

Quoin Flinders Island
Development Application Report
Site Civil & Hydraulic
Infrastructure Requirements

30 July 2015

Ref: DAR 07915 – Quoin Development Application Report



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Introduction

This report relates to the development proposal to be known as Quoin – located adjacent to Mt Killiecrankie on the northern end of Flinders Island. The proposal is for a resort and includes accommodation, a main facility and wellness centre, staff accommodation and ancillary facilities. The proposal is described in detail in the plans and documents prepared by S Architecture.

In this report consideration is given to the water supply needs of the facility, the wastewater disposal needs and road infrastructure requirements. This is not a final design but gives clear direction on these important functional elements.

The Site

The Quoin property is located on the northern end of Flinders Island, near the township of Killiecrankie and is adjacent to Mount Killiecrankie. Farming activities are undertaken on the 1220 acres of land. The western portion of the site bounds the beach and ocean and consists of undulating coastal sand dunes. The Quoin proposal is located in this western portion of the site.

Currently an access track extends from the main house located near Palana Road down to a house on a separate title near the beach front in an east-west orientation. The boundary of the property to the south is connected to Killiecrankie Road via an unnamed road. It is proposed to access the Quoin Resort from this point.

Services Discussion

The portion of the site proposed for this tourism development is remote and not serviced by sewer and water connections. The vision is to create world class a tourism experience. This will be enhanced by the breathtaking natural environment. The requirements of the built environment will be to enhance the experience of the natural environment.

In the provision of services the scope explored relates to an “off grid” approach. This makes the facility in relation to civil and hydraulic infrastructure stand alone.

In the establishment of stand-alone infrastructure for water supply, it is proposed to collect rainwater from the roof, store it rainwater tanks and reticulate to the point of use. To deliver acceptable outcomes to this scheme the Standards Australia HB230-2008 Rainwater Tank Design and Installation Handbook will be followed. Fire-fighting water supply tanks will have to be considered in concert with the domestic water supply.

For wastewater disposal, the sand soil stratum is suitable for standard septic systems. The grouping and size of development in each location is at a domestic scale and hence the requirements of AS1547:2012 – On-site Domestic Wastewater Management are appropriate.

In the design of access roads, the rural character needs to be maintained while providing suitable all weather access, for patrons, service vehicles and emergency services. The design of the road network will be in accordance with IPWEA standards & Guidelines for Development in Bushfire Prone Areas of Tasmania.



Water Supply

Discussion on water supply has focussed on the rainwater harvesting. This method of water supply has to be tested to establish if this design philosophy is sustainable into the future. The simple idea of rainwater harvesting is to collect roof water, pipe into a pump tank and pump it into a storage header tank. When the water is required for use a gravity line with the required head will supply to the use point. At this use point the water will be treated with a UV filter and then consumed. This is shown below in Diagram 1.

