

BEFORE THE CANTERBURY REGIONAL COUNCIL AND WAIMAKARIRI DISTRICT COUNCIL

IN THE MATTER OF the Resource Management Act 1991

AND

IN THE MATTER OF six resource consent applications filed by **Waimakariri Irrigation Limited** in relation to constructing storage ponds at Wrights Road and Dixons Road, Burnt Hill, namely:

CRC122897 to use land for earthworks associated with the construction, maintenance and use of storage ponds and associated infrastructure;

CRC122898 to use land to store and use up to 10,000 L of diesel and other hazardous substances in an above ground portable fuel storage container;

CRC120610 to dam up to 8.2 million m³ of water;

CRC122899 to discharge fugitive dust and combustion products to air during the construction of storage ponds and associated structures; and

CRC122900 to discharge stormwater to land during the construction of storage ponds and to discharge post-development stormwater; and

RC135478 to construct, maintain and use storage ponds and associated structures at the corner of Wrights Road and Dixons Road, Burnt Hill, being Lot 1 DP27020.

REPORT AND DECISION OF HEARING COMMISSIONERS

PAUL ROGERS (CHAIR), DEAN CHRYSTAL and JOHN LUMSDEN

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1 INTRODUCTION

- 1.1 Paul Rogers (Chair), Dean Chrystal, and John Lumsden were appointed as independent hearings Commissioners by Canterbury Regional Council (CRC) and Waimakariri District Council (WDC) under s 34A(1) of the Resource Management Act 1991 (RMA) to decide on six applications by the Waimakariri Irrigation Limited (WIL). This decision sets out our findings on the applications, focusing on the principal issues in contention and the reasons for our decision.
- 1.2 In addition to the evidence and submissions provided by WIL and submitters at the hearing, we record that we have all read and taken full account of the application documents, including the Assessments of Environmental Effects and all of the written submissions. Although not every witness and submission is referred to in our decision, this does not mean that they have not been considered, simply that we have endeavoured to focus on key issues and avoid repetition in our decision where possible.
- 1.3 In accordance with s 113(3) RMA, we have also cross-referenced and adopted parts of the Assessment of Environmental Effects, the s 42A Officer Reports, and written evidence throughout this decision as appropriate.
- 1.4 The principal issue raised by this application revolves around safety or the risk that the proposed storage ponds presents, in particular in terms of s 3(f) of the RMA. That section provides for effects of low probability, but of high potential impact. We are dealing with an effect that *may* occur, as distinct from effect that *will* occur. Also, we are dealing with trying to understand the probability in terms of risk of an effect occurring.
- 1.5 The concern of the submitters is that the embankments of the proposed storage ponds (described below) may fail should an earthquake of significant size and scale strike and cause a catastrophic failure in the embankments, causing immediate release of the impounded waters. Those waters would in turn cause significant damage to property and cause potential loss of life.
- 1.6 The submitters contended this risk arose primarily because WIL had not properly appreciated the level of earthquake risk, including vertical accelerations and, consequently, could not properly provide for that risk in its embankment or dam design processes. Throughout this document we refer interchangeably to embankment or dam, but these words are to be read as having the same meaning. In greater detail, the submitters contended the presence of historic geological features suggested the site had a vulnerability to earthquakes, which had not been properly evaluated and understood. Without proper understanding of the site seismicity, any risk caused by earthquakes could not be provided for within the embankment design process.
- 1.7 The submitters also held serious concerns over the choice of the pond liner, its role and how it would perform in response to earthquakes.
- 1.8 The submitters also contend there are available alternatives to WIL, i.e., a smaller pond with embankments of lesser height, excavating the site so as to reduce embankment height and/or a range of smaller on-farm ponds, or choosing a site located close to a river to provide an escape route for water.
- 1.9 WIL argued that the probability of a catastrophic embankment failure event occurring was below the threshold of low such that it does not qualify to be assessed as a potential effect under s 3(f).

- 1.10 WIL contended that the seismicity of the site had been properly understood and that development of the site as proposed was appropriate. Further, WIL contended any seismic issues had been appropriately provided for within the embankment design process. WIL also contended the risk (or rather, the effect of a large magnitude earthquake on the embankments) had been taken into account within the design process.
- 1.11 Through its experts WIL contended that if a large magnitude earthquake did occur, then the embankments would retain their integrity and would be able to continue to impound the water. In short, WIL argued that it had properly applied the embankment design process meeting the relevant guidelines and in doing so had properly provided for, and allowed for, the risks of concern to the submitter residents.
- 1.12 Other potential risks (other than those caused by a sudden earthquake) were also raised during the course of this hearing. These effects were more of the type that might become apparent over a period of time and were intended to be addressed by both appropriate monitoring and remediation.
- 1.13 WIL's position on alternatives was that consideration of them was not needed because the significance of effects that the proposed storage ponds gives rise to, particularly considering its view on risk and safety, were acceptable.
- 1.14 So as we apprehend our role, what we have to do is make judgements to assess those possible future risks.

2 EXECUTIVE SUMMARY

- 2.1 We do not for one moment doubt the genuineness with which the submitters both hold and express their concerns about this proposal. A strong thread throughout their evidence was the enjoyment and high value they placed upon the existing environment. Undoubtedly, their concerns about risk of embankment failure are heightened by the recent Canterbury earthquakes. Indeed, that circumstance was ever present in our minds during our deliberations.
- 2.2 In the end we have to make a decision driven by our judgement of the competing issues. In this decision we hope we have been able to explain clearly why we have made the findings we have on those competing issues.
- 2.3 Both Dr McVerry and Mr Connell on behalf of WIL demonstrated their experience and expertise in responding to the submitters' concerns. With the exception of these residual concerns, relating primarily to vertical acceleration and liner issues, in the main, subject to what follows, we were satisfied with their explanations and responses to the submitters' concerns to enable consent with conditions to issue.
- 2.4 However, we found ourselves in a very challenging set of circumstances. The Canterbury earthquakes and their effects were uppermost in our mind. The very strong challenges raised by the submitters in relation to the key issues of vertical accelerations and efficacy of the proposed liner caused us concern. We were also well aware that this storage proposal is the largest of its kind to date in the Canterbury region to seek consent. The size of the embankments and the quantity of water impounded set it apart from other storage facilities in the Canterbury region. The location given its proximity to, primarily, rural lifestyle developments and activities coupled with a lack of an 'exit path' for floodwaters to a river or waterway also created challenges. All of these matters raised the issue of risk and uncertainty in our minds. However, we did accept WIL expert

assessment of the likely seismic risk of the preferred site. This was a critical finding.

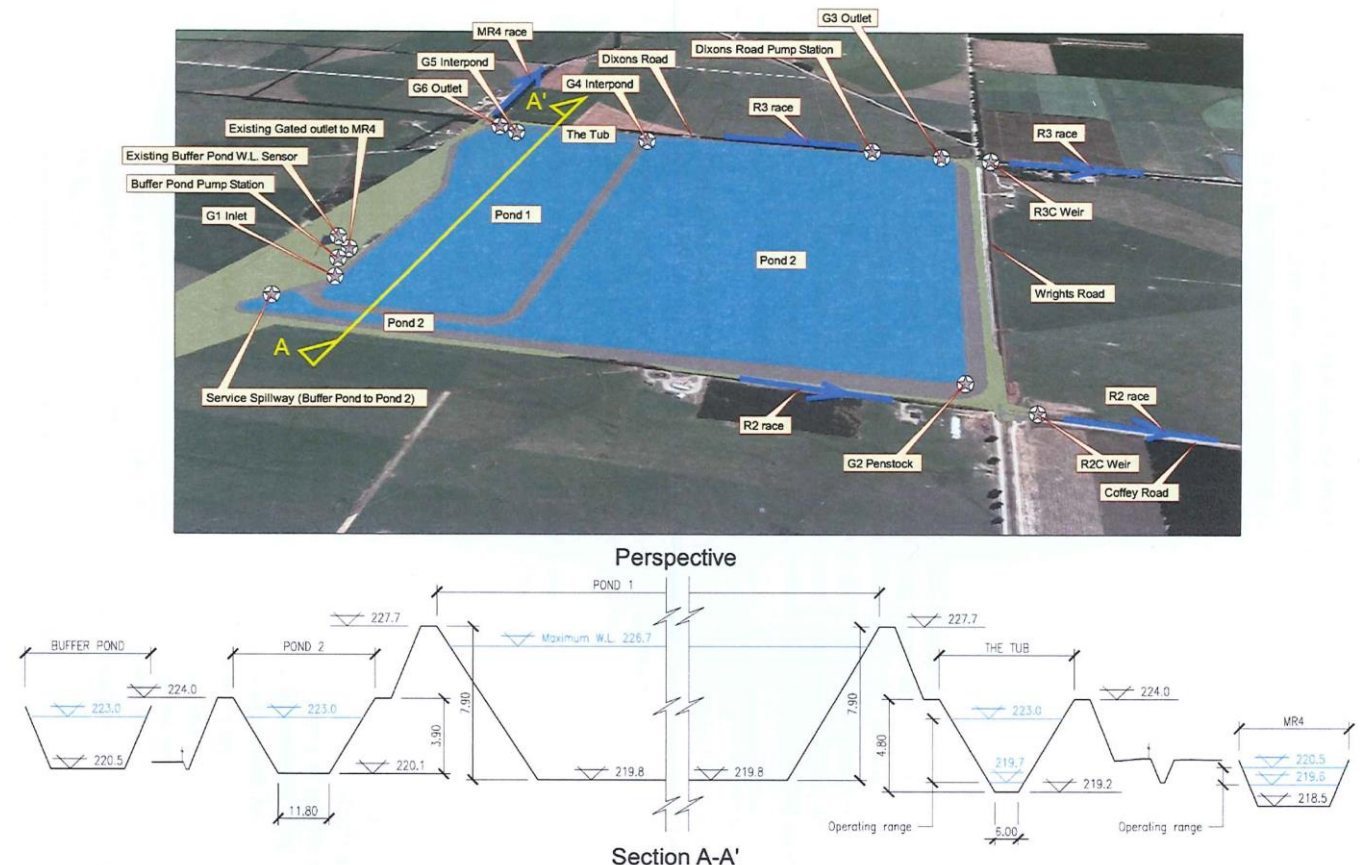
- 2.5 To address and provide for this residual uncertainty we concluded it was appropriate we include conditions that provide for a peer review of the design of the proposed storage ponds, including a peer review of the seismic investigations and a review of the adequacy of the proposed liner before construction and operation of the proposed storage ponds commences. This peer review we think will also further assist to resolve any remaining submitter concerns.
- 2.6 Conditions of this sort we consider are an appropriate way to provide for and deal with any residual concerns that may arise about the risks of catastrophic failure of the embankments. We think that, provided conditions relating to seismic issues and dam design are sufficiently robust, then safety issues or risk should not count against a grant of consent.
- 2.7 During the hearing, conversation occurred between ourselves and the participants about independent peer review. We took from WIL's comments in response that it had no objection of any sort to a condition requiring independent peer review. That response fortified our view that such conditions were appropriate.
- 2.8 We consider, with the inclusion of robust conditions, the project can proceed while at the same time the issues of concern raised by the submitters are addressed.

3 DESCRIPTION OF THE PROPOSED STORAGE PONDS

- 3.1 WIL is applying to construct, maintain, and use a two pond storage system and associated infrastructure for the purpose of storing water abstracted from the Waimakariri River for later use in the Waimakariri Irrigation Limited Irrigation Scheme. WIL has lodged six applications for this purpose.
- 3.2 WIL has lodged five applications with the Canterbury Regional Council (CRC) and one with the Waimakariri District Council (WDC).
- 3.3 Applications lodged with CRC are:
 - (a) CRC122897 – to use land for earthworks associated with the construction, maintenance and use of storage ponds and associated infrastructure;
 - (b) CRC122898 to use land to store and use up to 10,000 L of diesel and other hazardous substances in an above ground portable fuel storage container;
 - (c) CRC120610 – to dam up to 8.2 million m³ of water;
 - (d) CRC122899 – to discharge fugitive dust and combustion products to air during the construction of storage ponds and associated structures; and
 - (e) CRC122900 – to discharge stormwater to land during the construction of storage ponds and to discharge post-development stormwater.
- 3.4 The application lodged with WDC is:
 - (a) RC135478 – to construct, maintain and use storage ponds and associated structures at the corner of Wrights Road and Dixons Road, Burnt Hill, being Lot 1 DP27020.
- 3.5 The proposal has two distinct stages, with two distinct stages of effects. These

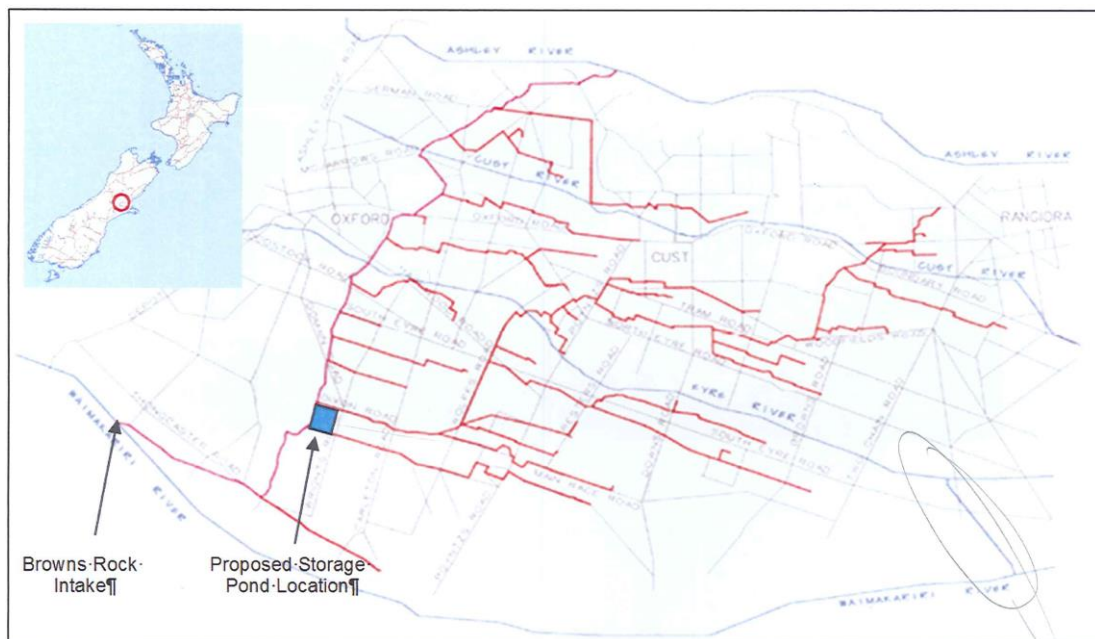
are those occurring during the construction period and those associated with the ongoing operation of the facility.

- 3.6 WIL proposes to construct the proposed storage ponds on a site at the corner of Wrights Road and Dixons Road, Burnt Hill, being lot 1 DP 27020.
- 3.7 WIL are proposing to construct two storage ponds that will extend over an area of 120 ha. The proposed storage ponds will have a maximum water depth of 11 m. The embankment heights will range from 4.5 m to 12.5 m. The proposed embankments will be setback from land boundaries and the adjacent roads as follows:
- (a) 6 m setback from the western boundary, parallel to the main water race MR4;
 - (b) 6 m setback from the northern and eastern the road boundary, parallel to Dixons Road (race three) and Wrights Road respectively; and
 - (c) 8 m setback from the southern boundary to accommodate water race R2.
- 3.8 WIL are seeking to excavate up to 6 m below ground level, the depth varying to suit the natural slope of the site. The total cut and fill volumes for the dams is 1.4 – 1.5 million m³. It is expected the construction activities will take 12 to 20 months. During construction, access to the site will be off Wrights Road. Stripping of the top soil will occur in a single stage, the excavation and embankment construction will be undertaken in stages. Fuel will be stored in either portable tankers or on a stationary tank on skids with a refuelling pad. Fuel storage tank(s) on site will be temporary and removed completely from the site once construction is completed.



Proposed pond layout inclusive of cross-sections

- 3.9 Once the dams are operational, WIL will construct and maintain access points at the Dixons Road pump station and Wrights Road. These will include parking space for two to three vehicles.
- 3.10 Along with the initial establishment of plant and equipment, further repairs and maintenance will be required during the life of the dams. WIL is proposing to develop a maintenance schedule to address inspection, maintenance, repairs and Emergency Action Plans (EAP). The inspection regime will be developed with reference to the New Zealand Dam Safety Guidelines (NZSOLD, 2000).
- 3.11 A consent duration of 35 years has been requested.
- 3.12 The location of the WIL site can be seen on the map below:



Location of WIL site

- 3.13 WIL has already obtained a building consent from CRC for the construction of the proposed storage ponds.

4 EXISTING ENVIRONMENT

- 4.1 Within s 5 of the AEE, WIL set out a comprehensive description of the existing and affected environment, including full details of the cultural, ecological, and community values for the area of the proposed site.
- 4.2 The site itself is flat, open pastoral paddocks, separated by shelter belt planting of macrocarpa trees and similar. The immediate surrounding environment is rural in nature and used for agricultural purposes. There is a large dairy farm being developed in proximity to the site. There are a number of houses on the edge of the site. Some owners and occupiers of those houses were submitters in opposition.
- 4.3 The significant landscape features in the broader environment include Burnt Hill to the west of the site, Waimakariri River to the south, Eyrewell Forest to the east, and a small reserve of ecological significance immediately to the south.
- 4.4 If a dam breach occurred, the area at risk includes a large area to the east of the site. This consists of open farm land, forestry and rural residential lifestyle blocks.

We learnt from the submitters in opposition that some of them operate their businesses and employ people on those sites. In fact, some submitters described highly specialised businesses/industries they were operating generating employment opportunities and high earnings. They claimed these businesses would be decimated if a dam breach occurred. Apart from these exceptions the area is typical of the Canterbury Plains farm land, with a high and increasing number of smaller farms and lifestyle blocks closer to the metropolitan areas to the east.

- 4.5 The geological conditions and formations were described to us. We were also told the site is over an unconfined/semi-confined aquifer with GIS planning maps showing groundwater being deeper than 6 metres below ground level. Ground water flow is north-west to south-east. There are a number of active wells within 2 kilometres of the site boundary, mostly located in a cross gradient direction.
- 4.6 We were told that the proposed dam site did not include any land currently registered on the CRC Land Listed Use Register. The site and dam break inundation extents do not include any silent file or statutory acknowledgment areas under the Ngāi Tahu Claims Settlement Act 1998.

5 NOTIFICATION, SUBMISSIONS AND HEARING

- 5.1 WIL initially made applications for consent in July 2012. These were subject to substantial further information requests, and WIL subsequently put this application 'on hold'. WIL made fresh applications on 1 October 2013. The applications were rejected and returned to WIL on 7 October 2013 as an assessment of the application determined the application was incomplete. Resubmitted applications were received and accepted by CRC and WDC on 17 December 2013.
- 5.2 CRC required further information from WIL, and both the CRC applications and the WDC applications were subsequently put on hold. On 31 January 2014, further information was received and accepted by CRC.
- 5.3 WIL has applied separately to take and use surface water for the purpose of dust suppression, construction works, and vegetation establishment associated with construction of the irrigation storage ponds (CRC142156). The assessment of this water permit application is not part of this decision.
- 5.4 WIL requested public notification and suggested, via email on 13 January 2014, an area for notification (the s 95 notification report identifies this area). The suggested notification area encompasses most property owners and occupiers that would be potentially adversely affected by the activity and may be inundated in a breach of the dam. Some additions were necessary, as the effects extended beyond the boundaries of the suggested notification area.
- 5.5 The consent applications were publicly notified on 15 February 2014 at the request of WIL. A copy of the public notice was served on the parties in the notification area, along with other potentially affected parties such as Te Runanga o Ngāi Tahu, Fish and Game, Mainpower, Chorus, Transpower, and the Department of Conservation. A public notice was published in The Press and Northern Outlook newspapers (refer to Appendix 3 of the s 42A officers report for a copy of the notice). Submissions closed on 14 March 2014.
- 5.6 A total of 160 submissions were received in respect of all six applications, with 44 submission in support, 115 in opposition, and one submission in neither support nor opposition. There were no late submissions. 57 submitters requested to be

heard.

- 5.7 The hearing on all applications began on 3 June 2014 at 9 am and ran until 6 June 2014. The hearing resumed in the week beginning 9 June until 13 June. We reconvened the hearing on Monday and Tuesday, 18 and 19 August 2014 to hear supplementary evidence provided by WIL, ECESS, the s 42A officers, and the right of reply from WIL.
- 5.8 We formally closed the hearing on Wednesday, 3 September 2014. Subsequently, we issued a minute dated 22 September 2014 extending the time period for the issue of this decision until Wednesday, 1 October 2014.

6 SITE VISIT

- 6.1 On the 5th of June 2014 we undertook a site visit of the application site and the immediate and wider surrounding area.
- 6.2 We visited locations which potentially would be subject to inundation in the event of a dam breach. We also looked at a number of 'on farm' dams in the vicinity. Finally we visited the application site itself where we were able to consider the height of dam walls, the proximity of dwelling houses and infrastructure to the dam site, the proximity of the Eyrewell Scientific Reserve to the dam and the existing infrastructure associated with the present WIL scheme.

7 OUR APPROACH

- 7.1 There are two points we wish to make. The proposal before us is made up of a number of individual consents. Those consents cover and provide for all of the activities that make up the proposed storage ponds. In assessing effects and plan provisions our approach is to consider the proposed storage ponds in the round and only when necessary consider the individual consent applications. So our assessment of effects is taken from this broader view.
- 7.2 In terms of the evidence in this decision, we have tried to focus on recording our evaluation and considerations on the key issues. This means that some of the submitters who appeared before us raising concerns do not receive a direct mention within the decision. We have taken this course to avoid repetition and duplication. We stress this does not mean that in our deliberations we have not carefully considered all the submissions.
- 7.3 Also, because the key issue raised by many submitters related to safety or risk and, given that the Eyre Community Environmental Safety Society Incorporated (ECESS) presented a comprehensive case focused on these issues that is where we have focused our decision. Given the commonality of interest between many of the individual submitters and ECESS, we considered this approach was appropriate and provided coverage and consideration of all issues.
- 7.4 We observe that a large number of submissions raise dam break issues and identify that their submissions relate to all applications lodged before us. These issues are relevant to the land use implications than, say, other applications such as the air discharge application. That is the way we have treated these submissions.

8 PLANNING FRAMEWORK

- 8.1 In this section, so as to provide some context to what follows, we identify what we considered are relevant Policy Statements, Regulations, Standards, and Plans.

In the main, discussion about these provisions and how the WIL proposal sits alongside them comes later in this decision.

National Environmental Standards and Regulations

8.2 The following National Environmental Standards are relevant to this application:

- (a) the National Environmental Standard for Ambient Air Quality (NESAQ); and
- (b) the National Environmental Standard for Sources of Human and Drinking Water (NES Source for Human Drinking Water)

National Policy Statements

8.3 The National Policy Statement (Freshwater Management 2011) sets out objectives and policies to manage water in an integrated and sustainable way, while providing for economic growth within set limits. Of relevance are Objective A1 which seeks the sustainable management of land use and discharge to safeguard the life-supporting capacity, ecosystems process and indigenous species of water, and Policy A3 which requires conditions on discharge permits to ensure that limits and targets set in regional plans can be met.

Canterbury Regional Policy Statement

8.4 The Canterbury Regional Policy Statement 2013 (CRPS) became operative on 15th of January 2013 and applies to this application.

8.5 Of particular relevance from a natural hazard perspective are:

Objective 11.2.1 – Avoid new subdivision, use and development of land that increases risks associated with natural hazards.

New subdivision, use and development of land which increases the risk of natural hazards to people, property and infrastructure is avoided or, where avoidance is not possible, mitigation measures minimise such risks.

8.6 The principal reasons and explanation note that this objective seeks that risks from natural hazards are avoided in the first instance and otherwise mitigated. Avoiding these impacts involves ensuring that development does not occur in high hazard risk areas but in lower risk areas. Where development may be otherwise appropriate in high hazard risk areas (where avoidance is not possible), mitigation measures may provide an alternate means of achieving the overall objective. Appropriate mitigation works in these areas should result in the avoidance of significant adverse effects of natural hazards, whilst themselves having minimal adverse effects on the surrounding environment. It is noted that some infrastructure may have to be located in hazard prone areas.

8.7 Policy 11.3.3 relates to earthquake hazards and seeks that new use and development of land on or close to an active earthquake fault trace, or in areas susceptible to liquefaction and lateral spreading, shall be managed in order to avoid or mitigate the adverse effects of fault rupture, liquefaction and lateral spreading.

8.8 The principal reasons and explanation note that active earthquake faults are defined as those faults in the earth's crust that have moved in the past and are likely to move again in the future, generating earthquakes. If an earthquake is

large and shallow the displacement on the fault may reach the ground surface, permanently offsetting the ground both horizontally and vertically by up to several metres along the fault trace. Fault rupture at the ground surface tends to occur repeatedly at about the same place in subsequent earthquakes. Therefore, where there is a known fault trace, the location of likely future fault rupture can be predicted with some degree of confidence within a relatively narrow corridor either side the fault trace. Because of this, and because most active fault traces in Canterbury are in sparsely populated mountainous areas, fault rupture hazard is relatively simple to avoid compared with other natural hazards.

- 8.9 The reasons and explanation go on to provide that active fault traces, and the areas immediately adjacent to them, should be avoided at the time of development of an area. However, in some cases, the level of activity of the fault is low enough that the risk to development is acceptable. This policy promotes a risk-based approach whereby zones of fault rupture hazard are identified within which site-specific investigations are required, and development within those zones is managed according to the nature of faulting, the activity of the fault (how often it is thought to move) and the type of building proposed for the site.
- 8.10 Policy 11.3.5 addresses general risk management stating that for natural hazards and/or areas not addressed by Policies 11.3.1, 11.3.2, and 11.3.3, subdivision, use or development of land shall be avoided if the risk from natural hazards is unacceptable. It goes on to say that when determining whether risk is unacceptable, the following matters will be considered:
- (1) the likelihood of the natural hazard event; and
 - (2) the potential consequence of the natural hazard event for: people and communities, property and infrastructure and the environment, and the emergency response organisations.
- 8.11 Where there is uncertainty in the likelihood or consequences of a natural hazard event, the policy states that the local authority shall adopt a precautionary approach. Formal risk management techniques should be used, such as the Risk Management Standard (AS/NZS ISO 31000:2009) or the Structural Design Action Standard (AS/NZS 1170.0:2002).
- 8.12 Provisions associated with air quality which have relevance in terms of the potential effects of dust are Objectives 14.2.1 and 14.2.2 which seek to maintain ambient air quality and enable the discharge of contaminants into air provided there are no significant localised adverse effects on social, cultural and amenity values, fauna and flora and other natural and physical resources.
- 8.13 Policy 14.3.3 requires the setting of standards, conditions and terms for discharges of contaminants to avoid, remedy or mitigate localised adverse effects on air quality, while Policy 14.3.5 relates to the proximity of discharges to air to sensitive land-uses where such activities are to be located at distance unless the adverse effects of the discharge can be avoided or mitigated.
- 8.14 Also relevant are the hazardous substances provisions contained in:
- (a) Objective 18.2.1, which recognises the need for the use of hazardous substances while ensuring the any potential adverse effects are avoided or mitigated;
 - (b) Objective 18.2.2, which seeks the avoidance of the contamination of land; and

- (c) Policy 18.3.2 which requires the avoidance, remedying or mitigation of adverse effects.
- 8.15 Other provisions of relevance in the RPS relate to support for primary production and water quality and quantity, and are as follows:
- (a) Objective 5.2.1 which encourages that development is located and designed so that it functions in a way that enables rural activities that support the rural environment including primary production and associated Policy 5.3.12 which seeks to maintain and enhance natural and physical resources contributing to Canterbury's overall rural productive economy in areas which are valued for existing or foreseeable future primary production.
 - (b) Objective 7.2.1 refers to the sustainable management of freshwater, while Objective 7.2.2 promotes that the abstraction of water and the development of water infrastructure occurs in parallel with improvements in the efficiency with which water is allocated for abstraction, the way it is abstracted and conveyed, and its application or use. Objective 7.2.4 seeks that fresh water is sustainably managed in an integrated way.
 - (c) Associated Policy 7.3.6 requires maintaining minimum water quality, Policy 7.3.8 promotes improved efficiency in the allocation and use of fresh water by amongst other things recognising the importance of reliability in supply for irrigation; and Policy 7.3.10 recognises the potential benefits of harvesting and storing surface water for improving the reliability of irrigation water and therefore efficiency of use.
 - (d) Finally Policy 9.3.1 requires the protection of identified areas of significant indigenous biodiversity value.

Regional Plans

- 8.16 The Canterbury Natural Resources Regional Plan (NRRP) and the Proposed Canterbury Land and Water Regional Plan (pLWRP) are both relevant to the application. We accept that the water provisions of the NRRP retain relevance due to appeals to the High Court on the pLWRP however we agree with Ms Buttimore, planning consultant for WIL, that the weight we should afford to those provisions is limited due the stage the pLWRP has reached.

Canterbury Natural Resources Regional Plan (NRRP)

- 8.17 The relevant provision of the NRRP in relation to dam safety is Policy WQN3(3) which refers to the matters to be considered when accessing resource consents for the damming of water and/or setting operating and level regimes for natural or artificial lakes and includes (f) the management required to avoid the risk of dam failure or slips and to avoid, remedy or mitigate the effects of flooding and any other hazards during construction or operation.
- 8.18 In terms of air discharge Objective AQL1 requires localised contaminant discharges not to result in significant adverse effects on the environment, while Policy AQL6 requires that discharges of dust shall not be corrosive, noxious, dangerous, objectionable, or offensive to the extent that it has or is likely to cause an adverse effect on the environment beyond the boundary of the site where the discharge originates.

- 8.19 In relation to surface water quality and hazardous substances Objective WQL1 establishes water quality outcomes for rivers and lakes. Associated Policy WQL2 controls the effects on water quality caused by a change to the flow of a river, while Policy WQL3 promotes the prevention of the discharge of contaminants to surface water and Policy WQL9 requires the prevention of hazardous contaminants entering groundwater.
- 8.20 Groundwater is addressed in Objective WQL2 which establishes water quality outcomes, and Policies WQL8, WQL11 and WQL 13 which require consideration of the effects on ground water quality from point source discharges onto or into land; the avoidance of groundwater contamination via excavations; and the protection of groundwater drinking supplies.

Proposed Canterbury Land and Water Regional Plan (pLWRP)

- 8.21 The pLWRP contains Objective 3.3 which refers to regionally significant infrastructure being enabled, resilient and positively contributing to economic, cultural and social wellbeing through its efficient and effective operation; Objective 3.4 which promotes a regional network of water storage and distribution facilities for sustainable, efficient and multiple use of water; Objective 3.11 which recognises water as an enabler of the economic and social wellbeing of the region; and Objective 3.21 which seeks that the diversion of water, erection, placement or failure of structures, the removal of gravel or other alteration of the bed of a lake or river or the removal of vegetation or natural defences against water does not exacerbate the risk of flooding or erosion of land or damage to structures.
- 8.22 Policy 4.48 is of particular relevance requiring that any dam or infrastructure for the storage of water is sited, designed, constructed and operated to minimise any risk of overspill, leakage, slips or other dam failure, provides for the diversion of floodwaters, and any associated risk of inundation or other adverse effects on people, communities or their property. Policy 4.96 is also of some relevance requiring that the consequential effects of seismic activity are recognised and timely and appropriate responses to such activity are facilitated.
- 8.23 In terms of surface water quality Objective 3.24 seeks that all activities operate at "good environmental practice" or better to optimise efficient resource use and protect the region's fresh water resources from quality and quantity degradation. Policy 4.3 refers to the management of surface water bodies and surface water quality so that they remain suitable for amongst other things recreation or human and animal drinking water use. Policy 4.17 refers to the management of stormwater run-off volumes, while Policy 4.18 seeks the avoidance of discharges of sediment and other contaminants to surface water from earthworks works and if this is not achievable, the best practicable option is used to minimise the discharge to water.
- 8.24 The relevant groundwater provisions are Policies 4.4, 4.19 and 4.23 which require the management of groundwater so that the overall water quality in aquifers does not decline; the avoidance or minimisation of the discharge of contaminants to groundwater from earthworks or excavation by ensuring that: activities are sited, designed and managed to avoid the contamination of groundwater; and the protection of drinking-water supplies from any discharge of contaminants.
- 8.25 In relation to hazardous substances Policy 4.25 requires that activities involving the use, storage or discharge of hazardous substances will be undertaken using the best practicable option to:

- (a) as a first priority, avoid the discharge (including accidental spillage) of hazardous substances onto land or into water, including reticulated stormwater systems; and
 - (b) as a second priority, to ensure, where there is a residual risk of a discharge of hazardous substances including any accidental spillage, it is contained on-site and does not enter surface water bodies, groundwater or stormwater systems.
- 8.26 In terms of cultural values Objective 3.1 seeks that land and water are managed as integrated natural resources to recognise and enable the relationship of Ngāi Tahu and their culture, and traditions, customary uses and relationships with land and water.

District Plans

- 8.27 The following Waimakariri District Plan provisions are relevant to this application.
- 8.28 In relation to the risk element Objective 8.1.1 relates to the community's understanding of natural hazards and its behaviour prior to, during, and after natural events avoids or mitigates natural hazards to an accepted level. Associated Policy 8.1.1.1 requires the provision of information to enable people to take appropriate precautions in relation to natural events. Policy 8.1.1.2 requires specific consideration to be given to the consequences when emergencies or disasters actually occur and ways to maximise personal safety and minimise material loss.
- 8.29 Also of relevance in the risk area are Objective 11.1.1 which promotes utilities that maintain or enhance the community's social, economic and cultural wellbeing, and its health and safety and associated Policy 11.1.1.1 states that a utility should, amongst other things, contribute to a safe environment; maintain or enhance public health; promote efficient use of resources and efficient development of the utility, so that resources are conserved and used in a sustainable manner; and maintain and enhance social wellbeing.
- 8.30 The landscape provisions seek to maintain and enhance the life supporting capacity of the land resource (Objective 4.1.1) and require that land use activities avoid, remedy, or mitigate adverse effects on environments susceptible to degradation such areas of significant indigenous vegetation (Policy 4.1.1.3). Objective 6.1.1 is more specific in seeking to safeguard indigenous biological diversity and ecosystem integrity, and recognise and provide for the protection of significant indigenous vegetation and significant habitats of indigenous fauna. Associated Policy 6.1.1.4 is to avoid or remedy adverse effects of activities on the ecological integrity of areas of significant indigenous vegetation.
- 8.31 From an amenity perspective Objective 12.1.1 seeks the maintenance of amenity values and the quality of environment, the protection of people's health, safety, and wellbeing, and an assurance that any potential adverse environmental effects from buildings and structures, noise and hazardous substances are avoided or mitigated. Objective 12.1.2 is also of some relevance in seeking the establishment of activities in the Rural Zones in a way which gives consideration to existing activities while maintaining a quality environment appropriate for the zone. Policy 14.1.1.3 requires the maintenance and enhancement of environmental qualities such as air and noise levels that contribute to the distinctive character of the Rural Zones, consistent with a rural working environment.

- 8.32 Specifically related to dust Objective 12.1.3 seeks to protect people, vegetation, animals, and other natural and physical resources, from the adverse effects resulting from the discharge of contaminants to air. While Policy 12.1.3.1 requires the activities that lead to the discharge of contaminants to air to locate so that any adverse effects on people, vegetation, animals, are avoided, or mitigated.
- 8.33 Specifically in terms of noise Policies 12.1.1.7 and 12.1.1.8 require the control of noise to a level that is not unreasonable, measured against the character and circumstances of the zone and the avoidance of noise adversely affecting the amenity values and health and safety of people on neighbouring sites or zones.
- 8.34 Relevant transport provisions relate to having access that provides for safe entry and exit for vehicles to a road without compromising the safety and efficiency of the road or road network (Policy 11.1.1.6) and the provision of on-site parking, loading and turning for vehicles (Policy 11.1.1.7).
- 8.35 Economic provisions relate to maintaining and enhancing rural production (Objective 14.1.1) and associated Policy 14.1.1.2 which promotes the continued domination of the Rural Zones by intensive and extensive agricultural, pastoral and horticultural land use activities.
- 8.36 Cultural provisions in the District Plan of relevance are Objective 2.1.1 which seeks effective and appropriate processes and practices that acknowledge the status of tangata whenua as a treaty partner and take into account the principles of the Treaty of Waitangi (Te Tiriti o Waitangi) and associated Policy 2.1.1.2 which requires the provision for participation of tangata whenua in the management of the District's natural and physical resources.

Other relevant matters

- 8.37 Whilst the following have no statutory weight under the RMA, we consider them to be relevant to this application:
- (a) the Canterbury Water Management Strategy (CWMS);
 - (b) the Waimakariri Implementation Program (WIP); and
 - (c) Iwi Management Plans (IMP).

9 STATUS OF THE ACTIVITIES

- 9.1 There was general agreement amongst the witnesses that the land use consent required from Waimakariri District Council was a fully discretionary activity under the Waimakariri District Plan. Consent was required in terms of the scale of earthworks, the size, coverage and location of the dam structure (considered to be a utility) and the parking provision. Non-compliance with Rules 31.1.1.10 (structure coverage) and 31.1.1.14 (setback from roads and internal boundaries) render the proposed storage ponds a discretionary activity.
- 9.2 The proposal requires various consents under the Regional Plans for land excavation, deposition of material, storage of hazardous substances, damming of water outside a stream bed, the discharge of contaminants to land and the discharge of contaminants to air. These were a mixture of controlled, restricted discretionary, discretionary and in the case of the use and storage of hazardous substances under the NRRP (Rule WQL38A) a non-complying activity. Both Ms Blyth and Ms Buttermore had bundled all these applications together and assessed them as a non-complying activity.

