

IN THE MATTER OF      The Resource Management Act 1991

AND

IN THE MATTER OF      applications for Resource Consents to Abstract water from  
Shepherds Creek and Coal Creek (CRC060253)and

BY                              Mrs Falconer, Mr Macassey & Cook Allan Gibson Trustee Co  
Limited) Applicant

TO                              Canterbury Regional Council

**EVIDENCE OF DAVID JOHN BORAMAN IN SUPPORT OF APPLICATIONS BY Mrs Falconer,  
Mr Macassey & Cook Allan Gibson Trustee.**

## INTRODUCTION

- 1.1. My Name is David John Boraman. I am a hydrological Consultant and a Director of Boraman Consultants Limited (BCL). I am a current member of the New Zealand Hydrological Society.
- 1.2. I hold a New Zealand Certificate in Engineering (Civil Option) I have been working in the field of Hydrology since 1986. I was employed by the South Canterbury Catchment Board, and by the Canterbury Regional Council (ECan) as a Hydrological Officer. I was later employed as the Hydrological Team Leader of the Southern (Timaru) Office, reporting directly to the Hydrologist.
- 1.3. In 1997 I was employed as the Field Hydrologist for Environmental Consultancy Services. (ECS) My work at ECS generally involved monitoring of irrigation abstractions and monitoring of flows for investigations for resource consent applications.
- 1.4. I am currently a Managing Director of Boraman Consultants Limited (formed in 2005). BCL monitor a proportion of South and Mid-Canterbury's irrigation takes and related minimum flow sites. BCL are currently involved in many investigations relating to resource investigations.
- 1.5. I am familiar with the hydrology and have been involved with monitoring flows in the Upper Waitaki Basin since the amalgamation of the Waitaki Catchment Commission and the South Canterbury Catchment Board into the Canterbury Regional Council in 1989.
- 1.6. Although this is a Regional Council hearing, I have prepared my evidence in compliance with the Code of Conduct for Expert Witnesses set out in the Environment Court's consolidated Practice Note dates 31 July 2006. I confirm that my evidence is within my area of expertise.

## 1. SCOPE OF EVIDENCE

My evidence will provide the following

- a. Introduction
- b. Flow Data Summary
- c. Analysis
- d. Conclusions and proposed 5 Year Seven Day Low Flows for each of the two subject waterways

My Flow report is attached as appendices to this evidence

## 2. INTRODUCTION

Boraman Consultants Limited were commissioned to determine the 5 year seven day low flow for Shepherds Creek, Coal Creek and Scrubby Creek. This measurement being the key statistic for these waterways in determining the minimum flow under the Waitaki Catchment Water Allocation Regional Plan (WCWARP)

3. A report produced by Environment Canterbury in 2005 titled "Seven Day mean annual low flow mapping of the Waitaki River" by Graeme Horrell and Suzanne Gabites provided limited statistics for Shepherds Creek, Coal Creek and Scrubby Creek, no correlations with were established. Figures derived by Gabites /Horrell were taken from interpolating isohydal maps indicating seven day mean annual low flow only, therefore an investigation by Boraman Consultants Limited into the low flows was started in February 2009.
4. Prior to this hearing, Mr Dave Stewart (consultant Hydrologist to ECan), Mr Richard DeJoux (Environmental Consultancy Services), Mr Frank Scarf (Hydrologist to Fish and Game) and I had agreed to work together until we agreed on the hydrological information. The information provided in my reports has been scrutinized, and used by Mr Dave Stewart in his Section 42A report.
4. The information available at time of writing my reports was correlated with many catchments. Many of these are in the region but not neighbouring catchments. Attempts to correlate with the Twizel River and Maryburn River provided very poor relationships. A correlation with the long term ECan site Rocky Gully at Rockburn (Site 69621) provided the best results for all three catchments

Rocky Gully at Rockburn Statistics

Table 1: Rocky Gully at Rockburn Statistics

<b>Statistic</b>	<b>Ecan</b>
Period	15/1/64 to Not Specified (Gabites and Horrell)
7DMALF	78 L/s
5Y7DLF	64 L/s
Mean Flow	312 L/s

**Shepherds Creek**

PREVIOUS INFORMATION

5. Flow measurements carried out by Ecan in 2005 on Shepherds Creek by Ecan were in a location not suitable for ongoing monitoring of minimum flows, and could not added to the dataset for analysis due to instream losses and gains. BCL carried out a flow measurement in February 2007 at the same location as the later flow measurements. This location was selected by Boraman Consultants Limited to install a permanent water level recorder in February 2009.

