

PROJECT NOTE

To:	Matt Drysdale (TasWater)	From:	Hugh Ludford (Pinion Advisory)
Date:	20/04/2023	Pages:	13
Project Code:	0045-01 - Bicheno RWS	Note Ref:	0045-TEN-BICR-EN-0001
Re:	Bicheno recycled water scheme water balance calculations	CC:	Brock Nadler (Pinion Advisory) & Jason Lynch (Pinion Advisory)

<input type="checkbox"/> <i>Urgent</i>	<input checked="" type="checkbox"/> <i>Review</i>	<input type="checkbox"/> <i>Comment</i>	<input type="checkbox"/> <i>Reply</i>
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Summary

This project note summarises the water balance requirements for the Bicheno Recycled Water Scheme (RWS) to achieve 100% reuse under median and 90th percentile rainfall conditions, for 2023 and 2043. Water balances have been prepared using averaged flow data provided by TasWater for the time period 2014 – 2021 (appendix 1), for 2023 and for 2043, assuming 1.5% annual growth¹. Water balances for median and 90th percentile (wet) rainfall conditions have been modelled for the current user (Bicheno Golf Club) and the future (Glenalbyn property) site.

Seasonal impacts of tourism are captured by increases in monthly wastewater flow data in the water balance, with wastewater flows during peak tourist season (summer and spring) greater than during the tourist off season (winter and autumn).

Water balance calculations have been undertaken using the methodology detailed in the Environmental Guidelines for the use of Recycled Water in Tasmania (2002).

To meet 100% reuse under 90th percentile rainfall conditions in 2023, an additional 50.1ML of storage and 49.3ha of irrigation area is required. This increases to 72.4ML of storage and 71.6ha of irrigation area in 2043 under 90th percentile rainfall conditions.

¹ TasWater 2021 Bicheno Growth and Capacity Plan

Crop water balances

To calculate the water balance requirements for Bicheno Golf Club and the proposed pivot development at the Glenalbyn property, crop water requirements are required. Table 1 below details the crop water requirements for the Bicheno Golf Club who are irrigating turf and the Glenalbyn pivot which will irrigate pasture. Crop water requirement calculations are shown in appendix 2. Crop water balances are detailed in appendix 3.

Table 1 Crop water requirements (ML/ha)

Rainfall condition	Turf	Pasture
90th %ile	1.7	3.0
Median	2.6	4.8

A number of assumptions have been made to inform the water balances:

- It is assumed that the Bicheno Golf Club storage availability (20ML) will remain constant for median and 90th percentile rainfall conditions in 2023 and 2043.
- It is assumed that the total area of irrigation available at the Bicheno Golf Club is 14ha. Currently only 10ha of area is developed, however a further 4ha may be developed in the future. Table 2 and Table 3 shows the difference in water use between 10ha and 14ha of turf.

Table 2 Bicheno Golf Club irrigation and storage requirements (10ha developed)

	Irrigation Area (ha)	Dam Storage Volume (ML)	Irrigation Volume Required (ML)
Median	10.0	20.0	26.3
90th	10.0	20.0	16.5

Table 3 Bicheno Golf Club irrigation and storage requirements (14ha developed)

	Irrigation Area (ha)	Dam Storage Volume (ML)	Irrigation Volume Required (ML)
Median	14.0	20.0	36.8
90th	14.0	20.0	23.2

Table 3 shows that the Bicheno Golf Club requires 36.8ML of water for irrigation in a median rainfall year and 23.2ML of water in a 90th percentile rainfall year.

After the golf course has used their requirement, the remaining recycled water will be available for use through the Glenalbyn pivot.

Table 4 details the area of land and storage volume required to irrigate the excess recycled water available from the Bicheno RWS in 2023 under median and 90th percentile rainfall conditions. 2043 irrigation area and storage volume requirements are detailed in The water balance for 2023 is shown in Table 4, with an irrigation area of 49.3ha and storage volume of 50.1ML required in a 90th percentile rainfall year at the Glenalbyn site, with 95.9ML available for irrigation after the Bicheno Golf Club has used their requirement.

In a median rainfall year 28.0ha of pasture is required for irrigation, as well as 37.8ML of storage, with 82.2ML available for irrigation.

Table 5. Table 4 and Table 5 irrigation areas and storage requirements are calculated on the assumption that 14ha of turf is irrigated at the Bicheno Golf Course.