- 9.3 In legal submissions at the hearing, Counsel for WIL Ms Appleyard submitted that it should only be the storage of hazardous substances that should be assessed as a non-complying activity. She said that the starting position was *Locke v Avon Motor Lodge*¹ where it was held that where multiple consents are required, the most stringent classification applies to every aspect of the proposed storage ponds. However, the Environment Court in *Southpark Corporation Limited v Auckland City Council*² added three exceptions to Locke at paragraph 15 as follows:

*"... while the Locke approach remains generally applicable, so a consent authority can consider a proposal in the round, not split artificially into pieces, that approach is not appropriate where: (a) one of the consents is classified as a controlled activity or a restricted discretionary activity; and (b) the scope of the consent authority's discretionary judgment in respect of one of the consents required is relatively restricted or confined, rather than covering a broad range of factors; and (c) **the effects of exercising the two consents would not overlap or have consequential or flow-on effects on matters to be considered on the other application, but are distinct.**"*

- 9.4 Ms Appleyard said that only (c) was relevant in this case. She submitted that all the resource consents applied for have the obvious connection in that they are necessary to allow for the proposed storage ponds. However when divided into individual components it was her submission that it would be a "*significant stretch*", for example, that activities associated with the earthworks and the construction of the embankments were connected with the storage of fuel. She said it might be possible (although practically difficult) for fuel to be stored off site. She said put simply there was a disconnect between the construction of the proposed storage ponds and the storage of fuel – and that each was quite separate from an effects perspective and could therefore be unbundled.
- 9.5 Mr Chapman Counsel for ECESS said that the regional consents could not be exercised independent of one another and must therefore be bundled and treated as non-complying in accordance with the relevant case law. In relation to the South Park Corp Ltd case he submitted that the three factors ((a) – (c)) were cumulative and must all be met.
- 9.6 We note first that Ms Appleyard did not refer to the land use consent from Waimakariri District Council as potentially being part of the bundle and it was clear that in his s 42A report Mr McCallum-Clark's assessment had been based on a discretionary rather than non-complying status. Mr Chapman did not pursue this either indicating that ECESS supported the District Council's assessment. We therefore do not consider that this land use consent would form part of any bundle of consents for the purpose of determining status and stands on its own as a discretionary activity (unrestricted).
- 9.7 We do note, however, there are cases where the Environment Court³ when considering a proposal involving obtaining a range of consents, has considered and granted separate consents for activities with differing status.
- 9.8 There have also been cases before the Environment Court⁴ where the Court declined to separate components of the proposed storage ponds on the basis of

¹ (1973) 4 NZTPA (SC).

² [2001] NZRMA 350.

³ *Lake Edge Holdings v Taupo DC* A053/05.

⁴ *Tairua Marine Limited* [2011] NZ EnvC 218.

different activity classifications. The reason the Court adopted that approach was that the non-complying activity lay at the heart of the proposed storage ponds.

- 9.9 In this case, it is our view that the non-complying activity - which is to do with hazardous substance storage - does not lie, as it were, at the heart of this proposal. We are therefore satisfied that it is appropriate to follow the approach adopted by planning witnesses and legal counsel relating to this particular point.
- 9.10 Turning to the bundling of the regional consents we have given some thought to this issue and found it difficult to separate the consents out from each other in this instance. In particular the storage of hazardous substances (the non-complying activity) would seem to us to be an integral part of the activity to construct the ponds. We consider it highly unlikely that the type of machinery used to construct the ponds would be taken offsite for refuelling and/or servicing and that onsite storage of hazardous substances would in the circumstances be virtually essential to the construction of the ponds in an efficient manner. We therefore do not consider that any of the tests of the South Park Corp Ltd case are met and that the regional consents should remain bundled and treated as non-complying activities.

10 STATUTORY CONSIDERATIONS

Building Act 2004

- 10.1 There is some overlap in the assessment of the application between the Building Act and the Resource Management Act (RMA). The dam structures for this proposal meet the definition of a dam in s 7 of the Building Act 2004. Given the size of the proposed structure (over 4 m high embankments) and the volume of water to be held (greater than 20,000 m³), the structure meets the definition of a "large dam" under s 7 of the Building Act.
- 10.2 WIL sought and was granted a building consent (BCA122892) for the proposed storage ponds subject to these limitations: to construct two storage ponds using earth embankments that range in height from 4.5 m to 12.5 m, with a stored volume of water for the ponds of 2.0 million m³ and 6.2 million m³ respectively.
- 10.3 Building consent was issued by CRC on 10 September 2013. We note that there are some risks to WIL in having the building consent first, in that if any resource consent granted limits design or requires modifications to the structures, this may conflict with the granted building consent.
- 10.4 Mr Chapman for ECESS made submissions to the effect that the existence of the building consent and the assessment undertaken under that Act cannot replace an RMA assessment. We agree with him, but we also accept what Ms Appleyard had to say about the interrelationship of the Building Act and its processes and the RMA. We consider the building consent is relevant and the fact that it has been granted to WIL has been taken into account. We accept for the purpose of the Building Act detailed assessments have been provided that deal with dam safety. However, the evidence we received from ECESS challenged those assessments.
- 10.5 We also agree that reliance on the Building (Dam Safety) Regulations 2008 and the NZSOLD Guidelines is a legitimate and orthodox means of achieving the safety aspects of Part 2 RMA. We also accept that references to the Building Act process and the assessment undertaken under it are also an appropriate and orthodox approach to addressing risk in the context of Part 2 RMA.

- 10.6 However, this position has to be tempered with the fact that here, in the context of this hearing, we have received and we need to evaluate evidence that directly challenges some of the underpinning assumptions made in support of the building consent.
- 10.7 So we are taking into account the existence of the building consent and acknowledge and accept that the statutory regime under which that consent has been issued addresses and provides for matters relating to safety. However, we still need to address and resolve the challenges raised by the submitters in opposition that primarily allege deficiencies in WIL's underlying assessments of risk.

Resource Management Act - ss 9, 13, 14 and 15 RMA – duties and restrictions

- 10.8 Part 3 RMA sets out duties and restrictions on activities, including the following sections that are particularly relevant to these applications:
- (a) s 9 – restrictions on the use of land that contravenes a regional rule.
 - (b) s 14 – restrictions on the damming, diverting, taking, and using of water. This includes activities such as taking water from rivers and lakes for use in irrigation.
 - (c) s 15 – restrictions on the discharge of contaminants into the environment. This includes activities such as discharging surplus irrigation water back into rivers and lakes.
- 10.9 The general principle under all of the above sections is that consent is required for these activities unless the activity is expressly permitted by a relevant regional plan or valid resource consent⁵. The activities that are the subject of these applications do not meet these exceptions and resource consent is therefore required pursuant to ss 9, 14 and 15 of the RMA.

Sections 104, 104B and 104D RMA – consideration of applications

- 10.10 Section 104(1) of the RMA sets out the matters we must have regard to in our consideration of the applications. The relevant matters are as follows:
- "(a) any actual and potential effects on the environment of allowing the activity; and*
 - (b) any relevant provisions of –*
 - (i) a national environmental standard:*
 - (ii) other regulations:*
 - (iii) a national policy statement:*
 - (ii) a New Zealand coastal policy statement:*
 - (iii) a regional policy statement or proposed regional policy statement:*

⁵ There are some exceptions to this, such as taking water for stock water and domestic use under s14(3)(b). The issue of stockwater is discussed later in this decision under the heading "Issues for Part B decisions".

- (iv) *a plan or proposed plan; and*
- (c) *any other matter the consent authority considers relevant and reasonably necessary to determine the application.*

10.11 The balance of s104 RMA contains a range of other matters that may also be relevant to our consideration, including the following (among others).

- (a) s 104(2) – Provides us with the discretion to disregard an adverse effect on the environment if the plan permits an activity with that effect (the permitted baseline).
- (b) ss 104(6) and (7) – Provides that we may decline a consent on the grounds of inadequate information, taking into account any requests for further information that have been made.

10.12 We note s 104(1) of the RMA provides that the matters therein listed are subject to Part 2 RMA, which includes ss 5 through to 8 inclusive. We consider Part 2 RMA matters subsequently. These sections apply then for a discretionary activity.

10.13 For non-complying activities, the same requirements of s104(1) apply. In addition, s 104D of the RMA contains particular restrictions for non-complying activities and provides:

- "(1) *Despite any decision made for the purpose of [section 95A(2)(a) in relation to adverse effects], a consent authority may grant a resource consent for a Non-Complying Activity only if it is satisfied that either –*
 - (a) *the adverse effects of the activity on the environment (other than any effect to which [section 104(3)(a)(ii)] applies) will be minor; or*
 - (b) *the application is for an activity that will not be contrary to the objectives and policies of –*
 - (i) *the relevant plan, if there is a plan but no proposed plan in respect of the activity; or*
 - (ii) *the relevant proposed plan, if there is a proposed plan but no relevant plan in respect of the activity; or*
 - (iii) *both the relevant plan and the relevant proposed plan, if there is both a plan and proposed plan in respect of the activity.*
- (2) *To avoid doubt, section 104(2) applies to the determination of an application for a Non-Complying Activity."*

10.14 In considering whether an effect on the environment is "*minor*", minor means lesser or comparatively small in size or importance and the judgment is to be made considering the adverse effects as a whole. In relation to the second jurisdictional hurdle, the word contrary is given a meaning of more than just non-complying, but opposed to in nature, different to, or opposite, We are required to consider whether the proposed activity would be contrary (in that sense) to the objectives and policies of the plan in an overall consideration of the purpose and scheme of the plan.

10.15 Based on the above, the process we will follow when considering a non-complying activity is to:

- (a) identify the relevant s 104 matters;
- (b) consider whether the jurisdictional hurdles in s 104D are met having regard to the relevant and rejecting irrelevant matters under s 104; and
- (c) if either one of the jurisdictional hurdles is passed, weigh the relevant matters under s 104 and Part 2 as part of the overall discretion whether or not to grant consent under s 104B.

10.16 In accordance with s 104B, after considering such applications, we may grant or decline consent. We must exercise that discretion having proper regard to the purpose of the RMA, which requires a balancing exercise of the various elements identified in the course of the hearing – particularly under s 104 and Part 2 of the RMA. If we grant the application, we may impose conditions under s 108.

10.17 It is clear from the above that all relevant issues must be considered when deciding whether or not to grant consent. This includes all potential effects on the environment and consideration of the relevant provisions of the various planning instruments discussed further below. Our consideration is not limited by the reason why consent is required (i.e. the particular rule which triggers consent). However, this may be of some relevance in evaluating the significance of the different issues arising from a particular proposal.

Section 105 and Section 107 discharges

10.18 In addition to the matters specified in s104 RMA, for applications for a discharge permit (of which there are two before us) we must also have regard to the following matters under s105(1):

- (a) *The nature of the discharge and the sensitivity of the receiving environment to adverse effects;*
- (b) *WIL's reasons for the proposed choice; and*
- (c) *Any possible alternative methods of discharge, including discharge into any other receiving environments.*

10.19 Under s 107 RMA we cannot grant a discharge permit to do something that would otherwise contravene s 15 RMA by allowing:

- (a) *The discharge of a contaminant or water into water; or*
- (b) *A discharge of a contaminant onto or into land in circumstances that may result in that contaminant ... entering water ... if, after reasonable mixing the contaminant or water discharged... is likely to give rise to all or any of the following effects in the receiving waters;*
- (c) *Production of any conspicuous oil or grease or grease films, scums or flows or floatable or suspended materials;*
- (d) *Any conspicuous change in the colour or visual clarity;*
- (e) *Any emission of objectionable odour;*

- (f) *The rendering of fresh water unsuitable for consumption of farm animals;*
- (g) *Any significant adverse effects on aquatic life.*

10.20 We have had regard to these matters where applicable in this decision.

Part 2 Matters RMA

10.21 Section 104(1) states that our consideration of the applications is subject to Part 2 of the RMA, which covers s 5 through s 8 inclusive. We record that our approach is that ss 6, 7 and 8 RMA contribute to and will inform our evaluation under s 5 RMA.

10.22 The overall purpose of the RMA is "*to promote the sustainable management of natural and physical resources*". In turn, "*sustainable management*" means:

"... managing the use, development, and protection of natural and physical resources in a way, or at a rate, which enables people and communities to provide for their social, economic, and cultural well-being and for their health and safety while –

- (a) *Sustaining the potential of natural and physical resources (excluding minerals) to meet the reasonably foreseeable needs of future generations; and*
- (b) *Safeguarding the life-supporting capacity of air, water, soil and ecosystems; and*
- (c) *Avoiding, remedying, or mitigating any adverse effects of activities on the environment".*

10.23 Section 6 identifies the following matters of national importance that we must "*recognise and provide for*" when making our decision:

- (a) *The preservation of the natural character of the coastal environment (including the coastal marine area), wetlands, and lakes and rivers and their margins, and the protection of them from inappropriate subdivision, use and development.*
- (b) *The protection of outstanding natural features and landscapes from inappropriate subdivision, use and development;*
- (c) *The protection of areas of significant indigenous vegetation and significant habitats of indigenous fauna;*
- (d) *The maintenance and enhancement of public access to and along the coastal marine area, lakes and rivers;*
- (e) *The relationship of Māori and their culture and traditions with their ancestral lands, water, sites, wāhi tapu, and other taonga;*
- (f) *The protection of historic heritage from inappropriate subdivision, use and development.*

10.24 Section 7 lists the following other matters that we shall "*have particular regard to*":

(a) Kaitiakitanga:

(aa) The ethic of stewardship:

(b) The efficient use and development of natural and physical resources:

(ba) The efficiency of the end use of energy:

(c) The maintenance and enhancement of amenity values:

(d) Intrinsic values of ecosystems:

(e) Repealed.

(f) Maintenance and enhancement of the quality of the environment:

(g) Any finite characteristics of natural and physical resources:

(h) The protection of the habitat of trout and salmon:

(i) The effects of climate change:

(j) The benefits to be derived from the use and development of renewable energy.

10.25 Finally, s 8 requires that we shall take into account the principles of the Treaty of Waitangi (Te Tiriti o Waitangi).

10.26 We have carefully considered the purpose and principles of the RMA as part of our evaluation of this proposal and return to the relevant provisions at the end of this decision.

Section 3(f) – effects of low probability but high potential impact

10.27 What we have gleaned from our reading of Environment Court cases when dealing with risk assessments and the standard of proof, particularly under s 3(f) RMA, is that each potential effect raised in the evidence should be assessed qualitatively or, preferably, quantitatively in the light of the principles of the RMA and the objectives and policies of the relevant planning instruments as to probability of occurrence and force of impact.

10.28 This can be 'short-handed' into, firstly, an assessment of the degree of probability of the effect and, secondly, an assessment of the seriousness of the impact.

10.29 We accept that if the embankments are not properly and adequately designed to deal with the effect of a severe earthquake on their integrity and consequent ability to continue to impound the stored water, the consequence of that water flooding the immediate environs would be unquestionably of very high impact. People's lives would be at risk; property would be damaged.

10.30 This leaves us then with the task of assessing degree of probability of the event described above occurring to bring about the very significant adverse effects we describe in the paragraph above.

11 SUBMITTERS IN SUPPORT

- 11.1 Mr Chris Sundstrum, a resident of South Eyre Road, presented his submission to us. Interestingly, he presented a submission that demonstrated a differing approach to a dam breach. He said he was appearing in favour of those who do nothing to pursue support for a proposal. Interestingly, his perspective on a dam breach was he believed it to be safe. He referred to the number of dams built and those dams surviving without affecting life or property, notwithstanding earthquakes. He was satisfied that this proposal should receive consent.
- 11.2 Mr Michael Bennett appeared in support of his submission. He appeared on behalf of the North Canterbury Province of Federated Farmers of New Zealand. That organisation was in support of the proposed storage ponds. He detailed the economic and social benefits of water storage. He directed us to what he considered to the relevant provisions of the pLWRP as they supported this proposal. He was of the view in terms of health and safety issues that they were capable of being addressed and satisfied by this proposal.

12 PRINCIPAL ISSUES IN CONTENTION

- 12.1 There are a number of principal issues arising from WIL's applications, with a number of sub-issues that must be discussed. These are as follows:
- (a) dam failure risk and consequent inundation;
 - (b) effects of the dust discharge
 - (c) effects of construction noise
 - (d) effects on water quality from construction and post-development phases, including surface water and groundwater;
 - (e) effects of fuel storage;
 - (f) effects on landscape amenity and ecology;
 - (g) secondary effects;
 - (h) economic effects;
 - (i) traffic effects; and
 - (j) effects on cultural effects.

13 DAM FAILURE RISK AND CONSEQUENT INUNDATION

- 13.1 The proposal is sited in an area with known potential natural hazards associated with earthquake activity and flooding. This section examines the extent to which these risks may or may not be exacerbated by the proposed storage ponds.
- 13.2 The risks associated with dam failure, and the effects such an event may have on those living within the potential floodplain, were the principal concerns of most of the submitters opposed to construction of the WIL ponds. That this was so came as no surprise to us, particularly in light of the recent seismic activity in Canterbury, and people's increased sensitivity and awareness as a result.
- 13.3 We propose to address these matters firstly by examining the evidence before us

concerning the geology and seismicity of the area, the design of the dam, the risk of failure, and the consequential impacts on those who may be affected by inundation. Next, we will examine the relevant objectives and policies from the various plans as they relate to the issue of dam safety and we finally consider the effects associated with dam safety.

WIL's evidence

- 13.4 We heard from several witnesses on behalf of WIL and also from submitters, who presented detailed and helpful information.
- 13.5 The principal evidence in relation to these matters, on behalf of WIL, was provided by Dr McVerry and Mr Connell.
- 13.6 **Dr Graeme McVerry**, who is a Principal Scientist at the Institute of Geological and Nuclear Sciences Limited (GNS), has over 30 years' experience in estimating seismic hazards. During that time he has been involved in seismic hazard studies for the assessment or design of many dams or water storage ponds. In his evidence he presented an overview of the engineering seismology/natural hazard issues associated with the construction of the WIL storage ponds. This included consideration of the active fault structures and the seismicity of the region, and the implications for seismic hazard.
- 13.7 In his evidence, Dr McVerry told us that there are major fault lines in the foothills and Southern Alps to the west of the Canterbury Plains. He said, for example, the Porters Pass – Amberley Fault Zone, and the Alpine Fault, are capable of generating large (magnitude ≥ 7.5) earthquakes that would impact on the region. In addition, lower-recurrence-rate tectonic structures beneath the plains have the potential to generate high local ground motions.
- 13.8 According to Dr McVerry, a number of NE-SW or E-W trending active tectonic structures have been identified in the area surrounding the Oxford-Darfield region. Although there are no known surface fault traces passing directly through the pond area, thick alluvium can mask evidence of these structures beneath the flat-lying plains, and detailed mapping would be required to confirm the absence of pre-existing traces.
- 13.9 Dr McVerry went on to tell us that there are active source seismic lines to the south of the area and these reveal buried tectonic structures extending from the foothills beneath the plains. The most significant known active feature identified close to the region of interest is the Hororata Fault. He said rupture of the Hororata Fault is inferred to have a low probability of occurrence given the long (though poorly constrained) average recurrence interval of 17,000 years, but it has the potential to produce earthquakes of magnitude $M \sim 7.2$ (according to the National Seismic Hazard Model⁶). This feature and associated structures are inferred to extend into the Oxford-Darfield region crossing the Waimakariri River southeast of Burnt Hill where the anticline has been identified on the northern river bank. The presence of Burnt Hill, which is some 3 km from the proposed WIL pond site, suggests the presence of a nearby fault/fold that has elevated bedrock above the adjacent region, although no such fault has been mapped at the surface.

⁶ Stirling, M.W., McVerry, G.H., Gerstenberger, M.C., Litchfield, N.J., Van Dissen, R.J., Berryman, K.R., Barnes, P., Wallace, L.M., Villamor, P., Langridge, R.M., Lamarche, G., Nodder, S., Reyners, M.E., Bradley, B., Rhoades, D.A., Smith, W.D., Nicol, A., Pettinga, J., Clark, K.J. and Jacobs, K. 2012. National seismic hazard model for New Zealand: 2010 update. Bulletin of the Seismological Society of America, 10(4): 1514-1542.

- 13.10 In his discussion of the seismicity of the region, Dr McVerry said the Oxford-Darfield region lies on the northern fringe of the aftershock zone associated with the 2010 M 7.1 Darfield earthquake.
- 13.11 We include, below, Figure 3 from Dr McVerry's evidence. This shows the seismicity in the region for the time period between 3 September 2010 and January 2012, i.e., following the Darfield earthquake. He noted that seismicity levels in the Oxford region were relatively low in the region prior to the Darfield earthquake. He said the recent intense seismicity near Darfield represents the immediate aftershock activity following the Darfield earthquake, mostly occurring in September-November 2010. That activity extended up to the Waimakariri River, although there was also some activity 7 km south of Oxford township (e.g. an M 4.3 event on 13th June 2011, at 6 km depth). Other activity, at latitude 43.2°S, is occurring near and possibly on the Porters Pass-Amberley Fault Zone.

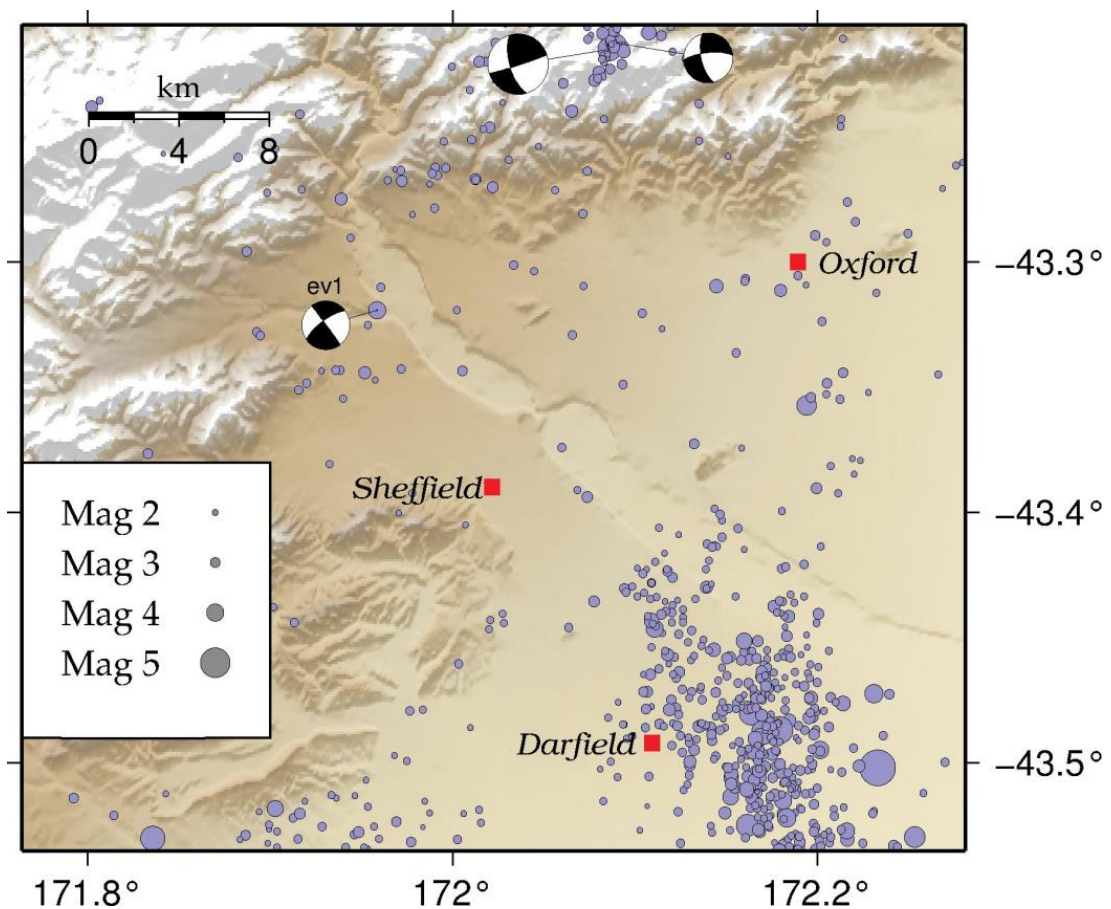


Figure 3: The location of earthquakes in the Oxford area detected by GeoNet between September 2010 and January 2012

- 13.12 Dr McVerry explained to us that Damwatch Services Limited (Damwatch) performed a preliminary seismic analysis for the proposed WIL Ponds using the NZS1170 Class D Deep Soil spectral shapes with the NZS1170 hazard factor for the location of $Z=0.34$. He told us that the hazard factor defines the strength of the spectrum for an annual exceedance probability (AEP) of 1/500.
- 13.13 In NZS1170.5, the spectra for other AEPs are derived by multiplying that for an AEP of 1/500 by return period factors R (the return period in years is the inverse of the AEP). The return period factors R were taken as 0.72, 1.8 and 3.0 for AEPs

of 1/150, 1/2500 and 1/10,000 respectively⁷. These are consistent with the R-factor versus return period curves given in NZS1170.5. The R-factor of 0.72 lies between the NZS1170 values of 0.5 and 0.75 for AEPs of 1/100 and 1/250, the value of 1.8 is directly from NZS1170, while the value of 3.0 is an extrapolation to a lower AEP than the 1/2500 minimum covered by NZS1170.

- 13.14 Dr McVerry went on to say that an AEP of 1/150 corresponds to the requirements of the NZSOLD New Zealand Dam Safety Guidelines (NZSOLD, 2000) for Operating Basis Earthquakes (OBE), an AEP of 1/10,000 to the Maximum Design Earthquake (MDE) motions (if defined probabilistically) for High PIC (Potential Impact Classification) dams. An AEP of 1/2500 is the commonly used value for MDE motions for Medium PIC dams⁸.
- 13.15 Damwatch subsequently requested a seismic hazard study from GNS to account for the enhanced seismicity in the Christchurch region that initiated with the M 7.1 Darfield earthquake on 4 September 2011. Dr McVerry told us that the long-term seismic hazard in the region predicted by the National Seismic Hazard Model⁹, for return periods of less than 2500 years, is dominated by earthquakes on major faults in the foothills and Southern Alps to the west (e.g. Porters Pass Fault, Alpine Fault). These faults typically have shorter recurrence intervals than local faults in the region, although local faults have the potential to generate higher ground accelerations.
- 13.16 Dr McVerry went on to say that, since the Darfield earthquake, revisions to hazard models in the Canterbury region have been necessary to reflect the increased short-term seismicity associated with the Canterbury earthquake sequence, and to account for the time-varying nature of the ongoing earthquake sequence. He said a much larger proportion of the contributions to the hazard estimates calculated from these models are provided by earthquakes of about M 6 or less, rather than by the recognised faults in the region. The results were provided to Damwatch and these included various estimates of peak ground acceleration (PGA).
- 13.17 Dr McVerry then discussed the recommended MDE spectrum. He referred us to two curves, included in Figure 4 of his evidence, that represented modifications to the Deep Soil Spectrum used by Damwatch, based on the New Zealand Standard NZS1170.5. In Figure 5 he compared the recommended MDE spectrum with several scenario spectra for specific earthquakes. We shall not repeat all that he had to say about this except to note his concluding remarks¹⁰ where he said:

The hazard assessments performed by GNS Science for the Waimakariri Irrigation Storage Ponds on behalf of Damwatch used seismicity models that took account of the enhanced seismicity rates in the Canterbury region from the on-going earthquake sequence that began with the 3 September 2010 Darfield earthquake. The adopted spectra and PGAs were based on a conservative approach of equalling or exceeding the values

⁷ Damwatch Services Limited (2012). Waimakariri Irrigation Ponds Design Report. Issue 2. September 2012.

⁸ Mejia, L., Gillon, M., Walker, J. and Newson, T. 2001 Criteria for developing seismic loads for the safety evaluation of dams of two New Zealand owners. Proceedings of New Zealand Society on Large Dams and Australian National Committee on Large Dams (NZSOLD-ANCOLD). 2001 Conference on Dams, Auckland, New Zealand. (Reprinted in NZSOLD Newsletter No.37).

⁹ Stirling, M.W., McVerry, G.H., Gerstenberger, M.C., Litchfield, N.J., Van Dissen, R.J., Berryman, K.R., Barnes, P., Wallace, L.M., Villamor, P., Langridge, R.M., Lamarche, G., Nodder, S., Reyners, M.E., Bradley, B., Rhoades, D.A., Smith, W.D., Nicol, A., Pettinga, J., Clark, K.J. and Jacobs, K. 2012. National seismic hazard model for New Zealand: 2010 update. Bulletin of the Seismological Society of America, 10(4): 1514-1542.

¹⁰ Dr McVerry, EIC at Para 39.

calculated from the alternative Bradley and McVerry ground-motion models for the required AEPs. They also exceed scenario spectra for the closest fault and a magnitude 7.2 earthquake occurring at the site. Consequently, I consider that the earthquake ground-shaking values adopted for the design are robust and conservative.

13.18 We accept Dr McVerry's evidence in these respects.

13.19 We now move on to consider the evidence of **Mr Nigel Connell** on behalf of WIL. Mr Connell is a Senior Engineer at Damwatch and has had some 50 years' experience in design and construction of water resource development projects. He headed the design team for the WIL storage ponds and had previously led the design teams for three other lined-pond projects of similar size.

13.20 Mr Connell, in his evidence, gave a general overview of the proposed storage ponds and addressed the issues surrounding dam safety. This included an overview of dam safety regulations in New Zealand as they relate to dam break analysis. He also discussed the identification and assessment of potential impacts or consequences of dam failure, and questions relating to risk management. General details of the proposed design were also provided and he responded to submitters' concerns.

13.21 Mr Connell explained [at Para 13 *et seq*] how dam design and operation in New Zealand is regulated by the Dam Safety Scheme. He told us the scheme is prescribed under the Building Act (2004) and the Building (Dam Safety) Regulations 2008. The Dam Safety Scheme requires dam owners to register their dams, which will be subject to different requirements according to dam height, reservoir volume, location and potential impact classification (PIC).

13.22 According to Mr Connell, all classifiable dams are required to undergo classification to determine their PIC as low, medium or high – with the classification of a dam reflecting the potential impact a dam failure could have on people, property and the environment. He acknowledged that questions of structural resilience and durability are normally matters that relate more to the building consent process rather than the RMA. However, in this case, these are also relevant to dam safety, which was the main issue of concern to submitters.

13.23 We were told that levels of design, commissioning, operation, maintenance and surveillance are addressed in the NZSOLD Dam Safety Guidelines¹¹ (the Guidelines), which are linked to the Building Act 2004. The Guidelines similarly recognise that dams do impose a risk on society in the areas where they are located and deal with this by classifying dams into a PIC of high, medium or low. These categories are based on the consequences of failure considering the potential threats to life and the socio-economic, and environmental effects resulting from failure. Mr Connell said this only considers the consequences of failure and does not take the probability of occurrence into account. The Guidelines then have a set of minimum procedures that apply to each level of PIC, with the High PIC classification, as in this case, requiring particular rigour in terms of investigations, design, construction, commissioning, operation and maintenance, and a high level of engineering expertise.

13.24 In accordance with the Guidelines, and the Dam Safety Scheme, a dam safety programme will operate for the life of the WIL dam. For High PIC dams this includes: routine surveillance, Annual Safety Reviews and Comprehensive Safety Reviews five yearly, and after incidents such as a significant earthquake.

¹¹ New Zealand Society on Large Dams, 2000, New Zealand Dam Safety Guidelines.

13.25 Mr Connell then discussed measures taken to prevent dam failure. At Para 22 he said:

Design, of particularly the water retaining embankments, utilised failure modes analysis which is an exercise to identify all potential failure mechanisms under; static loading, normal operation water level, flood and earthquake conditions (i.e. all external loading conditions) for dams, to assess those potential failure modes of enough significance to warrant continued awareness and attention to design, construction, visual observation, monitoring and remediation as appropriate.

13.26 Three failure modes have been addressed in the design and detailing of the pond embankments and associated structures:

- embankment failure due to earthquake induced slumping and consequent overtopping of water at locations of reduced embankment crest levels;
- embankment failure due to earthquake induced local deformations and consequent leakage through the damaged geomembrane liner; and
- piping through the embankment or foundation due to leakage through the liner leading to failure, possibly again initiated by earthquake shaking.

13.27 We note that the dam proposal requires that the embankments and the pond floor be fully-lined with a waterproof membrane. This is because the gravels underlying the pond footprint, which will be used to form the embankments, are porous in nature. Mr Connell said the proposed membrane is an artificial high quality material designed to deform and stretch, and this will cover the floor of the ponds and extend to the top of the embankments.

13.28 Among methods to prevent overtopping in the event of extreme rainfall, or due to malfunction of the control system, emergency spillways will be provided to allow the spilling of excess water in a controlled manner.

13.29 Mr Connell told us that the Guidelines require only an assessment of a dam's potential failure consequences, and the probability of dam failure is not required to be calculated. Thus, a numerical risk assessment has not been conducted for the WIL proposal. At Para 33 in his evidence he said:

... in New Zealand, dam safety looks at the consequences of failure, classifies the dam and then requires that the probability of failure of all components of the dam that carry any hazards, are reduced to acceptable levels and thus this reduces the overall risk that the dam poses. The risk of failure of components is further reduced by means of managing intervention that forms part of the surveillance and Dam Safety Assurance Programme. This system of management intervention influences the final outcome in terms of the probability of occurrence and hence the overall system risk.

13.30 He then went on to say, at Para 34 in his evidence:

... in accordance with the Guidelines, dams are assessed for damage during earthquakes. Two levels of earthquake are assessed during classification and design. These are the Operating Basis Earthquake (OBE) and the Maximum Design Earthquake (MDE). After an OBE event the dam must be undamaged or only have minor easily repairable damage that does not threaten the safety of the dam. This is generally an event with a return

period of 150 years (or a 1:150 annual probability). After an MDE event the dam must maintain structural integrity and continue to impound the water. Some damage may occur but must not lead to catastrophic failure. In design of these ponds we designed for aftershocks as well. For a High PIC the MDE earthquake return period is 10,000 years (or an annual probability of 1:10,000) and 2,500 years for a medium PIC dam (annual probability of 1:2,500).

- 13.31 Mr Connell said, in accordance with the Dam Safety Assurance Program (DSAP), which reflects and manages the probability (or risk) of occurrence, the physical processes involved with a potential dam failure need to be examined to see what combination of events must come together for a failure mechanism to develop. He described a chain of events, each of which has its own probability of occurrence and the overall probability of this chain reaction is the product of the probabilities of each step in the chain required for failure to occur. One incident along the chain of events, such as tearing of the pond liner during an earthquake, would not necessarily lead to catastrophic failure given the requirement for further failures, which may or may not occur. In his view, if regard is had to the other steps in the chain reaction necessary for dam failure (a number of which will have low probabilities of occurrence due to the defensive design adopted for the ponds), then the overall risk of failure has a very low probability.
- 13.32 He told us that, based on experience elsewhere, probabilities of a total catastrophic dam failure occurring are less than 1:1,000,000 for High and Medium PIC dams. He concluded that submitters' concerns about the risks associated with the prospect of dam failure arose from a lack of understanding of the risk of dam breach.
- 13.33 Mr Connell then went on to discuss a hypothetical catastrophic failure and the area of inundation that could result. This, in fact, is required as part of the PIC assessment for the dams. He said embankment dams breach from either piping or overtopping failure.
- 13.34 Piping failure occurs when water begins to seep through the dam embankment and internal erosion can cause the seepage channel to enlarge over time to form a 'pipe'. If the pipe continues to grow, it may lead to the collapse of the embankment and release a significant flood. Overtopping failure occurs when the reservoir water level exceeds the dam crest level and overflow erodes the dam body. Overtopping could also occur due to a large settlement of the embankment, caused by a severe earthquake.
- 13.35 Mr Connell presented maps showing the potential inundation areas for four different dam breach scenarios. These were located to show the greatest impact on nearby houses. The flood inundation maps were developed using a two-dimensional computational hydraulic model. Three hazard zones, specified in NSW (2005)¹², based on the depth and the velocity of the flood flow, were calculated for the assumed breaches. Impacts and likelihood for loss of life consequent on the hypothetical breach outflows were then assessed based on the houses located in the different hazard zones.
- 13.36 Mr Connell then discussed various design aspects of the WIL ponds. He said embankments, geomembrane, and inter-pond conduit and outlet structures, are designed for an OBE with a 1:150 annual exceedance probability. This design will avoid catastrophic release of the reservoir under MDE loading. Furthermore,

¹² NSW (2005). Floodplain Development Manual, New South Wales Government Department of Infrastructure, Planning and Natural Resources. April 2005.

alternative flow routes have been created by ensuring that, under extreme rainfall/runoff conditions, inflow to the ponds from the main supply canal is limited by ensuring that the main supply canal berms overtop preferentially by setting them lower than the pond embankment crests. Emergency spillways provide further protection against overfilling and consequent overtopping of the pond embankments.

- 13.37 Mr Connell noted that several submitters had questioned the appropriateness of the geomembrane lining. At Para 52 in his evidence he said:

The design report addresses requirements for the HDPE geomembrane lining in detail - including its physical properties, placement quality assurance, supporting surface, anchorage and ballasting requirements. It also explains that the specified 1.5 mm thick HDPE geomembrane is used extensively for similar applications both in NZ and overseas.

However, when we reviewed the design report, we found that Table 7.1, which referred to the use of geomembranes in large dams elsewhere in the world, showed that HDPE liners had been used in just 16 of the 240 examples. We have no way of knowing how these dams compared to the WIL proposal. We also noted that Table 7.2 in the design report showed that, while HDPE has some advantages in terms of chemical resistance, weld strength and low temperature properties, it suffers from a potential for stress cracking, a high degree of thermal expansion, poor puncture resistance and poor multi-axial strain resistance. Overseas, we understand HDPE membranes are typically covered, which is not the case here.

- 13.38 We were told by Mr Connell that the material from which the embankments would be formed would be excavated from the pond footprint and compacted to form a robust embankment that will perform well if subjected to earthquake shaking. He described the fill material as alluvial outwash sandy gravels with low fines content, which is free draining and not subject to liquefaction. He referred us to Mr Callander's evidence, which indicated that groundwater was probably not less than 20 m below ground level. The foundation, formed from the same materials as the embankment fill, also has low potential for liquefaction.
- 13.39 Mr Connell told us there is extensive favourable experience, particularly in Canterbury and notably in the Upper Waitaki Basin, with dam embankments constructed from and founded on very similar materials. He said that, notably, no dam was damaged in a major way by the recent earthquakes in the Christchurch area.
- 13.40 Mr Connell noted that the corners in the embankment have received special attention as transverse cracks are more likely to form high in the embankments at these locations following earthquake shaking. He said that the geomembrane lining has accordingly been doubled to enhance the ability of the lining to span potential transverse cracks in the upper embankment at corners. He told us that this method had been discussed with Mr JP Giroud, (an international expert on geomembranes) at a recent dam conference in New Zealand. He said Dr Giroud had agreed that similar doubling of geomembrane and geotextile has been used successfully elsewhere.
- 13.41 The proposed WIL storage ponds include a freeboard of 1.3 m to contain the run-up of wind generated waves on the smooth geomembrane surface at the crest of the embankments. Mr Connell told us that this is consistent with accepted international practice for large dams. Although some overtopping can be expected in extreme winds, the crest will be grassed although some maintenance after such events may be required.