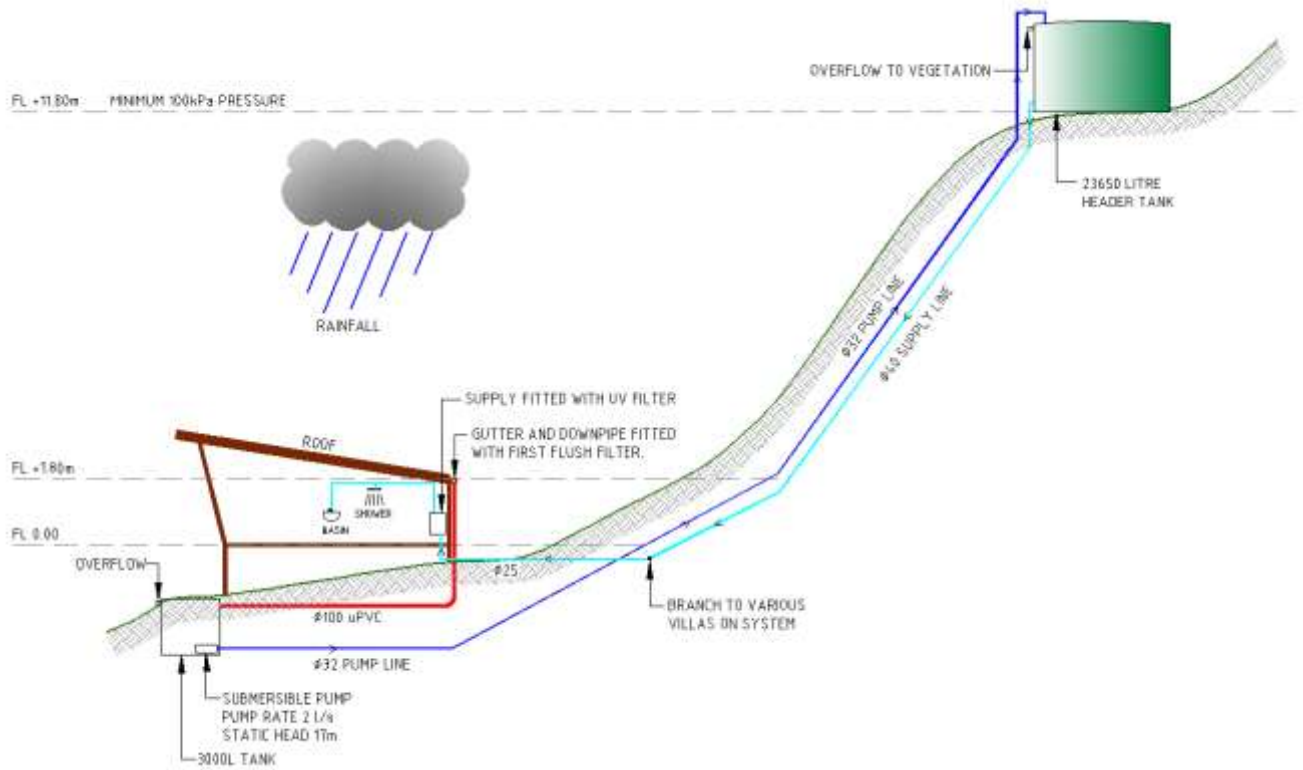


Diagram 1 – Rainwater Harvesting Schematic

To test the sustainability of the model the supply and usage scenarios need to be examined. This examination is a Water Balance Model. The Model is a month by month examination of water capture and usage. The capture and usage is divided into building groups. The reference in the model is to the areas shown on the site master plan.

In the water balance model for the site Water Capture is determined by two factors, monthly average rainfall measured in millimetres and building roof area in metres square. Water Usage is controlled by a number of variables, including occupation rates, number of days per month and consumptions rates. The monthly rainfall figures adopted and the monthly occupancy rates for projected maximum demand are listed in Table 1.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Rainfall mm	43	36	48	56	72	67	74	71	62	52	53	53
Occupancy %	76	76	76	66	44	44	44	44	50	50	76	76

Table 1 – Monthly Rainfall and Occupancy Rates

Rainfall Figures from Bureau of Meteorology for Killiecrankie Flinders Island TAS. Occupancy Rates from Business Plan Projections by 333

After an initial calculation it was determined that laundry requirements for the tourist accommodation and services could not be supplied from the roof areas on the site and that these services would be outsourced off site.

The Water Balance Model showed that the site requirements are deficient at the anticipated occupancy rates and that additional roof capture area is required. To manage the shortfall it is proposed to capture and store water from the Maintenance Shed (8) located on the main access track. This location is higher than all the tourism facilities and hence can gravity feed to all the tanks located close to each of the building groups. The calculated roof area to make up the shortfall is 600m². The assumptions used to calculate the water balance are shown in the following Table 2.