Table 4 2023 Glenalbyn pivot irrigation and storage requirements

	Irrigation Area (ha)	Dam Storage Volume (ML)	Irrigation Volume Available (ML)
Median	28.0	37.8	82.2
90th	49.3	50.1	95.9

The water balance for 2023 is shown in Table 4, with an irrigation area of 49.3ha and storage volume of 50.1ML required in a 90th percentile rainfall year at the Glenalbyn site, with 95.9ML available for irrigation after the Bicheno Golf Club has used their requirement.

In a median rainfall year 28.0ha of pasture is required for irrigation, as well as 37.8ML of storage, with 82.2ML available for irrigation.

Table 5 2043 Glenalbyn pivot irrigation and storage requirements

	Irrigation Area (ha)	Dam Storage Volume (ML)	Irrigation Volume Available (ML)
Median	43.3	59.1	125.9
90th	71.6	72.4	139.6

The water balance for 2043 forecast wastewater flows is shown in Table 5, with an irrigation area of 71.6ha and storage volume of 72.4ML required in a 90th percentile rainfall year at the Glenalbyn site. There is 139.6ML available for irrigation after the Bicheno Golf Club has used their requirement.

In a median rainfall year 43.3ha of pasture is required for irrigation, as well as 59.1ML of storage, with 125.9ML available for irrigation.

Figure 1 and Figure 2 below show the recycled water supply and demand for 2023 and 2043 respectively, generated by the water balances. The water balances are calculated with the assumption that storages are completely empty at the end of March, ready for filling as the irrigation season ceases. Figure 2 illustrates the requirement for 72.4ML of storage and 71.6ha of irrigation land on the Glenalbyn property in a 90th percentile rainfall year in 2043, given the Bicheno Golf Club irrigation area and storage area are the same between 2023 and 2043.