Submitters

- 13.42 We turn now to the evidence presented to us by and on behalf of submitters in relation to hazards, and the risks that may arise. In these respects we appreciated the efforts that the Eyre Community Environmental Safety Society (ECESS) went to in providing a co-ordinated response to the application and the helpful evidence that was provided. Here, to begin with, we canvass the evidence provided to us on behalf of ECESS by Mrs Campbell, Mr Hall and Mr Dodds.
- 13.43 **Mrs Jocelyn Campbell** has had a distinguished career, over 40 years, as an academic at the University of Canterbury. Her principal field is in structural geology. She has taught extensively in rock mechanics, engineering geology, regional tectonics, tectonic geomorphology and quaternary geology, among other things. She told us that, relevant to this proposal, is a regional mapping and research programme she instigated on the northern Alpine Fault in the 1980's. This evolved into the Canterbury Active Tectonics Programme in 1989, incorporating and extending this work into a systematic mapping of plate boundary deformation in North Canterbury and across the northern South Island. The objectives of the programme are to identify and map out the actively deforming structures through regional structural and geomorphic mapping supported by some geophysics. This has led to a wide-ranging output in regional tectonic analysis, detailed site investigations of active faults, and paleoseismology¹³.
- 13.44 In the main, Mrs Campbell's evidence referred to and summarised the essential points from her report entitled: *A Review of the Uncertainties in Assessing the Impact of Regional Seismicity at the WIL Site*, dated 28th May 2014. The objective of this report was to evaluate the uncertainties in assessing the probable level of seismicity that may be expected to impact the site of the WIL ponds and wider associated structures.
- 13.45 By way of background, Mrs Campbell told us that her report:
- ... reviews the limited knowledge of the geological setting of the WIL pond site which lies in close proximity to a number of active faults that converge on the area. It appears to be located on the northern extension of the Hororata Fault Zone, a complex fault system that projects across the Waimakariri River from the Harper Hills range front. Other active faults converge on the Hororata Fault in this general area and can be expected to interact with it, replicating the style of complex faulting and seismic activity highlighted in the recent 2010 Canterbury Earthquake Sequence. Given the vulnerability of this site to potential activity on this interconnected fault system and the downstream consequences of catastrophic failure, the quality of the input data and application of the lessons learned from the recent earthquakes needs to be critically reviewed.*¹⁴
- 13.46 Mrs Campbell said that the particular style of tectonic processes operating in the Canterbury region had, during recent earthquake activity, led to a combination of synchronous fault activity that created ground displacements and combined magnitude earthquakes larger than expected by conventional predictions based on the length of single faults. Peak ground accelerations varied widely within the near-source field, and of particular concern are the localised, exceptionally strong vertical accelerations in excess of 1 g, coinciding with fault intersections.

¹³ J Campbell, EIC, Para 5

¹⁴ J. Campbell, EIC, Para 12

- 13.47 Mrs Campbell claimed, in her evidence¹⁵, that while WIL had followed recommended standard procedures, based on NZS 1170.5, 2004, the input data that had been used is unreliable. She maintained that the procedures used by WIL were too simplistic to deal adequately with the diversity of tectonic styles in this country, making it difficult to standardise a nationwide methodology. The recent earthquake activity in Canterbury had reinforced this view.
- 13.48 Mrs Campbell then discussed the three stages leading to evaluation of a built structure, such as the pond embankments, in terms of its performance under seismic load. The first step, she said, is the characterisation of known active faults likely to produce significant shaking at the site and should include details of the fault size and geometry, sense of slip, an estimate of the magnitude of the probable Maximum Credible Earthquake (MCE) it could produce, the likely displacement, the long term cumulative slip rate and the average recurrence interval¹⁶. In the absence of any other information the MCE assumes that the full length and depth of an established fault plane ruptures.
- 13.49 The second step requires the effective Peak Ground Acceleration (PGA) to be determined from knowledge of the subsurface structure. Mrs Campbell said that, for most engineering purposes, only the horizontal component of PGA is used as a measure of the shear forces acting on the base of the structure, and this is incorporated into the analysis of predicted performance. She then discussed the standard procedures in terms of various spectra. We shall not repeat all that she said here except to note that she considered the Damwatch report to be ambiguous in stating that a near fault factor of M 7.2 for the Hororata Fault has been incorporated into calculation of the PGA, although the derivation of the basic MDE of M 0.69 is without reference to any inclusion of the near fault factor and is used in the settlement calculations.
- 13.50 Mrs Campbell said that it should be noted that analysis of the ground motion records of both the 2010 Darfield and 2011 Christchurch earthquakes has shown that there are some fundamental differences between the observed averaged normalised spectral response and the standardised curves of NZS1170.5. In particular, she said the hierarchy of the soil response is found to be the opposite to the standard curves, where stiffer soils amplify the spectral accelerations more than soft soils in the same period range. In essence, she said what this means is that, even where the calculations have conformed to standard practice in designing to code specifications, there is now uncertainty as to the adequacy of the current practice to represent the reality of local conditions¹⁷.
- 13.51 According to Mrs Campbell, neither the analysis provided by Dr McVerry nor the application documents address the question of vertical PGA. She reminded us that the Canterbury earthquakes were notable for the local high vertical accelerations, and high vertical to horizontal ratios above the default NZS 1170.5 factor for the vertical component of PGA as 0.7 of the horizontal value.
- 13.52 The third stage is that the crucial parameters derived from the above procedure becomes the basis for estimating the probability of damage both by the OBE and MDE. Mrs Campbell said¹⁸:

In the case of gravity earth dams shaking-induced damage will include potential failure of an embankment slope, but most commonly subsidence of the crest, tension cracking both transverse and longitudinally on the

¹⁵ J. Campbell, EIC Para 14.

¹⁶ J. Campbell, EIC, Para 18.

¹⁷ J. Campbell, EIC, Para 23.

¹⁸ J. Campbell, EIC, Para 26.

crest, and at the interface between concrete or steel ancillary structures and the earth dam fill.

- 13.53 Mrs Campbell then went on to voice her concerns about what she considered were significant gaps in WIL's evidence. She said the occurrence of local strong vertical accelerations in both the 2010 Darfield and 2011 Christchurch earthquakes raises significant questions and, in particular, the effect of strong >1 g vertical acceleration during the first main shock, together with continual aftershocks, on the effective shear strength of the embankments.
- 13.54 Mrs Campbell confirmed that, in common with international practice, GNS is setting up a national Probabilistic Seismic Hazard Model (PSHM) that provides a first order measure of the distribution of the likelihood of seismically induced ground motion. We were given to understand that GNS is currently building a database of recognised on-land and offshore active faults, allocating and updating the list of properties outlined above, but these vary widely in completeness and quality of the data. We were told that, locally, the maps and time-dependant Z value¹⁹ for the immediate Christchurch area have been modified by GNS (Letter Report 2012/141R) to allow for the influence of on-going aftershocks expected to be lower than M 6.0 but above "normal" background frequency for up to 50 years, and that this update has been utilized by Damwatch in their analysis of embankment performance.
- 13.55 Notwithstanding the above, Mrs Campbell felt that the presence of potentially M>7 faults in the immediate vicinity must also be taken into account. At Para 32 in her evidence she said consideration must also be given to the location of the site in terms of its relationship to the nearby faults and subsurface geology. According to NZS 1170.5, this includes:

... directivity and polarisation effects related to propagation from a moving rupture; "fault-fling" i.e. the growth of the permanent displacement associated with the fault offset; hanging wall effects associated with dip-slip faults; large vertical accelerations, with near-source vertical spectra often exceeding the horizontal spectra at short periods; and trapping of energy when the faulting penetrates into lower-velocity surface layers. These features are responsible for large variations in ground shaking for equivalent ground conditions and distance from the fault.

- 13.56 Ms Campbell went on to say²⁰:

Examples of all these effects have been featured in the recent earthquake sequence and from the little we know of the locations and three dimensional geometry of the WIL pond site, most of these are factors that are pertinent to the setting. They are not mentioned in the documentation.

- 13.57 In her view, an understanding of the geological setting of the site with respect to the location and geometry of the fault zone, the characteristic thicknesses, dip, and shear wave velocities of the underlying sediments, is critical to the estimation of the seismic hazard assessment at the WIL pond site. To achieve this, Mrs Campbell considered it is necessary to review the geometry and history of the nearby faults likely to affect the site and to determine what information is available to understand how slip may be distributed, and what evidence there is for paleoseismic events and the general level of activity.

- 13.58 In her description of the geological structural setting of the WIL site²¹, Mrs

¹⁹ Z is the regional seismic hazard factor (0.34 at the WIL site)

²⁰ J. Campbell, EIC, Para 32

Campbell said some form of the Hororata Fault Zone extends into the WIL site area, and was partially activated during the recent earthquakes. Appended to Mrs Campbell's evidence was an extensive report²² that evaluated the uncertainties in assessing the probable level of seismicity that may be expected to impact on the WIL site. We were left in no doubt that she considered the prospect of further faulting in the vicinity of the WIL site was a matter that should not be ignored. In her view, while it would be possible to improve on the knowledge of the subsurface geology of the general setting of the pond and intake canal site using a range of possible methods, reliable data on magnitudes and recurrence intervals of the surrounding major fault systems is far more long term and are presently constrained by the methods currently available.

- 13.59 Mrs Campbell said that the most active fault systems within the proximity of the WIL fault are the Porters Pass Fault crossing the Torlesse Range and the major range front faults. She noted that WIL regarded these faults as being sufficiently distant that attenuation of the seismic wave energy will make seriously damaging shaking unlikely²³. She noted that there appears to have been an increasing level of activity along the range front meaning that averaged long-term recurrence intervals may not be indicative of the current frequency. She said the possibility that a Porters Pass Fault rupture may initiate a cycle of activation of the faults closer to the WIL site should be considered.

- 13.60 In her summary, at the conclusion of her evidence, Mrs Campbell noted²⁴ that:

Seismic risk at the WIL pond site appears to have been underestimated with respect to the probability of potentially damaging shaking and to fulfil the requirements of High PIC performance.

and

Additionally, the assumed level of activity on the associated and nearby faults is ambiguous in the published data and generally appears to be underestimated.

- 13.61 In her concluding remarks, Mrs Campbell told us that the recent seismic activity in the Canterbury region had departed from predictions and, thus, obtaining reliable input data to use in the stability analysis is very difficult. She said there is no indication that any form of sensitivity analysis has been undertaken with regard to acceptable tolerance to possible variance in the input values. In her view²⁵, assumptions of up to M 7.2 as quoted for the Hororata Fault may not return an adequate estimate of effective peak ground acceleration to satisfy a High PIC rating. She was also concerned that the stability analyses of the pond embankment considered horizontal accelerations only whereas she believed the synchronous strong vertical acceleration should also have been addressed.

- 13.62 We shall return to Mrs Campbell's evidence later. We now canvass what **Mr Robert Hall** had to say on these matters. We note Mr Hall's civil engineering qualifications and that, since 1995 when he established R J Hall Civil & Environmental Consulting Ltd., he has been practicing as a consulting engineer in the area of water and soil engineering where he has had some 35 years' experience. Prior to 1995, Mr Hall was employed as a civil engineer by a number

²¹ J. Campbell, EIC, Para 35 et seq.

²² Campbell, J (2014): *A review of the uncertainties in assessing the impact of regional seismicity at the WIL site*. A report prepared for the Eyre Community Safety Society (ECESS), Unpub. 3 June 2014.

²³ J. Campbell, EIC, Para 46.

²⁴ J. Campbell, EIC, Para 52.

²⁵ J. Campbell, EIC, Para 56.

of catchment authorities in various parts of New Zealand. Mr Hall told us that he has had some 38 years' experience in the design of earth-dams in New Zealand, including the investigation, design and construction of a number of flood retention structures and dams that were primarily for the storage of irrigation water comprising both conventional structures and ring dams.

- 13.63 In his evidence, Mr Hall commented on various aspects of the proposed WIL ponds and the implications of Mrs Campbell's evidence in respect of the seismic design of the pond embankments and the proposed synthetic liner. He also referred to the adequacy of the information provided by WIL in respect of flooding and erosion hazards associated with dam break assessments.
- 13.64 Mr Hall reminded us of the dam design requirements and the process leading to the appropriate PIC classification. He considered that all parts of the dam should be designed to completely satisfy the higher standards required for the High PIC classification. In these respects, we understood from WIL's evidence that this is now the case.
- 13.65 Mr Hall noted²⁶ that the seismic design, undertaken by Damwatch, relied on information provided by GNS and that this considered only horizontal accelerations. In the absence of advice regarding estimated vertical accelerations, Clause 3.2 of NZS 1170.5 would normally be used to determine the maximum vertical acceleration at the site and this is defined as 70% of the maximum horizontal acceleration. He considered that, in light of Mrs Campbell's contention that the vertical accelerations are likely to be higher (and potentially considerably higher) than the horizontal accelerations at this site, the failure of WIL to consider this has significant implications for the adequacy of the dam design.
- 13.66 Apart from the prospect of structural failure of the embankments, Mr Hall said that strong vertical accelerations have the potential to rupture the lining at the junctions where the concrete structures are embedded in the fill. In his view, response of the dam to vertical accelerations could thus result in a catastrophic release of stored water, or the threat of release of stored water.
- 13.67 Mr Hall then went on to discuss Mrs Campbell's evidence and the doubts he considered this placed on the reliability of the GNS seismic information provided for the WIL site, in particular the evidence regarding the uncertain location of major faults in the area. In light of her evidence Mr Hall raised doubts about the soil classification for the site and the prospect of amplified ground accelerations. Based on his interpretation of Mrs Campbell's evidence he said that the Annual Exceedance Probability (AEP) for the MDE is likely to be considerably less than the 1 in 10,000 assigned by Damwatch. In other words, he considers the 1.06 PGA, upon which the design was based, would very likely be exceeded in a major earthquake event.
- 13.68 Mr Hall, again referring to Mrs Campbell's evidence, raised the prospect of bentonite deposits lying beneath the WIL pond site, and the likelihood of earthquake induced liquefaction, which again could have serious implications for the integrity of the dam design. He sought that four test bores be drilled to bedrock to determine whether or not the potential for liquefaction exists.
- 13.69 Mr Hall then said that if we preferred Mrs Campbell's evidence on the seismicity of the WIL site over that provided by GNS, then:

²⁶ R. Hall, EIC at Para 21.

... the present dam design has not been designed in accordance with the seismic design parameters required under the NZSOLD guidelines and this has significant implications for the Building Consent that has already been granted for the structures at this site.²⁷

- 13.70 We acknowledge that this application is somewhat unusual in that a building consent, which, among other things, would normally include a review of the structural integrity of a proposal, has already been issued for the WIL ponds. The extent to which we can take some comfort from this in determining whether or not the presence of the ponds would place an unacceptable level of risk on those residents likely to be inundated in the event of a dam failure is a matter that we shall come back to later in this decision.
- 13.71 Mr Hall then went on to discuss the response of ring dams and the validity of the embankment design procedures. At Para 30 in his evidence he said that numerous ring dams of this type have been constructed in Canterbury in recent years. These have been principally to store irrigation water for use primarily with centre pivot and long lateral irrigation systems. Apart from the South Rangitata Irrigation Scheme (currently under construction) he was not aware of any other ring dams that have been constructed on this scale. He said a major mitigation factor with the Rangitata Scheme is that, in the event of a major breach, the flood waters were designed to discharge back into the Rangitata River.
- 13.72 At Para 34 in his evidence Mr Hall told us that, although dynamic seismic analysis is not explicitly required by New Zealand dam design legislation for High PIC dams, and nor is it required under the current NZSOLD Guidelines, this does not imply that New Zealand dam designers need not undertake detailed dynamic seismic analysis for dams where the consequences of failure are great. He noted that overseas organisations, including the International Commission on Large Dams (ICOLD), the Indian Institute of Technology Kanpur, and the Gujarat State Disaster Management Authority (IITK- GSDMA), typically recommended procedures that provide a more robust approach to the design of the structures than that which has been employed in this case by Damwatch.
- 13.73 In his discussion of the performance of the proposed HDPE pond liner²⁸, Mr Hall raised concerns about the effects of sunlight over time on the elasticity of the liner, particularly those parts exposed to the sun. He felt that information on the durability of the liner and how this would be monitored over its lifetime were not adequately described in the application. Wind induced seiching leading to fluctuating hydraulic loading on the liner was another matter that, in his view, had not been properly considered by WIL.
- 13.74 Mr Hall then went on to discuss the flood plain modelling. He reminded us that, even with the best intentions, flood plain modelling is only a crude representation of reality. Since there have not been any previous dam failures or major flooding in the area, assumptions have had to be made on critical parameters such as hydraulic roughness. In terms of determining the PIC category for this dam the dam break modelling undertaken to date is considered by Mr Hall to be appropriate. He felt, however, that the modelling results have not been presented in a manner that would enable those persons who may be affected by a breach to clearly understand the circumstances that they could experience in such an event. He told us that:

²⁷ R. Hall, EIC at Para 26.

²⁸ R. Hall, EIC at Para 37 et seq.

... it needs to be appreciated that when the dam break surge makes contact with the up-plain wall of a dwelling that building is going to experience un-balanced hydrostatic loads arising from both the approaching water depth and its velocity head, the forces exerted by the stalling of the approaching flow in contact with the building, forces arising from impact from debris carried in the impacting flow, flow induced vibrations, uplift forces arising from buoyancy effects and localised scour around foundations. If the dam break failure is the result of a major earthquake, which is the most probable scenario, then the strength of the dwelling may already be impaired and accordingly have little in the way of reserve strength to accommodate the impact of a dam break surge. Clearly the lives or safety of any persons occupying such a building in these circumstances cannot be assured.²⁹

13.75 In Mr Hall's words:

... it is very difficult, if not impossible, for persons who live down plain and in the shadow of these structures to determine how they might be affected in the event of a catastrophic failure, based on the consultation and dam breach mapping that has been presented to them to date.³⁰

He went on to say that it is important for the effects of a dam breach to be much better understood by the community, and those assessing the effects of this proposal through the resource consent process. Avoidance of this issue by having a direct, unimpeded pathway to the Waimakariri River would be Mr Hall's preferred option.

13.76 Mr Hall then spent some time discussing flow velocities and the effects of a flood surge impacting on a dwelling. We do not propose to repeat here all that he had to say on this matter except to note that, while he expected buildings constructed in reinforced concrete masonry to survive the expected flooding, light timber-framed dwellings would not fare so well, and collapse of walls can be expected.

13.77 Mr Hall also expressed some concern that the application provides no information on the emergency procedures that are to be followed in the event that dam safety is threatened. He said consideration needs to be given as to how rapidly a drawdown needs to be able to proceed in an emergency, and how effective evacuation procedures to remove those persons whose lives may be at risk, can be instigated. Considering the difficulties involved, Mr Hall concluded that, in the event of a catastrophic failure, safe total evacuation of the area that would be affected by the resulting flooding does not look feasible.

13.78 We note that, during the hearing, there was some discussion of the need for a proper numerical risk assessment of the WIL proposal. Mr Hall acknowledged³¹ that a numerical risk assessment is not required in the (NZSOLD) Guidelines and nor is it required under the Building Act and Building (Dam Safety) Regulations. He said that this does not mean that a full assessment of risk is irrelevant. He noted that there is an obligation on the owner to identify the scale of the risk and to implement strategies to mitigate against failure. Mr Hall maintained that the only effective way to mitigate the risk of failure is to build the ponds in-ground (or not build them).

²⁹ R. Hall, EIC at Para 56.

³⁰ R. Hall, EIC at Para 58.

³¹ R. Hall, EIC at Para 98.

- 13.79 In his concluding remarks³², Mr Hall reiterated that, given the level of doubt that has been raised about the seismicity of the WIL site, and the absence of information on critical design components, he could not agree with WIL's contention that the design of the dam is in accordance with the NZSOLD Guidelines, and that the risk of failure is acceptable.
- 13.80 **Mr Karl Dodds**, who spoke to us at some length on behalf of ECESS about the merits of the proposed HDPE liner, also highlighted the concerns of many of the other submitters. Mr Dodds and his wife are residents on South Eyre Road and they believe that the proposed WIL ponds will expose them, their animals and others in the community to serious and enduring personal risk.
- 13.81 Mr Dodds, we note, is not an expert in the design or use of HDPE liners but he does have an extensive academic background in mathematics and physics, and has acted over many years as an industry consultant on instrumentation, control and analysis, and has specialised in computer software for instrumental and industrial process control. Having spent some time researching the matter, he presented to us his views of the proposed liner, its usage, and the dam's instrumentation efficacy. He believed that he identified issues that require further significant reconsideration, mitigation or redesign.
- 13.82 Mr Dodds told us that both WIL and Mr Hall had described the liner as a *'failure critical component'* and that this meant that the integrity of the dam is pivotal upon the integrity of the liner. In his words³³, there are *'well established internationally accepted standard practices'* that indicate that reliance on a geomembrane as a primary structural element is not appropriate.
- 13.83 Mr Dodds went on to discuss the additional loads likely to be placed on the liner through wave action and seiching. He considered that this could cause premature failure of the liner, particularly in the corners of the ponds where, he said³⁴, the forces would be increased, creating what he referred to as an impulse or impact force.
- 13.84 In his discussion of liner fundamentals³⁵, Mr Dodds referred to advice he had received from *'several large geo-membrane manufacturers'*. He told us that none of their products would be guaranteed in writing as suitable for the WIL ponds. There was no written confirmation to support this statement.
- 13.85 In particular, Solmax®, who we understand is the preferred membrane supplier, made a number of comments about the proposed use of an HDPE liner for the WIL ponds. According to Mr Dodds, Solmax® stated that:

*... although their liners have been used in reservoirs up to 12 m in height, their liners will inevitably leak and consequently, constant leak management and monitoring would be an essential part of routine monitoring and maintenance*³⁶

We understand that the fact that the liner will inevitably leak is not in dispute and that WIL has proposed a monitoring and maintenance regime.

- 13.86 Mr Dodds went on to comment on the merits of using a double liner in the corners of the ponds. At Para 24 in his evidence, he told us that Solmax® had

³² R. Hall, EIC at Para 109.

³³ K Dodds, EIC at Para 10 et seq.

³⁴ K Dodds, EIC at Para 16.

³⁵ K Dodds, EIC at Para 18 et seq.

³⁶ K Dodds, EIC at Para 20.

suggested that, when their liner is being used in a critical application, a managed, ducted double liner system should be used. Mr Dodds suggested that this is not the same as the double liner proposed by WIL for the corners of the ponds.

13.87 Mr Dodds also referred to the durability of the liner exposed to UV exposure. We note that this was discussed in Mr Hall's evidence but Mr Dodds went a stage further by referring to the quality of testing, which he felt was insufficient. He also suggested³⁷ that underground water chemistry and soil bacteria are well-known corrosive agents for plastics and that an HDPE liner would not be as unconditionally stable and inert as manufacturers claim. Mr Dodds also suggested that we should be concerned about the effects of alpha and beta radiation from radon gas on polyethylene plastics.

13.88 Mr Dodds expressed his concerns about the ability of the membrane liner to adequately span cracks in the embankments, and the prospect that damage to the liner would go undetected. Having considered WIL's evidence regarding the proposed liner, and conducted his own research into the matter, he said he had no confidence that the proposed HDPE liner, used in this dam design, will be capable of surviving the elastic deformations associated with even a moderate seismic disturbance. He considered there were too many uncertainties associated with the liner.

13.89 Later in his evidence, Mr Dodds opined that:

*International best practice requires that instrumentation monitor structural and functional performance of water reservoirs where complex or unusual site conditions are present or when there is a likelihood of loss of life or extensive property damage be both comprehensive in scope and regularly assessed and reviewed.*³⁸

In his view, the WIL proposal fails in all of these requirements.

13.90 At Para 57 et seq, Mr Dodds provided us with a number of observations and statistics from the U.S. Department of Interior Bureau of Reclamation, Dam Safety Office, which, he said, serves to put the potential failure of this dam into context. From this source, Mr Dodds produced a range of statistical data relating to dam failures in the USA. He then discussed the consequences of failure and how the death rate (in the USA) is a function of the warning issued to people at risk. He expressed his concern that, in his words, WIL has *not yet even contemplated let alone published their emergency plan*³⁹.

13.91 With respect to potential loss of life in the event of a catastrophic failure, Mr Dodds, based on his own calculations, broadly agreed with WIL's predictions. Notwithstanding this, he said such predictions are obviously unacceptable to ECESS. He reiterated his view that, in addition to the issues surrounding the dam's design, there is a parallel and equally serious series of issues surrounding the instrumentation, warning systems and dam operation under emergency conditions.⁴⁰ He felt that little work has been done on this critical aspect of the dam design and, thus, he considered it was not credible for WIL to say that the risk of dam failure would not have a significant impact upon the community when the pivotal instrumentation design is still incomplete.

³⁷ K Dodds, EIC at Para 37.

³⁸ K Dodds, EIC at Para 54.

³⁹ K Dodds, EIC at Para 67.

⁴⁰ K Dodds, EIC at Para 71.

- 13.92 We turn now to the submission by **Brentworth Dairy Farm Limited** (Brentworth) and those who spoke on behalf of the company. These included legal submissions from counsel, Malcolm Wallace and witnesses: Michael Smith, Graham Bain, Kevin Straight, Tim McMorran and Jane West. Brentworth is the owner of a large farm immediately adjacent to the WIL pond site. As with other submitters in opposition, their submissions were largely concerned about the use and durability of the liner, and the consequences of a catastrophic failure.
- 13.93 With respect to the risks associated with the potential for catastrophic dam failure we were particularly interested to hear what **Mr Tim McMorran** had to say. Mr McMorran is an engineering geologist employed by Golder Associates (NZ) Limited, based in Christchurch. He told us he had assisted in investigations, analysis and design and construction of several dams in New Zealand with high seismic risk.
- 13.94 Mr McMorran emphasised that he had not conducted a full peer review of the design but, in his evidence, he raised issues concerning the adequacy of the proposed liner, the ability of the design to identify and mitigate potentially dangerous leakage, the performance the embankments under strong earthquake shaking, the adequacy of the amount of freeboard to be provided, and the location of ponds with respect to the population at risk.
- 13.95 Mr McMorran said that embankment dams of the type proposed should be designed with '*multiple lines of defence*' that provide redundant features to ensure that the failure of one element does not lead to failure of the dam⁴¹. The proposed HDPE liner is of particular concern to Mr McMorran. He said this is the only water controlling element. He cited poor puncture resistance, the lack of a sand bedding layer under the liner, the lack of any UV protection where the liner is exposed to sunlight, and doubts about the liner's ability to span cracks in the embankment, among his concerns.
- 13.96 The proposals for the detection of leakage from the ponds was another area where Mr McMorran considered there were deficiencies in the design. In his opinion, an extensive array of appropriate monitoring instruments around and below the embankments was required to confirm that leakage was not occurring.
- 13.97 While it may be self-evident, Mr McMorran reminded us that the control of leakage from water impoundments is an important consideration in dam design. He told us⁴² that embankment dams usually incorporate filter and drainage elements to intercept and control seepage and to prevent the build-up of water within the embankment. He said these elements are important because they enable the performance of the dam to be monitored, and potentially dangerous leaks to be identified and addressed, before becoming a safety concern. He noted the proposed dam design does not include filter and drainage elements and nor does it make provision for such monitoring.
- 13.98 Mr McMorran also voiced concerns about the pipe penetrations through the embankment. He said low level pipe penetrations through embankments are a well-known location for dam leakage and erosion. He considered the dam design was deficient in this area as normally the pipes would be surrounded by a low permeability barrier such as concrete or clay.
- 13.99 Mr McMorran then went on⁴³ to discuss the performance of the embankment

⁴¹ T McMorran, EIC at Para 13.

⁴² T McMorran, EIC at Para 16.

⁴³ T McMorran, EIC at Para 17 et seq.

under strong earthquake shaking. He noted that the MDE equates to a PGA of 1 g, which he said is a demanding requirement, but he was concerned that there had been no evaluation of the potential for active faults to affect the dam footprint. He was also concerned that there had been no geotechnical investigations below 5 m (41 test pits). In his view, there is a significant likelihood that, given the depositional environment of the alluvium underlying the impoundment footprint, there may be finer-grained layers present below the ponds. The possible effects, according to Mr McMorran, include the prospect of perched water tables, liquefaction or cyclic softening and potential settlement during strong earthquake shaking. Such effects, he said, would, very likely, seriously compromise the HDPE liner.

- 13.100 Mr McMorran was of the view that a more sophisticated analysis is required to confirm that the proposed dam configuration will accommodate the MDE without suffering potentially catastrophic deformation. He said:

For a high PIC dam, I would expect to see more rigorous dynamic analysis using an accepted numerical model and earthquake time histories that will assess the likely deformations and associated loss of freeboard that will occur under the maximum design earthquake.⁴⁴

- 13.101 Mr McMorran also questioned the adequacy of the proposed 1.3 m freeboard. He said this needed to be sufficient to accommodate the anticipated effects of wave run-up due strong winds, and the potential effects of settlement of the dam crest.
- 13.102 Mr McMorran, as we have noted, is an experienced engineering geologist and it was perhaps disappointing that he did not devote some of his evidence to assisting us with some of the important geological aspects of the application, particularly as relates to earthquake response. As it was, he talked at some length about the liner and leakage from the ponds, matters about which we were given little information regarding his expertise.
- 13.103 Several other submitters presented submissions in their own right expressing genuine concerns about the potential risks to their well-being and livelihood that the presence of the proposed WIL ponds would create. Some of these submitters had clearly put a substantial amount of time and effort into their preparations for the hearing. While these submissions did not necessarily provide us with expert evidence to assist us in our determination of the extent of the potential hazards, they did convey to us the very real fears of those residents living within the area that could be inundated should a catastrophic failure occur.
- 13.104 The submission from **Warren Stevenson** and **Jan Stanway** was particularly thorough and reflected, in some detail, the concerns of other submitters. Much of their submission focussed on the adequacy of the potential flood modelling that had been carried out. They considered that the dam breach modelling that had been undertaken was not appropriate and their submission highlighted several shortcomings. We were interested to note that Ms Stanway is a structural engineer with some 20 years' experience in the design and construction of buildings. Her views on some of the technical aspects concerning the dam design were of interest to us.
- 13.105 Ms Stanway spoke to us specifically about her concerns regarding the design of the dam and the seismicity of the site. In particular she noted WIL's assumption

⁴⁴ T McMorran, EIC at Para 20.

that the site is a '*deep soil site*' but said no investigations had been undertaken to confirm this. She told us⁴⁵ that, if the site has less than 100 m depth of gravel, according to NZS 1170.5 the site cannot be considered a deep soil site. This, she said, would have the effect of increasing the spectral values and, therefore, the peak ground accelerations, compared with those provided by GNS.

- 13.106 Ms Stanway was concerned that the pseudo static analysis for the embankments considered only the PGA and not the duration of shaking. She noted that, in order to prove that the design meets NZSOLD guidelines, Damwatch had used the empirical method of Bray and Travesorou (2007)⁴⁶ to estimate the earthquake induced embankment settlements. We mention this because Ms Stanway took the trouble to contact one of the authors (Dr Bray from UC Berkeley). She said her advice from Dr Bray was that this method is based on conventional earth-filled dams that straddle valleys and ring dams that contain solid waste but not water.
- 13.107 Following this discovery, Ms Stanway found that the NZSOLD Guidelines were silent on the requirements for seismic design of earth-filled ring dams. However, she discovered that the ICOLD (International Commission on Large Dams) guidelines for selecting seismic evaluation parameters for dam projects, cautioned that pseudo static analysis for embankment dams cannot be relied upon to give a realistic evaluation of embankment stability.⁴⁷
- 13.108 Ms Stanway went on to tell us that the ICOLD guidelines recommend that, for dams with a high consequence of failure, detailed seismic assessment should be used with acceleration time histories. This, she said, was very different to the approach used by Damwatch in this case. Furthermore, she also told us that the ICOLD guidelines recommend that earthquake vertical accelerations also be considered in the design of dams.
- 13.109 Ms Stanway noted that NZS 1170.5⁴⁸ states that, at locations where the seismic hazard is dominated by a fault at a distance of less than 10 km, it is appropriate for designers to assume that the vertical spectrum equals the horizontal acceleration spectrum for periods of 0.3 seconds or less. She told us that embankment dams have periods less than 0.3 seconds and reminded us of Mrs Campbell's evidence and the possibility that there are faults close to the dam site.
- 13.110 Ms Stanway also raised issues about the use of an HDPE liner noting that it is critical to maintaining the integrity of the dam. The stiffness of the proposed liner anchorages, and the use of a double liner, were among her concerns.⁴⁹
- 13.111 At Para 25 in her submission, Ms Stanway was very critical of the justification presented by WIL (Mr Connell) for the use of a double HDPE membrane layer as a means of providing extra resilience in the corners of the ponds.

⁴⁵ W Stevenson, J Stanway submission, Para 6.4.

⁴⁶ Bray, J.D. and Travasorou, T. (2007). *Simplified Procedure for Estimating Earthquake-Induced Deviatoric Slope Displacements*. Journal of Geotechnical and Geoenvironmental Engineering 133:4, 381-392.

⁴⁷ W Stevenson, J Stanway submission, Para 6.11.

⁴⁸ NZS 1170.5 Supp 1:2004 (Structural design actions – Part 5: Earthquake actions – New Zealand – Commentary).

⁴⁹ W Stevenson, J Stanway submission, Para 6.121 et seq.

Evidence in Reply on behalf of WIL

- 13.112 Having considered the evidence of Mrs Campbell, Mr Hall, Mr Stevenson and Ms Stanway, and Mr McMorran, Dr McVerry presented his response to us when we reconvened on 18 August 2014. In doing so, he referred to a range of matters that had been raised by submitters.
- 13.113 Dr McVerry agreed that, while many of the points included in Mrs Campbell's submission were valid, the questions she raised would generally require long-term research to address them, and were not something that could normally be considered within the timeframe of a single project. He told us that the fault modelling used in the hazard estimates attempts to encompass the region covered by the complexity of short surface traces resulting in stronger ground-motion estimates than those that would be obtained using the distances to the closest surface expression of the faults. He also said that the ground-motion prediction equations used in the probabilistic estimates for the WIL ponds were enhanced by stress-drop factors considered appropriate for the Canterbury sequence.
- 13.114 Dr McVerry told us that, while Mrs Campbell's comments regarding the approximations and possible inaccuracies of the NZS1170.5:2004 method of constructing spectra from the product of the Ch(T), R and Z factors, both she and Mr Hall were incorrect to assume that GNS had assessed the PGA for this site based on NZS1170.5. In fact, the values of the PGAs and spectra provided by GNS, and which were adopted for design, were calculated directly from the combination of the earthquake source model (distributed seismicity and faults) and the two ground-motion models (McVerry modified by stress-drop factors, and Bradley).
- 13.115 Dr McVerry said that Mrs Campbell had questioned the classification of the site as NZS1170.5 Class D Deep or Soft Soil, a point picked up by Mr Hall. We note that Ms Stanway had also queried this point. NZS1170.5:2004 allows, as its least preferred method of assigning site class, a maximum depth of 100 metres of gravel to be taken as Class C. Dr McVerry told us that other work carried out by GNS indicated that the site is probably Class D but this cannot be stated with absolute certainty⁵⁰. After further discussion, including reference to Class D spectral shapes and Z factors, Dr McVerry said the matter was irrelevant as the models used by GNS to derive the recommended PGAs and spectra included the effect of decreasing amplification for Class D with respect to rock spectra as the strength of the motions increases.
- 13.116 The actual seismicity of the WIL site has a range of uncertainties with respect to PGAs, duration and recurrence intervals. These were highlighted in submissions, particularly by Mrs Campbell, Mr Hall and Ms Stanway. Dr McVerry said the issue of possible uncertainty in the recurrence intervals of the nearby faults was addressed by consideration of deterministic scenario spectra for several large hypothesised events located very close to the WIL site. These were of larger magnitude than the complex 2010 Darfield earthquake. He went on to say:

The scenarios considered were the ruptures capable of producing the strongest motions if they should rupture, namely a magnitude 7.0 earthquake on the Springbank Fault at a distance of 3 km from the site, and a magnitude 7.2 earthquake on the Hororata Fault at a distance of about 5 km from the site. Note that these distances are both considerably shorter than those from their surface traces, because of the conservative

⁵⁰ G McVerry, EIR, at Para 29.