Building Group with Master Plan Reference	Roof Area m ²	Consumption Rate
Community & Wellness Centre (1)	396	20 litres per person per day
Mountain Retreat (2)	680	100 litres per person per day
Double Mountain Retreat (3)	278	100 litres per person per day
Beach Retreat (4)	232	100 litres per person per day
Beach Retreat (5)	280	100 litres per person per day
Diamond Gully (6)	356	100 litres per person per day
Beach Retreat (7)	228	100 litres per person per day
Maintenance Shed (8)	600	200 litres per day
Staff Accommodation (9) & (10)	320	120 litres per person per day
Owners Residence (11)	323	600 litres per residence per day

Table 2 – Consumption Rates for Building Groups

Consumption Rates from HB 230-2008 and AS1547-2012 adapted to reflect usage in different types of buildings

The Water Balance Model has been set up to calculate the tank size required for each building group and the additional storage requirements at the maintenance shed. The additional supply from the Maintenance Shed Area will be reticulated to each of the building group areas and water will be drawn down as required through the use of a float arrangement. The Staff Accommodation and Owners Residence will have to be filled via a tanker or a reticulated pump system as they are at a higher elevation. In Table 3 the required tank sizes are shown for each building group.

Building Group with Master Plan Reference	Number of Tanks	Tank Size
Community & Wellness Centre (1)	1	14100 Litre + 23650 Litre
Mountain Retreat (2)	2	23650 Litre
Double Mountain Retreat (3)	1	23650 Litre
Beach Retreat (4)	1	23650 Litre
Beach Retreat (5)	1	23650 Litre
Diamond Gully (6)	2	14100 Litre
Beach Retreat (7)	1	23650 Litre
Maintenance Shed (8)	5	23650 Litre

Staff Accommodation (9) & (10)	1	23650 Litre
Owners Residence (11)	1	23650 Litre

Table 3 – Rainwater Tank Sizes for Building Groups

Results from the Water Balance Model

The final design of each system for a building group will be determined in future design and documentation phase. A sample layout is shown for Beach Retreat (5) in Diagram 2. The final Water Balance Model is shown in Appendix A.

While the assumptions made are established from recognised sources contingency plans need to be established to ensure the resort can function at an acceptable operational level. Threats to the assumptions are capture rate reduction due to climatic conditions, decrease in rainfall from historical averages and usage beyond anticipated levels.

A dam is proposed as shown on the site plan. Water can be harvested from the dam and piped to the maintenance shed area. At this point a water treatment plant will be used to treat the water prior to storing this in a tank. This tank can be set up as a stand-alone with a valve system that will allow the reticulation network to distribute as needed.

Fire Water Supply

Fire firefighting water supply is to be provided in accordance with the Guidelines for Development in Bushfire Prone Areas in Tasmania. All of the building groups have a curtilage area greater than 2500m² and hence require 20 000 litres of fire water supply. This will be located in close proximity to the building group that is services and stands alone from the supply water. A suitable hardstand for a fire fighting appliance will be provided along with suitable connections for the local brigade.

The water supply in each tank will have to be established prior to occupation of each building group to meet the requirement of the guideline. This may require an initial filling from an external water source.