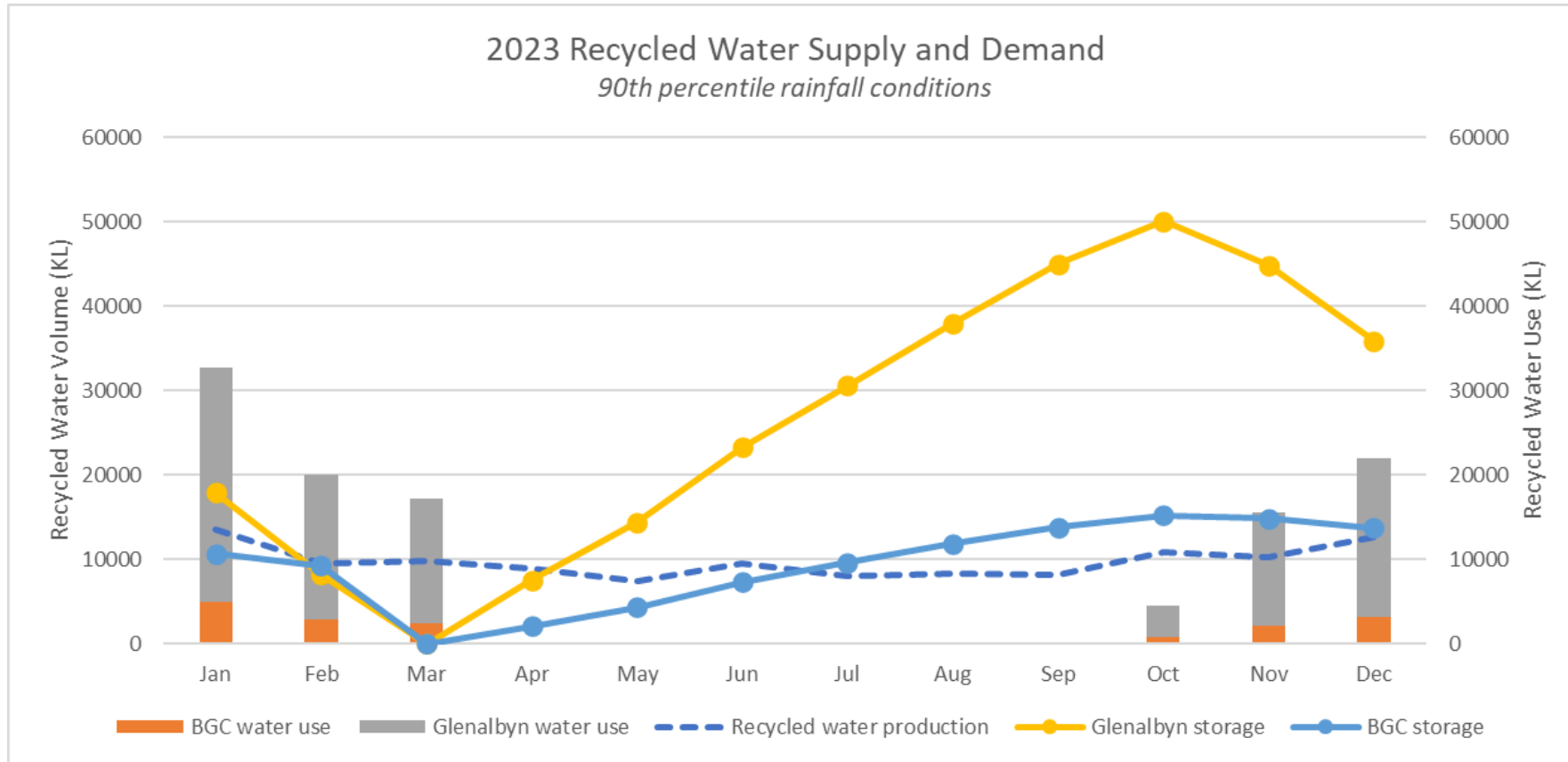


Figure 1 2023 Recycled water supply and demand in a 90th percentile rainfall year