*representation of the extent of the faults*⁵¹

- 13.117 He said, for further conservatism, the recommended MDE spectrum was also shown to exceed the spectrum for a Hororata Fault earthquake with an increased magnitude of 7.5, and that for a direct hit by a magnitude 7.2 reverse-faulting earthquake.
- 13.118 Dr McVerry, thus, considered that the deterministic analyses are sufficient to demonstrate that the estimated 1/10,000 AEP motions accommodate any reasonable fault-rupture scenario irrespective of its recurrence interval.
- 13.119 Mrs Campbell, Mr Hall and Ms Stanway, in their submissions, raised the issue of vertical accelerations during a strong earthquake. They correctly noted that GNS did not evaluate vertical motions in their hazard studies. However, in response to a recent request from Damwatch, Dr McVerry said he had advised them that the PGAs for all site conditions are taken as 0.9 times the horizontal rock PGAs. He understood from Mr Connell that vertical accelerations do not need to be considered but said that, if required, the hazard analyses should be extended to provide estimates of the vertical PGAs.
- 13.120 Dr McVerry outlined the work that would have to be done to carryout dynamic seismic analyses (as suggested in the submissions from Mr Hall, Mr McMorran and Ms Stanway) but said the need for this was outside his expertise.
- 13.121 In response to Mrs Campbell's and Mr McMorran's concern as to whether or not permanent tectonic ground deformation has impacted on the WIL site, Dr McVerry said that high resolution Digital Elevation Models (DEMs) of the WIL site, and surrounding areas, have been constructed from existing LiDAR data and there is no evidence that surface fault rupture deformation has impacted the location of the WIL site within the last approximately 18,000 years.
- 13.122 We now turn to what Mr Connell had to say in response to the concerns raised by submitters. He said submitters' issues concerning subsidence of the crest, tension cracking, and stress loadings on the corners of the pond embankment, had been considered in the design. He said the two key design considerations to minimise settlement in a large earthquake were the embankment materials and the HDPE liner.
- 13.123 In reference to embankment materials and construction⁵², Mr Connell reminded us that, when compacted, the sandy gravels form very stiff, robust and free draining embankments that are not susceptible to loss of strength or stiffness during earthquake shaking. He added that these compacted gravels are also not susceptible to piping due to seepage flows. He went on to say that no loss of embankment strength should occur at the WIL Ponds with the quantum of settlement expected to relate directly to the level of shaking at the site from an earthquake event.
- 13.124 Mr Connell did not consider there is any need for deep exploratory drilling to provide a better understanding of the geology underlying the site, as had been suggested a number of submitters.
- 13.125 Mr Connell maintained that the liner has been designed in accordance with methods developed by Dr J. P. Giroud (an international expert on membranes) and that he had discussed the double liner method adopted to span potential transverse cracks at corners of the ponds with Dr Giroud. He confirmed that Dr

⁵¹ G McVerry, EIR, at Para 29.

⁵² N Connell, EIR, Para 8.1 et seq.

Giroud had agreed that this was appropriate in November 2013.

- 13.126 We note the submission from Mr Dodds, to which we refer below, based on his own conversations with Dr Giroud. Regrettably, since Dr Giroud did not appear at the hearing and provided no written statement, we have no way of knowing who or what is correct. Mr Connell did not provide any information at the hearing that would have enlightened us about how such liners are designed or how they behave when doubled. We are, thus, left to determine how much weight we can put on his statement:

*I am comfortable that the use of a double membrane in the corner of the WIL storage ponds is an appropriate means of mitigating the risk of earthquake-induced settlement.*⁵³

- 13.127 Mr Connell then discussed the issues concerning earthquake loading and analysis. He noted that Dr McVerry had confirmed that the earthquake loadings adopted in the Damwatch design are appropriate. On the matter, raised by submitters, of whether or not vertical accelerations (earthquake) should be considered in the design of the embankments he pointed out that the ICOLD Bulletin referred to by Ms Stanway actually stated⁵⁴:

"it is usually considered that the dynamic response of embankment dams does not require consideration of the vertical component of ground motion or the hydrodynamic effects of the reservoir water"

- 13.128 Mr Connell went on to defend his use of the Newark method for the analysis of the embankments, supported by the work of others such as Bray and Travasarou⁵⁵. He said the purpose of this analysis was to ensure that the freeboard provided would be more than adequate, and that the liner could adjust to the settled shape without risk of tearing. We note Ms Stanway's concerns about the appropriateness of these methods. In support of the design approach used by Damwatch, Mr Connell said that Emeritus Professor Fell, from the University of NSW, who we were told is internationally respected in the field of embankment dams, supported the basic principles of the Newark method.

- 13.129 Mr Connell acknowledged that more sophisticated computational modelling systems could be used, and that these could incorporate vertical acceleration. In his experience, Damwatch would expect such an analysis to refine the estimations of deformation rather than indicate deformations grossly out of proportion with their estimate. Mr Connell did not expect that a more sophisticated analysis would change the design.

- 13.130 Mr Connell defended the peer reviews that have been undertaken as part of the application for a building consent. He told us the design had been peer reviewed by a Chartered Professional Engineer, independent of Damwatch, and producer statements by this reviewer, Anthony John Pickford, supported the successful building consent application. He said this review was in accordance with the NZSOLD Guidelines for High PIC dams. He said that the proposed storage ponds had also been subject to a regulatory review by Riley Consultants Ltd., as part of the review for the building consent. Mr Connell questioned the need for further review.

⁵³ N Connell, EIR, Para 8.12.

⁵⁴ N Connell, EIR, Para 12.

⁵⁵ Bray, J.D. and Travasarou, T. (2007). *Simplified Procedure for Estimating Earthquake-Induced Deviatoric Slope Displacements*. Journal of Geotechnical and Geoenvironmental Engineering 133:4, 381-392.

13.131 On the question of risk, a matter that goes to the heart of this application, Mr Connell told us that, in his opinion, the lack of a detailed risk assessment did not detract from the assessments that had already been provided. He said that in order to keep the risk of failure acceptable over the life of the ponds, and to operate them in accordance with the NZ Dam Safety Scheme for high PIC dams, a comprehensive Dam Safety Assurance Program (DSAP) would be followed over the life of the ponds⁵⁶. He said the ponds would have a high level of surveillance as part of the DSAP and that this would include:

- daily visual inspections;
- weekly route marches where piezometers are read and embankment and lining are visually inspected;
- monthly review of piezometer readings and observations;
- annual (and post any incident, earthquake or other safety incident, extreme rainfall, gale force wind) safety inspection and review by a dam engineer; and
- five-yearly comprehensive safety review evaluating the safe performance of the ponds, including the lining.

13.132 Mr Connell said that the monitoring under the DSAP provides for early intervention and implementation of the emergency action plan, which includes early notification and, if necessary, evacuation of those at risk.

Submissions in Reply

13.133 At the reconvened hearing, we heard submissions in reply from three submitters, all on behalf of ECESS.

13.134 Firstly, Mr Dodds refuted Mr Connell's claim that the liner design was supported by Dr Giroud. As evidence of this, he tabled an exchange of emails he had had with Dr Giroud. He said that Mr Connell's statement that the HDPE liner has been designed to span potential cracks is simply untrue. He told us the crack spanning capability of HDPE is relatively poor when compared to other liner materials.

13.135 Mr Dodds also said that Dr Giroud, among other comments, had told him that due to the poor mechanical properties of HDPE geomembranes, several other types of geomembranes are preferred when chemical resistance is not required, and that his general impression was that the design, as described by Mr Dodds, was likely to be inadequate. Mr Dodds maintained that the information provided by Dr Giroud confirms the validity and accuracy of his genuine concerns about the liner and refutes Mr Connell's claims.

13.136 Mr Dodds was also critical of the DSAP, as described by Mr Connell. He said there is no emergency action plan and the promise of "early notification and evacuation" is highly unlikely based on the immutable evidence of dam failure histories as presented in his original evidence.

13.137 We next heard from Mrs Campbell. She said that the essential points in her EIC remained unchanged. In her EIR she maintained that:

⁵⁶ N Connell, EIR, Para 31.

Neither the subsurface location and geometry of the component faults and underlying stratigraphy, nor the predictable frequency and magnitude of the major earthquake is adequately documented. The essential question is whether a high PIC structure with the now well documented consequences of a catastrophic failure should be permitted?

- 13.138 Mrs Campbell referred us to a paper by Kerr et al (2003)⁵⁷, published by the Ministry for the Environment. She told us they make it clear that it is unacceptable to build a high PIC structure i.e. a Class 4 structure "...capable of causing hazardous conditions that extend beyond the property boundaries" on a fault of uncertain complexity on a greenfield site. She raised this⁵⁸ because:

... the nature and location of a system of largely concealed but relatively shallow faults, as it might affect the WIL ponds, is not known accurately enough to determine if a fault avoidance zone could be defined.

- 13.139 And she noted:

Dr McVerry's essential argument is that sufficient conservatism is built into his recommended parameters for pga values to be used in the pond design for seismic loading that, "the estimated 1/10,000 AEP motions would accommodate any fault-rupture scenario irrespective of its recurrence interval"

- 13.140 Mrs Campbell then spent some time drawing our attention to a number of observations supporting her views relating to faulting in the area. We do not need to repeat here everything that she had to say about this complex matter. We do note, however, what she told us at Para 18 in her EIR:

... the purpose of bringing together this overview of aspects of the geology of the site was to collate the evidence that despite the relatively featureless topography in terms of any simple evidence of a fault zone, that a complex fault network underlies the wider vicinity of the WIL pond site.

- 13.141 Mrs Campbell went on to comment on a range of matters raised in Dr McVerry's EIR. In her final remarks she emphasised that much remains unknown about the geological setting of the WIL pond site, but the available evidence suggests it would be within a zone of active ongoing deformation on underlying structure of uncertain depth and geometry.

- 13.142 We now move on to what Mr Hall had to say in response, on behalf of ECESS. He started out by discussing the merits of the design reviews that had been undertaken. He said the review done by Riley Consultants Ltd had largely been in the form of a statutory review to assist CRC and WDC in their s 42A assessments. He did note, however, that correspondence between Riley Consultants and the councils showed that there were aspects of the design that they felt were deficient. These included: the limited nature of the evaluation of the performance of these structures under MDE seismic loading, the effectiveness of the partial double lining proposed for the corners of the structure, and concern about the use of clay-silt material of low plasticity as a bedding material for pipe penetrations through the walls of these dams with no form of protection against erosion other than the limited protection that may be

⁵⁷ Kerr, J, Nathan, S., Van Dissen, R., Webb, P, Brunsdon, D, King A., 2003 Planning for development of land on or close to active faults. Institute of Geological and Nuclear Sciences client report 2002/124 Published by the Ministry for the Environment July 2003.

⁵⁸ J Campbell, EIR at Para 11.

afforded by a 1.5 mm HDPE liner.

- 13.143 Mr Hall noted that the Pickford review did not include site seismicity, seismic loadings, slope stability nor critical vulnerabilities in the design. Mr Hall said it was clear to him that significant parts of the design had not been peer reviewed as Mr Connell had claimed.
- 13.144 Mr Hall agreed that the two Canterbury Regional Council bore logs provide a reasonable representation of the subsurface soils to the depths penetrated by those bores but they provide no information about what lies beneath a depth of 83 m.
- 13.145 Mr Hall restated his concerns that earthquake induced vertical accelerations had not been considered in the design of the embankments. He said⁵⁹:

The unwillingness of Connell to recognise the threats that strong vertical accelerations at this site may have on the Damwatch design is difficult to comprehend given the seriousness of the consequences of catastrophic failure on the land and the community down plain and in and adjacent to the area that could be affected by such a breach.

- 13.146 Mr Hall made it clear to us his belief that the potential risks associated with this proposal were such that a higher level of analysis is required in determining the likely performance under strong ground motions. He told us⁶⁰ this can only be achieved by the use of sophisticated modelling techniques employing time-history records and a good knowledge of the dam, its form, and the characteristics of the materials used in its construction and those that exist in its foundations.
- 13.147 Mr Hall noted that the proposed dams have inherent weaknesses in that they lack basic defensive measures such as chimney drains and toe drainage blankets, and have large diameter pipes penetrating the alluvial foundation gravels at the corners of the embankment, bedded on clay silt material of low plasticity, and where the height of the embankment is at its greatest. He felt the risk of failure under operating conditions is greater than under earthquake conditions. Actual failure, he said, is more likely to be a combination of earthquake and weakened embankment corners.
- 13.148 The merits of the HDPE liner was also discussed by Mr Hall. We are aware of the concerns about the liner expressed by submitters, and have noted Mr Hall's comments. This led on to his concerns about leakage through and under the embankments and, more particularly, around the pipe penetrations. He felt⁶¹ that early detection and intervention of internal erosion may not be possible, nor the ability to respond and draw down water levels in the dam sufficiently fast to avoid catastrophic failure, even if detection is possible.

Canterbury Regional Council and Waimakariri District Council joint s 42A planning report

- 13.149 The s 42A Planning Report was prepared by **Suzanne Blythe** (CRC) and **Mathew McCallum-Clark** (for WDC). We refer here to those matters in the s 42A Report relevant to the question of dam failure risk and inundation.
- 13.150 CRC's jurisdiction with respect to dam failure and inundation was limited to the effects on ground water quality. Ms Blyth referred us to the WDC officer's

⁵⁹ R Hall, EIR at Para 16.

⁶⁰ R Hall, EIR at Para 19.

⁶¹ R Hall, EIR at Para 38.

section of the report for the assessment of the consequences of a dam breach on people and communities, and ecological values.

- 13.151 Ms Blyth, in summary, considered there is the potential for a dam breach to have an adverse effect on groundwater quality within the inundation zone. While she considered that any effects are likely to be temporary, there is still potentially an adverse effect on the community downstream, particularly for those who rely on groundwater for their drinking water supplies.
- 13.152 At Paras 273 et seq, Mr McCallum-Clark reported, on behalf of WDC, on the matters concerning hazard risk and the consequences of a dam breach. He told us his comments need to be considered alongside the information provided by WIL, and also by **Mr Titus Smith** of Riley Consultants Limited, who provided advice to the relevant councils as a part of this s 42A Report.
- 13.153 Mr McCallum-Clark noted⁶² that the concerns of submitters, with respect to a dam breach, had been well-highlighted in the submission from ECESS. These included potential loss of life, destruction or damaged property, buildings, crops and businesses, ecological impacts, effects on infrastructure and cultural values, and identification of “secondary effects”, such as effects on the value of properties, insurance premiums and need for the recording of the risks on the relevant property Land Information Memoranda.
- 13.154 Noting submitters’ criticisms of the flood modelling carried out by WIL, Mr McCallum-Clark said that WDC’s consultant, Mr Smith, had advised that, while the modelling is based on a range of assumptions, overall it is likely to be a reasonable representation of what may occur. Mr McCallum-Clark, in the s 42A report, goes on to say that the flood modelling had shown that between 4 and 107 people would be at risk in the event of a dam breach. In the worst case scenario to the modelling showed that approximately three lives could be lost. Secondary effects are also acknowledged.
- 13.155 Mr McCallum-Clark noted that, in the present circumstances, there are only limited opportunities to mitigate a dam breach. He also raised the question of whether WIL should hold third party insurance cover to compensate landowners for losses incurred in the event of a breach.
- 13.156 The probability of a dam breach is the most vexing question. Among other things, it invokes consideration of s3(f) and whether or not a dam breach is of such low probability that, in terms of the RMA, it is not an effect. Mr McCallum-Clark discusses this at Para 292 et seq in the s 42A Report. Here, he noted that WIL’s risk assessment considered the probability of a breach of the dam under a range of scenarios. It was noted that these have been challenged extensively by the submitters and questions have been raised as to the appropriateness of assumptions, data used, and adequacy of the assessments. Mr McCallum-Clark said a large amount of the information provided by WIL was technical in nature and this has been assessed by Mr Smith. Much of this information was provided as part of the building consent process, and assessment has been undertaken through that process. Mr McCallum-Clark said that WIL places considerable reliance on the building consent process as a mechanism to show that the design is appropriate.
- 13.157 At Para 294, Mr McCallum-Clark referred to the design earthquake for the dam structure being based on a one in 10,000 year event. He understood that this is generally used as an acceptable design criteria for structures of this type. Mr

⁶² S.42A Planning Report at Para 277.

McCallum-Clark, in the s 42A Report, was not able to reach a conclusion on the acceptability of the risk of dam breach to the community.

- 13.158 We turn now to what Mr Smith, as the councils' technical expert, had to say at hearing as part of the presentation of the officers' report. We acknowledge that Riley Consultants Ltd., and Mr Smith in particular, have the requisite skills and experience to advise on the engineering aspects of the WIL ponds in relation to the design and the risk of failure. We were interested to hear Mr Smith's views, particularly on the more controversial aspects of the application, and we shall deal with each of the points he made in turn.
- 13.159 Mr Smith advised that WIL had provided an external peer review of the design and construction, conducted by Pickford Consulting Limited, and that this was in accordance with the NZSOLD Guidelines. He noted that this peer review did not include a detailed review of the design, checks on design methods, arithmetic accuracies or compliance with the relevant building codes. Mr Smith did, however, expect that the Pickford review extended to the '*critical vulnerabilities of the design*' as raised by Mr Hall. We were left unsure as to how this could be the case without conducting a detailed review of the design.
- 13.160 Mr Smith then referred to the review completed by Riley Consultants Limited on behalf of CRC. He explained that this was a 'regulatory review' undertaken as part of processing the building consent. He noted that such a review does not assess the design objectives, process, options, assumptions or method but only tests the submitted design against regulatory parameters. It is intended to ensure, however, that the design meets the minimum requirements of the Building Act and the NZSOLD Guidelines.
- 13.161 In his discussion of the seismic analysis of the embankment, Mr Smith echoed Mr Connell's view that a more sophisticated analysis, using time-history seismic records, would be unlikely to provide a different outcome to that determined by Damwatch. He considered that, in light of the appropriately conservative design margins, the defensive approach, the analytical methods utilised by Damwatch are appropriate for this application.
- 13.162 Mr Smith referred to Mr Hall's comments about the poor safety records of homogenous dams. He said that, as the proposed dam includes a liner it is not considered to be a homogenous dam but is more comparable to dams that have an upstream earth core or a concrete-faced rock-fill dam, both of which have excellent safety records.
- 13.163 Mr Smith did not think the failure mechanism described by Mr Hall in his evidence, whereby undetected seepage into the free draining gravel beneath the dam could result in internal erosion, had any credibility.
- 13.164 We were reminded by Mr Smith that the NZSOLD Guidelines recommend an Emergency Action Plan (EAP) and that a procedure was set out in Appendix F of the guidelines. He noted that an EAP had not been submitted as part of the resource consent process. He felt that, given community concerns and lack of confidence in WIL's monitoring proposals, further detail about the EAP should be provided.

Mitigation of and effects of a breach

- 13.165 The modelling of a breach and potential damage caused by a breach were provided to us by WIL. We accepted the modelling results were but an indication of the scope and extent of damage that may occur if a catastrophic

dam failure eventuated. The submitters were strongly critical of how realistic the modelled results were. We do accept many of their criticisms about the adequacy of the modelling. Nevertheless, the results were sufficient to make us well aware of the disastrous effects of a dam failure if one eventuated.

- 13.166 One of the potential effects of a dam failure is to impact on drinking water sources. This brings into play the National Environmental Standard for Sources of Human Drinking Water (NES HDW).
- 13.167 In our view, relying on Mr Connell's assessment, primarily that the potential for a dam breach to occur is extremely unlikely, we accept the consequence that is extremely unlikely that human drinking water would be affected given the proposed design construction and monitoring of the proposed storage ponds. We also acknowledge and accept the evidence of both Mr Callander and Mr Hanson that in the unlikely event of a dam breach it is most likely drinking water sources would be affected for only a very limited period of time.
- 13.168 It was clear to us that the range of potential mitigation measures if a dam breach occurred was limited. Many of the submitters sought some form of early warning system; on the other hand other submitters raised issues with any early warning system complaining that cell phone coverage was either non-existent or patchy. Submitters made the point that in the course of their daily pursuits they are frequently outdoors on their small holdings and thus exposed to any dam breach. They would not be easily contactable in that circumstance.
- 13.169 Other submitters raised issues about the limited road network, pointing out for us if dam breach occurred, evacuation could be compromised because of flooding over that limited road network. They raised concerns that if a dam breach coincided with winter rainfall, which already flooded some parts of the roading network, then evacuation would be near impossible.
- 13.170 Putting the matter in context, the planning officer recorded the results of consultation with Ms Karen Wolbers, assistant emergency management officer at the Council. The point was made that the type of emergencies relevant to these early warning systems were ones where "early warning" was actually available. For example, in case of a tsunami. In those circumstances, the warning system itself was not likely to be affected by the event causing the risk.
- 13.171 In the end, in relation to an early warning system, we accepted that such a system is unlikely to be functional should the most likely mechanism by which a dam breach would occur, being a large-scale devastating earthquake, eventuate.
- 13.172 In other instances of lesser risk, for example, an escape of water that did not pose an immediate threat and was not caused by an earthquake, then an early warning system is, we thought, likely to be of value.
- 13.173 Insurance was promoted by the submitters as a possible means of remedy if a dam breach occurred. WIL promotes a form of insurance to compensate landowners from property damage if a catastrophic dam breach occurs causing loss to property.
- 13.174 We agree that some form of insurance held by WIL to help it provide compensation to land owners and occupiers for losses occurred by a breach is critical. We have included such a condition. We received information from the Waimakariri District Council in the form of a memo from Gerard Cleary, manager utilities and roading. That memo provided advice on the total value of

council assets that could be potentially damaged by the dam breach. It amounted to some \$3.1 million. That assessment was based upon a number of assumptions and was founded on the dam breach scenario provided by WIL in its evidence. Working out an appropriate value for insurance cover of both council assets and those of potentially affected submitters will require specialist assistance. We have addressed these issues in conditions.

- 13.175 Other than insurance and bonding, which we will refer to later, we agree that there are no mitigation measures available once a major breach has occurred given the proposed storage ponds before us. We think that insurance provisions are in accord with the policy and objective framework we refer to below.

Our findings

Objectives and policies

- 13.176 The broader policy documents, such as the Canterbury Regional Policy Statement (CRPS), through their objectives and policies adopt an approach which first recognises natural hazards and then seeks to avoid them by ensuring that development does not occur in high hazard areas. In greater detail, the CRPS promotes a risk based approach whereby zones of fault rupture hazard are identified within which site specific investigations are required, and development must be managed according to the nature of the faulting.
- 13.177 We were not made aware that the subject site had been identified within the planning documents as a site on which development should not occur. As noted above, we have had the benefit of a level of investigation of the subject site to determine the existence or otherwise of fault rupture hazards. The evidence from Dr McVerry and Mrs Campbell conflicted on this point.
- 13.178 Mrs Campbell was of the view that not enough was known about the level of activity on the site and the associated and nearby faults. She was also concerned research on the proposed site itself to find evidence of faulting was not detailed enough.
- 13.179 Dr McVerry on the other hand was of the view that there are no known surface fault traces passing directly through the area. He was satisfied that the most significant known features identified close to the site, namely the Hororata Fault, had a very low probability of occurrence or rupture given the long average recurrence interval of 17,000 years.
- 13.180 He had taken into account the recent intense seismic activities near Darfield and, while noting that activity extends up to the Waimakariri River, it did not seem to exhibit impacts beyond that. He noted other activity occurring near and possibly on the Porters Pass-Amberley Fault Zones. In his reply evidence, Dr McVerry referred us to high resolution digital evaluation models (DEMs) of the WIL site. He was very clear that the result of those models showed that there was no evidence that surface fault rupture deformation has impacted the location of the WIL site within the last approximately 18,000 years. We accepted then Dr McVerry's expert evidence that there was no evidence of surface fault rupture of the WIL site.
- 13.181 We were satisfied that the evidence we received and accepted from WIL demonstrated it was possible to provide for development, provided that development was managed according to the nature of faulting. We accepted the evidence that the hazard assessments were based on a conservative

approach and took into account the recent Canterbury earthquake experience, so that we agreed the earthquake ground shaking values adopted for the design were robust and conservative.

- 13.182 The CRPS in its policies, particularly Policy 11.3.5, to a degree mimics s 3(f) of the RMA in providing that when considering general risk management of natural hazards, and determining whether that risk is acceptable, we should consider the likelihood of that natural hazard event and its potential consequences. Both of those considerations were clearly in play. We note, where there was uncertainty in likelihood or consequences, then a precautionary approach and application of risk management standards and structural design standards should be adopted.
- 13.183 In this case, we understood that the NZSOLD Guidelines provided for the likelihood and consequence of a natural hazard event by making provision within the design and construction of embankments safety provisions, which would address the natural event, in this case an earthquake. In this way we saw the purpose of the policy being satisfied.
- 13.184 The NRRP objectives and policies, in particular Policy WQN3(3), were focused on avoiding the risk of embankment failure and to avoid, remedy or mitigate the effects of flooding during construction and/or operation.
- 13.185 We considered Policy WQN3(3) is achieved because the design approach to the embankments, subject to conditions, is directed at avoiding the risk of embankment failure and avoiding flooding and other hazards which may occur during construction and/or operation.
- 13.186 The pLWRP held a Policy 4.48, which is of direct relevance. That policy does not have an imperative of avoidance but its objective requires any dam is sited, designed, constructed and operated to minimise any risks, including overflows, leakage, slips or other dam failures.
- 13.187 In our view, having particular regard to the conditions we propose, which are primarily directed at dam design, construction, and operational requirements, we consider that Policy 4.48 is achieved.
- 13.188 The District Plan contains broader based objectives and policies. They relate to the community's understanding of natural hazards, so that it can respond natural hazards prior to and during natural events, and seeks to avoid or mitigate natural hazards to an acceptable level. We think that the design and development of the embankments, subject to the conditions we propose, will satisfy these provisions.
- 13.189 Policy 8.1.1.1 requires the provision of information to enable people to take appropriate precautions in relation to natural events; this is where the emergency evacuation planning would come into play. We think that the development of this emergency action plan will achieve this policy. We return to this issue later.
- 13.190 Taken as a whole then, we read the primary purpose of the objectives and policies is to identify faulting hazards of sites under consideration. If that investigation demonstrates the sites are likely to be subject to unacceptable fault risk, the response of the plans is to avoid development on those sites. In this case, based on the evidence of Dr McVerry we find that the WIL site is not a site that should be precluded from development.

- 13.191 A secondary focus of the objectives and policies is we think to provide for natural hazards in that the proposed development must be managed according to the nature of the faulting. Notwithstanding our finding about the lack of existence of faulting on the subject site, we accept that WIL in its assessments has provided for a conservative representation of the extent of any nearby faults and that sufficient conservatism has been built into the seismic design parameters to offset the concerns of any submitters and satisfy the thrust of this part of the objectives and policies.

Effects

- 13.192 As we noted at the beginning of this discussion, the most critical issues concerning this proposal are those attached to the risks and consequences of a catastrophic failure of the earth embankments (dams) retaining the very large volume of water that would be stored in the proposed WIL ponds.
- 13.193 Commencing with the dam break flooding analysis, we record our acceptance of that analysis as presented by Mr Connell on behalf of WIL. However, we note that many of the submitters, including Mr Hall on behalf ECESS, raised very useful criticisms of that modelling. We accepted the modelling results should be seen as only a crude representation of the reality, and we agreed with him that the assumptions made have a critical impact on modelling outcomes. Nevertheless, subject to these reservations the modelling aptly demonstrated for us the very real consequences of a catastrophic failure of the embankments.
- 13.194 In examining the evidence and submissions before us we have focussed in some detail on the information provided to us from Dr McVerry and Mr Connell (for WIL) and also on some very detailed and helpful submissions, particularly those from Mrs Campbell, Mr Hall and Mr Dodds (on behalf of ECESS), and Mr McMorran (for Brentworth) and Ms Stanway.
- 13.195 We have also taken account of the matters raised by other submitters, most of whom were understandably concerned about the risks and consequences of dam failure. While we have not repeated here everything that these submitters had to say, we have noted their concerns and have considered their views very carefully.
- 13.196 To put it simply, WIL submits that the embankments have been designed according to accepted practice so that they will not fail (in a catastrophic sense) when subjected to a maximum design earthquake. This, we were told, is equivalent to a 1 in 10,000 year event. Given that, for actual failure (collapse) to occur, a sequence of actions (or lack of) would have to take place, according to WIL the probability of failure and inundation of the land downstream is more likely to be in the region of 1 in 1,000,000. Of course these are convenient figures used to give an indication of the risks involved but there can be no mathematical certainty attached to these odds.
- 13.197 In a technical sense, we accept that it is possible to design the ponds and their embankments in such a way that flooding will not occur or, if something unforeseen should happen and it did, there are mechanisms in place to prevent flooding in a manner that would place people and property at risk. This might either be that the dams are so robust that they cannot fail or, if they did, the water that is released can be controlled so that there are no significant adverse effects.
- 13.198 From the evidence before us it is apparent that this is not the case here and neither does WIL claim that it is. In fact WIL's evidence discusses inundation

and the effects of dam failure in some detail.

- 13.199 We are well aware that earth embankment dams are not new. Such structures have always been built to store water and there are probably thousands existing today. Of course, there have been failures and Mr Hall alerted our attention to this. However, there was no evidence to suggest that a properly designed and operated embankment dam would not be a safe structure.
- 13.200 The question for us is, does WIL's proposal meet this standard? As we see it, there are two distinct parts to this matter about which we need to be satisfied. That is the quality and validity of the design parameters, and the robustness of the design. By the latter, we mean not just the embankments but also the efficacy of the liner and other parts of the pond infrastructure such as the outlet pipes and provisions for releasing the impounded water.
- 13.201 There were no concerns put to us regarding the design of the embankments and their foundations for the static loads imposed by the impoundment of up to 12 m of water. The seismic design data was another matter, however, and the adequacy of these attracted considerable criticism from submitters. Mrs Campbell, who spoke about this at length, was a credible witness and her evidence was detailed and helpful. In essence she told us that there are significant unknowns with respect to faulting in the area around the WIL site and that the recent earthquake activity in Canterbury had highlighted considerably uncertainty as to the ability of current seismic design practices to represent the reality of local conditions. In particular, she referred to the unprecedented high vertical accelerations that had been experienced, and her concern that the design had failed to take this information into account.
- 13.202 We were left with no doubt in our minds that, in an ideal world, a proposal such as this, where the consequences of failure are not acceptable, a level of design information would be sought, which is not only sufficient but is the best that can be provided. The reality is that this is not always practical and, thus, where there are shortcomings, perceived or otherwise, then a degree of conservatism must be built in to the design.
- 13.203 Turning to Dr McVerry's evidence on the seismicity of the WIL site, and the design parameters provided to the pond designers (Damwatch), we acknowledge that GNS is a leading institution in New Zealand when it comes to earthquake hazards, and that Dr McVerry is a well-respected engineering seismologist. We note that he had no fundamental disagreement with much of Mrs Campbell's evidence except to say that most of the information she said was lacking could only be obtained after an extensive amount of long-term research, which was not practical under the circumstances. We accept Dr McVerry's evidence that there are no known surface fault traces passing directly through the area and the known active features are the Hororata Fault and the Porters Pass-Amberley Fault Zone. We accept his finding that in respect of the Hororata Fault it is inferred to have a low probability of rupture given the average reoccurrence interval of some 17,000 years. We also accepted his evidence based on his LiDAR data that there is no evidence that surface fault rupture deformation has impacted the location of the WIL site within the last approximately 18,000 years. Finally, we agree and accept Dr McVerry's evidence that sufficient conservatism has been built into the seismic design parameters provided to Damwatch to offset the concerns of Mrs Campbell and others.
- 13.204 This brings us to the design process undertaken by Damwatch, and the proposed storage ponds for managing dam safety after construction. Here, we

have reservations about the information that has been provided to us by WIL, principally through the evidence of Mr Connell. We acknowledge that Damwatch is a well-recognised designer of dams and that Mr Connell is an experienced dam engineer, and that he is satisfied that the design process undertaken is in accordance with accepted practice in New Zealand. While we are not saying that this has not been the case, submitters have raised a number of concerns that we feel are valid and must be addressed in coming to a decision.

- 13.205 Firstly, we refer to the matter of whether or not vertical accelerations during strong earthquake activity should have been considered. We understand and accept that these are not normally considered in the design of embankment dams and nor do the current NZSOLD Guidelines require this. However, we are presented here with a proposal to build a very large storage ponds requiring embankment dams of unprecedented size in New Zealand, in an area of uncertain seismicity and where the consequences of failure are unacceptable. With this in mind, it can be said that, as a result of recent earthquake experience in Canterbury, where very high vertical accelerations were recorded, ignoring vertical accelerations and possible ground deformation may no longer be appropriate – particularly in areas where knowledge of local faulting is imprecise.
- 13.206 The efficacy of the liner also remains a matter of concern to us. While it may be satisfactory, Mr Connell's evidence that the proposed HDPE liner is an appropriate choice under the circumstances was not convincing. His assertion that HDPE liners have been widely used in similar circumstances, both here and overseas, did not seem to be supported by the facts. Furthermore, his statement that the use of a double liner in the corners of the ponds, had been considered acceptable by an international expert (Dr Giroud) was placed in some doubt in the submission from Mr Dodds. We were not able to question Dr Giroud about this and Mr Connell did not produce a statement in writing to support his evidence. We note also that Mr Smith (Riley Consultants) also referred to the fact that using a double liner was unusual.
- 13.207 We accept that, given the materials from which the embankments would be constructed and in the absence of an impervious core, a liner is necessary because minimising (and controlling) leakage from the ponds is clearly important. It is also apparent that, whatever is used to line the ponds, leakage to some degree can be expected. We think it is important that such leakage as may occur needs to be able to be monitored and we were not convinced by the evidence that appropriate measures have been provided. For example, we understand, and Mr McMorran referred to this, that it is common in embankment dams overseas to provide internal drainage zones that intercept seepage and direct it to points where it can be measured and properly monitored. We do not know if this is a practical proposition in this case but it does seem more sensible to us than relying on the visual inspection of some 4 km of embankment where leakage may not always be readily apparent let alone measurable.
- 13.208 Concern was also raised by submitters, including Mrs Campbell, Ms Stanway, and Mr Hall, about the adequacy of the geotechnical investigation. It seemed to us, that relying on a series of 5 m deep holes excavated over the site was probably more suited to establishing that the ground would yield suitable and sufficient materials from which to build the embankments, than the provision of sound geotechnical data. Given the scale of the proposed storage ponds, and the importance of its design, we find it surprising that data from bore logs drilled to bedrock or at least to 100 m, as suggested by Mrs Campbell and others, was not considered to be a necessary part of the site investigation.

13.209 We have previously noted that this application was somewhat unusual in that WIL had already sought and obtained a building consent for the project. WIL's view seemed to be that we could, therefore, accept that the structural integrity of the design had already been scrutinised and we could take some comfort from that. While structural adequacy of a proposal is not always a matter for concern during the RMA process (often the detailed design will not have been done), in this case there are serious matters relating to the risk of dam failure that are relevant to the RMA and that require us to be satisfied that the design is robust. We cannot be certain that this has been sufficiently addressed in the building design process to give us this confidence.

13.210 We are aware that the NZSOLD Guidelines, among the general requirements, states among its principles⁶³:

... appropriate quality assurance procedures should be implemented at all stages including use of peer review for higher potential impact dams

13.211 The guidelines are, however, silent on the level of detail to which peer reviews should be undertaken.

13.212 Mr Connell emphasised to us that the proposed storage ponds, during the building consent process, had been subjected to two peer reviews, one by a chartered engineer independent of Damwatch, and also one by the councils' engineering consultants. However, it was apparent to us that these reviews were mainly for statutory or compliance purposes, and that neither review had considered the design of the proposed storage ponds in any detail.

13.213 To reiterate, we find that the issues that have been raised about the design are significant and must be taken into consideration in our decision. Having said that, we note that such concerns are not unusual when dam construction is contemplated and we do acknowledge that the fears, which people who could be placed at risk in the event of a dam failure have, are very real.

13.214 We need to make the point here that, despite perceived shortcomings in the proposed storage ponds, we are not saying that it is necessarily not fit for purpose. It is simply that we cannot be certain that it is.

13.215 Therefore, we do not consider the matters raised above are necessarily fatal to this decision and that, subject to the proposed storage ponds satisfying the other requirements of the RMA, consent could be granted subject to provision of strict conditions requiring appropriate independent expert evaluation and peer review.

13.216 We would expect that a proper peer review process would, as a minimum, include evaluation by a panel, including at least three independent experts, of the site investigations and geotechnical assessment, the choice of dam, the design parameters, the design of the embankments and pond infrastructure, the suitability of the liner, the commissioning process and operation of the ponds including maintenance and the means of monitoring leakage, and the Dam Safety Programme and proposals for emergency management. In the event that shortcomings or deficiencies are found in any of these matters, we expect that the outcome would include discussion and recommended actions concerning the measures required to ensure that the proposed storage ponds is designed, constructed and operated to the required standards.

⁶³ NZSOLD Guidelines at Para III.3.2 (vi).

- 13.217 Referring back to our earlier discussion on the relevant objectives and policies, it is our finding that, given our acceptance of Dr McVerry's evidence on his seismic assessment of the site and the conditions we intend to impose, we consider that the proposed storage ponds subject to those conditions generally accords with the relevant objectives and policies.
- 13.218 We have placed most weight on the Proposed Land and Water Regional Plan (pLWRP) and the District Plan. In our view, the objective and policy base of the pLWRP demonstrates a differing focus than the NRRP. In our view, the NRRP focuses on the management required to avoid the risk of dam failure and to avoid, remedy or mitigate the effects of flooding and other hazards during construction or operation. So we see emphasis on avoidance as the primary step.
- 13.219 In contrast, the pLWRP holds objectives that recognise the role that significant infrastructure plays in contributing to economic, social, and cultural well-being. The objectives promote a regional network of water storage and distribution facilities for sustainable, efficient and multiple use of water. The pLWRP also recognises water as an enabler of the economic and social wellbeing of the region.
- 13.220 Of most relevance, Policy 4.48 of the pLWRP seeks an outcome of siting, designing, constructing and operating the infrastructure so as to minimise risks, including those of overspill, leakage or dam failure, as well as any associated risk of inundation or other adverse effects on people, communities, and their property. We do not read Policy 4.48 as being as focused on avoidance as a key outcome as, for example, Policy WQN3(3) of the NRRP.
- 13.221 Overall, placing particular weight on the conditions we have decided to include, we reach the view that the grant of consent would result in the achievement of the objectives and policies of the CRPS, NRRP, and pLWRP as they relate to the dam safety issue.
- 13.222 In terms of the District Plan, we see the relevant objectives, namely Objective 8.1.1 and Policies 8.1.1.1 and 8.1.1.2 being broader in their focus than, for instance, those in the NRRP. There is a greater emphasis on ensuring the community has a good understanding of natural hazards and how to respond to them, both prior to, during, and after natural events. To some extent this would include ensuring the siting, design, construction, and operation of the embankment has properly taken into account and allows for any likely natural hazards. We think WIL, both through the conditions it proffers and the ones we have decided to include, properly allows for and provides for impacts of natural hazards on the embankments.
- 13.223 The District Plan also seeks to maintain amenity values and quality of the environment and provide protection of people's health, safety and wellbeing. Also, Objective 12.1.1 seeks an assurance that any potential adverse environmental effects from, relevantly structures, are avoided or mitigated. We consider that given the design processes undertaken by WIL to date coupled with the peer review conditions we have included, that the result will be maintenance of amenity values, protection of people's health, safety and wellbeing, and also an assurance that potential adverse environmental effects from the proposed storage ponds will be avoided or mitigated.
- 13.224 For these reasons, we consider that the grant of consent with the conditions we have included satisfies the relevant objectives and policies within the District Plan.

