

**Before the Commissioner / Hearing Panel appointed  
by Canterbury Regional Council**

**IN THE MATTER OF** The Resource Management Act  
1991

**AND**

**IN THE MATTER OF** Application CRC120223 by  
Christchurch City Council for a  
discharge permit to discharge  
contaminants (being stormwater)  
onto and into land and into water  
associated with the South-West  
Area of Christchurch City.

**Section 42A Officer's Report**

**Date of Hearing: 14 November 2011**

**Report of Tony Oliver**

# Table of Contents

Introduction ..... 3

General Comments ..... 3

Heathcote catchment & floodplain ..... 4

Halswell catchment & floodplain ..... 6

Reccomendations ..... 7

## **INTRODUCTION**

1. Christchurch City Council (CCC) has applied for consent to discharge all current and future stormwater from the South-West Christchurch area with discharges to both land and surface water. The receiving surface water environment includes the mainstem and tributaries of the upper Heathcote and upper Halswell rivers.
2. I am employed by Environment Canterbury as a Principal Hazards Analyst (Floods). I hold a Bachelor of Engineering Degree (Agriculture), and a New Zealand Certificate in Engineering (Civil). I have over 30 years work experience in water engineering, working in central and local government and private consultancy, both in New Zealand and the United Kingdom. This experience includes water resource engineering, hydrologic and hydraulic analyses, flood mitigation investigations and design, hydrologic and hydraulic computer modelling, and floodplain management planning. I am a member of the Institution of Professional Engineers New Zealand and the New Zealand Hydrological Society.
3. My report will provide information and advice related to the effects of the proposed discharges on surfacewater quantity.
4. My report is supplementary to the Overview Section 42A report prepared by Brent Hamilton, for the above application by the CCC. Full details of the consent application are provided in that report.
5. I have read the Code of Conduct for Expert Witnesses in giving evidence to the Environment Court. I agree to comply with that code when giving evidence to the Hearing Panel in this matter. All my evidence is within my expertise and I have considered and stated all material facts known to me which might alter or qualify the opinions I express.

## **GENERAL COMMENTS**

6. The applicant summarises the existing receiving environment with respect to flooding in Section 4.5.2.3 of the AEE.
7. Any urbanisation on greenfield sites has the potential to increase storm runoff, which if unmitigated, can result in increased downstream flooding, and the Stormwater Management Plan (SMP) recognises this. The Heathcote and Halswell floodplains are already subject to flooding every 2 – 5 years on average. It is therefore important that appropriately designed stormwater mitigation measures co-incide with future urbanisation to maintain the status quo, at least.
8. The main stormwater quantity mitigation measures in this application are stormwater soakage (soil adsorption) basins and stormwater retention basins. These are to be designed to cope with all storms upto and including the 2 % AEP (Annual Exceedance Probability) or 50 year return period event for the critical storm durations for the Heathcote (36 hours) and Halswell (60 hours) catchments.
9. The mix of recommended mitigation are described in a general manner in the application but is appropriate for this higher level SMP consent application and for the proposed urban development time frames. I believe the proposed measures are current best practice with an appropriate emphasis on soakage where it can be achieved, and swales and larger retention basins. The concept of creating green corridors and siting mitigation measures within larger reserves is the correct approach.

10. As stated in the application stormwater soakage is the preferred measure as this more closely duplicates the natural process, provides water quality treatment, and maintains general shallow groundwater levels. Soakage, however, is only possible where underlying ground conditions are suitable.
11. Where soakage is not possible retention basins are proposed. The retention basins are intended to detain the additional runoff from new developments, upto and including the 2% AEP rainfall event, for upto 36 hours in the Heathcote Catchment and upto 60 hours in the Halswell Catchment. These durations are based on the storms predicted to result in the most serious flooding on the downstream floodplains. The 2% AEP critical storm design standard is considered appropriate, providing appropriate design parameters are used.
12. Following the critical storm duration, outflows from the detention basins, would be slowly released at flow rates no greater than the existing landuse runoff rate. However, there are no details how this will be achieved, but outlet structures will have to be designed appropriately to achieve this. It will also be important to ensure that the combined timing of released flows do not exacerbate downstream flooding.
13. The proposed basin volumes have been calculated using the Rational Formula. This analysis is satisfactory for preliminary indicative purposes and the volumes indicated appear to be in the right order. However, for design purposes appropriate computer modelling should be undertaken to determine runoff peak flows (existing and future), basin volumes, and outflow rates more accurately. Christchurch City Council has confirmed this will be the case.
14. It is noted that in some areas retrofitting stormwater mitigation structures/measures is proposed to help reduce the downstream effects of existing urban development. There is also some discussion in the application of possibly enhancing the flood storage within the natural ponding areas of Hoon Hay Valley, Hendersons Basin, and the Cashmere/Worsley Valleys. However there is not a lot of certainty about if, when, or how this will be achieved.
15. When rainfall events greater than the 2% AEP design standard occur, structural mitigation measures, while still providing some benefit, will overflow. It is important when such overflows occur they do so in a manner causing the least amount of damage, for example, roads, reserves, etc should be used to carry these secondary flows, rather than flowing through sections and potentially flooding houses. These secondary flowpaths need to be clearly identified and preserved.