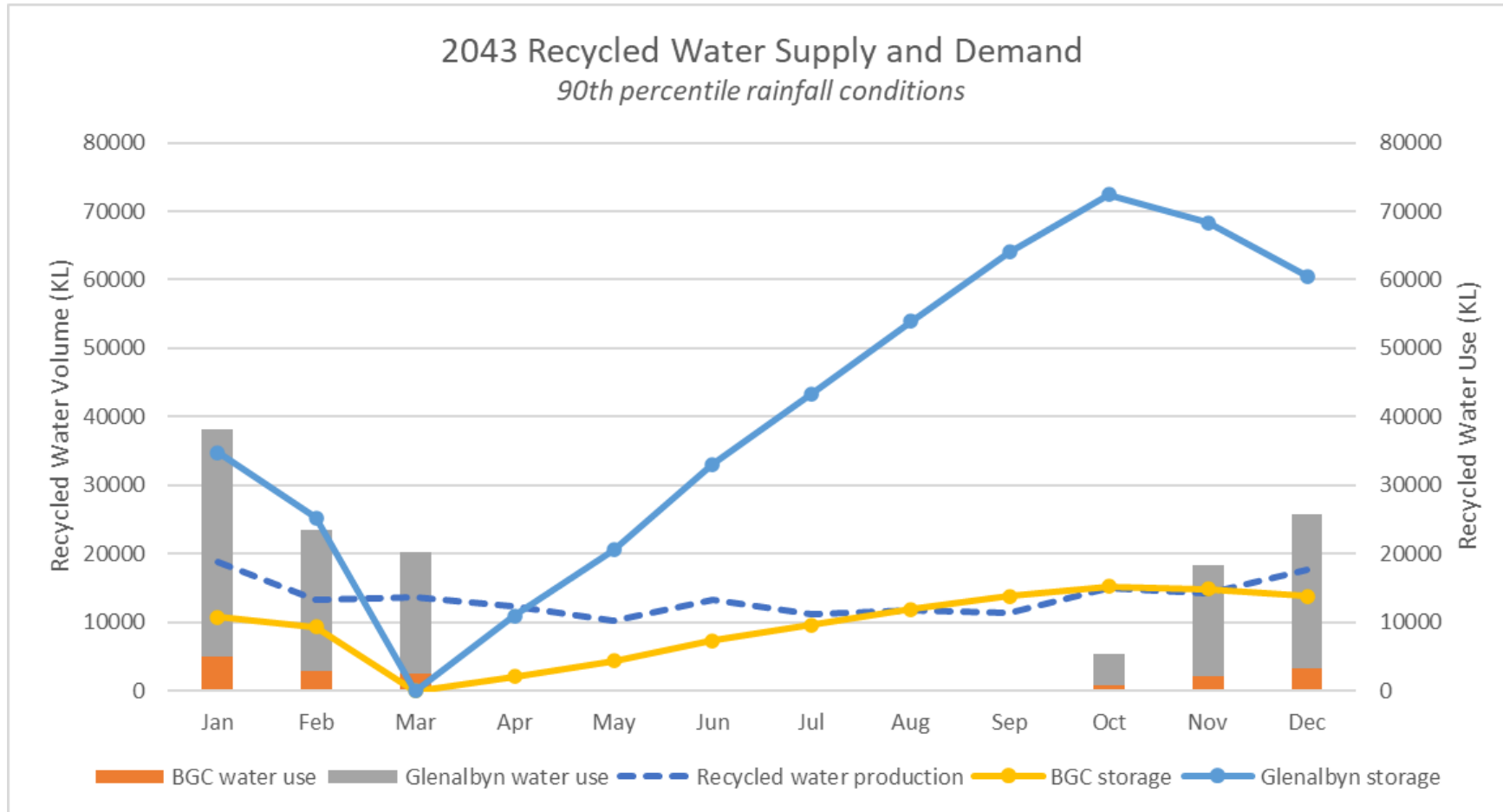


Figure 2 2043 Recycled water supply and demand in a 90th percentile rainfall year

Appendix 1. 2014 - 2021 average monthly Bicheno STP flow data

	2014 - 2021 monthly totals (ML)	Average monthly flow (ML)
Jan	107.8	13.5
Feb	77.0	9.6
Mar	78.8	9.8
Apr	70.9	8.9
May	59.3	7.4
Jun	76.9	9.6
Jul	64.7	8.1
Aug	67.2	8.4
Sep	65.4	8.2
Oct	86.3	10.8
Nov	82.5	10.3
Dec	101.3	12.7
	Total	117.3

Appendix 2. Crop water requirement calculations

Turf

Median rainfall	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	TOTAL
Land available for irrigation (ha)	14	14	14	14	14	14	14	14	14	14	14	14	
Irrigation demand (ML/ha)	0.0	0.0	0.1	0.2	0.4	0.5	0.6	0.4	0.4	0.0	0.0	0.0	2.63
Total irrigation demand (ML)	0.0	0.0	0.8	3.3	5.2	6.8	8.9	6.0	5.2	0.6	0.0	0.0	36.8
<i>Based on land suited to irrigation have irrigation water applied from September to April</i>													
90th percentile rainfall	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	TOTAL
Land available for irrigation (ha)	14	14	14	14	14	14	14	14	14	14	14	14	
Irrigation demand (ML/ha)	0.0	0.0	0.0	0.1	0.2	0.3	0.5	0.3	0.3	0.0	0.0	0.0	1.7
Total irrigation demand (ML)	0.0	0.0	0.0	1.1	3.0	4.5	6.9	4.1	3.5	0.0	0.0	0.0	23.2
<i>Based on land suited to irrigation have irrigation water applied from October to March</i>													

Pasture

Median rainfall	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	TOTAL
Land available for irrigation (ha)	40.0	62.7	62.7	62.7	62.7	62.7	62.7	62.7	62.7	62.7	62.7	62.7	
Irrigation demand (ML/ha)	0.00	0.00	0.20	0.40	0.74	0.90	0.99	0.76	0.65	0.15	0.00	0.00	4.78
Total irrigation demand (ML)	0.0	0.0	12.5	25.0	46.6	56.2	62.1	47.4	40.6	9.2	0.0	0.0	299.7
<i>Based on land suited to irrigation have irrigation water applied from September to April</i>													
90th percentile rainfall	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	TOTAL
Land available for irrigation (ha)	62.7	62.7	62.7	62.7	62.7	62.7	62.7	62.7	62.7	62.7	62.7	62.7	
Irrigation demand (ML/ha)	0.00	0.00	0.00	0.18	0.45	0.60	0.80	0.53	0.46	0.00	0.00	0.00	3.0
Total irrigation demand (ML)	0.0	0.0	0.0	11.0	28.4	37.5	50.3	33.4	28.9	0.0	0.0	0.0	189.5
<i>Based on land suited to irrigation have irrigation water applied from October to March</i>													