Section 3(f)

- 13.225 Given our findings, we are now able to revisit s 3(f). We have in our approach endeavoured to undertake an assessment of the degree of probability of the effect and then secondly, an assessment of the seriousness of the impact. The second part is straight forward, we do not believe anybody could seriously suggest an impact of a catastrophic failure of the embankments would not be serious.
- 13.226 In assessing the degree of probability, we find that the degree of probability is towards the bottom end of the scale of probability. We do not accept the WIL contention that the degree of probability is so low that s 3(f) is not in play. However, we do acknowledge that the evidence of Mr Connell and Dr McVerry significantly impact on the degree of probability and on the basis of that evidence we assess the degree of probability to be at the bottom end of the scale of probability.
- 13.227 Simply because s 3(f) is in play that does not count against the grant of consent, but is simply a matter that we have been mindful of throughout our consideration and deliberations. We hope we have been able to demonstrate that approach in this decision.

14 EFFECTS OF THE DISCHARGE OF DUST

- 14.1 It was generally accepted that the discharge of dust could occur from a number of sources including the stripping of vegetation and the excavation/ deposition of materials, vehicle movements, and stockpiling of construction materials. We note the dwellings and property in close proximity to the site and that submitters had raised concerns about the effects of dust on vegetation, health effects, and effects on pasture used to graze cows.
- 14.2 To control the frequency and intensity of dust emissions WIL proposed preparing a Dust Management Plan in accordance with the Ministry for the Environment Good Practice Guide for Assessing and Managing the Environmental Effects of Dust Discharges.
- 14.3 Ms P Harwood for ECan considered that the construction of the embankments, given their scale, in addition to the initial stripping stages was likely to have a high potential for creating offensive levels of dust beyond the boundary. She said considerable resources would be required to prevent and control dust and that contingency measures for extreme weather events were required.
- 14.4 Ms Harwood considered the use of water and other surfactants to be the most effective methods to prevent and control dust emissions. In addition she considered that instrumental monitoring in addition to visual inspections may be required. Regardless she had reservations as to whether the mitigation measures proposed would be sufficient to adequately avoid, remedy or mitigate dust discharges on the nearest residences in adverse weather conditions.
- 14.5 Ms Harwood recommended that the Dust Management Plan include mitigation and remediation methods that would provide relief to the residents most likely to be affected by the discharge of dust (those within 200 metres of the site boundary). This she said may include measures such as the relocation of the buildings, regular cleaning of houses or temporary rehousing of residents.
- 14.6 Mr A Curtis, an air quality specialist for WIL, said that the key to dust control for this project will be mitigation measures, and prior to construction commencing, a

comprehensive management plan will be developed. He was confident that through the use of the various measures which had been outlined that dust emissions could be controlled to acceptable levels. He also agreed that total suspended particulates (TSP) concentrations should not exceed the levels that the Ministry for the Environment has identified as resulting in nuisance.

- 14.7 Mr Curtis said he was comfortable that the proposed quantity of water would generally be sufficient for the proposed construction methodology, however it was important to emphasise that water must be used in conjunction with a range of additional mitigation measures. He said that in addition to the regular mitigation measures that would be carried out as a matter of course, that there was a need in this case for some contingency measures that could be implemented in the event that construction activities generated a greater level of dust nuisance than predicted. In this regard he said the contingency measures required related to the three sets of occupied dwellings near the site.
- 14.8 The contingency measures Mr Curtis considered may be necessary if trigger levels were exceeded are offering to clean residences; offering to install positive pressure ventilation systems on the residential properties; offering to install a first flush system for any residences with a roof based water supply system; and using greater volumes of water for dust control (above the 250 m³) indicated.
- 14.9 Mr Curtis said it was extremely unlikely that there would be any potential for effects beyond a couple of hundred metres from the site boundary. He went on to say that for those residences within that distance there were a range of mitigation and contingency measures that could be implemented to ensure that ambient TSP concentrations did not result in nuisance or health effects. In particular he recommended that the installation of TSP monitors in the vicinity of two of property groups to ensure that there was proactive management of dust, to minimise the potential for nuisance.
- 14.10 In terms of dusts effects on vegetation Mr Curtis said his experience was that the bulk of vegetative effects occur within 10 m of construction activity and that beyond this effects are minimal. Consequently he considered the Eyrewell Scientific Reserve was unlikely to be affected because it was beyond that distance. He also considered it unlikely that pasture on the Brentworth Dairy Farm would experience any significant reduction in grass production over and above that which might already occur due to traffic on the unsealed Wrights Road. In any event he said the farm was serviced by a central pivot irrigator which, in the unlikely event that there were evidence of additional dust build up that either affected production or reduced the palatability of the grass to cows, could be operated over the affected section to remove the dust.
- 14.11 Mr Curtis also said that the mitigation measures proposed were sufficient to safeguard the general 'values' (including mauri⁶⁴) of the air, and that the consent conditions proposed were appropriate to ensure that this mitigation occurs
- 14.12 In response to Ms Harwood's concerns regarding the quantity of water available for dust control Mr Curtis said that based on his review of the evaporation data, and discussions with Mr Agnew (and engineer for the main contractor) who had estimated the water requirement based on experience at other similar sites, he was comfortable that the stated water volume would be adequate for most of the time given that the actual exposed area that is active will be significantly less than the total area of the site.

⁶⁴ Life force.

- 14.13 Mr Curtis did not agree that the relocation of residents was necessarily the most appropriate or first option to consider from a dust control point of view, noting that these residents were already subject to dust from unsealed roads and that if dust were reaching this sort of level then there would have been a significant failure in the dust control measures and that even in worst-case conditions if dust control fails there is only a relatively small period of time in which nuisance would be experienced.
- 14.14 Mr Curtis considered the proposed consent conditions to generally be appropriate however made a number of suggested amendments.
- 14.15 Ms West, consultant planner for Brentworth Dairy Farm Ltd, considered that there was potential for more than minor adverse dust effects on the closest neighbours to the site given the length of the construction period. She raised questions with regards the procedures to manage dust when staff were not on the site. Mr Smith a Brentworth Dairy Farm Ltd director also raised concerns in terms of dust covering pasture.
- 14.16 In terms of combustion emissions, that is, combustion emissions from stationary diesel engines powering on-site screening plants and the like, Ms Harwood in her evidence concluded that such engines would conform to the conditions of the permitted activity Rule AQL25A, with the exception of the limit on maximum operating hours. She also told us that concentrations of combustion contaminants at or beyond the boundary of the property will be well below the NESAQ thresholds that protect human health. So it was her expert view that it was unlikely that there would be any adverse effects on health due to the discharge of combustion emissions from the on-site engine. This assessment was not challenged and we agree with it.

Findings

- 14.17 We have considered the potential dust effects, in particular the potential for high level of dust particles to be distributed beyond the site boundary in wind events. In this regard we acknowledge that the site is reasonably exposed to both the prevailing north-east and strong north-west winds.
- 14.18 Construction of this type and length is always going necessitate a strong and effective plan to deal with the effects of dust particularly given the proximity of nearby residential properties. We consider this is achievable with adherence to the relevant environmental standards and robust conditions.
- 14.19 We have reviewed the methods proposed to deal with dust and the conditions now proposed. The proposed conditions include the preparation of a Dust Management Plan (including a procedure for managing dust when staff are not on site); the methods to be used in dust control; the monitoring of TSPs; threshold triggers for either implementing additional dust control measures or ceasing operations altogether; a 200 m separation distance for the stripping or placements of dusty material upwind of occupied dwellings when established wind speeds are exceeded; and remediation of exposed surfaces.
- 14.20 We consider overall that the methods and conditions proposed are extensive and thorough and should ensure that dust nuisance and/or adverse effects are avoided or kept to a minimum during the construction period to the point where the relevant provisions are achieved.

15 EFFECTS OF CONSTRUCTION NOISE

- 15.1 It was generally accepted that the effects of operational noise would be minimal on the dwellings located close to the site however that they would be subject to noise associated with the construction of the ponds.
- 15.2 Construction noise is primarily governed by NZS 6803:1999 which has been widely adopted in New Zealand as the best practice approach to the assessment and management of noise from construction activities. It contains recommended noise limits (70 dBA Leq) and recommendations to manage construction noise.
- 15.3 Mr McCallum-Clark considered that noise emissions during construction were likely to be significant given a duration of up to 20 months. He noted that the Marshall Day Acoustics' report prepared for WIL had identified that at times it was possible, during the construction of the embankments, that the 70 dBA Leq noise limit would be exceeded. He said that the report was heavily reliant on management of construction noise as a primary mitigation measure, specifically the construction of the embankments adjacent to the dwellings was identified as having immediate noise mitigation benefits.
- 15.4 In terms of the recommended conditions by WIL Mr McCallum-Clark said that while these would go some way to mitigating the likely adverse effects of construction noise on surrounding residents, there was no escaping the reality that there were seven existing residential dwellings in close proximity to the boundary of the site which currently enjoy relatively low ambient noise levels and that the construction effects would result in significant long term noise exposure, which is likely to significantly compromise the amenity of those residents during the construction phase. Overall, he was unable to conclude that the construction noise effects on the surrounding residents, particularly the four closest dwellings would be no more than minor and as a result the proposed storage ponds were potentially inconsistent with Policies 12.1.1.7 and 12.1.1.8 of the District Plan.
- 15.5 Mr Farren of Marshall Day Acoustics indicated in his evidence for WIL that under the scenarios he had evaluated, construction noise levels were below the 70 dB LAeq daytime noise limit recommended in NZS 6803. However, he noted that the potential existed for relatively high noise levels for short periods when construction of the perimeter embankments occurred in the vicinity of existing dwellings. He was confident, however, that the application of the noise management techniques and recommended noise limits in NZS 6803:1999 will result in reasonable noise effects and expect that construction noise levels would be compliant at all times at the Brentworth residences.
- 15.6 Once the embankments were at a height of around two metres Mr Farren considered they would start to act as an effective barrier and construction noise from within the site would be reduced at the site boundaries. He considered the implementation of both the construction noise management practices and construction noise limits in NZS6803:1999 would be appropriate for the project to ensure that noise effects were reasonable. In answer to a question Mr Farren said his assessment did not rely on the embankments nearest the dwellings being formed at the early stage but he accepted that this would be a positive effect.
- 15.7 Turning to Policy 12.1.1.7 Mr Farren said that NZS 6803:1999 had been developed to ensure that reasonable levels of construction noise were achieved over the construction period of a project and he did not consider that the phrase "*character and circumstances of the zone*" in the policy should be interpreted to mean that a rural area deserves lower construction noise levels. This he said would be inconsistent with the approach set out in NZS 6803 which affords all

residences the same level of protection. Similarly, he considered that compliance with NZS 6803 would:

"Avoid noise adversely affecting the amenity values and health and safety of people on neighbouring sites or zones" as outlined in Policy 12.1.1.8.

- 15.8 Mr Farren went on to recommend that, should consent be granted, the following text be used as the basis for conditions relating to noise:

Construction noise should be assessed and managed in accordance with NZS 6803: 1999 "Acoustics - Construction Noise". A Construction Noise Management Plan (CNMP) should be prepared for the project and submitted to [Insert title of appropriate person at council here].

- 15.9 He said in particular, that the CNMP should address how potential noise effects of bund formation will be managed at the nearest residences.
- 15.10 Finally, Mr McCallum-Clark had sought as a condition that construction noise comply with Table 2 of NZS 6803:1999 "Acoustics – Construction Noise". Ms Appleyard submitted that this was unrealistic in the course of construction.

Findings

- 15.11 We have considered the impact of construction effects and the potential for significant noise exposure which might compromise the amenity of adjacent residents. We accept that such effects are, due to the nature of construction, often difficult to overcome.
- 15.12 We note that whilst the overall construction duration of the project would be around 20 months it is over a very large area. The amount of time that construction would occur in the vicinity of any dwellings would be a lot less than 20 months. Further, construction would occur during the day when it might be expected that at least some of the residents would be at work or engaged in activities on their properties. In the evening construction is proposed to be restricted by condition and therefore there should be no sleep disturbance effects, while no activity is to occur on Sunday's.
- 15.13 We also note that the evidence was that once constructed the embankments closest to the neighbouring dwellings would provide a barrier to ongoing construction noise elsewhere on the site. It would therefore seem to us to make some sense that this occurred at an early point in any construction.
- 15.14 Overall therefore, for relatively short periods there may be some loss of amenity during the day for some of the residents, but night-time amenity and sleep protection would be preserved. Consequently, we consider it unlikely that residents would experience significant long term noise exposure and consider construction noise effects will be reasonable and consistent with the policy framework. We accept that such noise effects should be assessed and managed in accordance with NZS 6803: 1999 "Acoustics - Construction Noise" and a CNMP be prepared.

16 EFFECT ON WATER QUALITY FROM CONSTRUCTION AND POST-DEVELOPMENT PHASES

- 16.1 Mr Callander, a hydro geologist, advised us that environmental monitoring had been carried out in the WIL Scheme area since 1999. He said that the conclusions which could be drawn from that monitoring were:

- (a) that land use activities by WIL shareholders are not having any significant adverse effects on groundwater utilised by abstraction bores, relative to the situation prior to the WIL scheme commencing;
 - (b) that since the WIL scheme had been operating the seasonally low groundwater levels were not as low as they historically were, which was beneficial to groundwater users and low land streams. With respect to the high groundwater levels, the monitoring indicated that the highs are not any higher than historic levels; and
 - (c) that analysis of water quality data for two lowland (groundwater fed waterways) was undertaken and found that concentrations of dissolved inorganic nitrogen and dissolved reactive phosphorus was elevated, but there was no increasing trend since the commencement of the Waimakariri Irrigation Scheme in 1999.
- 16.2 Mr Callander said that groundwater was likely to be more vulnerable to nitrate leaching where there was an unreliable irrigation supply due to the more variable growth of pasture and crops that will occur. He said the lower reliability of water supply will tend to lead to larger applications of irrigation water than may be ideal, so as to provide a buffer during times of water supply shortfall. Furthermore, he said reduced growing capacity during dry periods when water supply is restricted also corresponds to reduced nutrient uptake in the soil, leaving a greater mass of nutrients in the soil for leaching during heavy rainfall events. He considered the addition of water storage would reduce the variability of water supply allowing for more stable plant growth and uptake of nutrients from the soil. He said that proper nutrient management on farm sites, particularly in terms of fertiliser application and the use of irrigation, is important to minimise the leaching of nutrients into groundwater.
- 16.3 Mr Callander referred to key measures that would be implemented to ensure that the risk of sediments and other contaminants entering the water races around the site was reduced during construction. These included excavating the site such that the stormwater was contained in the excavated areas and allowed to soak into ground; provision of a vegetated riparian strip between excavation works and the water races; placement of stockpiled materials away from the water races; works to be carried out in accordance with the ECan Erosion and Sediment Control Guideline (2007); storage of fuel and refuelling activities located away from the water races or open water areas; and development and implementation of a site-specific accidental spill management plan.
- 16.4 In terms of post construction run-off Mr Callander said that this was expected to contain only minor amounts of entrained sediment, which would be trapped and filtered by vegetation on the embankments prior to entering the water races.
- 16.5 In relation to the quality of water in the ponds Mr Callander acknowledged that if the water was stored too long without sufficient turnover, there was the potential for the water quality to be degraded, encouraging algal growth which could potentially limit the use or impact the down-gradient water users. However he considered in the case of the WIL storage ponds the risk was relatively low. In particular he noted that the lining of the ponds avoided issues related to the decomposition of organic matter within the dam footprint; the source of the storage pond water is from the Waimakariri River and is of good quality and low in nitrogen enrichment; and the water in the ponds would be regularly mixed as part of the pond filling and delivery process particularly during the summer months.

- 16.6 Mr Callander considered there could be a maximum potential residence time in the order of 9 months (May-January) where there could be limited inflow or outflow. However he said any problems with algal growths required elevated nutrients, sunlight and temperature to all coincide, so he considered it was an effect that was best to be monitored (via conditions) with mitigation effects in place should signs of problems start to appear. He considered this was a better approach than setting specific trigger levels.
- 16.7 In terms of groundwater Mr Callander advised us that bores in the vicinity contained groundwater at depths of 41.3 m and 51.05 m. He said that even at the revised 6 m depth of proposed excavation this well above the expected depth of groundwater. He said that to avoid interception of groundwater during excavation, a condition restricting the maximum excavation depth for the construction, use and maintenance of the proposed storage ponds and associated infrastructure should be restricted to 6 m below ground level. On this basis he considered that the effect on the groundwater quality from the excavation was minor.
- 16.8 Overall Mr Callander considered that potential adverse effects on the water quality in the water races and the surrounding groundwater could be avoided or mitigated by ensuring that activities were carried out in accordance with the mitigation measures and consent conditions.
- 16.9 Ms Blyth acknowledged that the management of impounded water had the potential to affect the water quality particularly if water was stored too long as there was the potential for degraded water quality and algal growth which potentially needed active management to maintain acceptable water quality outcomes.
- 16.10 In terms of stormwater runoff Ms Blyth agreed in principal that the mitigation measures proposed would protect the water quality of any adjacent surface water bodies by preventing any discharge of stormwater off the site. She also considered that as sediment is likely to be in primary contaminant in the construction phase, this is unlikely to have an adverse effect on ground water.

Findings

- 16.11 We acknowledge the evidence of Mr Callander that there are potential benefits of more regular irrigation in terms of water quality in the wider area. We also accept that groundwater is unlikely to be intercepted at a depth of 6 m and that setting a separation distance would protect groundwater from being intercepted.
- 16.12 In term of the quality of water in the ponds we accept that there will be a level of mixing of water occurring as part of pond filling however as acknowledged by Mr Callander there may be long periods with limited mixing. It would be prudent therefore in our view that regular monitoring of the water quality was undertaken to ensure that any deterioration was picked up at an early stage and could be remediated.
- 16.13 Finally, we consider impacts associated with surface water run-off both during and post construction on the adjoining water races are able to be adequately addressed through conditions.
- 16.14 Overall, we are satisfied that in terms of groundwater and surface water quality that appropriate conditions are able to be put in place to address any potential adverse effects and that the relevant objectives and policies are able to be achieved.

17 EFFECT OF FUEL STORAGE

- 17.1 The storage of hazardous substances, primarily fuel, was identified as potentially effecting water quality, contaminating soils and impacting upon cultural values.
- 17.2 Ms Blyth had noted that there was the potential for the discharge of contaminants into stormwater from the vehicles used for excavation, transportation and processing of aggregate, primarily through leaks and spills. She said these had the potential to enter groundwater however, she considered that the discharge of stormwater was unlikely to have an adverse effect on groundwater or surface water within the site provided hazardous substances were handled appropriately and managed in accordance with the Hazardous Substances and Spill Response Plan.
- 17.3 Ms Blyth acknowledged that a significant set of measures to avoid and mitigate any adverse effects from the result of the storage of hazardous substances were proposed. However, she considered there were additional mitigation measures required, which she set out, to provide greater certainty and clarification.
- 17.4 Mr Callander considered that the additional conditions proposed by the Reporting Officer were generally consistent with conditions contained in the permitted activity rules for the storage and use of hazardous substances. In his view they were reasonable and provided further assurance that the potential adverse effect on groundwater and water races from the activities can be managed so as to be minor. In response to questions Mr Callander said refuelling of vehicles would occur on site and within a bunded area which had sufficient capacity for the volume of the refuelling tanker.
- 17.5 Overall Mr Callander considered the potential impacts to surface water and groundwater quality arising from the use and storage of diesel and small quantities of other construction-related substances when managed properly were unlikely to have an adverse effect given the site management measures, including accidental spill response measures and the verification of the use of suitable containers, would ensure that potential effects arising from the use and storage of hazardous substances are avoided or mitigated.

Findings

- 17.6 The key issue associated with hazardous substances is the potential for a spill and subsequent impact on in particular water quality.
- 17.7 To combat a potential spill a suite of conditions are proposed which include the storage of containers in a bunded enclosure; total limits on the substances stored; security provisions; and regular inspections. The conditions also include procedures in the event of a spill occurring. We consider the conditions are appropriate and in accordance with good practise. We also note that for the most part hazardous substance storage in the volumes proposed will only be temporary in nature, that being the time of construction.
- 17.8 We note that the closest down gradient well is approximately 285 metres south east of the site. We accept that at this distance any spills are very unlikely to migrate from the site to this well or any other well further away.
- 17.9 Overall we do not consider with the conditions proposed that any adverse effects will result from the storage of hazardous substances and that these are consistent with the relevant objectives and policies.

18 EFFECTS ON LANDSCAPE AMENITY AND ECOLOGY

- 18.1 Mr Edge, a landscape architect on behalf of WIL, assessed the existing landscape character of the site and its context in relation to the broader regional landscape. He also assessed the proposed storage ponds in the context of their local landscape character and cultural issues and went on to address opportunities for improving recreational and biodiversity associated with the proposed storage ponds.
- 18.2 Mr Edge was of the opinion that the visual amenity impact would not be adverse; the form of the embankment structure was not foreign to the local environment and the proposed planting regime consisting of a grassland meadow with planting at the toe of the embankment would successfully mitigate any visual effects of the proposed storage ponds.
- 18.3 Overall Mr Edge said that the scale of the plains landscape in a broader sense dwarfed the scale of this large storage facility and that the scale of the man-modified agricultural landscape with all its contributing characteristics similarly allows the structure to appropriately fit into the environment. He was of the opinion that any potential for adverse effects on the amenity values of the receiving landscape were likely to be less than minor.
- 18.4 In response to questions we posed Mr Edge said there would be deer fencing around the toe of the embankments for security reasons and that in his opinion the key visual issue was the scale of the embankment along Wrights Road. In relation to this latter issue Ms Buttimore said that the potential loss of the hedges on the adjoining properties would not change her overall view in terms of minimal effects on amenity.
- 18.5 The ecological effects were assessed by Dr Roper-Lindsay on behalf of WIL. She said that there were few indigenous ecological components in the landscape that could be inundated should a breach occur, however one of the largest areas and most valuable was the Eyrewell Scientific Reserve, located immediately to the south of the storage pond. She advised us that this reserve supported a diverse community of plants and animals associated with kanuka woodlands and dry grasslands. She said that inundation damage would include direct loss of plants and animals, siltation, introduction of weeds and pests, and damage to fencing allowing stock damage.
- 18.6 Dr Roper-Lindsay also identified the potential for slow leakage to adversely affect the adjacent dry land vegetation. The changes to soil moisture could undermine the dry land species and have adverse effects on the health of the plants. This adverse effect she considered could be mitigated by the monitoring of the proposed storage ponds and of the reserve for changes.
- 18.7 Dr Roper-Lindsay identified that a further threat to the Reserve vegetation could occur from the long-term stockpiling of earth during construction. This was likely to expose soils to weed growth for a longer period than normal farming regimes, enabling weeds to spread into the Reserve. She said the monitoring and management of stockpiled earth during construction should also take place to minimise this threat.
- 18.8 Dr Roper-Lindsay considered that the proposed plantings around the storage pond and wider race system provided an opportunity to add to the native plant and habitat diversity in the area, which has been lost over the years with more intensive agricultural use.

- 18.9 We also note here that Ms Buttimore considered s 6(c) of the RMA was of relevance here given that the site adjoins the Eyrewell Scientific Reserve, which contains significant indigenous vegetation and habitats of indigenous fauna.
- 18.10 The reporting officers noted that for the occupiers of dwellings nearer to the higher sections of the bund, the views were likely to be of a relatively imposing structure of considerable bulk during the construction phase and the years following until the vegetation became well established. However, they noted that the top of the embankments were well set back from the boundaries and considered that, given this setback along with their slope, compliance with any recession plane in the District Plan, could be achieved and accordingly it was unlikely that any significant shadowing or shading effects would occur.
- 18.11 The reporting officers also noted that the effects of the vegetated embankments might be similar to a dense shelterbelt, which under the District Plan was a permitted activity in the Rural Zone. They said the visual effects of a shelter belt were similar to the visual effects of the embankments with substantial vegetation i.e. shading and greenery and indeed, the dam could be ultimately be screened behind shelterbelts. Having regard to this permitted activity in relation to the proposed storage ponds, they considered the landscape and natural character effects of the proposed storage ponds were, at a general level, not unexpected in the rural environment.
- 18.12 The reporting officers also considered that the landscape planting appropriately mitigated any adverse effects on the broader landscape. They largely agreed with Mr Edge that the effects on the broader landscape were likely to be negligible and the effects on adjacent properties likely to be no more than minor.

Findings

- 18.13 We accept that the existing landscape is rural in nature and highly modified for agricultural use. We also acknowledge that storage ponds, as we saw, are becoming an increasingly common feature in the rural environment, and the landscape effects associated with them are reasonably well known. Notwithstanding this, however, the proposed storage pond or dam in this instance is significantly larger both in height and scale than any other water storage facility in the wider environment, and will result in a loss of a large area of productive rural land.
- 18.14 We acknowledge that the site is relatively remote from significant public viewpoints, and is adjacent to roads, which are primarily utilised by nearby residents and farms. The relatively low height of the embankments, in the context of the Canterbury Plains, will mean that the structure will not be visible from a wider area.
- 18.15 For those properties and dwellings adjacent to the site, the construction and long term appearance of the embankments is likely to result in more significant effects on the landscape certainly in the short to medium term while landscape planting becomes established. With the establishment of vegetation, however, the visual amenity effects will, we consider, over time diminish although perhaps not to the extent that the top of the embankments will be screened. In this regard, we note the comments made at the hearing with respect to the potentially increased risks associated with tree plantings onto the embankments.
- 18.16 Subject to now limiting tree planting on the embankments we consider the landscape planting to be appropriate and consider it will to a large extent in the fullness of time mitigate the localised visual effects of the dam. In the wider

context we consider the dam is acceptable in landscape term and that the loss of productive land is balanced by the potential for increased productivity associated with more reliable irrigation.

- 18.17 We also acknowledge that the proposed planting of kanuka and indigenous species will supports the restoration of dry shrub land in the area and will be a valuable contribution to biodiversity conversation on the plains.
- 18.18 In terms of the Eyrewell Scientific Reserve and the potential ecological effects we consider that aside for a dam breach appropriate monitoring of the proposed storage ponds and of the reserve for changes in soil moisture and the stockpiled earth in terms of weeds should ensure that the reserve is adequately protected.
- 18.19 Overall, we consider that when put in context the landscape and ecological effects are minimal and the proposed storage ponds generally accord with the relevant objectives and policies.

19 SECONDARY EFFECTS

- 19.1 There are two topics to address under this heading. They are community perceptions and the issue of effects on property values.
- 19.2 Community perceptions of risk are not in themselves effects on the environment. While it may seem harsh, it is the case that as decision-makers we should not be influenced simply by the number of people who express opposition to this proposal or perceive themselves to be at risk or concerned about possible adverse effects.
- 19.3 Rather, it is the adverse effects on the environment we are required to concentrate on. If those adverse effects are shown to be well-founded, then they are the issues that should gain our attention rather than the supposed secondary result of them. It would be wrong if we focused on those secondary results and let them inappropriately influence our ultimate judgement.
- 19.4 The focus of the submitters' concerns related to the recording of risk on Land Information Memoranda and the likely increase in insurance premiums. We agree with Mr McCallum-Clark's views that whether or not there is an increase in insurance premiums or a decrease in property values has a high degree of uncertainty. After referring to the comparatively low probability of a 1:10,000 year event occurring, he referred us to research on the effects on property values caused by potential inundation. Mr Matthew McCallum-Clark advised that research demonstrated relatively limited implications for property values. He also referred to recent anecdotal information from Wellington with respect to public information on tsunami risk, which showed a relatively low risk of detrimental impacts on property values. We think his views on this point are sound and we accept them.
- 19.5 So, while we acknowledge members of the community who appeared before us genuinely expressed their concerns and fears, we have to place those views within a resource management context. When we have regard to the requirements of the NZSOLD Guidelines dealing with embankment design, construction and operation, combined with the conditions we have imposed, we are well-satisfied that the risk of adverse effects occurring on the environment have been as well-addressed in our decision, as they can be. If our robust conditions deliver on the outcome or objective they seek of a safe embankment, then the fears of the residents can be seen to have been addressed.

- 19.6 Turning to property values, in a similar way effects on property values are not a relevant consideration in determining whether or not a resource consent can be granted. Diminution in a property's value is really another register or way of measuring an adverse effect on amenity value.⁶⁵
- 19.7 In any event, the quality of the evidence we received, primarily from the submitters, on negative impacts on property values was largely speculative. There was no expert evidence available to substantiate their claim of a loss in value. It is, we think, much more important that we concentrate our assessment on the physical effects on the environment, particularly on amenity values. We have endeavoured to address amenity issues within our landscape section.
- 19.8 The other point we make is simply an observation in that, over time, it seems to us that perceptions of negative impacts on property values dissipate. In context, once the ponds are established and have been in operation for some time they may be "accepted" as part and parcel of the environment and not as a threat to safety with a consequent negative impact on property values.

20 ECONOMIC EFFECTS

- 20.1 Mr Ford, an agricultural and resource economist for WIL, had undertaken a simple "with and without" economic analysis of the storage option, which took into account the change in the level of reliability of irrigation water (pre and post storage), the current land use mix, creation of farm models and the increase in capital costs on and off farm.
- 20.2 Mr Ford said that his modelling showed that for the most part farmers Cash Farm Surplus would increase by approximately \$300 / ha as a result of the improved reliability of the irrigation water. This was after the costs of the additional water charges had been deducted. He said that the returns for those few who had yet to convert to dairy and that wished to change their land use offered a very good return on the capital cost of conversion of between approximately 18% and 22%.
- 20.3 Mr Ford said that for the scheme promoters the Net Present Value for the project is \$98.9 million with a very satisfactory Internal Rate of Return of 29%. He went onto say that the flow on impacts to the wider community would be significant with output increasing by 6% and value added increasing by 22%. This he said would result in a substantial increase in both economic activity and employment.

Findings

- 20.4 We acknowledge the need for increased reliability in water storage to provide for greater production from irrigated land is a core tenet of the Canterbury Water Management Strategy. The strategy identifies water storage, as being of long term and significant benefit to Canterbury.
- 20.5 With the above in mind, we accept that the dam would provide greater reliability of irrigation water and that this would mean that there was a much more consistent period when crops and pasture could be grown than at present, thus providing farmers with greater certainty.
- 20.6 There are also therefore, potential financial benefits to those involved in the scheme and potential flow on effects into the wider community in terms of employment and financial spending.

⁶⁵ *Foot v Wellington CC* EnvC W073/98.

- 20.7 Overall, therefore, we consider the above to be positive elements of the proposed storage ponds in terms of our considerations, which support the enhancing of rural production (Objective 14.1.1) and the domination of the Rural Zones by intensive and extensive agricultural (Policy 14.1.1.2).

21 TRAFFIC EFFECTS

- 21.1 Traffic volumes on local roads and noise from traffic were raised as issues by some submitters, who believed that during the construction period these two effects would be of concern. However, given WIL's estimate that approximately 250 vehicles per week may enter or leave the site during peak times, an estimate that we found reasonable, we do not think that traffic noise and traffic volumes are an issue of concern.
- 21.2 We note that it is intended the majority of the construction material will be from the site. We were not told that there would be a large number of heavy vehicles either moving fill to the site or carting it away. So, the likely cause of traffic flow will be workers coming and going to the site, and sporadic deliveries of equipment and supplies to support the project.
- 21.3 WIL dismissed noise from vehicles on roads as a matter that should be controlled, particularly by the District Plan. We agree with that view. In any event, we agree with the view expressed by Mr Matthew McCallum-Clark that road traffic noise, particularly when considered in the context of site construction noise would not be significant.
- 21.4 We also note that the vehicle movements do in fact comply with the District Plan limits. Car parking in excess of ten car parks in the Rural Zone does require resource consent.
- 21.5 In terms of the relevant roading network Mr Matthew McCallum-Clark set that out for us in detail. The essential measures we took from that is the roading network has ample capacity to absorb the proposed level of traffic, and the network is overall a safe network with no limitations relating to view distances or safety issues with respect to accessways. It was his view, and we agree with him, that overall the traffic effects of the proposed activity are expected to be no more than minor.
- 21.6 He did refer us to the relevant objectives and policies in the District Plan, and based on the above assessment of effects, namely that they are minimal, we can conclude that the proposed storage ponds is in accord with Policies 11.1.1.6 and 11.1.1.7.

22 EFFECTS ON CULTURAL VALUES

- 22.1 Effects could potentially arise, particularly in relation to Ngāi Tahu cultural values via water quality effects and other potentially adverse environmental effects during construction. The coverage of the site from the construction of dams has also been identified as a potential effect.
- 22.2 Relevantly, the pLWRP includes Objective 3.1, which seeks to manage land and water as integrated natural resources to recognise and enable the relationship of Ngāi Tahu and their culture, traditions, customary uses, and relationship with land and water.
- 22.3 We heard from Claire Gibb, planning advisor to Mahaanui Kurataiao Ltd (MKT), on behalf of the submitter Te Ngāi Tuahuriri Runanga. She detailed the Te Ngāi

Tuahuriri associations for the area, which were strongly connected with the Waimakariri River.

- 22.4 She was critical of the engagement or consultation process undertaken by WIL, and considered that appropriate consultation had not been undertaken between WIL and Ngāi Tuahuriri whānau as the manawhenua for the area of the proposed works. She particularly expressed concern about extraction of large quantities of water from the Waimakariri River. However, she conceded that the issue of abstraction was not before us.
- 22.5 She had three key points relating to cultural landscape, water quality, and protection of wāhi tapu and wāhi taonga.
- 22.6 Ms Gibbs informed us that proposed site was recognised in the Mahaanui Iwi Management Plan (Part 6.4 Waimakariri Objective 6) as a "*cultural landscape of immense importance*". She referred us to Objective 3.1 of the LWRP, which is to enable Ngāi Tahu and their culture, traditions, customary uses, and relationship with land and water. She also referred us to Mahaanui IMP s 6.4, Policy WA15.2, which is "*to work towards restoring cultural and physical connectivity of the coastal lowland areas... and therefore the cultural landscape values...*".
- 22.7 She considered neither objectives nor policy were adequately addressed in the application or the s 42A officer report.
- 22.8 However, to achieve the objectives and policy noted above, she recommended a viewing platform with an information panel should be established on top of the proposed embankment. The viewing platform would mitigate the adverse effects of the proposed structure by enabling views of the landscape and the information panel would support cross-cultural understanding. This would, she submitted, support restoration of the visual connectivity across this cultural landscape. Further, the establishment of a cycleway past this site would enhance the physical connectivity.
- 22.9 WIL responded to the viewing platform issue, pointing out provision of a platform would potentially create health and safety risks. It would necessitate allowing people access to the site to use the platform. For these very good reasons it did not support the submitter's request. We agree with WIL on this point. As to the information panel, that perhaps could be located elsewhere and we leave that point to the submitter and WIL to resolve. As to the cycleway, Mr Edge told us that the existing track would be modified during construction of the embankments, and improved to provide a public accessible cycle/walking route.
- 22.10 The MKT submission identified a need for appropriate conditions of consent to ensure the protection of water quality. Māori consider water a taonga to be protected for future generations. Water connects Ngāi Tahu to the landscape and the culture and traditions of the tupuna.
- 22.11 The s 42A officer report identifies management and design methods that will ensure stormwater runoff is contained on site, which are supported by MKT. In particular, the containment of stormwater within the site and its discharge to ground, are supported. Furthermore, the use of silt fences, control over the locations of stockpiles, and the retention of the vegetative buffers around the site are supported by this submitter.
- 22.12 For the protection of wāhi tapu and wāhi taonga, the s 42A officer report supports the inclusion of an Accidental Discovery Protocol, which was recommended by this submitter.

- 22.13 MKT supports the approach of proposed site rehabilitation via use of native plantings. This is seen to both restore and enhance the mahinga kai values as well as in supporting native biodiversity, which acknowledges tangata whenua through their whakapapa and ancestral relationships with these species.
- 22.14 Through its landscape expert's report (Appendix 1, paragraph 99), WIL has welcomed the opportunity to collaborate with the Runanga on the plant selection design process for the site, which we can support this by imposing a condition of consent on WIL that it work with MKT on the design and establishment of a planting plan for the site.

Findings

- 22.15 We consider that by imposing conditions of consent on WIL to work with MKT on protection of water quality as stated above; an Accidental Discovery Protocol; the enhancements to the existing track; and in the design and establishment of a planting plan for the site, that the cultural values relating to landscape, water quality, and protection of wāhi tapu and wāhi taonga will be protected and enhanced by this proposal. This approach will also ensure the relevant objectives and policies are satisfied. To be clear, we do not support the inclusion of the viewing platform.

23 CONSIDERATION OF ALTERNATIVES

- 23.1 The submitters in opposition contended there were readily available alternatives for WIL to pursue. They claimed those alternatives would provide a safer outcome with much reduced risk of dam failure.
- 23.2 Among their favoured alternatives was for WIL to excavate further into the ground to create the pond and minimise the height of any embankment, thereby reducing risk. WIL advised us it had considered that option, but discounted it primarily because of cost. As we understood it, the cost implications of excavation resulted in the proposed storage ponds not being economic for WIL. Increased costs arose, not only from the excavation, but from the cost of disposal of extracted materials.
- 23.3 A further alternative favoured by the submitters was a number of smaller farm-based ponds. WIL explained it had considered this alternative. However, that alternative impacted significantly on the efficiency of the irrigation network. Also, WIL would need to enter into agreements with landowners to effect this alternative.
- 23.4 WIL also made the point that our scope to consider alternative locations or methods was restricted. It accepted that alternate locations or methods may be a relevant matter to consider for s 104(1)(c) RMA. However, Ms Appleyard pointed out that Schedule 4 requires an assessment of effects on the environment to include a description of any possible alternate locations or methods for undertaking an activity, where the activity would result in any significant adverse effects on the environment or to involve a discharge.
- 23.5 Her core contention was that having regard to all of the conditions proposed, this activity would not result in any significant adverse effects on the environment. Mr Chapman for ECESS argued the contrary.
- 23.6 We agree the trigger point to consider alternatives is the occurrence of significant adverse effects on the environment. However, we think that while the availability of alternatives is a relevant matter for consideration, the obligation placed on WIL

is to provide a description of alternative locations in relation to the area within the district. As we read the relevant case law on this point, it is not open to us to insist upon a full assessment or comparison of all alternatives. A description does not, we accept, extend to a full cost benefit analysis of alternative locations and/or alternative methods. We agree also that WIL is not required to demonstrate that its proposal represents the best use of the subject resource or is the best proposal in net benefit terms.