## **HEATHCOTE CATCHMENT & FLOODPLAIN**

16. The Heathcote River floodplain Management Strategy (CRC 1998) requires the maintenance of 1991 flood levels for the Heathcote River catchment. To date, however, and as acknowledged by Christchurch City Council, this has not been achieved with the current flood mitigation systems.
17. Table 3 of section 4.5.2.4 of the AEE shows a small increase (in the order of 50 mm) in flood levels on Cashmere Stream and the Heathcote River between 1991 and 2002. I don't regard the modelled increase as particularly significant and within the accuracy and uncertainties of the modelling. However, assuming all other model parameters are the same, the increase could be due to unmitigated urban development within the catchment over that time.

18. The 2007 modelling which supports this application was undertaken using NIWA's 1992 design rainfall for Christchurch and without any additional allowance for climate change.
19. This design rainfall was updated by NIWA (funded jointly by CCC and ECan) in 2009. This analysis, including another 20 years of rainfall data, resulted in lower design rainfall depths. However by the time allowance was made for projected increased storm rainfall as a result of mid range climate change predictions, the figures are very similar to the 1992 figures.
20. I have confidence that the proposed mitigation measures to compensate for the effects of urban runoff (with respect to water quantity) will achieve the objectives of maintaining the status quo for events up to the 2 % AEP (50 year return period) event.
21. I note that the applicant has not modelled the 0.5 % AEP (200 year return period) event through the proposed mitigation measures. While this is above the design standard I believe it would be worthwhile doing this. Having said this I note the applicant has employed NIWA to update the current model to include any changes as a result of the earthquake. I also note the proposed modelling is to be undertaken using a 2 dimensional model which may give a slightly more accurate indication of flood levels in ponding areas and the Heathcote River floodplain. This would be an opportune time to also route the 200 year return period design flows through the various mitigation structures/measures. It is also important to ensure that the timing of the peak outflows from the proposed mitigation measures do not create a cumulative adverse effect.
22. The mitigation measures will still provide significant benefit for events larger than the 50 year design event, and because of the widespread flooding in such events, I do not believe the effect of increased discharges from the new urban areas will be more than minor. Additionally retrofitting stormwater mitigation facilities for some existing urban areas will help compensate the additional runoff in these higher than design events.
23. The Cashmere Rural Landowners submission has raised a large number of concerns, particularly regarding Hendersons Basin. However it needs to be recognised that this basin was a former raupo swamp and has always been a natural ponding area. Although it has been significantly modified over the last 150 years with drains to allow farming activities, its lowlying nature means it floods regularly after heavy rainfall events. Providing the mitigation measures are designed and constructed as stated I do not believe there will be an adverse effect to flooding in the Hendersons Basin area. The computer modelling also indicates this. The submission also raises concerns about effects of the earthquake. While there maybe some localised effects of the earthquake in small flood events, in the larger flood events when large areas of Hendersons Basin are under water any earthquake effects are likely to be negligible. It is also noted that the applicant is undertaking further modelling to confirm this, using post earthquake ground levels.