Appendix 3. Crop water balance calculations

Bicheno Golf Club

2023 & 2043 median rainfall

Assumptions		Median rainfall year													
Median rainfall data obtained from	Bicheno Council Depot BoM site# 92003														
Evaporation data obtained from	Silo modelling BoM site# 92003														
Total irrigation area	14														
Average Wastewater flow of	36800	KL/year	based on projected monthly and annual production levels and monthly wastewater flows by TasWater												
	unit	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	TOTAL	
Evaporation (Pan)	A	mm	153.7	119.8	104.7	64.4	40.1	30.9	35.5	49.2	70	97.7	117.8	140.7	1025
Effective Lagoon Evaporation	B	mm	123.0	95.8	83.8	51.5	32.1	24.7	28.4	39.4	56.0	78.2	94.2	112.6	820
Rainfall	C	mm	51.7	49.8	44.1	53.8	62	67.4	54	56.9	56.6	57.3	56.3	61.3	671
Effective Rainfall	D	mm	36.2	34.9	30.9	37.7	43.4	47.2	37.8	39.8	39.6	40.1	39.4	42.9	470
Direct Crop Coefficient	E		0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	
Evapotranspiration (A x E)	F	mm	99.9	77.9	68.1	41.9	26.1	20.1	23.1	32.0	45.5	63.5	76.6	91.5	666
Irrigation Requirement (F - D)	H	mm	64	43	37	4	0	0	0	0	6	23	37	49	263
Net Lagoon Evaporation	I	kL	1069	691	595	-34	-449	-640	-384	-263	-9	313	569	769	2226
Wastewater Flow	J	kL	4230	3021	3090	2782	2327	3015	2538	2638	2566	3384	3235	3973	36800
Net Lagoon Inflow (I + H)	K	kL	3161	2331	2495	2816	2776	3655	2922	2901	2575	3071	2666	3204	34574
Water Used in Irrigation (G x Irrigation Area)	L	kL	6372	4301	3719	420	0	0	0	588	2340	3716	4855	26309	
Average Daily Irrigation Rate	M	kL/d	206	154	120	14	0	0	0	20	75	124	157		
Cumulative Storage (Storage in Previous Month + J - K)	N	kL	11459	9489	0	2396	5172	8827	11749	14651	16637	17369	16319	14669	
Lagoon Depth	O	m	0.8	0.6	0.0	0.2	0.3	0.6	0.8	1.0	1.1	1.2	1.1	1.0	

Lagoon (reuse dam) Area	ha	1.5
Assume Effective Rainfall Factor		0.70
Irrigation Area Required	ha	10.0
Lagoon Volume Required	ML	17.4
Lagoon Depth	m	1.2

Notes:

Worksheet based on Water Budget Table "Guidelines for Wastewater Irrigation" Victorian EPA

Effective rainfall (ie that available for vegetation growth) is that which does not run off, or is intercepted by vegetation (leaves, branches etc) and is evaporated.

Direct crop coefficient is a factor relating crop water use to pan evaporation. Varies monthly and also depends on what crop is being irrigated - Pasture has been used in this scenario

2023 & 2043 90th percentile rainfall

Assumptions	90th percentile rainfall (wet year)														
90th percentile rainfall data obtained from	Bicheno Council Depot BoM site# 92003														
Evaporation data obtained from	Silo modelling BoM site# 92003														
Average Wastewater flow of	23200 ML/year	based on projected monthly and annual production levels and monthly wastewater flows by TasWater													
		unit	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	TOTAL
Evaporation (Pan)	A	mm	153.7	119.8	104.7	64.4	40.1	30.9	35.5	49.2	70	97.7	117.8	140.7	1025
Effective Lagoon Evaporation	B	mm	123.0	95.8	83.8	51.5	32.1	24.7	28.4	39.4	56.0	78.2	94.2	112.6	820
Rainfall	C	mm	71.9	69.2	61.3	74.8	86.2	93.7	75.1	79.1	78.7	79.7	78.3	85.2	945
Effective Rainfall	D	mm	50.3	48.5	42.9	52.4	60.3	65.6	52.6	55.4	55.1	55.8	54.8	59.7	653
Direct Crop Coefficient	E		0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	
Evapotranspiration (A x E)	F	mm	99.9	77.9	68.1	41.9	26.1	20.1	23.1	32.0	45.5	63.5	76.6	91.5	
Irrigation Requirement (F - D)	H	mm	50	29	25	0	0	0	0	0	0	8	22	32	165
Net Lagoon Evaporation	I	kL	766	399	337	-349	-812	-1035	-700	-596	-341	-23	239	410	-1706
Wastewater Flow	J	kL	2667	1905	1948	1754	1467	1901	1600	1663	1618	2134	2040	2505	23200
Net Lagoon Inflow (I + H)	K	kL	1901	1506	1611	2103	2279	2936	2300	2260	1958	2156	1800	2095	24906
Water Used in Irrigation (G x Irrigation Area)	L	kL	4958	2940	2513	0	0	0	0	0	0	773	2177	3179	16540
Average Daily Irrigation Rate	M	kL/d	160	105	81	0	0	0	0	0	0	25	73	103	
Cumulative Storage (Storage in Previous Month + J - K)	N	kL	10702	9268	0	2103	4382	7318	9618	11878	13836	15219	14843	13759	
Lagoon Depth	O	m	0.7	0.6	0.0	0.1	0.3	0.5	0.6	0.8	0.9	1.0	1.0	0.9	
Lagoon (reuse dam) Area		ha	1.5												
Assume Effective Rainfall Factor			0.70												
Irrigation Area Required		ha	10.0												
Lagoon Volume Required		ML	15.2												
Lagoon Depth		m	3.0												
Notes:	<p>Worksheet based on Water Budget Table "Guidelines for Wastewater Irrigation" Victorian EPA</p> <p>Effective rainfall (ie that available for vegetation growth) is that which does not run off, or is intercepted by vegetation (leaves, branches etc) and is evaporated.</p> <p>Direct crop coefficient is a factor relating crop water use to pan evaporation. Varies monthly and also depends on what crop is being irrigated - Pasture has been used in this scenario</p>														