- 23.7 So, rather than focus on alternatives and whether or not they are available, we have focused on the proposed storage ponds before us. We have reached the view that, having regard to the conditions we have imposed, the activity will not result in any significant adverse effects. Thus the need to trigger alternative locations or methods is not reached.
- 23.8 Under 105(1) RMA, we are required to consider alternatives when considering applications for discharge permits. That section directs our attention to a number of matters we should have regard to. The two discharges relevant here are the stormwater discharge and the dust discharges. WIL prefers discharging stormwater to land as opposed to a discharge to surface water. We agree with the reporting officer's assessment that because the stormwater is likely to contain contaminants, namely sediment, a discharge to surface water is not appropriate because additional treatment would be required rather than if the discharge was to land. We support discharging stormwater to land.
- 23.9 In terms of the dust discharges there is effectively no practical alternative of the proposed discharge of dust to air. We observe, after full consideration, that the reporting officers generally support the mitigation measures advanced by Ms Harwood for the Regional Council and Mr Curtis on behalf of WIL. Thus the effects are likely to be minor. We concur with the planning officers on this point.

24 SECTION 104D JURISDICTIONAL HURDLES

- 24.1 As we earlier noted, we have "bundled" all of the CRC consents so that their status is non-complying. In the earlier sections of this decision we have set out our key findings in respect of the principal issues in contention and we have also set out our findings in relation to the policy and objective base of the relevant plans. Our next step then is that we must consider whether the proposed storage ponds, as a non-complying activity, is able to meet one of the threshold tests specified in s 104D RMA.
- 24.2 In considering the statutory tests we are considering the proposed storage ponds subject to the conditions which attach to, and form part of, this decision.

First gateway test

- 24.3 The first gateway test requires us to consider the effects of the proposed storage ponds on the environment. We must be satisfied to utilise this gateway that the effects of the proposed storage ponds on the environment will be minor. We understand when determining this gateway test that we cannot take into account positive effects - in the way that they act as an offset to adverse effects. So we can consider the effects of the proposed storage ponds as mitigated by the conditions of consent, but not the positive effects of the proposed storage ponds.
- 24.4 From our discussion of and findings on the effects as we described them earlier within this decision, they relate to:
- (a) Risk of embankment failure;

- (b) Hazardous substance escape;
- (c) Dust;
- (d) Water quality; and
- (e) Cultural issues.

- 24.5 As to risk, we reach the conclusion after taking into account the conditions we are imposing, particularly those relating to peer review of the design of the dam, that issues as to safety should be satisfied. We have already acknowledged that there is real and reasonable apprehension about safety issues. In the main, the evidence from the WIL experts went a long way to satisfy us that the risk of a catastrophic dam failure had been properly evaluated and sufficiently reduced by the design of the dam and the obligations expressed in the conditions proffered by WIL. However, we did have some level of residual doubt and we have sought to resolve that by imposing the peer review conditions. We think those conditions are sufficiently robust to ensure that the safety issues or risk of embankment failure can properly be seen as a minor effect.
- 24.6 Turning to hazardous substances, the key issue is the potential for a spill of fuels and a subsequent impact on, in particular, water quality. Having regard to the mitigation measures proposed, particularly bund enclosures, total limits on the substances stored, security provisions, and regular inspections, we are satisfied that the possibilities of a potential spill are remote. In addition, in the event of a spill occurring we are well satisfied that the proposed conditions will limit any potential impact.
- 24.7 The risk of contamination to groundwater, particularly in relation to existing wells, is very remote given the distance between the closest down gradient well and the proposed site. We are well satisfied that after taking into account the conditions, the effects resulting from the storage of hazardous substances will be minor and this gateway test is met.
- 24.8 We acknowledge controlling dust during the construction phase, particularly given the proximity to nearby residential properties will be a challenge. Nevertheless, we consider that good dust control is achievable provided there is adherence to accepted practice, relevant environmental standards, and conditions.
- 24.9 Taking into account the conditions, which we consider are effective, extensive and robust, dust effects are capable of being avoided or kept to a minimum during the construction period. We are satisfied that the effects of dust on the environment will be minor, thus this gateway test is met.
- 24.10 The discharge of stormwater to land during construction and post-development phases of the proposed storage ponds and associated structures will not, we are satisfied, give rise to adverse effects. We are similarly satisfied that the quality of the water within the dams can be maintained at an appropriate level through effective monitoring. Given our earlier considerations we are satisfied that the actual and potential effects are acceptable, provided that WIL undertakes the mitigation as proposed and included within conditions. WIL is applying good environmental practice to ensure the protection of freshwater quality. Stormwater runoff is not likely to exacerbate erosion nor is the discharge to land likely to contaminate groundwater or drinking water sources. Overall we are satisfied the first gateway test is met, which is sufficient to move onto the wider considerations. Nevertheless, we have considered the second gateway test for completeness.

Second gateway test: objectives and policies of the plan

- 24.11 We now move to consider the effects on the environment of the proposed activity against the objectives and policies of the CRPS, NRRP, and pLWRP. We must be satisfied the activity will not be contrary to the objectives and policies of those plans.
- 24.12 Case law has established that the phrase "*contrary to*" in the context of s104D(1)(b) RMA is not to be given a restrictive definition. Therefore if a proposal does not comply with the objectives and policies of the relevant regional plans, it does not necessarily mean it is contrary. In this context, the RMA envisages something that is "*opposed in nature, different to, or opposite*". In addition, while an application may be contrary to one or more policies or objectives, when considered together it may not be contrary to them all.

The Canterbury Regional Policy Statement – risk issues

- 24.13 Objective 11.2.1 seeks to avoid new development of land that increases risks associated with natural hazards. Such risk is to be avoided or where avoidance is not possible, mitigation measures are to minimise risk. In our view, the level of risk that the subject site gives rise to in terms of a fault or earthquake risk has been, in the main, thoroughly and appropriately investigated and understood. We accept Dr McVerry's findings that the proposed site is not subject to earthquake faulting ruptures. We think that again, in the main, the dam design provides for any issue or increase the risk of the seismic hazard on this site may have to people, property and infrastructure. We are strengthened in that view because of the conditions we have imposed.
- 24.14 We note the policy is not absolute, in that it provides where avoidance is not possible mitigation measures should be employed to minimise such risks. Mitigation as such is not readily available here but remedy through provision of insurance and bonding is available.
- 24.15 Policy 11.3.3 specifically refers to development close to active fault traces. Such development is to be managed in order to avoid remedy or mitigate, relevantly here, avoid fault rupture. We think that the conditions we have included, particularly the peer review conditions, will result in the development being managed in order to avoid adverse effects of fault rupture because the dam is to be designed and operated in such a manner that if a fault rupture occurs the embankments retain their integrity and continue to impound water, notwithstanding the earthquake event.
- 24.16 In a similar way, while Policy 11.3.5 addresses general risk management by seeking to avoid risk from natural hazards, particularly when that risk is unacceptable, it is addressed here, we think, by the dam design and peer review conditions. We think that, through these conditions, the risk from natural hazards is capable of being addressed. In determining that risk we have, as the policy directs, considered the likelihood of the natural hazard event and the consequences of that event.
- 24.17 Primarily taking into account our findings on the seismic characteristics of the proposed site and taking into account the dam design and peer review conditions, we think that the grant of consent is consistent with the Canterbury Regional Policy Statement.

The Natural Regional Resources Plan and the Proposed Land & Water Regional Plan – risk issues

- 24.18 Policy WQN3(3) of the NRRP sets out matters to be considered when assessing resource consents for the damming of water and seeks to avoid the risk of dam failures and to avoid, remedy or mitigate the effects of flooding or any other hazard during construction or operation.
- 24.19 For much the same reasons as recorded above, primarily the dam design and peer review conditions, we consider that this form of management is being deployed to avoid the risk of dam failure. In relation to the effects of flooding, we consider that the insurance and bonding provisions will provide a means of remedy or mitigation in the unlikely event of embankment breach.
- 24.20 In terms of the pLWRP, Policy 4.48 is the key policy. That requires any dam or infrastructure to be sited, designed, constructed, and operated to minimise risk of, amongst other things, dam failure. It also provides that any associated risk of inundation or adverse effects on people, communities, or their property is to be minimised. Again, primarily for dam design and peer review along with insurance and bonding provisions, we consider this policy is met.

The Canterbury Regional Policy Statement – hazardous substances

- 24.21 Objective 18.2.1 recognises the need for use of hazardous substances while ensuring that any potential adverse effects are avoided, remedied or mitigated. Related objectives and policies seek to avoid contamination of land and to avoid, remedy or mitigate adverse effects. In our view, with the conditions we have proposed the likelihood of a spill is remote and if one does occur, WIL has procedures in place that will avoid, remedy or mitigate any adverse effects. Taking into account the conditions, we conclude that this proposal is consistent with the above-described objectives and policies.

The Natural Regional Resources Plan and the Proposed Land & Water Regional Plan – hazardous substances

- 24.22 The NRRP objectives WQL1, Policies WQL2, WQL3, and WQL9 which have been discussed earlier seek to control and prevent the discharge of contaminants to surface water and prevent hazardous contaminants entering groundwater.
- 24.23 The pLWRP has Policy 4.25, which seeks to ensure that the best practical option in terms of two priorities are implemented when hazardous substances are being utilised. The first is to avoid the discharge and the second is to ensure that any residual risk of discharge is contained on site so it does not enter any surface water bodies or groundwater systems.
- 24.24 For reasons already discussed, we reach the conclusion that his proposal is consistent with the relevant objectives and policies in the NRRP and the pLWRP.

The Canterbury Regional Policy Statement – dust

- 24.25 Objectives 14.2.1 and 14.2.2 and Policies 14.3.3 and 14.3.5 seek to maintain ambient air quality and enable discharge of contaminant into air provided there are no significant localised adverse effects on social, cultural and amenity values, fauna and flora and other natural physical resources. Specific reference is made to the proximity of sensitive land-use activities.
- 24.26 We consider that granting consent to this proposal, particularly having regard to

the conditions, is consistent with these provisions.

The Natural Regional Resources Plan and the Proposed Land & Water Regional Plan – dust

- 24.27 Objective AQL1 and Policy AQL6 seek to ensure that localised contaminant air discharges do not result in significant adverse effects on the environment or that discharges of dust are not corrosive, noxious, dangerous, objectionable or offensive beyond the boundary of the site where the discharge originates. We consider these policies will be satisfied with the conditions proffered by WIL.

The Canterbury Regional Policy Statement – water quality

- 24.28 Objective 7.2.1 and Policy 7.3.6 are relevant for reasons already advanced, particularly those relating to conditions dealing with the discharge of stormwater to land during construction and post-development phases of the proposed storage ponds and associated structures and maintenance of water quality in the dams. The erosion and sediment control measures will effectively prevent contamination of freshwater and monitoring of water quality in the dam will be undertaken.
- 24.29 We consider for these reasons this proposal is consistent with those objectives and policies.

The Natural Regional Resources Plan and the Proposed Land & Water Regional Plan – stormwater

- 24.30 For reasons already advanced we consider the proposed storage ponds will not be contrary to Objectives WQL1 and Policies WQL2 and WQL3 of the NRRP.
- 24.31 We also conclude that Objective 3.24, Policies 4.3, 4.4, 4.17, 4.18, 4.19, and 4.23 of LRWP will be achieved.
- 24.32 We accept WIL will actively apply good environmental practice to ensure the protection of fresh water quality. We consider stormwater runoff is not likely to exacerbate erosion, neither will the discharge to land likely contaminate groundwater. Finally, we are of the view that drinking water sources will also be protected.

Proposed Land & Water Regional Plan – cultural issues

- 24.33 In our section on effects on cultural values we also canvassed the relevant objectives of this plan and the Mahaanui Iwi Management Plan and set out our findings that subject to appropriate conditions granting consent would be consistent with those plans.

Conclusions on second gateway test

- 24.34 For the above reasons, we consider the proposed storage ponds are not contrary to the objectives and policies of the relevant plans when read as a whole. Accordingly the second gateway test has also been met. We now move to consider the applications lodged with the Waimakariri District Council under s 104B.
- 24.35 We will then undertake our assessment of the relevant Part 2 matters, following which we will complete our overall evaluation as to whether all consents should be granted.

Waimakariri District Plan – risk issues

- 24.36 We have earlier identified the relevant objectives and policies. They are focused on providing for the community's understanding of natural hazards and its response to them. The policies seek to provide information to enable people to take appropriate precautions in relation to natural hazards. In respect of broader objectives, such as Objective 12.1.1, this objective seeks to maintain amenity values and quality of environment for different parts of the district, while ensuring any potential environmental adverse effects from ... structures... are avoided or mitigated.
- 24.37 Primarily because of the dam design and peer review conditions, we are satisfied that the proposed storage ponds are consistent with the relevant objectives and policies of the Waimakariri District Plan as they relate to risk and probability of a dam breach.
- 24.38 The District Plan also contains other objectives and policies that we consider are supportive of the proposed storage ponds. They include Objective 12.1.2, which seeks the establishment and expansion of both farming activities and other activities in the Rural Zones in a way that gives consideration to existing activities while maintaining a quality environment appropriate for the zone.
- 24.39 As best able, the proposed storage ponds have been designed and include landscaping to ensure the amenity values and quality of the surrounding environment are provided for. We have already commented on short term negative impacts such as dust and noise.
- 24.40 Objective 14.1.1 seeks to maintain and enhance both rural production and rural character of the Rural Zones. The storage ponds will help maintain and enhance rural production. Storage of water in this manner will enable agricultural activities not only continue but to be enhanced. We also note that storage ponds are becoming a common feature in Rural Zones.

Waimakariri District Plan – hazardous substances

- 24.41 Policy 12.1.1.10 provides that hazardous substances should be securely contained in storage, use and transportation and monitoring and contingency procedures should be established, to minimise the risk of spillage or leakage or contamination of land and water.
- 24.42 The proposal does include the storage of hazardous substances at a volume permitted by the District Plan and is accordingly consistent with Policy 12.1.1.10. Earlier we concluded the effects are considered to be less than minor.

Waimakariri District Plan – dust

- 24.43 Objective 12.1.3 and Policy 12.1.3.1 are both relevant. The objective seeks to protect people, vegetation, animals and other natural physical resources from the adverse effects resulting from the discharge of contaminants to air. The policy seeks location and/or design of the activities that lead to the discharge so that any adverse effects are avoided or mitigated.
- 24.44 For reasons already advanced we conclude that the adverse effects of dust during the construction phase, particularly as it relates to the amenity of adjacent residents, will be appropriately dealt with by the mitigation measures proposed by WIL and supported by the officers. On that basis the proposed activity is not inconsistent with the objectives and policies relating to dust discharge into air.

Waimakariri District Plan – noise

- 24.45 The relevant policies seek to control noise to a level that is not unreasonable measured against the character and circumstances of the zone. They also seek to avoid noise adversely affecting amenity values and the health and safety of people on neighbouring sites.
- 24.46 For reasons already advanced, we acknowledge that construction noise, particularly as it impacts on the seven existing residential dwellings in close proximity to the boundary of the site, will be significant. Those residents currently enjoy relatively low ambient noise levels. We agree the construction noise effects directly upon them will be for a limited period of time compared to the overall construction timeline for the entire development.
- 24.47 We consider that construction noise should be managed in accordance with NZS 6803:1999 Acoustics – Construction Noise, and a construction noise management plan be prepared. Taking these matters into account, we think that the noise effects will be reasonable and consistent with the policy framework as it appears in the District Plan.

Waimakariri District Plan – cultural issues

- 24.48 The District Plan contains objectives and policies, notably Policies 2.1.1.1 and 2.1.1.2 that are directed at providing appropriate processes and practices that acknowledge the status of tangata whenua as a treaty partner and take into account the principles of the Treaty of Waitangi. They seek to provide for the participation of tangata whenua in the management of the district's natural and physical resources.
- 24.49 We acknowledge that WIL's consultation process has been challenged by MKT. However we note the officers were comfortable that WIL had consulted throughout the resource consent process.
- 24.50 In any event, apart from these criticisms WIL is prepared to continue to liaise with MKT as its project is implemented. For all of these reasons, we consider the proposed storage ponds are consistent with these objectives and policies.

25 PART 2 RMA

- 25.1 Section 104(1) RMA states that the matters that we have discussed above are subject to the purpose and principles in Part 2 of the RMA. We discuss the principles of the RMA in ss 6 to 8 below, and return to the overriding sustainable management purpose of the RMA (s 5) in our overall evaluation of the proposed storage ponds.
- 25.2 Sections 6 to 8 contain principles that inform and guide our ultimate decision as to whether or not the WIL proposal is an appropriate development that will promote the sustainable management of natural and physical resources. The exercise does not involve a mechanical application of a checklist or some sort of simple score sheet approach. One matter does not trump or override another, the weight or significance the matters in ss 6 to 8 are driven by the context in which the matter appears. We must take all of these matters into careful consideration.

Section 6 matters of national importance

- 25.3 Sub-section 6(c) is a matter of national importance to be recognised and provided

for. This relates to the protection of significant indigenous vegetation and significant habitats of indigenous fauna.

- 25.4 Sub-section 6(e) is also of relevance. That section requires us to recognise and provide for, relevantly, the relationship of Maori and their culture and traditions with ancestral lands and water.
- 25.5 Sub-section 6(c) is particularly relevant to the Eyrewell Scientific Reserve. We were well-satisfied that based on the assessment of ecological effects provided to us by Dr Roper-Lindsay, an expert in her field, that apart from inundation damage this area of significant indigenous vegetation and habitat was being recognised and provided for by the proposed storage ponds. We agreed with her that stockpiling, in particular weed control related to stockpiling, needs careful monitoring and management so as to avoid any threat that weed infestation may cause to the reserve. We also agreed that changes to soil moisture would be a risk to the dryland species within the reserve, but this risk could be avoided by monitoring.
- 25.6 In relation to sub-section 6(e) we consider that WIL's agreement to continue to work with MKT demonstrates that s 6(e) matters are being recognised and provided for.

Section 7 other matters

- 25.7 We now turn to the relevant matters we are to have particular regard to under s 7. These relate to ss 7(a), (b), (c), (d), (e), and (f).
- 25.8 Both Kaitiakitanga and the ethic of stewardship we consider is addressed by WIL's agreement to continue to work with and consult MKT. We consider the damming of the water enables an efficient use of the water resource and is in accord with emerging community values relating to utilising water storage systems. Thus s 7(b) is satisfied.
- 25.9 In terms of s 7(c), we accept during construction - particularly for the residents located in close proximity to the site - that at least in the short term there will neither be maintenance or enhancement of amenity values. Those values will be impacted by relatively short term construction noise and possibly by dust.
- 25.10 We are able to conclude that any effect on an intrinsic ecosystem is in all likelihood temporary. At the site itself we consider there is unlikely to be detrimental effects on the quality of the environment. We agree with the officers that the storing of water for irrigation will not be out of context in the local environment. This satisfies ss 7(d) and (e).
- 25.11 The proposal is we consider unlikely to limit the use of any finite natural or physical resource because it is storing a renewable resource, namely water. Thus we have had particular regard to s 7(f).

Section 8 Treaty of Waitangi

- 25.12 Finally, s 8 RMA requires that we shall take into account the principles of the Treaty of Waitangi (Te Tiriti o Waitangi). For reasons already advanced, we think through the continued consultation and consideration of views expressed by MKT the principles of the Treaty are being provided for.

26 OVERALL EVALUATION

- 26.1 If an application for a non-complying activity passes through either of the jurisdictional hurdles in Section 104D, there is a discretion as to whether consent should be granted. This requires an overall judgement to achieve the purpose of the RMA and is arrived at by:
- (a) Taking into account all relevant matters identified under s 104;
 - (b) Avoiding considerations of any irrelevant matters;
 - (c) Giving different weight to the matters identified under s 104 – depending on our opinion as to how they are affected by the application of ss 5(2)(a), (b), and (c), and ss 6-8 to the particular facts of the case and in the light of the above; and
 - (d) Allowing for comparison of conflicting considerations, the scale or degree of conflict and their relative significance or proportion in the final outcome.

Effects on the environment

- 26.2 We have discussed at some length in this decision the actual or potential effects on the environment of allowing the WIL proposal. We summarise our findings below.
- 26.3 We have found there are a number of positive effects that would result from the WIL proposal, including:
- (a) The proposal would lead to an increased reliability of water supply, a circumstance that has been recognised for many years as a precursor to supporting higher value production from irrigated land;
 - (b) It is estimated that the WIL shareholders' economic productivity will increase by approximately \$300 per hectare with water storage. The scheme currently provides irrigation over 18,000 hectares.
 - (c) This benefit of reliability is further enhanced because WIL holds the largest single take from "A" Block water, which is the second most reliable block of water behind community takes and stockwater supply.
 - (d) The ability to store water when flows naturally reduce in the Waimakariri River, particularly during January/February will enable a buffer to be established, providing more reliable water to WIL shareholders advancing them from a run of river level of reliability;
 - (e) Gains in reliability will result in improved irrigation efficiency and nutrient uptake. Water will be there to be used instead of being applied just in case there will be no more. Increases in reliability will result in increased production with an increase in higher risk profile crops, leading to greater profitability;
 - (f) There will be positive economic effects, particularly for WIL shareholders, including economies of scale available from such a large-scale development. We accept that economic benefits will go beyond the WIL shareholders and will be felt by the wider community because increased productivity will require increased support from community members providing supplies, equipment, and services to WIL shareholders;

- (g) The storage ponds will also provide a significant benefit to New Zealand fire-fighting services. WIL is to make the pond water available if and when needed for fire-fighting purposes; and
 - (h) The proposed landscaping and cycle accessways will enhance the amenity of the immediate environs.
- 26.4 On the other hand, we found that there will be a number of negative effects and potential negative effects that may result from the WIL proposal, including:
- (a) The risk of dam breach;
 - (b) The inability to mitigate the effects of a breach were it to occur;
 - (c) The uncertainty about protection that insurance may provide to compensate land owners for losses incurred for a dam breach; and
 - (d) Short term dust and noise effects, particularly impacting upon the amenity of close by residents.
- 26.5 We must consider all these effects and evaluate their significance and the weight to be given to them in the context of plan provisions and Part 2 RMA.

Relevant provisions of the plans

- 26.6 Earlier in this decision we set out our findings on the relevant objectives and policies of the plans. On the key issue of risk we think that the plans provide for a cautious approach, particularly where there are risks posed to development by natural hazards such as active fault traces. We think the plans direct us to determine whether or not the level of activity or likelihood of a natural hazard event precludes the WIL site from being developed. We have found that the WIL site is not precluded from being developed. However, in making that assessment we consider we are able to give full weight to the manner in which dam design construction and operation addresses and provides particularly for seismic hazards. If those seismic hazards can properly be provided for within dam design, construction, and operation, then the likelihood of a natural hazard even causing catastrophic dam failure is reduced to a realistic level of risk. We consider with the imposition of conditions this outcome has been achieved.
- 26.7 The other key thrust of the objectives and policies direct us to consider the potential consequences of a natural event hazard for people, communities, their property, infrastructure, and the environment. We consider that if the likelihood of the natural hazard event causing a catastrophic failure of the embankments has been properly provided for this must mean that the potential consequence will be appropriately avoided.
- 26.8 We are satisfied that the WIL proposal with conditions imposed will generally satisfy the relevant plan provisions as we have identified them within this decisions.
- 26.9 The proposal will assist in delivering objectives such as Objective 12.1.2 within the Waimakariri District Plan in that it will support the establishment and expansion of both farming and other activities in the Rural Zone while at the same time giving consideration to existing activities and maintaining a quality environment appropriate for the zone.

- 26.10 The proposed storage ponds will ensure amenity values and the quality of the surrounding environment are provided for. They will enable establishment and expansion of farming activities through a greater and more efficient use of water. The safety conditions we will impose provides for consideration of existing activities. In a similar way, Objective 14.1.1, which seeks to maintain and enhance rural production and rural character, would be achieved by a grant of consent.
- 26.11 We also conclude that Objective 3.4 of the pLWRP, which provides for a regional network of water storage distribution facilities, will be achieved by a grant of consent. In a similar way, Objectives 3.10 and 3.11, which are directed at the use of water to support social and economic activities and recognises water as an enabler of the economic and social wellbeing of the region, will be achieved by a grant of consent.
- 26.12 We recognise the tension that Policy 4.48 of the pLWRP brings to bear on the above objectives and policies, but we have concluded that the dam structure is able to be sited, designed, constructed and operated to minimise any risks of overspill, leakage, slips or other dam failure.
- 26.13 We also think that the grant of consent will achieve the objectives of the National Policy Statement for Freshwater Management, in particular Objectives A1 and A2 and Objectives B1 to B3, inclusive.

Exercise of discretion

- 26.14 In exercising our discretion we have had regard to all our findings that we have reached in accordance with the legal statutory framework and directions. We acknowledge that there will be some avoidable effects albeit of limited duration in relation to primarily noise and dust. We are conscious of the economic and water efficiency gains consenting the proposed storage ponds will provide. We consider that the dam design, construction, and operation conditions we have imposed will appropriately address the key issue of risk.
- 26.15 Balancing the adverse impacts as we have described them we find that the overall needs of people in communities, the provision of their economic wellbeing through the wise use and management of the natural resource, being water, best meets the single purpose of the RMA: namely, sustainable management.
- 26.16 We think that taking into account the conditions that we have imposed, all of the subparagraphs of 5(a), (b) and (c) will be adequately met and provided for.
- 26.17 Having reviewed the application documents, all of the submissions, and taking into account the evidence received and all relevant provisions of the RMA and other relevant statutory instruments, we have concluded that the outcome that best meets the purpose of the RMA is to grant consent subject to conditions.

27 DURATION AND LAPSE PERIOD

- 27.1 WIL sought an unlimited duration for the use of land for the construction and ongoing use and maintenance of the dams, and a consent duration of 35 years for the discharge and dam permits.
- 27.2 The issue is with allowing the activities and discharges associated with the construction phase to continue for an extended period of time after the construction has been completed. We agree with the planning officers that granting the consents associated with the construction activities for the proposed

duration of 35 years is inappropriate.

- 27.3 We think that a 5-year lapse period is reasonable for those consents. Providing a longer lapse period would we think unreasonably impact on the surrounding land owners; that impact being caused by uncertainty. From WIL's point of view, we do note that a lapse period is capable of being extended at the discretion of the consent authority after taking into account the factors set out in ss 5(1(b) RMA. So WIL will not be excluded from extending the lapse date if this is required.
- 27.4 In reaching this view we have relied on WIL's evidence that the actual construction period is expected to last somewhere from twelve to twenty months. We were not aware of any impediments to give effect to the consent.
- 27.5 In a similar way and for similar reasons we have concluded that the land use consent to store hazardous substances and the discharge permit for stormwater be granted for five years and only apply to the construction of the ponds. In respect of post-construction discharges we are satisfied they should be consented for 35 years.
- 27.6 We agree that the duration of the post-development stormwater discharges and dam permit is appropriate.
- 27.7 In relation to the air discharge, we that Ms Harwood recommends that the consent apply only to the construction of the ponds and the duration of the consent is short. She recommends three years. However, we conclude we should be consistent and provide a duration of five years.
- 27.8 For the WDC land use consent, an unlimited duration is the default position and there is no particular circumstance why this should be considered inappropriate.

28 CONDITIONS

- 28.1 This is not a case where either the geotechnical seismic evidence or the dam design evidence was unchallenged. We are well aware under NZSOLD the proposed embankments are, in the main, classified as high potential impact. This classification reflects the consequences that a failure of the embankments would have, namely it would be major or catastrophic. Given that classification, high design standards are specified and required to be met, coupled with a dam safety insurance program and an emergency action plan.
- 28.2 Overall, while we acknowledge Mr Connell's evidence that the embankments can withstand an earthquake of a magnitude equalling or exceeding the magnitude of the Canterbury earthquakes and his evidence that the foundation and the embankments would likely survive such a significant event without failing, we still had concerns.
- 28.3 Again we acknowledge his evidence that the probability and consequences of a catastrophic failure had been properly evaluated and provided for, and reduced by the design process and the obligations contained in the conditions.
- 28.4 However, as we have already alluded to, we held some residual concerns. They related to:
- (a) the inclusion or not of vertical accelerations within the design process of the embankments;

- (b) whether additional and/or deeper bore logs drilled to bedrock should be undertaken;
 - (c) whether provision should be made for internal drainage zones that intercept seepage and direct it to points where it can be properly measured and monitored; and
 - (d) whether or not a more sophisticated analysis using time history seismic records should be undertaken.
 - (e) There were also challenges relating to the suitability of the proposed HDPE liner.
- 28.5 To address these issues and because they are interrelated we have concluded that a comprehensive peer review condition is appropriate. So as to ensure all matters are addressed we have worded our condition broadly. The purpose of the condition is to review the current proposal to ensure that it is designed and will be constructed and operated in accordance with the required standards.
- 28.6 We have reached this position for two reasons. Based on our conversation during the hearing with WIL we did not see that they had any inherent objection to such a condition. Indeed, we took from it that WIL promoted it. Next we are extremely conscious this is a very large structure impounding a very substantial volume of water. We are conscious of recent seismic events in Canterbury. We acknowledge that the proposed storage ponds are located in a "semi developed rural area" containing people, property, and infrastructure.
- 28.7 We wish to stress that we accept the experience and expertise and confidence of the experienced engineers and assessors that we heard from on behalf of WIL. We were impressed that they were well aware of and concerned to see that the safety conscious provisions of NZSOLD were deployed. However, it seems to us every opportunity should be taken to ensure that conditions relating to the construction of the dam ensure that all aspects of site investigations, design, construction, operation, and maintenance are independently review by a panel of experts at appropriate milestones.
- 28.8 Other conditions of consent we wish to comment on relate to management plans. WIL proposed management plans for construction and ongoing management of the scheme, along with an emergency action plan.
- 28.9 The detail supporting those various plans available to us was limited. This was explained on the basis that the proposed storage ponds were still being developed. Some submitters were concerned that these management plans given their importance would be developed and finalised without their input.
- 28.10 While that outcome is not without its difficulties, it is not unusual to face this occurrence on large complex projects.
- 28.11 The way in which these tensions are to be addressed⁶⁶ is that the conditions of consent must identify the performance standards or objectives that are to be met by the management plan. If this cannot be achieved, then the concern of the submitters will eventuate in that approval of these management plans would likely amount to a delegation to the regional and district council to make decisions without public involvement in the process.

⁶⁶ *Application by Canterbury Cricket Association Incorporated* [2013] NZ EnvC 184.

28.12 The proposed management plans are:

- (a) Construction Management Plan (CMP). This plan will ensure that all construction and work related activity, including provision for erosion and sediment control, weeds, hazardous substances, oils and fuels and the like, are provided for.
- (b) A Spill Management and Response Plan. This plan has the purpose of avoiding and utilising best practical options to prevent and contain spills or leaks of any hazardous substance being discharged.
- (c) An Erosion and Sediment Control Plan. The purpose and objective of this plan is to ensure that during construction all practicable measures are to be undertaken to minimise discharges of sediment-laden runoff, offsite or into surface water, and that the discharge of construction site stormwater shall only take place during the construction period on the site. Stormwater generated at the site does not flow over or onto refuelling or vehicle repair areas.
- (d) A Dust Management Plan. The purpose of this plan is to ensure control of dust at each source during construction and provide for means of managing and monitoring dust. It is also to provide for recording and responding to dust complaints from the public.
- (e) Water Quality Monitoring Plan. The purpose and objective of this plan is to address water quality within the ponds and provide for a regime of sampling, monitoring, and identify mitigation measures to manage any adverse trends or trigger levels as identified within the plan.
- (f) A Landscape Management Plan. This plan will provide for a planting maintenance and management strategy for landscaping of the ponds, plus the development and implementation of an annual monitoring plan for the Eyrewell Scientific Reserve.
- (g) A Water Storage Commissioning Plan. This plan will provide for the staging and monitoring of the first filling of each component of the ponds, along with commissioning and testing the control system and structures, along with a monitoring program for liner integrity and leakage.
- (h) A Dam Safety Assurance Plan and an Emergency Action Plan. The purpose of these plans is to minimise risks from the ongoing operation of the ponds. These plans will include and provide for emergency procedures, including emergency responses; dam draw-down; and early warning systems for the community, including integration with Council emergency services.

28.13 The above plans are further and better detailed within the relevant conditions sets.

29 DECISION

29.1 Pursuant to the powers delegated to us by the Canterbury Regional Council and the Waimakariri District Council and for all of the above reasons and pursuant to ss 104, 104B, 104D, 105, and 107 of the Resource Management Act 1991, we **GRANT** consent to the following application by WIL:

- (a) **CRC122897** to use land for earthworks associated with the construction, maintenance and use of storage ponds and associated infrastructure;
- (b) **CRC122898** to use land to store and use up to 10,000 L of diesel and other hazardous substances in an above ground portable fuel storage container;
- (c) **CRC120610** to dam up to 8.2 million m³ of water;
- (d) **CRC122899** to discharge fugitive dust and combustion products to air during the construction of storage ponds and associated structures; and
- (e) **CRC122900** to discharge stormwater to land during the construction of storage ponds and to discharge post-development stormwater; and
- (f) **RC135478** to construct, maintain and use storage ponds and associated structures at the corner of Wrights Road and Dixons Road, Burnt Hill, being Lot 1 DP27020.

29.2 Pursuant to s 108 RMA the grant of consent is subject to conditions specified at Appendices A to F, which conditions form part of this decision and consent.

DECISION DATED AT CHRISTCHURCH THIS 1ST DAY OF OCTOBER 2014

Signed by:

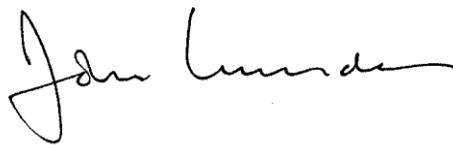
Paul Rogers



Dean Chrystal



John Lumsden



APPENDIX A

CRC122897 - to use land for earthworks and associated with the construction, use, and maintenance of storage ponds and associated infrastructure (Canterbury Regional Council Consent CRC122897)

Activity authorised

- 1 The works shall be limited to the use of land to:
 - (a) excavate material; and
 - (b) deposit material
- 2 For the purposes of the construction, use and maintenance of storage ponds and associated infrastructure shall occur on land parcel Lot 1 DP 27020, located on the corner of Wrights Road and Dixons Road, Burnt Hill, at or about map reference Topo BW22:3480-9720, as shown on **Plan CRC122897A** (the site), which forms part of this consent.
- 3 All activities authorised by this consent shall be undertaken in accordance with the information contained in the Application, the Assessment of Environmental Effects (Waimakariri Irrigation Limited Storage Ponds), and all supporting technical documents and plans as provided to the Canterbury Regional Council, except where inconsistent with these conditions.

Peer review

- 4 At least 6 months prior to commencing works under this consent, the Consent Holder shall engage, at its cost, an independent peer review panel of at least three suitably experienced and qualified dam design and construction experts. The experts will have qualifications and experience appropriate for the matters that are to be reviewed. In the event that particular skills, not available among the members of the panel, are required, the Consent Holder shall ensure that an appropriately qualified person is engaged to advise the peer review panel, and that Canterbury Regional Council is so informed.
- 5 Appointments to the peer review panel shall be acceptable to Canterbury Regional Council.
- 6 The expert panel will review and report to the Consent Holder and the Canterbury Regional Council, with particular reference to ensuring the safety of the dam, the site investigations, the geotechnical assessment, the choice of dam, the design parameters, the design of the embankments and pond infrastructure, the suitability of the liner, the commissioning process and operation of the ponds, including maintenance and the means of monitoring leakage, and the dam safety assurance program and proposals for emergency management.
- 7 Construction of the storage ponds shall not commence until such time as the Consent Holder has presented the Canterbury Regional Council with a written report from the peer review panel, which certifies the design and that all relevant and applicable design and safety criteria, and standards, codes, regulations, and statutory and Good Engineering Practice (including, but not limited to, being consistent with the latest Dam Safety Guidelines issued by the New Zealand Society on Large Dams and the requirements of the Building Act 2004) and any

other requirements applicable to the construction, operation, and maintenance of the Waimakariri Irrigation Storage Ponds have been achieved as they relate to:

- (a) the Consent Holder's dam design,
 - (b) the site investigations,
 - (c) the geotechnical assessment,
 - (d) the choice of dam,
 - (e) the design parameters,
 - (f) the design of the embankments and pond infrastructure,
 - (g) the suitability of the liner,
 - (h) the commissioning process and operation of the ponds, including maintenance and the means of monitoring leakage, and
 - (i) the dam safety program and proposals for emergency management as contained within the Consent Holder's Application (see Condition 3 above)
- 8 The certification report shall be submitted to the RMA Compliance & Enforcement Manager at the Canterbury Regional Council at least 1 month prior to commencing works under this consent.
- 9 In the instance that the independent review panel does not so certify, then the Consent Holder will implement the necessary alterations and/or changes to secure certification before commencing construction of the Waimakariri Irrigation Storage Ponds.

Detailed design geotechnical investigations

- 10 The seismic hazard assessment for the Waimakariri Irrigation Storage Ponds shall be reviewed and updated by the Consent Holder 3 months prior to commencing further detailed design work or construction, whichever occurs earlier.
- 11 The Consent Holder shall undertake any necessary further geotechnical investigations.
- 12 A report detailing the results of these further geotechnical investigations and updated seismic assessments shall be provided to the RMA Compliance & Enforcement Manager at the Canterbury Regional Council at least 3 months before construction works commence. The report shall be prepared by a suitably qualified person, acceptable to the Canterbury Regional Council and shall provide details of the geotechnical investigations undertaken and recommendations for remedial works where necessary.

Maximum depth of excavations

- 13 Prior to any construction occurring on the site, natural ground level shall be identified and recorded utilising conventional land survey methodology. The maximum depth of excavation shall not exceed 6 metres below that established natural ground level.

Pond liner

- 14 Subject to the outcome of the peer review, the ponds shall be lined with a membrane of HDPE material, of a minimum thickness of 1.5 mm.