BORAMAN CONSULTANTS ANALYSIS

6. In February 2009 Boraman consultants commenced a study into the hydrology of Shepherds Creek, between February 2009 and May 2009 a further 5 flow measurements were carried out and a water level recorder was installed on 24 February 2009.
7. Boraman Consultants Limited derived a flow record utilizing a correlation with the measured instantaneous values of Shepherds Creek and the Daily mean recorded value for the Rocky Gully Stream. The calculated R2 for the correlation was 0.94 indicating good reliability. The correlation 'best fit' utilised and 'Power' trend line which is less desirable than the usual linear trend line. However given the limited dataset the 'power' equation was accepted.
8. Although a power trend line was this used a flow measurement much higher than what is usually used. I accept that this higher flow measurement has given the impression of a 'good-fit', this is not the case. The trendline indicates the 'best fit' of the available data. Therefore I would like to suggest that the proposed minimum flow be catagorised as interim, and the future monitoring requirements will provide more information to improve the dataset.

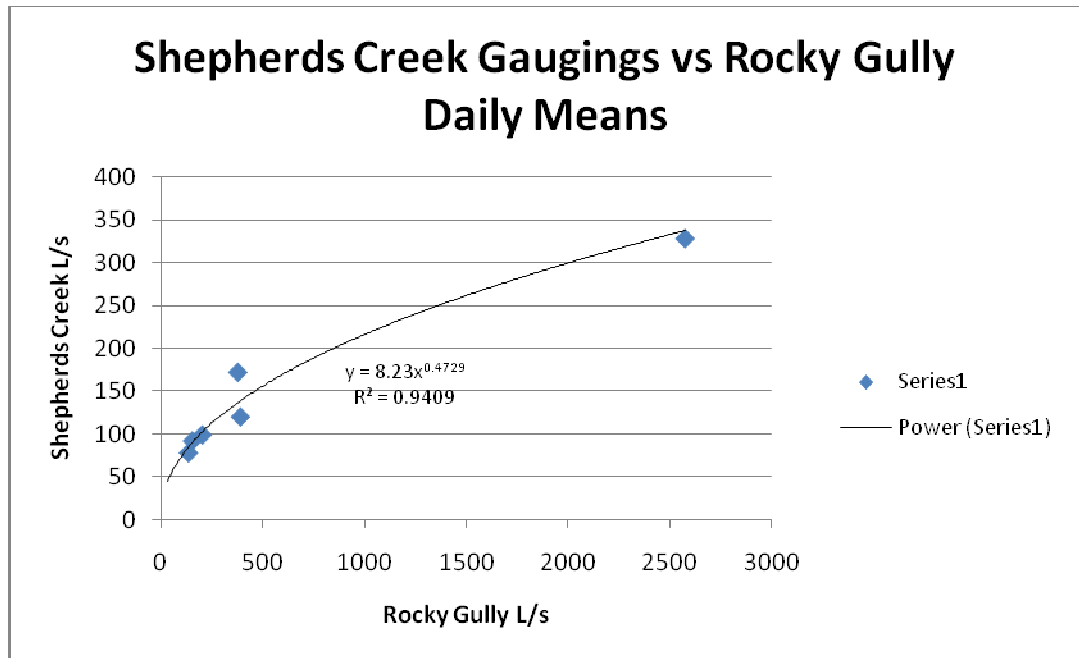


Figure 1: Shepherds Creek Gaugings vs Rocky Gully Daily Means Flows (L/s)

9. The derived flow for Shepherds Creek utilises the equation

$$\text{Shepherds Creek} = 8.23x (\text{Rocky Gully})^{0.4729}.$$

10. From my analysis I consider that the statistics for Shepherds Creek are:

Table 2: Shepherds Creek Statistics

Statistic	Rocky Gully Stream	Shepherds Creek
Period	15/1/1964 to not specified (Gabites Horrell)	15/1/1964 to not specified
7DMALF	78 L/s	64 L/s
5Y7dLF	64 L/s	59 L/s
Mean Flow	312 L/s	124 L/s

## CONCLUSIONS

11. My analysis supports the contention that the figure for 5 Year Seven Day Low Flow for Shepherds Creek is 59 Litres per second. In accordance with the Waitaki Catchment Water Allocation Regional Plan the proposed interim minimum flow should be 60 L/s.