Glenalbryn property
2023 median rainfall

Assumptions	Median rainfall year														
Median rainfall data obtained from	Bicheno Council Depot BoM site# 92003														
Evaporation data obtained from	Silo modelling BoM site# 92003														
Total irrigation area															
Average Wastewater flow of	82200	KL/year	based on projected monthly and annual production levels and monthly wastewater flows by TasWater												
		unit	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	TOTAL
Evaporation (Pan)	A	mm	153.7	119.8	104.7	64.4	40.1	30.9	35.5	49.2	70	97.7	117.8	140.7	1025
Effective Lagoon Evaporation	B	mm	123.0	95.8	83.8	51.5	32.1	24.7	28.4	39.4	56.0	78.2	94.2	112.6	820
Rainfall	C	mm	51.7	49.8	44.1	53.8	62	67.4	54	56.9	56.6	57.3	56.3	61.3	671
Effective Rainfall	D	mm	36.2	34.9	30.9	37.7	43.4	47.2	37.8	39.8	39.6	40.1	39.4	42.9	470
Direct Crop Coefficient	E		0.7	0.7	0.7	0.6	0.5	0.45	0.4	0.45	0.55	0.65	0.7	0.7	
Evapotranspiration (A x E)	F	mm	107.6	83.9	73.3	38.6	20.1	13.9	14.2	22.1	38.5	63.5	82.5	98.5	657
Irrigation Requirement (F - D)	H	mm	71	49	42	1	0	0	0	0	0	23	43	56	286
Net Lagoon Evaporation	I	kL	1069	691	595	-34	-449	-640	-384	-263	-9	313	569	769	2226
Wastewater Flow	J	kL	9449	6748	6902	6215	5198	6735	5669	5893	5731	7559	7227	8875	82200
Net Lagoon Inflow (I + H)	K	kL	8380	6058	6307	6249	5646	7375	6053	6156	5740	7246	6658	8106	79974
Water Used in Irrigation (G x Irrigation Area)	L	kL	19478	13367	11572	267	0	0	0	0	0	6382	11744	15162	77974
Average Daily Irrigation Rate	M	kL/d	628	477	373	9	0	0	0	0	0	206	391	489	
Cumulative Storage (Storage in Previous Month + J - K)	N	kL	14075	6766	0	5981	11628	19003	25056	31212	36952	37816	32729	25673	
Lagoon Depth		m	0.7	0.3	0.0	0.3	0.6	1.0	1.3	1.6	1.8	1.9	1.6	1.3	
Lagoon (reuse dam) Area		ha	2												
Assume Effective Rainfall Factor			0.70												
Irrigation Area Required		ha	28.0												
Lagoon Volume Required		ML	37.8												
Lagoon Depth		m	1.9												
Notes:															
Worksheet based on Water Budget Table "Guidelines for Wastewater Irrigation" Victorian EPA															
Effective rainfall (ie that available for vegetation growth) is that which does not run off, or is intercepted by vegetation (leaves, branches etc) and is evaporated.															
Direct crop coefficient is a factor relating crop water use to pan evaporation. Varies monthly and also depends on what crop is being irrigated - Pasture has been used in this scenario															