Construction Management Plan

- 15 At least 3 months prior to the commencement of any activity authorised by this consent, the Consent Holder shall submit a final Waimakariri Irrigation Storage Ponds Construction Management Plan (CMP) prepared by a suitably qualified and experienced person(s) to the Canterbury Regional Council: Attention RMA Compliance and Enforcement Manager for certification that the CMP meets the objectives and performance standards set out in Conditions 17 and 18 below:
- 16 All activities in furtherance of this consent, both on and off the site, shall be undertaken in accordance with the CMP.

Construction objectives

- 17 The objectives for the CMP for all construction activities managed under it are:
- (a) To ensure that the construction activities achieve compliance with the conditions of consent for these activities;
 - (b) To avoid, where possible, adverse environmental effects and, where not possible, ensuring appropriate mitigation or appropriate remediation is undertaken;
 - (c) To minimise the environmental nuisance effects of construction activities;
 - (d) To minimise the release of sediment, either to water or to air, during construction activities;
 - (e) To provide a method to ensure that parties under its control respect and apply the CMP, so that compliance with conditions of consent for construction effects can be achieved;
 - (f) To ensure a copy of the current CMP is available on-site at all times;
 - (g) To minimise the extent or time that areas of the site disturbed; and
 - (h) To integrate good environmental practice into construction activities.

Performance standards

- 18 The CMP shall include, but not be limited to:
- (a) Methods of the works, including but not limited to, the staging of the works, the site layout plan and procedures to be used;
 - (b) An erosion and sediment control plan prepared in accordance with Condition 24 below;
 - (c) Details of measures shall be identified and implemented to prevent the development of weed seeds on stockpiled material in order to prevent the contamination of the Eyrewell Scientific Reserve with unwanted weed seeds;

- (d) Details of measures shall be identified and implemented to avoid the entrainment of oil, fuels or any other hazardous substances in stormwater, with particular emphasis on re-fuelling areas and repair areas;
 - (e) Details of measures taken shall be identified and implemented to prevent unauthorised access to and/or the unauthorised deposition of material into the excavated areas;
- 19 The Consent Holder may commence construction activities in accordance with the CMP unless the Canterbury Regional Council advises the Consent Holder within 20 working days of receiving the CMP that it refuses to certify the CMP on the grounds that it fails to meet the requirements of these conditions in relation to an activity and provides reasons why that view is held.
- 20 Should the Canterbury Regional Council refuse to certify the CMP in accordance with these conditions, the Consent Holder shall submit a revised CMP to the Canterbury Regional Council for certification as soon as is practicable. The certification process shall follow the same procedure as outlined above.
- 21 Once certified the CMP may be varied by the Consent Holder. The certification process for a CMP variation shall follow the process outlined above. Construction activities subject to the variation shall not commence until the variation has been certified by the Canterbury Regional Council.
- 22 The Consent Holder shall comply with the certified CMP at all times.

Supervision, implementation, and amendment of the CMP

- 23 The name, experience and qualifications of a person nominated by the Consent Holder to supervise the implementation of, adherence to, any amendments to the CMP. Amendments to CMP shall be reviewed by a suitably qualified person to ensure compliance the conditions of this consent. The revised (CMP) and the name of the person preparing or reviewing any part of the CMP, and their qualifications and experience, shall be provided to the Canterbury Regional Council, within two weeks of the amendments being made.
- 24 The Consent Holder shall:
- (a) Adopt and implement the best practicable options to prevent the discharge of sediment and contaminants into excavated land and surface water. These shall include but not be limited to:
 - (i) measures necessary to provide for soakage of stormwater;
 - (ii) inclusion or maintenance of a vegetated strip between earthworks and water races;
 - (iii) siting of stockpiles to prevent sediment-entrained runoff entering races or going off-site;
 - (iv) stabilisation and maintenance of site entrances from public roads; and
 - (b) Ensure that erosion and sediment control measures are constructed and maintained in general accordance with the Environment Canterbury Erosion and Sediment Control Guidelines (Report R06/23, February 2007).

Complaints register and non-compliance

- 25 Before commencing any activities on the site, the Consent Holder shall prepare and maintain a complaints register at the site office and make this available to the Canterbury Regional Council on request. The complaints register shall record the following:
- (a) Date and time of the incident that has resulted in the complaint;
 - (b) Location of the complainant when the incident was detected;
 - (c) A description of any relevant matters such as, wind speed and wind direction when the effects were detected by the complainant;
 - (d) The possible cause of the incident; and
 - (e) Any corrective action undertaken by the Consent Holder to avoid, remedy or mitigate the effects identified by the complainant, including the time of that corrective action.
- 26 Unless otherwise stated within these conditions, in the event of any breach of compliance of the conditions the Consent Holder shall notify the RMA Compliance & Enforcement Manager of the Canterbury Regional Council within 48 hours of the breach being detected.
- 27 Within five days of any breach, the Consent Holder shall provide written notification to that officer, which explains the cause of the breach and if the cause was within the control of the Consent Holder, steps that were taken to remedy the breach and steps that will be taken to prevent any further occurrence of the breach.

Importation of materials

- 28 Where it is necessary to import material to construct, use and maintain the storage ponds the imported material shall:
- (a) Meet the criteria of clean fill (as defined in the Ministry for the Environment guide to Managing Cleanfills); or
 - (b) Be virgin aggregate; or
 - (c) Be any other material that is necessary for the purpose of construction of the storage ponds and associated infrastructure.
- 29 The material can be a mixture of the aforementioned materials.
- 30 The delivery of cleanfill material sourced outside of the fill site shall be supervised by the Consent Holder (or designated agent) at all times. A record of all material coming on to the site shall be kept. The record shall include:
- (a) the name of the person and company that delivered the clean fill to the site;
 - (b) the date of deposition;
 - (c) the source of the material;
 - (d) a description of the material;

- (e) the volume of the material deposited; and
- (f) where on the site the material is deposited.

Notification

- 31 The Consent Holder shall be responsible for all the contracted operations relating to the exercise of this consent, and shall ensure that all personnel working on the site are aware of and have access to the contents of this consent document and shall ensure compliance with consent conditions.
- 32 The Canterbury Regional Council, RMA Compliance & Enforcement Manager, shall be notified of:
 - (a) the intention to exercise any consent at least three months prior to the commencement of any activities under this consent;
 - (b) no less than 48 hours prior to commencement of the works authorised by this consent;
 - (c) of the intention to complete construction works three months prior to the cessation of construction activity.
 - (d) as soon as practicable of the date that construction activity ceases.

Accidental discovery

- 33 In the event of any disturbance to Koiwi Tangata (human bones) or taonga (treasured artefacts), the Consent Holder shall immediately follow the Accidental Discovery Protocol set out in Appendix 3 of the Mahaanui Iwi Management Plan, and attached to this consent as **Attachment CRC122897A**.

Bonding of Construction, Operation, Maintenance, and Remediation

- 34 The Consent Holder shall construct, maintain, operate, repair, and remediate the works authorised under these consents.
- 35 To secure Condition 34, the Consent Holder shall, during the construction, operational, maintenance, and remediation phases, in relation to this consent, provide and maintain in favour of the Canterbury Regional Council, a bond or bonds on terms and conditions satisfactory to it in all respects.
- 36 All bonds shall be in a form generally used by a bank or insurance company registered to conduct business in New Zealand and approved by the Canterbury Regional Council.
- 37 The bonds shall apply to construction as well as providing cover for operational, maintenance, and reinstatement phases and works relating to this consent, and shall provide that the Consent Holder shall be liable and remain liable for meeting the lesser costs (including any contingency and GST) of:
 - (a) Completion costs; or
 - (b) Operation and maintenance costs; or
 - (c) Costs for reinstating land affected by the construction, including making safe and mitigating any adverse effects arising from the work undertaken during construction.

- 38 The bond shall be divided into three component parts, providing a bond for construction, operation and maintenance, and reinstatement.
- 39 The payment of the bond quantum by the Consent Holder shall be guaranteed by a Guarantor acceptable to the Canterbury Regional Council.
- 40 The Guarantor shall bind itself to pay up to the bond quantum for the carrying out and completion of all obligations of the Consent Holder under the bonds.
- 41 If the Consent Holder is unable at any time to arrange a Guarantor for the quantum of the bonds as determined in accordance with these conditions, or the Guarantor provided is unacceptable to the Canterbury Regional Council, the Consent Holder shall provide a cash bond or bonds for the required quantum.
- 42 The bonds shall be executed at least four months before the commencement of any construction works associated with this consent, and may be renewed from time to time in accordance with this condition, and shall remain in place for the duration of this consent.
- 43 The Consent Holder shall not exercise this consent or continue to exercise this consent until the bond or bonds or varied bonds have been executed by the Consent Holder and Guarantor and are acceptable in all respects to the Canterbury Regional Council and are deposited with the Canterbury Regional Council.
- 44 The bonds may vary from time to time, but at any given time shall be sufficient to cover the lesser of the estimated costs of completion (including any contingency and GST), operations and maintenance, and remediation and reinstatement, and/or compliance with all conditions:
- 45 In the event of the Consent Holder and the Canterbury Regional Council not reaching agreement on the initial or subsequent bonds and their amounts, they will be assessed by a suitably qualified and experienced independent bond assessor appointed by the Canterbury Regional Council, and the decision of that person shall be final and binding.
- 46 The amount of the bonds will then be reviewed and reassessed by the Consent Holder and the Canterbury Regional Council every 12 months from the date the initial bond amount was lodged.
- 47 During the construction, operation, maintenance, and reinstatement phase of the Scheme, a scope of works planned for each phase will be provided by the Consent Holder to the Canterbury Regional Council, both prior to setting the initial bond amounts, and again at each annual reassessment and six months prior to any change in phase, to assist in setting the bond amounts.
- 48 The Consent Holder shall meet the full and reasonable costs of providing any bonds, including legal advice to the Canterbury Regional Council, the costs of preparation of the bonds and any substitute bond, and the costs of any bond assessor engaged to resolve the appropriate quantum of the initial bond to be provided or any varied bond on review and reassessment.
- 49 If at any time the amount of the bonds are varied, then the Consent Holder and guarantor approved by the Canterbury Regional Council, shall within 30 working days of notification to the Consent Holder of the varied bond amount, execute and lodge with the Canterbury Regional Council a new bond for the varied amount or the additional amount required in excess of the existing bond.

- 50 At all times the Consent Holder shall comply with the terms of the bond or bonds or varied bond(s).
- 51 Should the Consent Holder not agree with the bond quantum determined in accordance with these conditions then the matter shall be referred to arbitration in accordance with the provisions of the Arbitration Act 1996.
- 52 Arbitration shall be commenced by written notice by the Consent Holder to the Canterbury Regional Council advising that the amount of the bond is disputed. Such notice to be given within 14 days of the bond sum being set. If the parties cannot agree upon an arbitration within 7 day of the notice of arbitration, then an arbitrator shall be appointed by the President of the Institution of Professional Engineers of New Zealand. Such arbitrator shall give an award in writing to the parties within 30 days after his or her appointment, unless the parties agree otherwise. The Consent Holder shall bear the full and reasonable costs of the parties in connection with the arbitration. Pending the outcome of the arbitration, the current bond and bond sum continue in force. However, the bond quantum shall be adjusted in accordance with the arbitrator's decision.

Insurance

- 53 The Consent Holder shall, at its costs, at least three months prior to construction commencing and at all times thereafter, have in place public liability insurance on terms acceptable in all respects to the Canterbury Regional Council.
- 54 The insurance provided under this condition must be sufficient to cover all reasonable insurable contingent risks associated with the operation of the WIL storage ponds, including offsite impacts to third party property, including any assets, infrastructure or otherwise of the Canterbury Regional Council and the Waimakariri District Council, associated with any reasonable foreseeable failure of any part of the proposed ponds, together with a reasonable provision for reconstruction and reinstatement; and the proceeds of the insurance policy shall be applied for those purposes only.
- 55 The terms of the insurance policy shall provide for the following:
- (a) The Canterbury Regional Council shall be an additional insurance party and should be able to enforce its terms;
 - (b) At least three months prior to construction commencing and at all times thereafter the Consent Holder shall ensure that the Canterbury Regional Council has written confirmation that the insurance required by this condition is in place.
 - (c) The Consent Holder shall ensure that the insurer is required to copy all relevant information regarding the insurance policy to the Canterbury Regional Council. This obligation includes an express term that the insurer must immediately the Canterbury Regional Council of any non-performance of the terms of the insurance by the Consent Holder.
 - (d) In the event of any nonperformance of any term of the insurance policy, the Canterbury Regional Council shall be given the opportunity to rectify that non-performance before the insurance policy is cancelled.
- 56 The Consent Holder will, at its cost, prior to arranging the insurance policy, obtain advice from a person qualified and experienced within the insurance industry to determine the limit of indemnity and coverage provided for by this insurance policy. In providing that advice, that person is to ensure the purpose of the policy

is met, which is to provide coverage and protection in the instance of a failure of the works authorized under this consent to third parties whose properties and possessions may be damaged, including motor vehicles and the assets and infrastructure of both the Canterbury Regional Council and Waimakariri District Council.

- 57 A copy of the advice relating to the insurance policy will be provided to the RMA Compliance & Enforcement Manager at the Canterbury Regional Council for review and comment, and any comments and suggestions that are provided to the Consent Holder will be taken into account and provided for within the insurance policy.
- 58 The limits of indemnity and coverage and terms of the policy are to be reviewed by the Consent Holder at least every three years, and if that review results in amendment or alteration to the insurance cover, then agreement of the Canterbury Regional Council to any such amendments or alterations will be required.
- 59 If the parties cannot agree on the terms of insurance cover, the coverage, or indemnity value, the dispute shall be referred to arbitration, applying the bond arbitration clause above as appropriate.

Water storage commissioning plan

- 60 The Consent Holder shall prepare a Water Storage Commissioning Plan for the Waimakariri Irrigation Storage Ponds that seeks to minimise risks from the initial filling of the ponds, in accordance with NZSOLD (2000) New Zealand Dam Safety Guidelines (Appendix 10). The commissioning plan shall include the matters set out in the conditions below, and shall be submitted to the RMA Compliance & Enforcement Officer at the Canterbury Regional Council for certification at least two months prior to the first filling or partial filling of the storage ponds with water.
- 61 The first filling or partial filling of the storage ponds with water shall not occur until the Water Storage Commissioning Plan has been certified by the RMA Compliance & Enforcement Officer at the Canterbury Regional Council.
- 62 The commissioning of the storage ponds and associated activities shall be undertaken in accordance with the Water Storage Commissioning Plan certified by the RMA Compliance & Enforcement Officer at the Canterbury Regional Council.
- 63 The Water Storage Commissioning Plan shall include:
- (a) The staging and monitoring of the first filling of each component of the ponds;
 - (b) The commissioning and testing of control structures and systems, pumps, and monitoring systems; and
 - (c) Methods outlining surveillance of the ponds during commissioning and reporting requirements.
- 64 All activities in furtherance of this consent shall be undertaken in accordance with the Water Storage Commissioning Plan.

Dam safety assurance plan

- 65 The Consent Holder shall submit a Dam Safety Assurance Plan prepared and produced by a suitably experienced and qualified engineer as defined by the "Building Dam Safety Regulations 2008" for the Waimakariri Irrigation Storage Ponds that seeks to minimise risks from the ongoing operation of the ponds in accordance with the NZSOLD (2000) New Zealand Dam Safety Guidelines (Appendix E). The Dam Safety Assurance Plan shall include the matters set out in the conditions below, and shall be submitted to the RMA Compliance & Enforcement Officer at the Canterbury Regional Council for certification at least two months prior to the first filling or partial filling of the storage ponds with water.
- 66 The Dam Safety Assurance Plan will be peer reviewed by the independent peer review panel.
- 67 The first filling or partial filling of the storage ponds with water shall not occur until the Dam Safety Assurance Plan has been certified by the RMA Compliance & Enforcement Officer at the Canterbury Regional Council.
- 68 The operation of the storage ponds and associated activities shall be undertaken in accordance with the Dam Safety Assurance Plan certified by the RMA Compliance & Enforcement Officer at the Canterbury Regional Council.
- 69 The Dam Safety Assurance Plan shall be reviewed by the Consent Holder every twelve months, for the first two years of operation following the initial filling of the storage ponds, and thereafter every five years coinciding with Comprehensive Safety Reviews and also whenever a trigger event, as identified in the Dam Safety Assurance plan, occurs. The review shall evaluate the Dam Safety Assurance Plan, the results of any inspections and any monitoring data and communications to or from the Waimakariri District Council and the Canterbury Regional Council. The results of the review shall be recorded in writing and sent to the RMA Compliance & Enforcement Officer at the Canterbury Regional Council within one month of the review occurring. If necessary, the Dam Safety Assurance Plan shall be amended to improve its effectiveness in reducing the risks and the matters in the conditions below, be further subjected to peer review by the independent peer review panel and resubmitted for certification by the RMA Compliance & Enforcement Officer at the Canterbury Regional Council.
- 70 The Dam Safety Assurance Plan shall include the following components:
- (a) Procedures and processes for dam operations, routine monitoring and inspections;
 - (b) Emergency procedures, including emergency responses, dam drawdown, early warning systems for the community and integration with Council and emergency services;
 - (c) Requirements for (annual) structural integrity and maintenance inspection by a suitably qualified person and reporting;
 - (d) Requirements for post-event (earthquake or similar event) structural integrity inspection by a suitably qualified person and reporting.
 - (e) Include a monitoring system capable of reliably and accurately detecting signs of threats to dam safety and increased soil moisture in the Eyrewell Scientific Reserve.

- (f) Specifies an organisation approach that efficiently records processes, and evaluates and reports observations of the dam's performance.
- (g) Includes trigger levels for observational results that are considered to require action;
- (h) Includes a strategy of mitigation and actions to be undertaken in the event the specified trigger levels are exceeded;
- (i) Provide for the reporting to the Council's District Plan Manager any trigger level exceedance and actions taken to address such exceedance;
- (j) Provide for the immediate inspection of the dam and its associated components and accessory structures as soon as practicable after any earthquake with an intensity of VII (Very Strong) on the Modified Mercalli Scale is experienced at the Waimakariri Irrigation Storage Ponds; and
- (k) Certification that the Dam Safety Assurance Plan meets and satisfies all necessary requirements, including those identified in Condition 65 above.

71 The Consent Holder shall comply with the Dam Assurance Safety Plan at all times.

Emergency action plan

- 72 Prior to activities commencing on the site, the Consent Holder shall engage a professional engineer with experience in management of large dams with an assessed potential impact category to prepare an emergency action plan (EMP), to ensure appropriate management of the risk associated with any uncontrolled abnormal or excessive flow releases from the dams.
- 73 The EMP shall be prepared in consultation with the Community Liaison Group (see RC135478, Conditions 58 to 63 inclusive), the Civil Defence Emergency Management Group, including the Waimakariri District Council and the Canterbury Regional Council, and will, as far as practicable, be consistent with any Civil Emergency Management Group Plan governing the Canterbury Regional Council District and the Waimakariri District pursuant to the Civil Defence Emergency Management Act 2002.
- 74 The EMP shall contain as a minimum:
- (a) Maps of land areas modelled as being subject to inundation in the event of abnormal or excess flow release and contact details for people resident within those areas, where they can be ascertained;
 - (b) Contingency plans for alerting people within the identified areas of inundation and relevant Civil Defence authorities of the risk of such events;
- 75 Three months prior to storage pond filling, a copy of the EMP shall be provided to the RMA Compliance & Enforcement Officer at the Canterbury Regional Council, the Waimakariri District Council, the Christchurch City Council, the Canterbury District Health Board, the NZ Police, the NZ Fire Service, and the NZ Transport Agency for their information. Any input to the EMP those organisations provide will be taken into account within the EMP by the Consent Holder.
- 76 The Consent Holder shall review the EMP periodically, at least annually, timed to coincide with a review of the Civil Emergency Management Group Plan referred to above.

- 77 All activities in furtherance of this consent shall be undertaken in accordance with the EMP.

Construction plans

- 78 At least 1 month prior to the date upon which the Consent Holder intends to commence activities, as notified under these conditions, the Consent Holder shall provide to the RMA Compliance & Enforcement Officer at the Canterbury Regional Council detailed engineering plans that have been peer reviewed and certified by an appropriately qualified and experienced engineer acceptable to the Canterbury Regional Council.
- 79 Within 12 months of the date of construction activities ceasing, as notified under these conditions, "as built" detailed engineering plans shall be provided to RMA Compliance & Enforcement Officer at the Canterbury Regional Council.
- 80 All activities in furtherance of this consent shall be undertaken in accordance with the construction plans.

Certification procurement

- 81 The Consent Holder shall procure certification from a suitably qualified and experience dam construction expert that the design of the dam and its construction are in accordance with good engineering practice, including being consistent with the Dam Safety Guidelines issued by the New Zealand Society on Large Dams and the requirements of the Building Act 2004. This certificate shall be submitted to the RMA Compliance & Enforcement Officer at the Canterbury Regional Council at least 2 months prior to the first filling of the dam reservoir.

Certified management plans to be held on site

- 82 A copy of the certified versions of all relevant management plans shall be kept on the site, and the Consent Holder shall ensure that all key personnel are made aware of each plan's contents.

Review

- 83 The Canterbury Regional Council may, annually on the last five working days of May or November, serve notice on the Consent Holder under s 128(1) RMA of its intention to review the conditions of these consents that they have administrative responsibility for the following purposes:
- (a) To review the effectiveness of any of the conditions of the consents in avoiding, remedying or mitigating any adverse effects on the environment from the exercise of the consents and, if necessary, to avoid, remedy, or mitigate such effects by way of further or amended conditions;
 - (b) To ensure that the conditions are consistent with any policies or rules in a regional plan or National Environmental Standard or Regulation that becomes legally effective after the grant of consent;
 - (c) To review the adequacy of, and necessity of, monitoring undertaken by the Consent Holder.

Administrative charges

- 84 The Consent Holder shall pay to the Canterbury Regional Council any administrative charges fixed in accordance with s 36 RMA or any charge prescribed

in accordance with regulations made under s 360 RMA and s 690a of the Local Government Act 1974. The administrative charges shall be paid to the Canterbury Regional Council for the carrying out of their functions in relation to the administration, monitoring and supervision of these consents and for carrying out their functions under s 35 RMA.

Other charges or costs

- 85 The Consent Holder shall pay all costs relating to peer reviews or engagement of others to undertake any actions or services required in terms of these conditions.

Lapse date

- 86 The lapsing date for the purposes of s 125 shall be five years from the commencement of this consent.

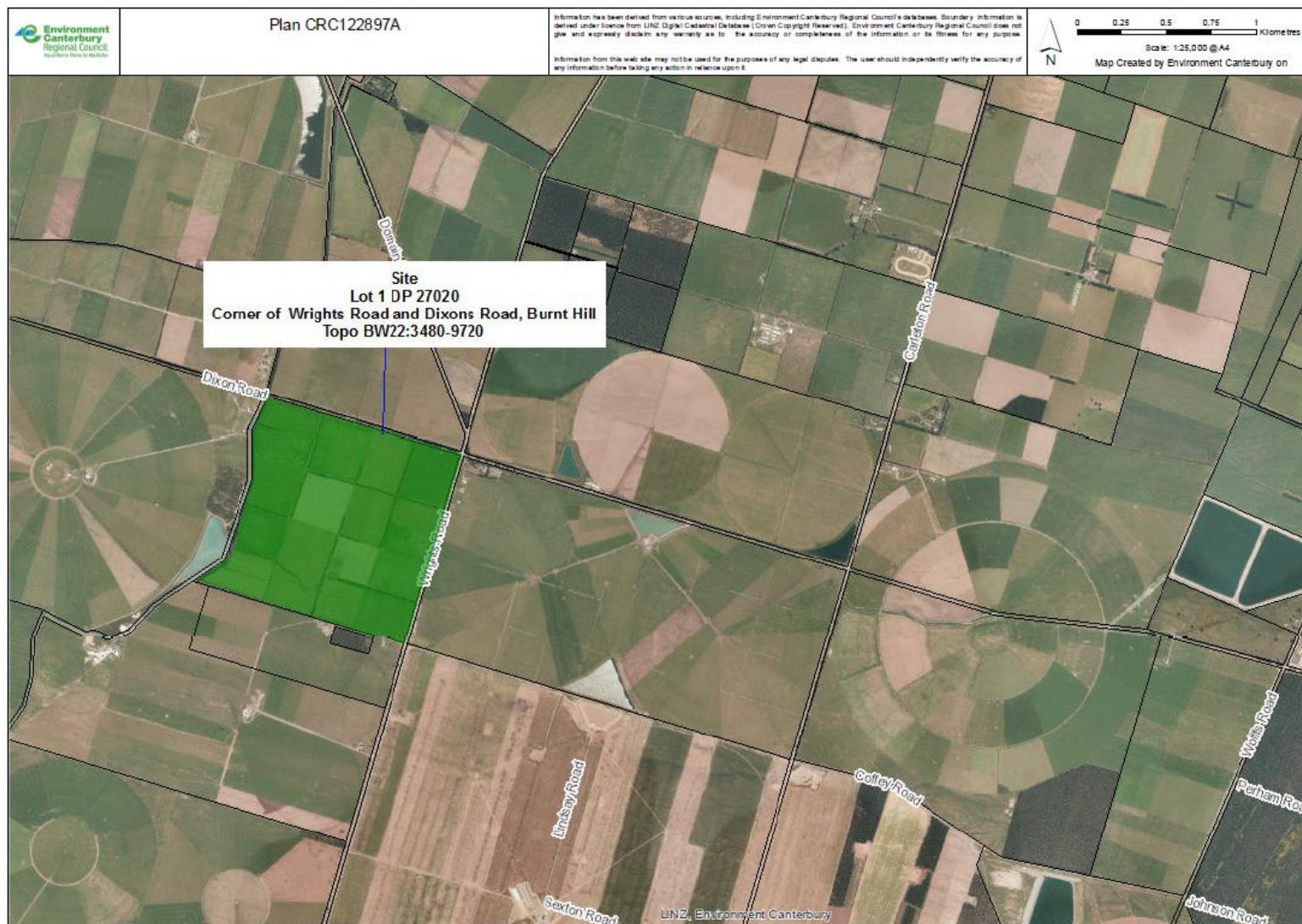
Definitions

- 87 For the purposes of this consent, the following definitions shall apply to all conditions:

Remediation means ensuring that inundation of land outside the site does not occur; and that all dangerous and hazardous materials and substances are removed; and that the site is made safe and free of hazards or alternatively, that hazards are identified and provided for; and that landscaping then in place is maintained.

Advice Note: For the purposes of this consent "certify" "certified" or "certification by the Council" means assessed by Council staff or consultant acting in a technical certification capacity to determine whether the document or matter is consistent with or sufficient to meet the conditions of this consent.

Plan CRC122897A



Accidental Discovery Protocol (CRC ADP Modified after WDC 30 September 2014)

- 1 In the event of any discovery of archaeological material:
 - (a) the consent holder shall immediately:
 - (i) Cease earthmoving operations in the affected area and mark off the affected area; and
 - (ii) Advise the Canterbury Regional Council of the disturbance; and
 - (iii) Advise the Heritage New Zealand Pouhere Taonga of the disturbance.
- 2 If the archaeological material is determined to be Kōiwi Tangata (human bones) or taonga (treasured artefacts) by the Heritage New Zealand Pouhere Taonga, the consent holder shall immediately advise the office of the appropriate rūnanga/ Kaitiaki Rūnanga (office contact information can be obtained from the Canterbury Regional Council) of the discovery.
- 3 If the archaeological material is determined to be Kōiwi Tangata (human bones) by Heritage New Zealand Pouhere Taonga, the consent holder shall immediately advise the New Zealand Police of the disturbance.
- 4 The consent holder will also consult the Kaitiaki Rūnanga on any matters of tikanga (protocol) that are required in relation to the discovery and prior to the commencement of any investigation.
- 5 If kōiwi Tangata (human remains) are uncovered, in addition to the steps above, the area must be treated with utmost discretion and respect, and the kōiwi dealt with according to both law and tikanga, as guided by the Kaitiaki Rūnanga.
- 6 Work may recommence if Heritage New Zealand Pouhere Taonga (following consultation with Kaitiaki Rūnanga if the site is of Māori origin) provides a statement in writing to the Canterbury Regional Council, Attention: RMA Compliance and Enforcement Manager that appropriate action has been undertaken in relation to the archaeological material discovered. The Canterbury Regional Council shall advise the consent holder on written receipt from Heritage New Zealand Pouhere Taonga that work can recommence.

Advice Note: This may be in addition to any agreements that are in place between the consent holder and the Papatipu Rūnanga. (Cultural Site Accidental Discovery Protocol).

Advice Note: Under the Heritage New Zealand Pouhere Taonga Act 2014 an archaeological site is defined as any place associated with pre-1900 human activity, where there is material evidence relating to the history of New Zealand. For sites solely of Māori origin, this evidence may be in the form of accumulations of shell, bone, charcoal, burnt stones, etc. In later sites, artefacts such as bottles or broken glass, ceramics, metals, etc., may be found or evidence of old foundations, wells, drains, tailings, races or other structures. Human remains/kōiwi may date to any historic period.

Advice Note: It is unlawful for any person to destroy, damage, or modify the whole or any part of an archaeological site without the prior authority of Heritage New Zealand Pouhere Taonga. This is the case regardless of the legal status of the land on which

the site is located, whether the activity is permitted under the District or Regional Plan or whether a resource or building consent has been granted. The Heritage New Zealand Pouhere Taonga Act 2014 provides for substantial penalties for unauthorised damage or destruction.

APPENDIX B

CRC122898 - to use land to store and use up to 10,000 litres of diesel and other hazardous substances in an above ground portable fuel storage container

Scope

- 1 All activities authorised by this consent shall be undertaken in accordance with the information contained in the Application, the Assessment of Environmental Effects (Waimakariri Irrigation Limited Storage Ponds), and all supporting technical documents and plans as provided to the Canterbury Regional Council, except where inconsistent with these conditions.
- 2 The land use shall be for the use and storage of diesel fuel oil and oils and greases in mobile or temporary stationary storage containers, and shall include the following:
 - (a) delivery of fuel;
 - (b) refilling the mobile storage containers;
 - (c) dispensing of diesel fuel oil from the mobile storage containers; and
 - (d) dispensing of diesel fuel from delivery trucks.
- 3 The land use described in Condition 2 above shall occur at land parcel Lot 1 DP 27020, located on the corner of Wrights Road and Dixons Road, Burnt Hill, at or about map reference Topo BW22:3480-9720, as shown on **Plan CRC122898A**, which forms part of this consent.

Design

- 4 The total aggregate storage capacity of the mobile or temporary stationary diesel storage containers shall not exceed 10,000 litres.
- 5 The mobile and temporary diesel storage containers shall be within a bunded enclosure with a containment volume of not less than 110 percent of that of the storage volume.
- 6 The total aggregate quantity of oils and greases stored shall not exceed 300 litres.
- 7 An overfill device shall be used on each storage container, where practicable.
- 8 All mobile storage containers shall comply with the Hazardous Substances (Tank Wagons and Transportable Containers) Regulations 2004.
- 9 All hazardous substances on site shall be stored and used in accordance with the requirements under the Hazardous Substances and New Organisms Act 1996.
- 10 The Consent Holder shall ensure that the hazardous substances are stored and used in a facility that is designed, constructed and managed to prevent the uncontrolled release of substances or contaminated water into the environment.
- 11 The Consent Holder shall ensure stormwater generated on or over any re-fuelling areas and/or vehicle repair areas is managed such that stormwater entrained with oil/fuels/hazardous substances from these areas is not discharged to groundwater or surface waters without treatment to enable it to be disposed of.

- 12 The Consent Holder shall provide certification from an independent, suitably qualified and experienced person prior to the use of the containers used for storage of hazardous substances that the storage system complies with the Hazardous Substances (Emergency Management) Regulations 2001 and Hazardous Substances and New Organism Act 1996.
- 13 The Consent Holder shall undertake a leak testing programme prior to the use of any diesel storage and provide certification that the containers and any pipework have been tested as being leak free from leaks by a suitably-qualified person.
- 14 The Consent Holder shall establish and maintain a stock reconciliation inventory system. Reconciliation shall be carried out on a monthly basis. Records of the inventory shall be provided to Canterbury Regional Council: Attention RMA Compliance and Enforcement Manager upon request.

Spill Response Plan

- 15 Access to dispensing of diesel oil, oils and greases shall only be via a security system that precludes any public access.
- 16 The diesel oil, oils and greases shall not be stored or distributed within 50 metres of a bore used to supply drinking water or a surface water body.
- 17 Weekly visual inspections of tank connections and piping for leaks shall be carried out and tank connections and piping shall be remediated as necessary. In addition, the bunded areas shall be inspected on a regular basis to ensure there is capacity to cope with a spill of hazardous substances.
- 18 The Consent Holder shall maintain on site at all times, measures to prevent spills entering land or water bodies, including water races. These measures shall include but not be limited to:
 - (a) Using a documented tank filling procedure to prevent spills during any fuel delivery. Such procedures shall include but not be limited to:
 - (i) Re-fuelling procedure;
 - (ii) Emergency spill procedure; and
 - (iii) Staff training;
 - (b) Using storage containers that are free from rust and corrosion;
 - (c) Using catch trays with a minimum volume of 10 litres under transfer line connections, and fill points on all equipment serviced from portable containers;
 - (d) Making spill kits available to contain or absorb any spilled diesel fuel oil at or with each storage container;
 - (e) Maintaining signs to identify the location of spill kits; and
 - (f) Maintaining written procedures in clearly visible locations that are to be undertaken to contain, remove and dispose of any spilled diesel fuel oil.
- 19 In the event of an accidental spill of a hazardous substance, with a volume greater than 10 litres, the Consent Holder shall inform the Canterbury Regional Council,

Attention: RMA Compliance and Enforcement Manager, within 24 hours of a spill event and shall provide the following information:

- (a) Date, time, location and estimated volume of the spill;
- (b) The cause of the spill;
- (c) The type of hazardous substance(s) spilled;
- (d) Clean up procedures undertaken;
- (e) Details of the steps undertaken to control and remediate the effects of the spill on the receiving environment;
- (f) An assessment of any potential effects of the spill; and
- (g) Measures undertaken to prevent a recurrence.

20 The Consent Holder shall use the best practicable options to contain spills or leaks of any hazardous substance from being discharged. These shall include but not be limited to the following:

- (a) Under/taking the storage and use of hazardous substances in accordance with a Spill Response Plan which shall be incorporated into the Construction Management Plan;
- (b) Communicating the Spill Response Plan to all persons undertaking activities authorised by this consent and keeping a copy kept on site at all times;
- (c) Detailed the in the Spill Response Plan will be the methods and processes by which the Consent Holder shall use best practicable options to prevent and contain spills or leaks of any hazardous substance from being discharged and shall include, but not be limited to:
 - (i) Documentation of hazardous substances used and stored on site (in a hazardous substance register), including the quantities and substance materials safety data safety sheets (MSDS);
 - (ii) A plan showing the location of the temporary stationary storage diesel storage tanks on the site;
 - (iii) Description of the storage, including labelling, package, storage and bunding, signage, and security;
 - (iv) Refuelling, inspection and maintenance procedures;
 - (v) Training of staff for appropriate storage, use and emergency measures and containment of spilled hazardous substances;
 - (vi) Identification of appropriate emergency measures and containment of spilled hazardous substances; and
 - (vii) Staff responsibilities and emergency contact phone numbers including the Emergency contact information for the Canterbury Regional Council Pollution Hotline.

21 A copy of the Spill Response Plan shall be prepared in accordance with Conditions 18, 19, and 20 and shall be submitted to the Canterbury Regional Council

(attention: RMA Compliance and Enforcement Manager) at least 20 working days prior to construction commencing. Any updates or revisions to the spill response plan shall be submitted to the Canterbury Regional Council (attention: RMA Compliance and Enforcement Manager) with 15 working days of that update or revision.

- 22 Any contaminants or clean up material removed from the site shall be disposed of at an appropriate facility and the Consent Holder shall provide the Canterbury Regional Council (attention: RMA Compliance and Enforcement Manager) with written confirmation of such disposal within 10 working days.

Administration

- 23 The Consent Holder shall be responsible for all the contracted operations relating to the exercise of this consent, and shall ensure that all personnel working on the site are aware of and have access to the contents of this consent document and shall ensure compliance with consent conditions.

Review

- 24 The Canterbury Regional Council may, annually on the last five working days of May or November, serve notice on the Consent Holder under s 128(1) RMA of its intention to review the conditions of these consents that they have administrative responsibility for the following purposes:
- (a) To review the effectiveness of any of the conditions of the consents in avoiding, remedying or mitigating any adverse effects on the environment from the exercise of the consents and, if necessary, to avoid, remedy, or mitigate such effects by way of further or amended conditions;
 - (b) To ensure that the conditions are consistent with any policies or rules in a regional plan or National Environmental Standard or Regulation that becomes legally effective after the grant of consent;
 - (c) To review the adequacy of, and necessity of, monitoring undertaken by the Consent Holder.

Administrative charges

- 25 The Consent Holder shall pay to the Canterbury Regional Council any administrative charges fixed in accordance with s 36 RMA or any charge prescribed in accordance with regulations made under s 360 RMA and s 690a of the Local Government Act 1974. The administrative charges shall be paid to the Canterbury Regional Council for the carrying out of their functions in relation to the administration, monitoring and supervision of these consents and for carrying out their functions under s 35 RMA.