12. The above figure should be treated as interim and a flow measurement program set up to further the dataset. The statistics and analysis should be reviewed when a season where the interim 5y7dlf has been surpassed.
13. Note my analysis as been accepted as an interim 5 year seven day low flow for Shepherds Creek by Mr. Dave Stewart consultant hydrologist to Ecan, and Mr Frank Scarf, Hydrologist for Fish and Game Society

Coal Creek

#### PREVIOUS INFORMATION

14. There were flow measurements carried out by ECan in 2005 on Coal Creek by ECan, they were measured in a location where the stream goes dry, these measurements could not added to the dataset for analysis due to in stream losses. BCL carried out a flow measurement in February 2007 at a location which has continuous flow in all seasons. This has been agreed with Mr. Dave Stewart, Consultant hydrologist, as a suitable monitoring site.

#### BORAMAN CONSULTANTS ANALYSIS

15. In February 2009 Boraman consultants commenced a study into the hydrology of Coal Creek, between February 2009 and May 2009 a further 5 flow measurements were carried out.
16. Boraman Consultants Limited derived a flow record utilizing a correlation with the measured instantaneous values of Coal Creek and the Daily mean recorded value for the Rocky Gully Stream. The calculated R2 for the correlation was 0.93 indicating good reliability. The correlation 'best fit' utilised and 'Power' trend line which is less desirable than the usual linear trend line. However given the limited dataset the 'power' equation was accepted.

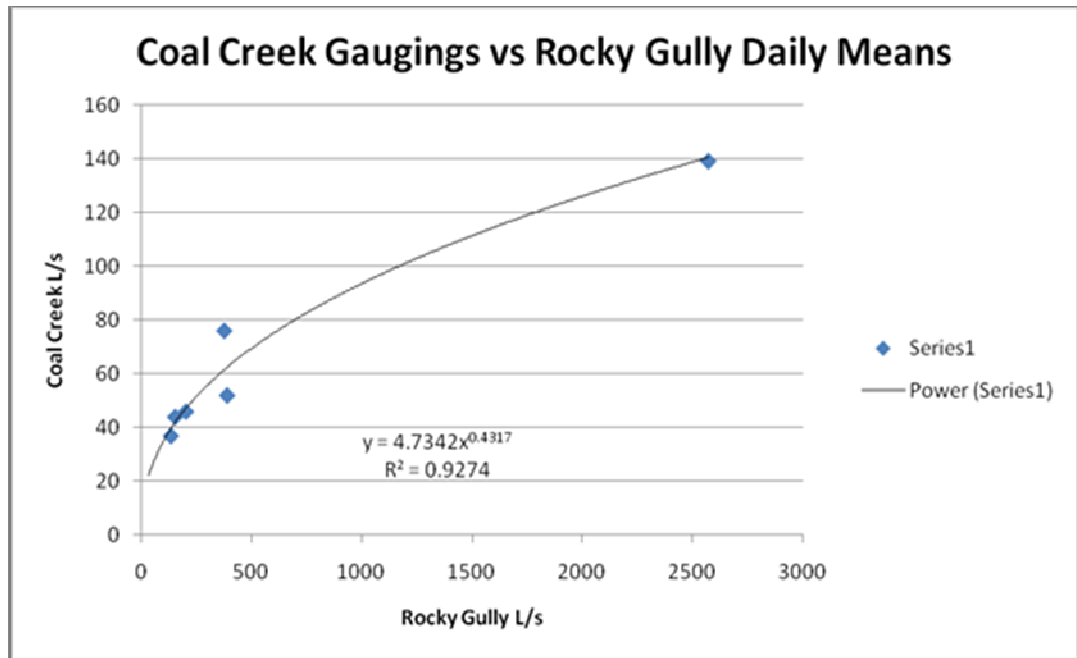


Figure 2: Coal Creek Gaugings vs Rocky Gully Daily Means Flows (L/s)

17. The derived flow for Coal Creek utilises the equation

$$\text{Coal Creek} = 4.7342 (\text{Rocky Gully})^{0.4317}.$$

18. From my analysis I consider that the statistics for Coal Creek are:

Table 3: Coal Creek Statistics

Statistic	Rocky Gully Stream	Coal Creek
Period	15/1/1964 to not specified (Gabites Horrell)	15/1/1964 to not specified
7DMALF	78 L/s	31 L/s
5Y7dLF	64 L/s	29 L/s
Mean Flow	312 L/s	56 L/s