2023 90th percentile rainfall

Assumptions	90th percentile rainfall (wet year)														
90th percentile rainfall data obtained from	Bicheno Council Depot BoM site# 92003														
Evaporation data obtained from	Silo modelling BoM site# 92003														
Average Wastewater flow of	95500	ML/year	based on projected monthly and annual production levels and monthly wastewater flows by TasWater												
		unit	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	TOTAL
Evaporation (Pan)	A	mm	153.7	119.8	104.7	64.4	40.1	30.9	35.5	49.2	70	97.7	117.8	140.7	1025
Effective Lagoon Evaporation	B	mm	123.0	95.8	83.8	51.5	32.1	24.7	28.4	39.4	56.0	78.2	94.2	112.6	820
Rainfall	C	mm	71.9	69.2	61.3	74.8	86.2	93.7	75.1	79.1	78.7	79.7	78.3	85.2	933
Effective Rainfall	D	mm	50.3	48.5	42.9	52.4	60.3	65.6	52.6	55.4	55.1	55.8	54.8	59.7	653
Direct Crop Coefficient	E		0.70	0.70	0.70	0.60	0.50	0.45	0.40	0.45	0.55	0.65	0.70	0.70	
Evapotranspiration (A x E)	F	mm	107.6	83.9	73.3	38.6	20.1	13.9	14.2	22.1	38.5	63.5	82.5	98.5	
Irrigation Requirement (F - D)	H	mm	57	35	30	0	0	0	0	0	0	8	28	39	197
Net Lagoon Evaporation	I	kL	766	399	337	-349	-812	-1035	-700	-596	-341	-23	239	410	-1706
Wastewater Flow	J	kL	10977	7840	8019	7220	6039	7825	6586	6846	6659	8782	8396	10311	95500
Net Lagoon Inflow (I + H)	K	kL	10211	7442	7682	7569	6851	8860	7286	7443	6999	8805	8157	9901	97206
Water Used in Irrigation (G x Irrigation Area)	L	kL	27731	17135	14704	0	0	0	0	0	0	3744	13394	18799	95506
Average Daily Irrigation Rate	M	kL/d	895	612	474	0	0	0	0	0	0	121	446	606	
Cumulative Storage (Storage in Previous Month + J - K)	N	kL	17922	8228	0	7569	14420	23280	30566	38009	45008	50069	44832	35934	
Lagoon Depth	O	m	1.2	0.5	0.0	0.5	1.0	1.6	2.0	2.5	3.0	3.3	3.0	2.4	
Lagoon (reuse dam) Area		ha	1.5												
Assume Effective Rainfall Factor			0.70												
Irrigation Area Required		ha	49.3												
Lagoon Volume Required		ML	50.1												
Lagoon Depth		m	3.0												
Notes:	<p>Worksheet based on Water Budget Table "Guidelines for Wastewater Irrigation" Victorian EPA</p> <p>Effective rainfall (ie that available for vegetation growth) is that which does not run off, or is intercepted by vegetation (leaves, branches etc) and is evaporated.</p> <p>Direct crop coefficient is a factor relating crop water use to pan evaporation. Varies monthly and also depends on what crop is being irrigated - Pasture has been used in this scenario</p>														

2043 median rainfall

Assumptions	Median rainfall year														
Median rainfall data obtained from	Bicheno Council Depot BoM site# 92003														
Evaporation data obtained from	Silo modelling BoM site# 92003														
Total irrigation area	43.3														
Average Wastewater flow of	125900	KL/year	based on projected monthly and annual production levels and monthly wastewater flows by TasWater												
		unit	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	TOTAL
Evaporation (Pan)	A	mm	153.7	119.8	104.7	64.4	40.1	30.9	35.5	49.2	70	97.7	117.8	140.7	1025
Effective Lagoon Evaporation	B	mm	123.0	95.8	83.8	51.5	32.1	24.7	28.4	39.4	56.0	78.2	94.2	112.6	820
Rainfall	C	mm	51.7	49.8	44.1	53.8	62	67.4	54	56.9	56.6	57.3	56.3	61.3	671
Effective Rainfall	D	mm	36.2	34.9	30.9	37.7	43.4	47.2	37.8	39.8	39.6	40.1	39.4	42.9	470
Direct Crop Coefficient	E		0.7	0.7	0.7	0.6	0.5	0.45	0.4	0.45	0.55	0.65	0.7	0.7	
Evapotranspiration (A x E)	F	mm	107.6	83.9	73.3	38.6	20.1	13.9	14.2	22.1	38.5	63.5	82.5	98.5	657
Irrigation Requirement (F - D)	H	mm	71	49	42	1	0	0	0	0	0	23	43	56	286
Net Lagoon Evaporation	I	kL	1069	691	595	-34	-449	-640	-384	-263	-9	313	569	769	2226
Wastewater Flow	J	kL	14472	10336	10571	9518	7961	10316	8682	9025	8778	11578	11069	13594	125900
Net Lagoon Inflow (I + H)	K	kL	13403	9646	9976	9553	8410	10956	9066	9289	8787	11265	10499	12825	123674
Water Used in Irrigation (G x Irrigation Area)	L	kL	24224	16625	14392	332	0	0	0	0	0	7937	14606	18857	96974
Average Daily Irrigation Rate	M	kL/d	781	594	464	11	0	0	0	0	0	256	487	608	
Cumulative Storage (Storage in Previous Month + J - K)	N	kL	31425	24446	0	9220	17630	28586	37652	46940	55728	59055	54949	48917	
Lagoon Depth	O	m	1.6	1.2	0.0	0.5	0.9	1.4	1.9	2.3	2.8	3.0	2.7	2.4	