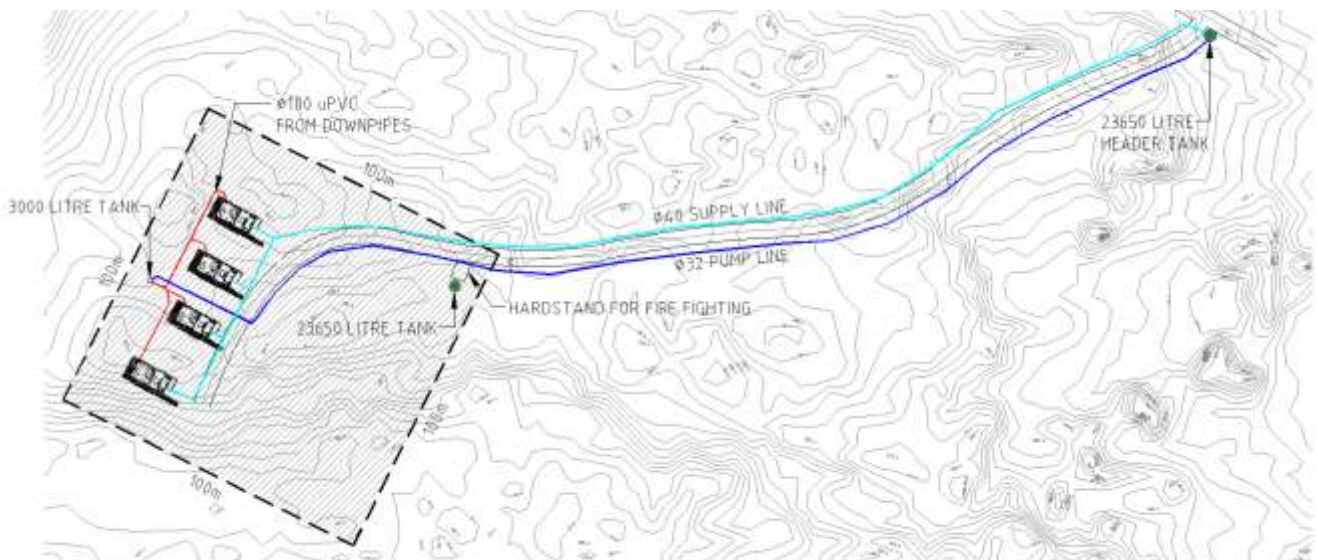


Diagram 2 – Beach Retreat (5) Sample Site Layout - Water Supply and Fire Water Supply

On-Site Wastewater Management

The preliminary discussions with the geotechnical consultant have confirmed the suitability of the sand for absorption of septic treated wastewater. Each building group will be collected with sewer pipes, treated in a suitably sized septic tank and disposed by the absorption trenches. Keeping this treatment system close to the source will be the most economical and effective solution.

The Restaurant as part of the Community and Wellness (1) will require a triple interceptor as a pre-treatment to remove grease prior to passing through the septic tank. A sample treatment system is shown in Diagram 3.

