

Guide to Calculating Annual Allocation Volume for the Waitaki Catchment, January 2007

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1 Introduction

This document serves as a step by step guide to calculating spray and border dyke irrigation annual volumes for the Waitaki Catchment. The data and method utilised are all taken from Glasson Potts Fowler (GPF) report for Meridian Energy to the Waitaki Catchment Allocation Board..

2 Objectives

- How to calculate spray irrigation seasonal volumes in the Waitaki Catchment

3 Method

The GPF report utilizes certain assumptions namely:

- Spray irrigation is assumed to require 0.59 L/s/ha for 118 days/year above the Waitaki Dam, unless a volume is given on the face of the consent.
- Borderdyke irrigation is assumed over 155 days/year at consented rate above the Waitaki Dam if the rate is consistent with the area irrigated, otherwise the allocation was taken as area times 1.5 m water depth (i.e. 15 applications of 100 mm).
- Spray irrigation is assumed to require 0.45 L/s/ha for 158 days/year below the Waitaki Dam, unless a volume is given on the face of the consent.
- Borderdyke irrigation is assumed over 206 days/year at consented rate below the Waitaki Dam if the rate is consistent with the area irrigated, otherwise the allocation was taken as area times 1.5 m water depth (i.e. 15 applications of 100 mm).
- Community water supply was taken as 365 days per year, 24 hours per day unless consent gave a limiting volume.
- The borderdyke profile was based on measured values for the Morven Glenavy and Lower Waitaki Irrigation Schemes.
- The spray profile was based on a climate assessment

Using the Lower Waitaki Spray as an example, the following table from the GPF report is explained in detail and its assumptions outlined.

APPENDIX G

WATER DEMAND (MM/MONTH) AND TOTAL

Based on Coastal Rainfall at Timaru

Net Irrig (ha)	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Total mm/yr
mm/month	48	67	93	110	113	76	57	48	0	0	0	0	512
Days at peak	12.4	17.3	24.0	28.4	29.1	19.6	14.7	12.4	0.0	0.0	0.0	0.0	158
At 0.45 L/s/ha													

Based on the following assumptions:

- Rainfall is taken as 80% effective for the mean rainfall.
- Rainfall is taken as 90% effective for the 1:10 year dry months.
- All crops have equal water requirements, with a crop factor of 1.0.
- 90 % off-farm efficiency (piped, canal and river supply)
- 80 % on farm efficiency (centre pivot or K-line)
- Monthly demand based on following climate statistics:

Monthly Climate Figures (mm)

Timaru Aero	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Total
PET	30	82	105	118	117	89	69	36	18	9	11	25	709
Rainfall	34	43	47	49	45	47	49	31	44	39	46	47	521
Eff rain	27	34	38	39	36	38	39	25	35	31	37	38	417
10% rain	6	14	15	19	22	19	22	12	21	4	12	11	
10% eff rain	5	13	14	17	20	17	20	11	19	4	11	10	
Mean Def	3	48	67	79	81	51	30	11	11	4	11	10	370
10% Def	25	69	92	101	97	72	49	25	-1	5	0	15	

Seasonal Demand

Timaru Area	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Total
Effective Deficit (mm/month)	a, d, f	c, e	c, e	c, e	c, e	c, d	a, d	a, d, f	c				
Gross Scheme Application (mm/month)	25	48	67	79	81	51	30	25	0	0	0	0	406
	48	67	93	110	113	76	57	48	0	0	0	0	611

- a On-farm irrigation efficiency taken as 70%.
- b There is on average no monthly soil moisture deficit in May. However in extreme drought years, some irrigation may be required.
- c On-farm efficiency taken as 90%.
- d Management Efficiency of 75% as need set depth
- e Management Efficiency of 80%
- f In shoulder season the 10%tile month effective deficit is used due to wide variability

To determine how many days at peak irrigation (maximum consented rate 24 hours a day) GPF have outlined the total seasonal demand occurring on a farm taking into account the potential evapotranspiration (PET) and the rainfall.

PET and rainfall is based on climate data taken from Timaru. Rainfall is further manipulated into effective rainfall and 10% effective rainfall for the purposes of determining the total deficit for corresponding months.

E.g. November effective rainfall deficit is based on a PET of 105mm – effective rainfall of 38mm = 67mm/month.

Once the effective deficit for the month has been calculated then the gross application rate required by irrigation is calculated. This is manipulated to take account of irrigation efficiency corresponding to management efficiencies e.g. design return periods leakage from races etc and on farm efficiency e.g. distribution uniformity of the spray pattern.

E.g. November Effective Deficit

=67mm/month

/ On farm efficiency of 90%

/ Management Efficiency of 80%

= 93mm/month

To determine how many days at peak application is required to make up the 93mm/month deficit a system capacity of 0.45l/s/ha has been assumed.

0.45l/s/ha = 3.88mm/ha

93mm/month / 3.88mm/day

= 24 days at peak.

While a system capacity of 0.45l/s/ha is recognised as being low for modern systems, it is not considered to be low for older irrigation systems.

A high efficiency is attributed to delivering the water 90% and 80% respectively. It is considered that this is likely to be much higher than is occurring on farm. So while these two parameters may not be entirely accurate the balance of them is likely to reflect current usage with spray systems.

For border systems and the upper Waitaki a similar process has been undertaken. The system efficiency for the Upper Waitaki is higher than the lower as due to the limited growing season, irrigation systems are geared to delivering a higher volume of water.