19. A cross catchment correlation between Coal and Shepherds creek was carried out, gaugings that were carried out on the same day were compared, indicating an excellent correlation between the two catchments with an  $R^2 = 0.999$

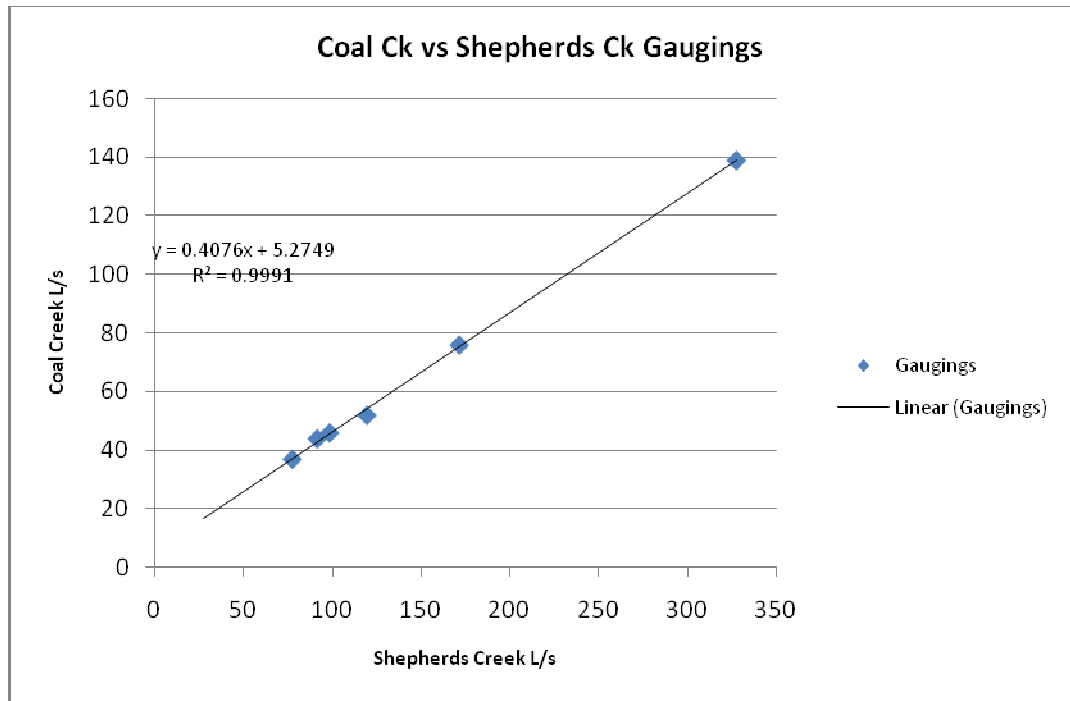


Figure 3: Coal Creek Gaugings vs Shepherds Creek Gaugings (L/s)

20. From this relationship it is recommended that minimum flow monitoring be carried out on Shepherds creek only. This is to be used as a trigger for Coal Creek to be placed on restriction.

#### CONCLUSIONS

21. My analysis supports the contention that the figure for 5 Year Seven Day Low Flow for Coal Creek is 29 Litres per second. In accordance with the WCWARP the proposed interim minimum flow should be 30 L/s.

22. The above figure should be treated as interim and a flow measurement program set up to further the dataset. The statistics and analysis should be reviewed when a season where the interim 5y7dlf has been surpassed.

23. Monitoring of minimum flows to be carried out on Shepherds creek only

#### NOTES ON SECTION 42 REPORTS

24. The matter of the minimum flow site being below the points of abstraction has been addressed in my evidence relating to UWAG clients, when referring to Section 42A report 2A. It should be noted that this is the case with Shepherds Creek. The minimum

flow site is below the point of abstraction and the annexed graph will not work as the WCWARP intended.

25. When referring to the annexed graph for Shepherds and Coal Creeks the flow of the creeks must be referred to as the natural flow, i.e. the residual in addition to the abstraction from Shepherds Creek.

26. The conditions set out in section 42A report 12 paragraph 17 (iii) are correct.