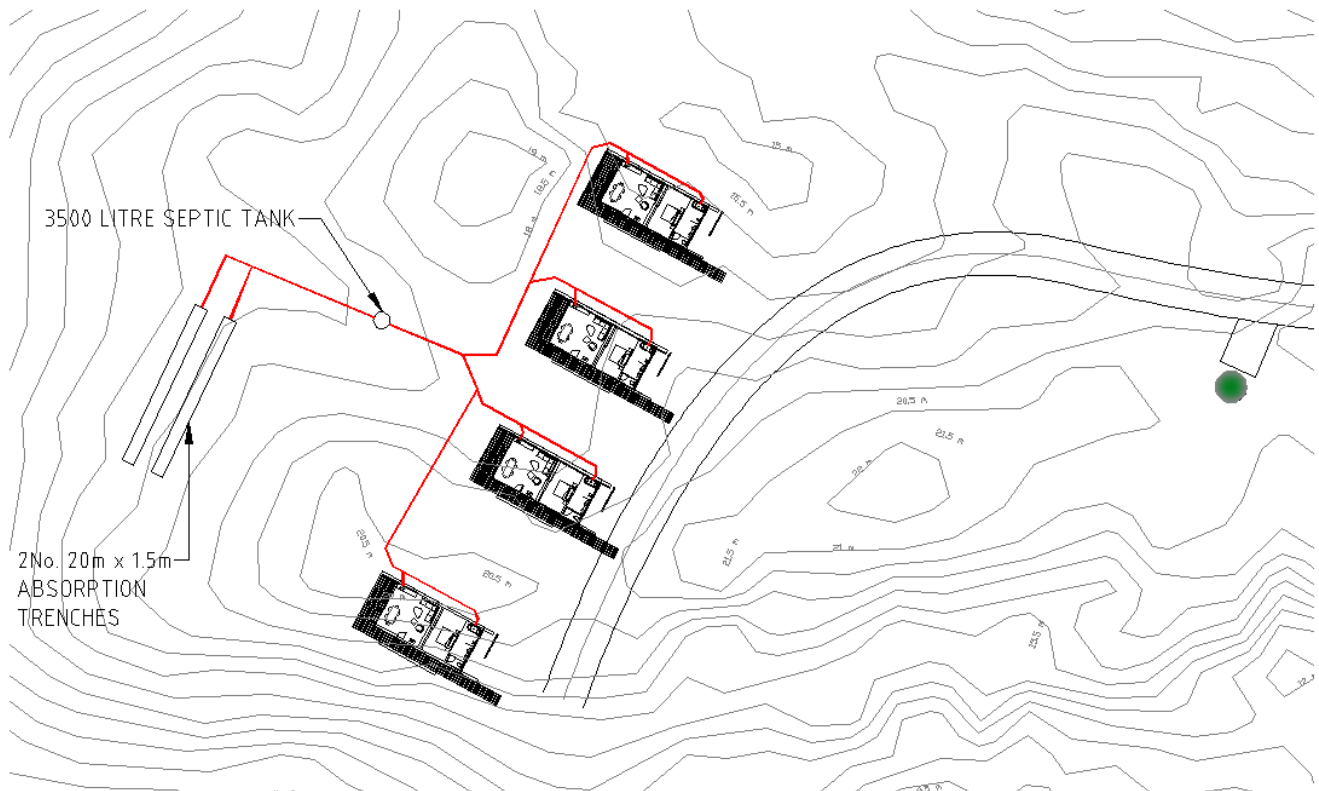


Diagram 3 – Beach Retreat (5) Sample Site Layout – Wastewater Management System

Final design of the wastewater system for each building group will be completed at the final design phase. Preliminary septic tank sizing has been determined in accordance with AS1547:2012 and is shown in Table 4.

Building Group with Master Plan Reference	No. Septic Tanks	Septic Tank Size
Community & Wellness Centre (1)	2	3000 Litre
Mountain Retreat (2)	1	4500 Litre
Double Mountain Retreat (3)	1	4000 Litre
Beach Retreat (4)	1	4000 Litre
Beach Retreat (5)	1	4000 Litre
Diamond Gully (6)	2	3000 Litre
Beach Retreat (7)	1	4000 Litre

Maintenance Shed (8)	1	3000 Litre
Staff Accommodation (9) & (10)	1	3500 litre each location
Owners Residence (11)	1	3500 litre

Table 4 – Septic Tank Sizing for Each Building Group

In accordance with Table J1 – AS1547:2012

Road Network

The road network provides access to the site facilities for guests, services vehicles, maintenance vehicles and fire-fighting appliances. Most of the network will have to be constructed by clearing trees and shrubs along the proposed road route. The road widths will be 6 metres wide for the main access road and the lower order network of roads will be 5 metres wide. The 5 metre wide sections will be developed with an extra 1 metre wide section 20 metres long at 90 metre intervals to meet the access requirements of the Guidelines for Development in Bushfire Prone Areas in Tasmania. The road network will provide access for fire-fighting appliances and appropriate hard stand areas will be located adjacent to tanks with fire water supply.

The quality sandy subgrade means an allowance of 200mm for pavement road base is a recommendation that will provide suitable all weather access. The future road pavement design will be developed with tested consideration of the pavement subgrade.

The road network will be maintained with suitable side clearance to vegetation in accordance with Guidelines for Development in Bushfire Prone Areas in Tasmania.

Conclusion

This report has shown that water supply for Quoin Resort can be made from a rainwater harvesting method with a high level of confidence based on the established water balance model. On-Site Wastewater Management is a simple application of the guidelines in AS1547:2012 with the use of septic tanks and absorption trenches.