Lagoon (reuse dam) Area	ha	2
Assume Effective Rainfall Factor		0.70
Irrigation Area Required	ha	43.3
Lagoon Volume Required	ML	59.1
Lagoon Depth	m	3.0

Notes:

Worksheet based on Water Budget Table "Guidelines for Wastewater Irrigation" Victorian EPA

Effective rainfall (ie that available for vegetation growth) is that which does not run off, or is intercepted by vegetation (leaves, branches etc) and is evaporated.

Direct crop coefficient is a factor relating crop water use to pan evaporation. Varies monthly and also depends on what crop is being irrigated - Pasture has been used in this scenario

2043 90th percentile rainfall

Assumptions	90th percentile rainfall (wet year)														
90th percentile rainfall data obtained from	Bicheno Council Depot BoM site# 92003														
Evaporation data obtained from	Silo modelling BoM site# 92003														
Average Wastewater flow of	139600	ML/year	based on projected monthly and annual production levels and monthly wastewater flows by TasWater												
		unit	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	TOTAL
Evaporation (Pan)	A	mm	153.7	119.8	104.7	64.4	40.1	30.9	35.5	49.2	70	97.7	117.8	140.7	1025
Effective Lagoon Evaporation	B	mm	123.0	95.8	83.8	51.5	32.1	24.7	28.4	39.4	56.0	78.2	94.2	112.6	820
Rainfall	C	mm	71.9	69.2	61.3	74.8	86.2	93.7	75.1	79.1	78.7	79.7	78.3	85.2	933
Effective Rainfall	D	mm	50.3	48.5	42.9	52.4	60.3	65.6	52.6	55.4	55.1	55.8	54.8	59.7	653
Direct Crop Coefficient	E		0.70	0.70	0.70	0.60	0.50	0.45	0.40	0.45	0.55	0.65	0.70	0.70	
Evapotranspiration (A x E)	F	mm	107.6	83.9	73.3	38.6	20.1	13.9	14.2	22.1	38.5	63.5	82.5	98.5	
Irrigation Requirement (F - D)	H	mm	57	35	30	0	0	0	0	0	0	8	28	39	197
Net Lagoon Evaporation	I	kL	766	399	337	-349	-812	-1035	-700	-596	-341	-23	239	410	-1706
Wastewater Flow	J	kL	16046	11461	11721	10554	8827	11438	9627	10008	9733	12838	12273	15073	139600
Net Lagoon Inflow (I + H)	K	kL	15280	11062	11385	10903	9639	12473	10327	10604	10074	12861	12034	14663	141306
Water Used in Irrigation (G x Irrigation Area)	L	kL	33247	20544	17629	0	0	0	0	0	0	4488	16058	22539	114506
Average Daily Irrigation Rate	M	kL/d	1072	734	569	0	0	0	0	0	0	145	535	727	
Cumulative Storage (Storage in Previous Month + J - K)	N	kL	34744	25262	0	10903	20543	33016	43343	53947	64021	72393	68369	60493	
Lagoon Depth	O	m	2.3	1.7	0.0	0.7	1.4	2.2	2.9	3.6	4.3	4.8	4.6	4.0	
Lagoon (reuse dam) Area		ha	1.5												
Assume Effective Rainfall Factor			0.70												
Irrigation Area Required		ha	71.6												
Lagoon Volume Required		ML	72.4												
Lagoon Depth		m	3.0												
Notes:	<p>Worksheet based on Water Budget Table "Guidelines for Wastewater Irrigation" Victorian EPA</p> <p>Effective rainfall (ie that available for vegetation growth) is that which does not run off, or is intercepted by vegetation (leaves, branches etc) and is evaporated.</p> <p>Direct crop coefficient is a factor relating crop water use to pan evaporation. Varies monthly and also depends on what crop is being irrigated - Pasture has been used in this scenario</p>														