers or pipes and repair them immediately
		Look for flooding or washed sand patches that indicate broken
		Keep an eye out for dying plants or turf. This may indicate a faulty or damaged irrigation system
Fortnightly	Record on fortnightly checklist	Clean filters if non potable water is used
		Check irrigation controller time, date and programs against your 'irrigation station mapping'
		Manually test all stations and check for blocked spray heads, leaks and sprinkler or pipe damage
		Adjust spray radius and arc on sprinklers to ensure water is not spraying on pathways, roads or buildings
		Visually check spray pattern for water pressure
		Read and record water meter readings and compare against last reading for consistency (this can identify leaks in your system)
Seasonal	Record on seasonal assessment checklist	Clean all filters
		Measure and record station pressure and compare to system design pressures (this can identify sub surface leaks)
		Adjust irrigation program run times to reflect seasonal changes
		Flush all drip line systems
		Check all solenoid and manual valve operations
		Check and clean your rain sensor

11. Future expansion requirements and considerations

It is not expected for the irrigation system to be expanded in future, however the controls system being a decoder configuration, additional irrigation zones can easily be added.

12.Summary

Utilising a hybrid, smart irrigation watering products, 36 Warry St will be incorporating the latest irrigation technology and design adaptions to maximise watering efficiencies with maximising landscape growth.

The rainwater harvesting system will also compliment the efficient irrigation system, by taking advantage of rainwater catchment from the Roof Top Level area of **$95m^2$** and storing in a rational and practical sized **34,000L tank**.

With no irrigation occurring during a typical week of rainfall during summer peak period, and the harvested water volume providing 4 weeks worth of irrigation water **(4 x 7,584L = 30,336L)** from rooftop catchment into a **34,000L tank**, this results in the recommended tank sizing will support the irrigation requirements.

We trust this irrigation brief covers all requirements for project concept approval.
Should clarification of any aspect of this report be required, please contact us at your convenience.

Regards,

Darren Rowlatt
Director DPoV Consulting