The road network will be established to meet the access needs of all resort users and emergency services.

The fire-fighting requirements for water supply & the road network will be provided in accordance with the Guideline.



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Appendix A – Water Balance Model

Quoin Monthly Roofwater Balance Model

Monthly Rainfall mm	jan 43	feb 36	mar 48	apr 36	may 72	jun 07	jul 74	aug 71	sep 82	oct 82	nov 53	dec 36	Yearly Total Each Building (650) Kilolitres
Water Capture													
Wellness & Community (1)	13.28	11.12	14.83	17.30	22.24	20.69	22.86	21.53	19.15	16.06	16.37	17.30	213.13
Mountain Retreat (2)	22.81	19.09	25.46	29.70	38.19	35.54	36.25	37.66	32.88	27.56	26.11	29.70	365.98
Double Mountain Retreat (2)	9.32	7.81	10.41	12.14	15.61	14.53	16.05	15.40	13.44	11.28	11.49	12.14	148.62
Beach Retreat (4)	7.78	6.51	8.69	10.13	13.03	12.12	13.39	12.85	11.22	9.41	9.59	10.33	124.86
Beach Retreat (5)	9.39	7.86	10.48	12.23	15.72	14.63	16.16	15.51	13.54	11.36	11.58	12.23	160.70
Diamond Gully (6)	11.94	10.00	13.33	15.55	19.99	18.60	20.55	19.72	17.22	14.44	14.72	15.55	191.60
Beach Retreat (7)	7.65	6.40	8.54	9.96	12.80	11.92	13.16	12.63	11.03	9.25	9.43	9.96	122.71
Staff Accommodation (9 & 10)	10.73	8.95	11.98	13.98	17.97	16.72	18.47	17.72	15.48	12.98	13.23	13.98	172.22
Owners Residence (11)	10.63	9.07	12.09	14.11	18.14	16.88	18.64	17.66	15.63	13.10	13.35	14.11	173.84
Maintenance Shed (8)	30.12	16.89	22.46	26.21	33.70	31.38	34.63	33.23	29.02	24.34	24.80	26.21	322.92
Total Monthly Site Yield kilolitres	123.86	103.70	138.27	161.31	207.40	193.00	213.16	204.52	178.09	148.79	152.67	161.31	1987.31
Water Usage													
Wellness & Community (1)	24.50	22.15	24.50	20.89	14.19	13.73	14.19	14.19	15.00	16.12	23.71	24.50	227.95
Mountain Retreat (2)	47.12	42.56	47.12	39.60	27.28	26.40	27.28	27.28	30.00	31.00	45.50	47.12	438.36
Double Mountain Retreat (3)	18.85	17.02	18.85	15.84	10.91	10.56	10.91	10.91	12.00	12.40	18.34	18.85	176.34
Beach Retreat (4)	18.85	17.02	18.85	15.84	10.91	10.56	10.91	10.91	12.00	12.40	18.34	18.85	176.34
Beach Retreat (5)	23.56	21.28	23.56	19.80	13.64	13.20	13.64	13.64	15.00	15.30	22.60	23.56	219.18
Diamond Gully (6)	18.85	17.02	18.85	15.84	10.91	10.56	10.91	10.91	12.00	12.40	18.34	18.85	176.34
Beach Retreat (7)	10.96	10.32	10.96	14.26	9.82	9.60	9.82	9.82	10.80	11.16	16.42	10.96	157.81
Staff Accommodation (9 & 10)	18.60	16.80	18.60	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	219.00
Owners Residence (11)	6.20	5.60	6.20	6.00	6.20	6.00	6.20	6.00	6.00	6.20	6.00	6.20	73.00