## HALSWELL CATCHMENT & FLOODPLAIN

24. Section 4.5.2.3 of the AEE also refers to the Halswell Floodplain. The Halswell Floodplain at the base of the Port Hills is extremely flat and in its natural state was predominantly swamp. The area has been progressively drained since European settlement, to make farming viable. The existing drainage system, “The Halswell Drainage Scheme”, including 114 km of drains, is maintained by Environment Canterbury. The scheme is not a flood mitigation scheme and its main purpose is to remove water from the significant low lying areas and to control groundwater levels. Some ponding occurs during most winters and during larger rainfall events (approximately 5 yearly on average) large parts of the Halswell Floodplain are inundated.
25. Urban development within the upper reaches of the Halswell catchment is a particular concern to the Halswell Drainage District, as the drainage system and the Halswell River do not have the capacity to cope with additional runoff. Hence it is important that all new development in the Halswell Catchment is fully mitigated with respect to stormwater runoff. The AEE indicates Environment Canterbury intends to develop a floodplain management strategy for the Halswell River. This is not the intention at this stage, however, I have recently undertaken a detailed floodplain investigation, including floodplain modelling for the Halswell. This study has investigated the potential effects of urbanisation without mitigation within the catchment.
26. It is important that the capacity of the Halswell Drainage Scheme is not compromised by upstream development.
27. While very difficult to state categorically, it is most unlikely that groundwater levels will be adversely affected in the Halswell catchment. As no soakage/infiltration basins are proposed within the Halswell catchment, there will be no local or wider effects of elevated groundwater levels. All stormwater runoff from new developments will be routed through detention basins with slow release during and post rainfall events. This slow release may hold up water levels for slightly longer than pre development, but this effect is likely to be very localised and not a problem for the wider drainage scheme.
28. Additionally proposed retrofitting of stormwater mitigation for runoff from existing industrial areas within the upper Halswell catchment will help to reduce downstream levels.
29. The initial effects of the September 2010 earthquake in particular were changed spring flows and elevated drain, river and groundwater levels. ECan has since undertaken silt removal & undertaken channel widening/reshaping where lateral spreading occurred. This work is ongoing, however surface and groundwater levels now appear to be back to normal pre earthquake levels and if anything slightly lower as a result of dredging.
30. Although the Christchurch City Council does not appear to have a specific surface water objective for the Halswell catchment (unlike the Heathcote), they have indicated that the water quantity mitigation facilities will be designed to “provide Full Flood Attenuation for the post development 50 year critical duration event for the Halswell River”. This is appropriately included as a proposed condition of consent (condition 9).
31. However there is no additional monitoring proposed in the upper Halswell catchment to show that these mitigation measures are effective in their objective. Environment

Canterbury do maintain a continuous water level recorder at Ryans Bridge (downstream of Tai Tapu), however I consider this to be too remote from the new development areas to be useful in ensuring the above condition is being met.

32. I therefore believe it would be appropriate to install a new automatic water level recorder in the upper tributaries to monitor any changes as urbanisation occurs. This would also provide a good indicator of any baseflow/groundwater level changes.
33. As stated above, I have undertaken floodplain modelling to ascertain the impact of the proposed development within the Halswell catchment. Based on my understanding there could be an additional 250 ha of impervious surface created as a result of the proposed development over the term of this consent. Without any mitigation an additional 70 ha of rural land could be flooded in the 0.5% AEP (Annual Exceedance Probability) or 200 year return period event. With the proposed mitigation there should be no additional land flooded. Note: The total calculated inundated area in the 0.5 % AEP event is approximately 46 km<sup>2</sup> i.e. 4600 ha. In the 2 % AEP (50 year return period) event the inundated area for the critical 60 hour event is approximately 38 km<sup>2</sup>.
34. Although the proposed stormwater mitigation devices are designed to provide flood mitigation up to the 2 % AEP (50 year return period) event, they will also provide some mitigation in the larger 0.5 % AEP event.

## **RECOMENDATIONS**

35. Based on what I have discussed, below are additional recommendations (that do not appear to be part of the application) that I consider should be included in the SMP and/or consent conditions, if consent is granted:
  - To assist in measuring the effectiveness of mitigation (i.e. base & flood flows) in the Halswell it is recommended that a continuous water level recorder and flow rating site is established in an appropriate headwater tributary of the Halswell River. This monitoring will also aid the understanding of catchment urbanisation, with respect to quantity and assist in computer model calibration. The site could also be used for water quality monitoring purposes.
  - Provision for flexibility in terms of land area/design for climate change predictions and impacts, as greater certainty becomes apparent; in the meantime a precautionary approach is required.
  - That final design of mitigation structures/measures is based on appropriate hydrologic and hydraulic computer modelling, recognising the rational formula is not satisfactory for final design purposes. The modelling will also ensure cumulative adverse effects are avoided.

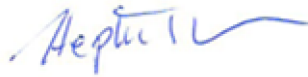


Signed: \_\_\_\_\_

Date: 27 October 2011

Tony Oliver - Principal Hazards Analyst

Reviewed by:



Signed: \_\_\_\_\_

Date: 1 November 2011

Stephen Timms - Principal Consents Planner