Total Usage Site kilolitres	212.34	191.79	212.34	181.61	133.37	129.07	133.37	133.37	143.40	148.18	205.49	212.34	2059.07
Site Tank Capacity													
Wellness & Community (1) Capacity	-68.47	-88.09	-74.07	-20.30	74.02	63.92	79.79	71.14	35.19	1.61	-62.82	-61.03	100 litres per person per day
Mountain Retreat (2) Capacity	133.36	45.27	-28.80	-49.10	74.02	137.95	217.75	288.88	324.07	305.66	272.86	221.83	100 litres per person per day
Double Mountain Retreat (3) Capacity	-11.22	-11.01	-8.68	-3.29	8.05	6.97	8.67	7.74	3.05	-0.06	-7.34	-7.21	100 litres per person per day
Beach Retreat (4) Capacity	9.16	-1.85	-11.53	-14.82	8.05	15.02	23.69	31.44	34.99	34.93	27.59	20.38	100 litres per person per day
Beach Retreat (5) Capacity	-24.31	-23.47	-21.66	-9.80	10.91	9.14	11.97	10.38	2.89	-3.42	-17.49	-17.42	100 litres per person per day
Diamond Gully (6) Capacity	-17.38	-40.83	-62.49	-72.38	10.91	20.05	32.02	42.39	45.28	41.86	24.37	6.85	100 litres per person per day
Beach Retreat (7) Capacity	-9.52	-9.22	-8.44	-3.70	4.70	3.97	5.13	4.48	1.44	-1.12	-6.75	-6.70	100 litres per person per day
Staff Accommodation (9 & 10) Capacity	-4.37	-13.59	-22.03	-25.72	4.70	8.67	13.80	18.29	19.73	18.61	11.86	5.15	100 litres per person per day
Owners Residence (11) Capacity	-11.07	-10.51	-10.16	-5.71	2.12	1.56	2.48	1.94	-0.78	-2.99	-6.65	-8.71	100 litres per person per day
System withdrawals	-24.10	-34.61	-44.78	-50.48	2.12	3.68	6.16	8.10	7.32	4.33	-4.32	-13.04	23 650 litre Tank
Maintenance Shed (8)	-8.46	-6.16	-8.36	-3.61	4.81	4.07	5.25	4.59	1.54	-1.04	-6.66	-6.62	23 650 litre Tank
	-3.51	-12.87	-21.04	-24.85	4.81	8.89	14.14	18.73	20.27	19.23	12.56	5.94	23 650 litre Tank
	-11.62	-11.28	-10.23	-4.25	6.35	5.40	6.91	6.08	2.22	-1.06	-8.08	-8.01	2 x 14 100 litre Tanks
	-1.82	-13.10	-23.33	-27.58	6.35	11.76	18.67	24.74	26.96	25.90	17.81	9.80	23650 litre Tank
	-11.20	-10.62	-10.31	-5.88	1.89	1.36	2.25	1.71	-0.97	-3.15	-6.81	-6.89	23650 litre Tank
	-25.82	-36.44	-46.75	-52.63	1.89	3.25	5.50	7.21	6.24	3.08	-5.73	-14.62	23650 litre Tank
	-7.77	-7.73	-6.51	-3.89	-0.46	-1.12	0.04	-0.71	-2.38	-5.50	-4.65	-4.49	23650 litre Tank
	-27.03	-34.76	-41.27	-45.16	-0.46	-1.58	-1.54	-2.25	-4.63	-10.13	-14.78	-19.27	23650 litre Tank
	-65.866	-83.84	-85.35	-40.23	-0.46	-1.12	0.00	-0.71	-4.13	-5.50	-14.70	-22.09	4 x 23650 litre Tanks
	13.92	11.25	16.26	20.21	27.50	25.36	28.43	27.03	33.02	18.14	18.90	20.01	
	202.20	213.45	225.71	249.37	273.00	262.85	281.26	268.31	131.33	149.46	166.27	188.28	
	135.30	129.61	144.36	209.09	27.04	51.73	81.28	107.00	127.19	143.96	153.57	166.16	