Other charges or costs

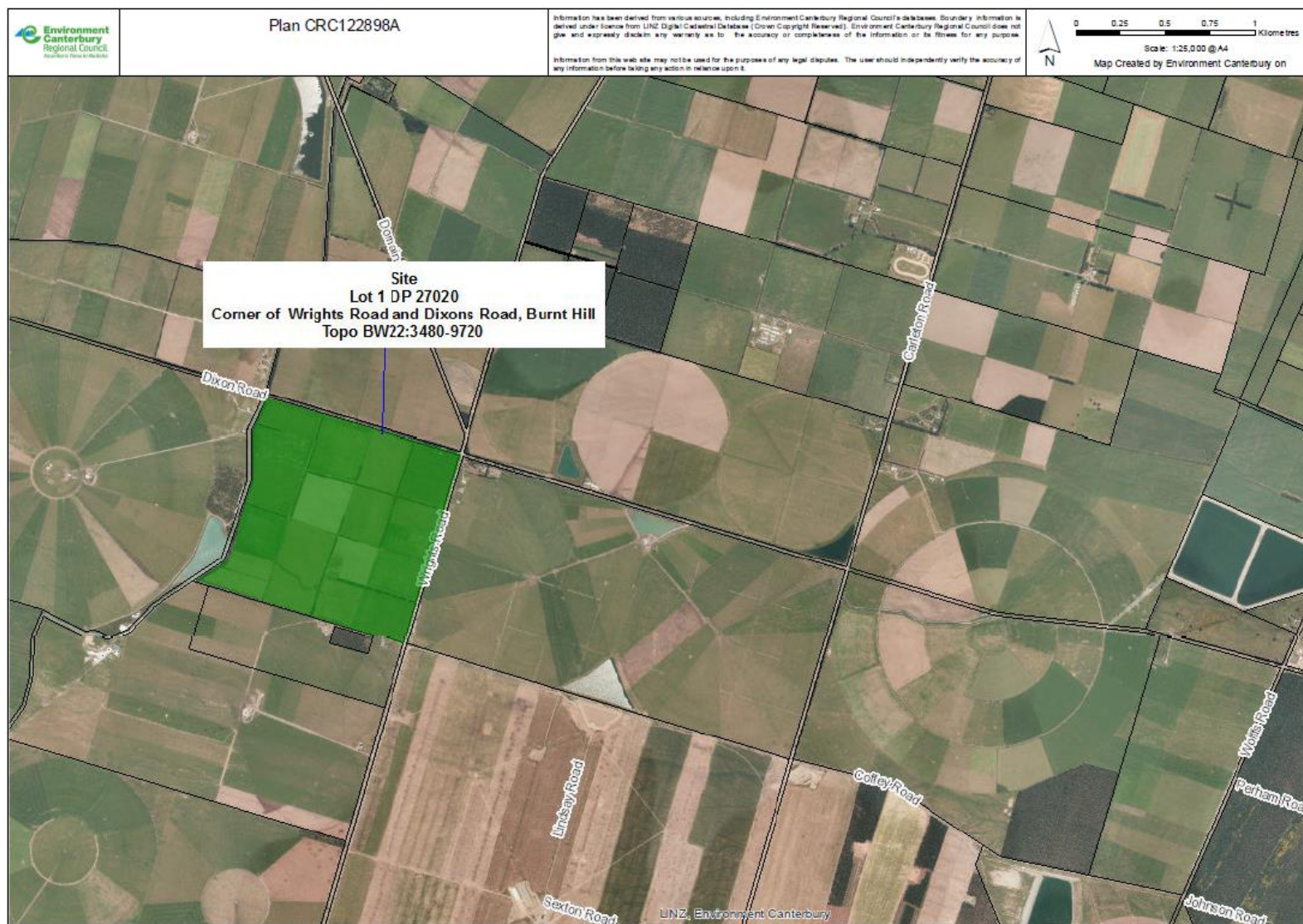
- 26 The Consent Holder shall pay all costs relating to peer reviews or engagement of others to undertake any actions or services required in terms of these conditions.

Lapse date

- 27 The lapsing date for the purposes of s 125 shall be five years from the commencement of this consent.

Advice Note: For the purposes of this consent "certify" "certified" or "certification by the Council" means assessed by Council staff or consultant acting in a technical certification capacity to determine whether the document or matter is consistent with or sufficient to meet the conditions of this consent.

Plan CRC122898A



APPENDIX C

CRC120610 - To dam up to 8.2 million m³ of water

Scope

- 1 All activities authorised by this consent shall be undertaken in accordance with the information contained in the Application, the Assessment of Environmental Effects (Waimakariri Irrigation Limited Storage Ponds), and all supporting technical documents and plans as provided to the Canterbury Regional Council, except where inconsistent with these conditions.

Limits

- 2 Water shall be diverted from the Waimakariri Irrigation Limited Buffer Pond on Lot 1 DP 3020 at map reference Topo BW22:3399-9685 and dammed only on land parcel Lot 1 DP 27020 at or about map reference Topo BW22:3480-9720, located on the corner of Wrights Road and Dixons Road, Burnt Hill, and as shown on **Plan CRC120610A**, which forms part of this consent.

Peer review

- 3 At least 6 months prior to commencing works under this consent, the Consent Holder shall engage, at its cost, an independent peer review panel of at least three suitably experienced and qualified dam design and construction experts. The experts will have qualifications and experience appropriate for the matters that are to be reviewed. In the event that particular skills, not available among the members of the panel, are required, the Consent Holder shall ensure that an appropriately qualified person is engaged to advise the peer review panel, and that Canterbury Regional Council is so informed.
- 4 Appointments to the peer review panel shall be acceptable to the Canterbury Regional Council.
- 5 The expert panel will review and report to the Consent Holder and the Canterbury Regional Council, with particular reference for ensuring the safety of the dam, the site investigations, the geotechnical assessment, the choice of dam, the design parameters, the design of the embankments and pond infrastructure, the suitability of the liner, the commissioning process and operation of the ponds, including maintenance and the means of monitoring leakage, the Dam Safety Assurance Plan, and proposals for emergency management.
- 6 Construction of the storage ponds shall not commence until such time as the Consent Holder has presented the Canterbury Regional Council with a written report from the peer review panel, which certifies the design and that all relevant and applicable design and safety criteria, and standards, codes, regulations, and statutory and Good Engineering Practice (including, but not limited to, being consistent with the latest Dam Safety Guidelines issued by the New Zealand Society on Large Dams and the requirements of the Building Act 2004) and any other requirements applicable to the construction, operation, and maintenance of the Waimakariri Irrigation Storage Ponds have been achieved as they relate to:
 - (a) the Consent Holder's dam design,
 - (b) the site investigations,

- (c) the geotechnical assessment,
 - (d) the choice of dam,
 - (e) the design parameters,
 - (f) the design of the embankments and pond infrastructure,
 - (g) the suitability of the liner,
 - (h) the commissioning process and operation of the ponds, including maintenance and the means of monitoring leakage, and
 - (i) the dam safety program and proposals for emergency management as contained within the Consent Holder's Application (see Condition 3 above)
- 7 The certification report shall be submitted to the RMA Compliance & Enforcement Manager at the Canterbury Regional Council at least 1 month prior to commencing works under this consent.
- 8 In the instance that the independent review panel does not so certify, then the Consent Holder will implement the necessary alterations and/or changes to secure certification before commencing construction of the Waimakariri Irrigation Storage Ponds.

Detailed design geotechnical investigations

- 9 The seismic hazard assessment for the Waimakariri Irrigation Storage Ponds shall be reviewed and, if required, updated by the Consent Holder 3 months prior to commencing further detailed design work or construction, whichever occurs earlier.
- 10 The Consent Holder shall undertake any necessary further geotechnical investigations.
- 11 A report detailing the results of these further geotechnical investigations and updated seismic assessments shall be provided to the RMA Compliance & Enforcement Manager at the Canterbury Regional Council at least 3 months before construction works commence. The report shall be prepared by a suitably qualified person, acceptable to the Canterbury Regional Council, and shall provide details of the geotechnical investigations undertaken and recommendations for remedial works where necessary.

Maximum volume and water depth

- 12 The maximum volume of water dammed within the ponds at any one time shall not exceed 8.2 million cubic metres.
- 13 The depth of water in the dam shall not exceed 11 metres measured from natural ground level, and at all times the Consent Holder will ensure a freeboard of 1.3 metres is available in all storage ponds. The full supply level of storage pond 1 is RL 226.70 m and that of storage pond 2 is RL 223.00 m.

Pond liner

- 14 Subject to the outcome of the peer review, the ponds shall be lined with a membrane of HDPE material, of a minimum thickness of 1.5 mm.

Water quality sampling

- 15 The Consent Holder shall undertake a water quality sampling and monitoring regime for the dammed water:
- 16 The water quality of the dammed water shall meet the following water quality standards:
 - (a) A maximum Trophic Level Index (TLI) trigger value of < 4.0 (Mesotrophic); and/or
 - (b) A maximum trigger level of 5 milligrams per cubic metre of Chlorophyll A; and
 - (c) If the water stored in the ponds breaches the trigger level set out in Conditions 16(a) and/or (b), the Consent Holder shall commence monitoring for cyanobacteria according to the Guidelines and any updates to the Guidelines in **Attachment CRC140610** and undertake remedial action to return the water quality below the trigger level set out in Conditions 16(a) and/or (b).

Water quality monitoring plan

- 17 At least 30 working days prior to the commencement of the activity authorised by this consent the Consent Holder shall submit a Water Quality Monitoring Plan. The monitoring and sampling regime shall be:
 - (a) prepared by suitably qualified person and approved by Canterbury Regional Council;
 - (b) The plan shall address:
 - (i) Water quality monitoring for dissolved oxygen (depth profile), temperature (depth profile); and observation of any algal or macrophyte growth and the presence of noxious or pest species of plant, algae, fish or invertebrates;
 - (ii) Timing of sampling;
 - (iii) Methods and locations of sampling in the storage ponds;
 - (iv) Mitigation measures to manage any adverse trends or potential exceedance of appropriate trigger levels identified in Condition 16;
 - (v) The frequency of reporting.
- 18 All activities in furtherance of this consent shall be undertaken in accordance with the Water Quality Monitoring Plan.

Bonding of Construction, Operation, Maintenance, and Remediation

- 19 The Consent Holder shall construct, maintain, operate, repair, and remediate the works authorised under these consents.
- 20 To secure Condition 19, the Consent Holder shall, during the construction, operational, maintenance, and remediation phases, in relation to this consent,

provide and maintain in favour of the Canterbury Regional Council, a bond or bonds on terms and conditions satisfactory to it in all respects.

- 21 All bonds shall be in a form generally used by a bank or insurance company registered to conduct business in New Zealand and approved by the Canterbury Regional Council.
- 22 The bonds shall apply to construction as well as providing cover for operational, maintenance, and reinstatement phases and works relating to this consent, and shall provide that the Consent Holder shall be liable and remain liable for meeting the lesser costs (including any contingency and GST) of:
 - (a) Completion costs; or
 - (b) Operation and maintenance costs; or
 - (c) Costs for reinstating land affected by the construction, including making safe and mitigating any adverse effects arising from the work undertaken during construction.
- 23 The bond shall be divided into three component parts, providing a bond for construction, operation and maintenance, and reinstatement.
- 24 The payment of the bond quantum by the Consent Holder shall be guaranteed by a Guarantor acceptable to the Canterbury Regional Council.
- 25 The Guarantor shall bind itself to pay up to the bond quantum for the carrying out and completion of all obligations of the Consent Holder under the bonds.
- 26 If the Consent Holder is unable at any time to arrange a Guarantor for the quantum of the bonds as determined in accordance with these conditions, or the Guarantor provided is unacceptable to the Canterbury Regional Council, the Consent Holder shall provide a cash bond or bonds for the required quantum.
- 27 The bonds shall be executed at least four months before the commencement of any construction works associated with this consent, and may be renewed from time to time in accordance with this condition, and shall remain in place for the duration of this consent.
- 28 The Consent Holder shall not exercise this consent or continue to exercise this consent until the bond or bonds or varied bonds have been executed by the Consent Holder and Guarantor and are acceptable in all respects to the Canterbury Regional Council and are deposited with the Canterbury Regional Council.
- 29 The bonds may vary from time to time, but at any given time shall be sufficient to cover the lesser of the estimated costs of completion (including any contingency and GST), operations and maintenance, and remediation and reinstatement, and/or compliance with all conditions:
- 30 In the event of the Consent Holder and the Canterbury Regional Council not reaching agreement on the initial or subsequent bonds and their amounts, they will be assessed by a suitably qualified and experienced independent bond assessor appointed by the Canterbury Regional Council, and the decision of that person shall be final and binding.

- 31 The amount of the bonds will then be reviewed and reassessed by the Consent Holder and the Canterbury Regional Council every 12 months from the date the initial bond amount was lodged.
- 32 During the construction, operation, maintenance, and reinstatement phase of the Scheme, a scope of works planned for each phase will be provided by the Consent Holder to the Canterbury Regional Council, both prior to setting the initial bond amounts, and again at each annual reassessment and six months prior to any change in phase, to assist in setting the bond amounts.
- 33 The Consent Holder shall meet the full and reasonable costs of providing any bonds, including legal advice to the Canterbury Regional Council, the costs of preparation of the bonds and any substitute bond, and the costs of any bond assessor engaged to resolve the appropriate quantum of the initial bond to be provided or any varied bond on review and reassessment.
- 34 If at any time the amount of the bonds are varied, then the Consent Holder and guarantor approved by the Canterbury Regional Council, shall within 30 working days of notification to the Consent Holder of the varied bond amount, execute and lodge with the Canterbury Regional Council a new bond for the varied amount or the additional amount required in excess of the existing bond.
- 35 At all times the Consent Holder shall comply with the terms of the bond or bonds or varied bond(s).
- 36 Should the Consent Holder not agree with the bond quantum determined in accordance with these conditions then the matter shall be referred to arbitration in accordance with the provisions of the Arbitration Act 1996.
- 37 Arbitration shall be commenced by written notice by the Consent Holder to the Canterbury Regional Council advising that the amount of the bond is disputed. Such notice to be given within 14 days of the bond sum being set. If the parties cannot agree upon an arbitration within 7 day of the notice of arbitration, then an arbitrator shall be appointed by the President of the Institution of Professional Engineers of New Zealand. Such arbitrator shall give an award in writing to the parties within 30 days after his or her appointment, unless the parties agree otherwise. The Consent Holder shall bear the full and reasonable costs of the parties in connection with the arbitration. Pending the outcome of the arbitration, the current bond and bond sum continue in force. However, the bond quantum shall be adjusted in accordance with the arbitrator's decision.

Insurance

- 38 The Consent Holder shall, at its costs, at least three months prior to construction commencing and at all times thereafter, have in place public liability insurance on terms acceptable in all respects to the Canterbury Regional Council.
- 39 The insurance provided under this condition must be sufficient to cover all reasonable insurable contingent risks associated with the operation of the WIL storage ponds, including offsite impacts to third party property, including any assets, infrastructure or otherwise of the Canterbury Regional Council and the Waimakariri District Council, associated with any reasonable foreseeable failure of any part of the proposed ponds, together with a reasonable provision for reconstruction and reinstatement; and the proceeds of the insurance policy shall be applied for those purposes only.
- 40 The terms of the insurance policy shall provide for the following:

- (a) The Canterbury Regional Council shall be an additional insurance party and should be able to enforce its terms;
 - (b) At least three months prior to construction commencing and at all times thereafter the Consent Holder shall ensure that the Canterbury Regional Council has written confirmation that the insurance required by this condition is in place.
 - (c) The Consent Holder shall ensure that the insurer is required to copy all relevant information regarding the insurance policy to the Canterbury Regional Council. This obligation includes an express term that the insurer must immediately the Canterbury Regional Council of any non-performance of the terms of the insurance by the Consent Holder.
 - (d) In the event of any nonperformance of any term of the insurance policy, the Canterbury Regional Council shall be given the opportunity to rectify that non-performance before the insurance policy is cancelled.
- 41 The Consent Holder will, at its cost, prior to arranging the insurance policy, obtain advice from a person qualified and experienced within the insurance industry to determine the limit of indemnity and coverage provided for by this insurance policy. In providing that advice, that person is to ensure the purpose of the policy is met, which is to provide coverage and protection in the instance of a failure of the works authorized under this consent to third parties whose properties and possessions may be damaged, including motor vehicles and the assets and infrastructure of both the Canterbury Regional Council and Waimakariri District Council.
- 42 A copy of the advice relating to the insurance policy will be provided to the RMA Compliance & Enforcement Manager at the Canterbury Regional Council for review and comment, and any comments and suggestions that are provided to the Consent Holder will be taken into account and provided for within the insurance policy.
- 43 The limits of indemnity and coverage and terms of the policy are to be reviewed by the Consent Holder at least every three years, and if that review results in amendment or alteration to the insurance cover, then agreement of the Canterbury Regional Council to any such amendments or alterations will be required.
- 44 If the parties cannot agree on the terms of insurance cover, the coverage, or indemnity value, the dispute shall be referred to arbitration, applying the bond arbitration clause above as appropriate.

Water Storage Commissioning Plan

- 45 The Consent Holder shall prepare a Water Storage Commissioning Plan for the Waimakariri Irrigation Storage Ponds that seeks to minimise risks from the initial filling of the ponds, in accordance with NZSOLD (2000) New Zealand Dam Safety Guidelines (Appendix 10). The Water Storage Commissioning Plan shall include the matters set out in the conditions below, and shall be submitted to the RMA Compliance & Enforcement Officer at the Canterbury Regional Council for certification at least two months prior to the first filling or partial filling of the storage ponds with water.

- 46 The first filling or partial filling of the storage ponds with water shall not occur until the Water Storage Commissioning Plan has been certified by the RMA Compliance & Enforcement Officer at the Canterbury Regional Council.
- 47 The commissioning of the storage ponds and associated activities shall be undertaken in accordance with the Water Storage Commissioning Plan certified by the RMA Compliance & Enforcement Officer at the Canterbury Regional Council.
- 48 The Water Storage Commissioning Plan shall include:
- (a) The staging and monitoring of the first filling of each component of the ponds;
 - (b) The commissioning and testing of control structures and systems, pumps, and monitoring systems; and
 - (c) Methods outlining surveillance of the ponds during commissioning and reporting requirements.
- 49 All activities in furtherance of this consent shall be undertaken in accordance with the Water Storage Commissioning Plan.

Dam safety assurance plan

- 50 The Consent Holder shall submit a Dam Safety Assurance Plan prepared and produced by a suitably experience and qualified engineer as defined by the "Building Dam Safety Regulations 2008" for the Waimakariri Irrigation Storage Ponds that seeks to minimise risks from the ongoing operation of the ponds in accordance with the NZSOLD (2000) New Zealand Dam Safety Guidelines (Appendix E). The Dam Safety Assurance Plan shall include the matters set out in the conditions below, and shall be submitted to the RMA Compliance & Enforcement Officer at the Canterbury Regional Council for certification at least two months prior to the first filling or partial filling of the storage ponds with water.
- 51 The Dam Safety Assurance Plan will be peer reviewed by the independent peer review panel.
- 52 The first filling or partial filling of the storage ponds with water shall not occur until the Dam Safety Assurance Plan has been certified by the RMA Compliance & Enforcement Officer at the Canterbury Regional Council.
- 53 The operation of the storage ponds and associated activities shall be undertaken in accordance with the Dam Safety Assurance Plan certified by the RMA Compliance & Enforcement Officer at the Canterbury Regional Council.
- 54 The Dam Safety Assurance Plan shall be reviewed by the Consent Holder every twelve months, for the first two years of operation following the initial filling of the storage ponds, and thereafter every five years coinciding with Comprehensive Safety Reviews and also whenever a trigger event, as identified in the Dam Safety Assurance plan, occurs. The review shall evaluate the Dam Safety Assurance Plan, the results of any inspections and any monitoring data and communications to or from the Waimakariri District Council and the Canterbury Regional Council. The results of the review shall be recorded in writing and sent to the RMA Compliance & Enforcement Officer at the Canterbury Regional Council within one month of the review occurring. If necessary, the Dam Safety Assurance Plan shall be amended to improve its effectiveness in reducing the risks and the matters in the conditions

below, and be subjected to peer review by the independent peer review panel and resubmitted for certification by the RMA Compliance & Enforcement Officer at the Canterbury Regional Council.

- 55 The Dam Safety Assurance Plan shall include the following components:
- (a) Procedures and processes for dam operations, routine monitoring and inspections;
 - (b) Emergency procedures, including emergency responses, dam drawdown, early warning systems for the community and integration with Council and emergency services;
 - (c) Requirements for (annual) structural integrity and maintenance inspection by a suitably qualified person and reporting;
 - (d) Requirements for post-event (earthquake or similar event) structural integrity inspection by a suitably qualified person and reporting.
 - (e) Include a monitoring system capable of reliably and accurately detecting signs of threats to dam safety and increased soil moisture in the Eyrewell Scientific Reserve.
 - (f) Specifies an organisation approach that efficiently records processes, and evaluates and reports observations of the dam's performance.
 - (g) Includes trigger levels for observational results that are considered to require action;
 - (h) Includes a strategy of mitigation and actions to be undertaken in the event the specified trigger levels are exceeded;
 - (i) Provide for the reporting to the RMA Compliance & Enforcement Officer at the Canterbury Regional Council any trigger level exceedance and actions taken to address such exceedance;
 - (j) Provide for the immediate inspection of the dam and its associated components and accessory structures as soon as practicable after any earthquake with an intensity of VII (Very Strong) on the Modified Mercalli Scale is experienced at the Waimakariri Irrigation Storage Ponds; and
 - (k) Certification that the Dam Safety Assurance Plan meets and satisfies all necessary requirements, including those identified in Condition 50 above.
- 56 The Consent Holder shall comply with the Dam Assurance Safety Plan at all times.

Emergency action plan

- 57 Prior to activities commencing on the site, the Consent Holder shall engage a professional engineer with experience in management of large dams with an assessed potential impact category to prepare an emergency action plan (EMP), to ensure appropriate management of the risk associated with any uncontrolled abnormal or excessive flow releases from the dams.
- 58 The EMP shall be prepared in consultation with the Civil Defence Emergency Management Group, including the Waimakariri District Council and the Canterbury Regional Council, and will, as far as practicable, be consistent with any Civil

Emergency Management Group Plan governing the Regional Council District and the Waimakariri District pursuant to the Civil Defence Emergency Management Act 2002.

- 59 The EMP shall contain as a minimum:
- (a) Maps of land areas modelled as being subject to inundation in the event of abnormal or excess flow release and contact details for people resident within those areas, where they can be ascertained;
 - (b) Contingency plans for alerting people within the identified areas of inundation and relevant Civil Defence authorities of the risk of such events;
- 60 Three months prior to storage pond filling, a copy of the EMP shall be provided to the RMA Compliance & Enforcement Officer at the Canterbury Regional Council, the Waimakariri District Council, the Christchurch City Council, the Canterbury District Health Board, the NZ Police, the NZ Fire Service, and the NZ Transport Agency for their information. Any input to the EMP those organisations provide will be taken into account within the EMP by the Consent Holder.
- 61 The Consent Holder shall review the EMP periodically, at least annually, timed to coincide with a review of the Civil Emergency Management Group Plan referred to above.
- 62 All activities in furtherance of this consent shall be undertaken in accordance with the EMP Plan.

Construction plans

- 63 At least 1 month prior to the date upon which the Consent Holder intends to commence activities, as notified under these conditions, the Consent Holder shall provide to the RMA Compliance & Enforcement Officer at the Canterbury Regional Council detailed engineering plans that have been peer reviewed and certified by an appropriately qualified and experienced engineer acceptable to the Canterbury Regional Council.
- 64 Within 12 months of the date of construction activities ceasing, as notified under these conditions, "as built" detailed engineering plans shall be provided to RMA Compliance & Enforcement Officer at the Canterbury Regional Council.
- 65 All activities in furtherance of this consent shall be undertaken in accordance with the construction Plans.

Certification procurement

- 66 The Consent Holder shall procure certification from a suitably qualified and experience dam construction expert that the design of the dam and its construction are in accordance with good engineering practice, including being consistent with the Dam Safety Guidelines issued by the New Zealand Society on Large Dams and the requirements of the Building Act 2004. This certificate shall be submitted to the RMA Compliance & Enforcement Officer at the Canterbury Regional Council at least 2 months prior to the first filling of the dam reservoir.

Certified management plans to be held on site

- 67 A copy of the certified versions of all relevant management plans shall be kept on the site, and the Consent Holder shall ensure that all key personnel are made

aware of each plan's contents.

Review

- 68 The Canterbury Regional Council may, annually on the last five working days of May or November, serve notice on the Consent Holder under s 128(1) RMA of its intention to review the conditions of these consents that they have administrative responsibility for the following purposes:
- (a) To review the effectiveness of any of the conditions of the consents in avoiding, remedying or mitigating any adverse effects on the environment from the exercise of the consents and, if necessary, to avoid, remedy, or mitigate such effects by way of further or amended conditions;
 - (b) To ensure that the conditions are consistent with any policies or rules in a regional plan or National Environmental Standard or Regulation that becomes legally effective after the grant of consent;
 - (c) To review the adequacy of, and necessity of, monitoring undertaken by the Consent Holder.

Administrative charges

- 69 The Consent Holder shall pay to the Canterbury Regional Council any administrative charges fixed in accordance with s 36 RMA or any charge prescribed in accordance with regulations made under s 360 RMA and s 690a of the Local Government Act 1974. The administrative charges shall be paid to the Canterbury Regional Council for the carrying out of their functions in relation to the administration, monitoring and supervision of these consents and for carrying out their functions under s 35 RMA.

Other charges or costs

- 70 The Consent Holder shall pay all costs relating to peer reviews or engagement of others to undertake any actions or services required in terms of these conditions.

Lapse date

- 71 The lapsing date for the purposes of s 125 shall be five years from the commencement of this consent.

Advice Note: For the purposes of this consent "certify" "certified" or "certification by the Council" means assessed by Council staff or consultant acting in a technical certification capacity to determine whether the document or matter is consistent with or sufficient to meet the conditions of this consent.



Decision Chart 1: Alert-level framework for planktonic cyanobacteria

Alert level	Actions (See section 2.4 for the recommended framework for roles and responsibilities relating to actions, and the text box at the beginning of Section 3 for advice on interpreting the guidance in this table.)
<p>Surveillance (green mode) <i>Situation 1:</i> The cell concentration of total cyanobacteria does not exceed 500 cells/mL.^a <i>Situation 2:</i> The biovolume equivalent for the combined total of all cyanobacteria does not exceed 0.5 mm³/L.</p>	<ul style="list-style-type: none"> Undertake weekly or fortnightly visual inspection^b and sampling of water bodies where cyanobacteria are known to proliferate between spring and autumn.
<p>Alert (amber mode) <i>Situation 1:</i> Biovolume equivalent of 0.5 to < 1.8 mm³/L of potentially toxic cyanobacteria (see Tables 1 and 2); or <i>Situation 2</i> ^c: 0.5 to < 10 mm³/L total biovolume of all cyanobacterial material.</p>	<ul style="list-style-type: none"> Increase sampling frequency to at least weekly.^d Notify the public health unit. Multiple sites should be inspected and sampled.
<p>Action (red mode) <i>Situation 1:</i> ≥ 12 µg/L total microcystins; or biovolume equivalent of ≥ 1.8 mm³/L of potentially toxic cyanobacteria (see Tables 1 and 2); or <i>Situation 2</i> ^c: ≥ 10 mm³/L total biovolume of all cyanobacterial material; or <i>Situation 3</i> ^e: cyanobacterial scums consistently present.</p>	<ul style="list-style-type: none"> Continue monitoring as for alert (amber mode).^d If potentially toxic taxa are present (see Table 1), then consider testing samples for cyanotoxins.^f Notify the public of a potential risk to health.

- a) A cell count threshold is included at this level because many samples may contain very low concentrations of cyanobacteria and it is not necessary to convert these to a biovolume estimate.
- b) In high concentrations planktonic cyanobacteria are often visible as buoyant green globules, which can accumulate along shorelines, forming thick scums (see Appendix 3). In these instances, visual inspections of water bodies can provide some distribution data. However, not all species form visible blooms or scums; for example, dense concentrations of *Cylindrospermopsis raciborskii* and *Aphanizomenon issatschenkoi* are not visible to the naked eye (see Appendix 3).

- c) This applies where high cell densities or scums of 'non-toxigenic' cyanobacteria taxa are present (i.e., where the cyanobacterial population has been tested and shown not to contain known toxins).
- d) Bloom characteristics are known to change rapidly in some water bodies, hence the recommended weekly sampling regime. However, there may be circumstances (eg, if good historical data/knowledge is available) when bloom conditions are sufficiently predictable that longer interval sampling is satisfactory.
- e) This refers to the situation where scums occur at the recreation site for more than several days in a row.
- f) Cyanotoxin testing is useful to: provide further confidence on potential health risks when a health alert is being considered; enable the use of the action level 10 mm³/L biovolume threshold (i.e., show that no toxins are present; and show that residual cyanotoxins are not present when a bloom subsides).

Source: Ministry for the Environment and Ministry of Health. 2009. *New Zealand Guidelines for Cyanobacteria in Recreational Fresh Waters – Interim Guidelines*. Prepared for the Ministry for the Environment and the Ministry of Health by SA Wood, DP Hamilton, WJ Paul, KA Safi and WM Williamson. Wellington: Ministry for the Environment.

APPENDIX D

CRC122899 to discharge fugitive dust and combustion products to air during the construction of storage ponds and associated infrastructures (Canterbury Regional Council Consent CRC122899)

Scope

- 1 All activities authorised by this consent shall be undertaken in accordance with the information contained in the Application, the Assessment of Environmental Effects (Waimakariri Irrigation Limited Storage Ponds), and all supporting technical documents and plans as provided to the Canterbury Regional Council, except where inconsistent with these conditions.
- 2 The discharge of contaminants to air shall be only particulate matter and the products of combustion associated with the construction of the Waimakariri Irrigation Storage Ponds and associated infrastructure at the corner of Wrights Road and Dixons Road, Burnt Hill, at or about map reference Topo BW22:3480-9720, as shown on **Plan CRC122899A**, which forms part of this consent.
- 3 The discharge of contaminants to air shall arise only from:
 - (a) excavation,
 - (b) earthmoving,
 - (c) stripping and stockpiling of soil,
 - (d) transport of materials,
 - (e) formation of dam embankments,
 - (f) screening of aggregate,
 - (g) vehicle movements,
 - (h) placement and anchoring of the geomembrane,
 - (i) combustion of diesel to power the screening plant,
 - (j) placement of cleanfill materials.
- 4 There shall be no discharge of dust or the products of combustion, as a result of the exercise of this consent, that is noxious, dangerous, offensive or objectionable to the extent that it causes an adverse effect beyond the boundary of the site on which the discharge occurs.
- 5 The rate of aggregate screening on site shall not exceed 60 cubic metres per hour (m³/hour).
- 6 The Consent Holder shall prepare and implement a Dust Management Plan (DMP) which shall be incorporated into the Construction Management Plan:

- (a) The DMP shall be prepared and provided to the Canterbury Regional Council at least 30 working days prior to the exercise of this consent.
- (b) The DMP shall be reviewed at least biannually by the Consent Holder.
- (c) The DMP and any revisions shall include all measures necessary to achieve compliance with the conditions of this consent.
- (d) The DMP shall include but not be limited to:
 - (i) A description of the dust sources on the site;
 - (ii) The methods to be used for controlling dust at each source during construction, including excavation, earthmoving, stripping and stockpiling of soil, transport of materials, formation of dam embankments, screening of aggregate, vehicle movements, placement of cleanfill and placement and anchoring of the geomembrane on the base of the ponds and the embankments;
 - (iii) A description of the monitoring requirements;
 - (iv) A system of training for employees and contractors to make them aware of the requirements of the DMP;
 - (v) Identification of staff responsible for implementing and reviewing the DMP;
 - (vi) A method for recording and responding to complaints from the public;
 - (vii) Procedures for managing dust when staff are not on site;
 - (viii) Guidance on planning for potentially dusty activities and considering forecasted weather conditions;
 - (ix) Contingency methods for controlling dust when the Total Suspended Particulate (TSP) and wind speed alert levels included in conditions (9) and (10) are exceeded;
- (e) This consent shall not be exercised until the DMP has been certified by the Canterbury Regional Council.

7 The methods used to control dust shall include, but not be limited to the following:

- (a) Stabilisation of all potentially dusty surfaces using water, chemical dust suppressants, compaction, straw mulching, temporary vegetation, gravelling, or other surface modification methods. The surfaces to be stabilised shall include internal roadways, the areas being worked by excavators and loaders, stockpiles and exposed soil areas as necessary to comply with condition 3 of this consent,
- (b) Locating the aggregate screening plant at least 300 metres from any dwelling on a neighbouring property,
- (c) Locating the stockpiles of potentially dusty materials such as topsoil and silt at least 200 metres from any dwelling on a neighbouring property,

- (d) Providing water sprays on the screening plant,
 - (e) Controlling vehicle speeds on site and minimising travel distances and vehicle movements over unconsolidated surfaces where practicable,
 - (f) Regularly maintaining main access ways by grading and the laying of fresh gravel,
 - (g) Minimising drop heights when loading and unloading vehicles.
- 8 At least one month prior to construction activities commencing on site:
- (a) The following shall be installed:
 - (i) A meteorological monitoring station that continuously measures and records wind speed, wind direction, rainfall, temperature and relative humidity;
 - (ii) An instrument that continuously measures and records Total Suspended Particulate concentrations.
 - (b) The meteorological monitoring station shall be installed and maintained in good working order as much as practical at one location on or adjacent to the site until construction of the ponds is complete.
 - (c) The Total Suspended Particulate monitor shall be located at one of the locations specified in Condition 10 below.
- 9 The meteorological monitoring shall be generally in accordance with the following:
- (a) The anemometer shall be installed at a height of at least 6 metres above preconstruction ground level and in accordance with AS 2923- 1987 Ambient Air Guide for Measurement of Horizontal Wind for Air Quality Applications.
 - (b) The meteorological monitoring station shall continue operating until the construction of the ponds is complete, including the planting and establishment of permanent vegetation on the embankments.
 - (c) The meteorological monitoring instruments shall be established, located and operated to the satisfaction of the Canterbury Regional Council.
 - (d) The meteorological monitoring results shall be continuously recorded using an electronic data logging system with an averaging time for each parameter of not more than two minutes. The results shall be available to the operators in real time and the logging system shall be able to send alerts via text message.
 - (e) The meteorological data shall be retained and copies provided to the Canterbury Regional Council on request.
- 10 The Consent Holder shall install and operate up to two instruments capable of continuously monitoring and recording total suspended particulates (TSP). These instruments shall be maintained in good working order for the duration of the works. The location and quantity of monitors shall be as follows:

- (a) One monitor on the western boundary of the site when constructing Pond 1, or
 - (b) One monitor in the eastern boundary and one monitor on the southern boundary of the site when constructing Pond 2.
- 11 The TSP monitoring shall be carried out generally in accordance with the following:
 - (a) The TSP monitoring shall be undertaken with a continuous monitoring instrument capable of providing real time data that can be compared against 1-hour and 24-hour guidelines.
 - (b) The TSP data shall be retained and copies provided to the Canterbury Regional Council on request.
 - (c) TSP monitoring shall undergo regular calibration and shall be of an appropriate standard and quality, to be able to indicate compliance with the TSP trigger levels set in Conditions 12 and 13 below.
 - (d) The TSP monitoring results shall be continuously recorded using an electronic data logging system with an averaging time for each parameter of not more than two minutes. The results shall be available to the operators in real time and the logging system shall be able to send alerts via text message.
- 12 The Consent Holder shall review dust sources and dust control measures and implement additional dust control methods when:
 - (a) TSP concentrations as measured by instruments installed and operated in accordance with Condition 11 of this consent exceed a 1-hour average concentration of 200 micrograms per cubic metre ($\mu\text{g}/\text{m}^3$), or
 - (b) TSP concentrations as measured by instruments installed and operated in accordance with Condition 11 of this consent exceed a rolling 24-hour average concentration of 80 micrograms per cubic metre ($\mu\text{g}/\text{m}^3$).
- 13 Site operations will cease, except for dust mitigation activities, when:
 - (a) TSP concentrations exceed a 1-hour average concentration of 220 micrograms per cubic metre ($\mu\text{g}/\text{m}^3$), or
 - (b) TSP concentrations exceed a rolling 24-hour average concentration of 120 micrograms per cubic metre ($\mu\text{g}/\text{m}^3$).
- 14 During dry conditions:
 - (a) the stripping or placement of potentially dusty material such as silt or topsoil shall not occur within 200 metres upwind of any occupied dwelling, if the wind gust speed (two minute average or less) measured at the site in accordance with Condition (7) exceeds 10 metres per second during the previous two consecutive ten minute periods.
 - (b) The above works may recommence when wind gust speeds (two minute average or less) are less than 7.5 metres per second (m/s) during the previous two consecutive ten minute periods.

- 15 The Consent Holder shall provide and maintain on site an adequate supply of water and equipment for watering all potentially dusty areas of the site for the purpose of dust suppression at all times during the construction of the ponds.
- 16 All exposed surfaces of soil on site at the completion of construction shall be stabilised either by gravelling or vegetation and maintained to prevent the generation of dust.
- 17 Cleanfill material deposited at the site shall not contain paper or other loose material that may be blown from the site.
- 18 The Consent Holder shall keep a record of any complaints relating to dust, and shall include (when provided that information):
 - (a) The location where the dust was detected by the complainant
 - (b) The date and time the dust was detected
 - (c) A description of the wind speed and wind direction when the dust was detected by the complainant
 - (d) The most likely cause of the dust detected, and
 - (e) Any corrective action undertaken by the Consent Holder to avoid, remedy or mitigate the dust detected by the complainant.
 - (f) This record shall be provided to the Canterbury Regional Council on request.
- 19 The Consent Holder shall be responsible for all the contracted operations relating to the exercise of this consent and shall ensure that all personnel working on the site are aware of the consent conditions, have access to the contents of this consent document and shall ensure compliance with consent conditions.

Review

- 20 Either the Canterbury Regional Council and/or the Waimakariri District Council may, annually on the last five working days of May or November, serve notice on the Consent Holder under s 128(1) RMA of its intention to review the conditions of these consents that they have administrative responsibility for the following purposes:
 - (a) To review the effectiveness of any of the conditions of the consents in avoiding, remedying or mitigating any adverse effects on the environment from the exercise of the consents and, if necessary, to avoid, remedy, or mitigate such effects by way of further or amended conditions;
 - (b) To ensure that the conditions are consistent with any policies or rules in a regional plan or National Environmental Standard or Regulation that becomes legally effective after the grant of consent;
 - (c) To review the adequacy of, and necessity of, monitoring undertaken by the Consent Holder.

Administrative charges

- 21 The Consent Holder shall pay to the Canterbury Regional Council any

administrative charges fixed in accordance with s 36 RMA or any charge prescribed in accordance with regulations made under s 360 RMA and s 690a of the Local Government Act 1974. The administrative charges shall be paid to the Canterbury Regional Council for the carrying out of their functions in relation to the administration, monitoring and supervision of these consents and for carrying out their functions under s 35 RMA.

Other charges or costs

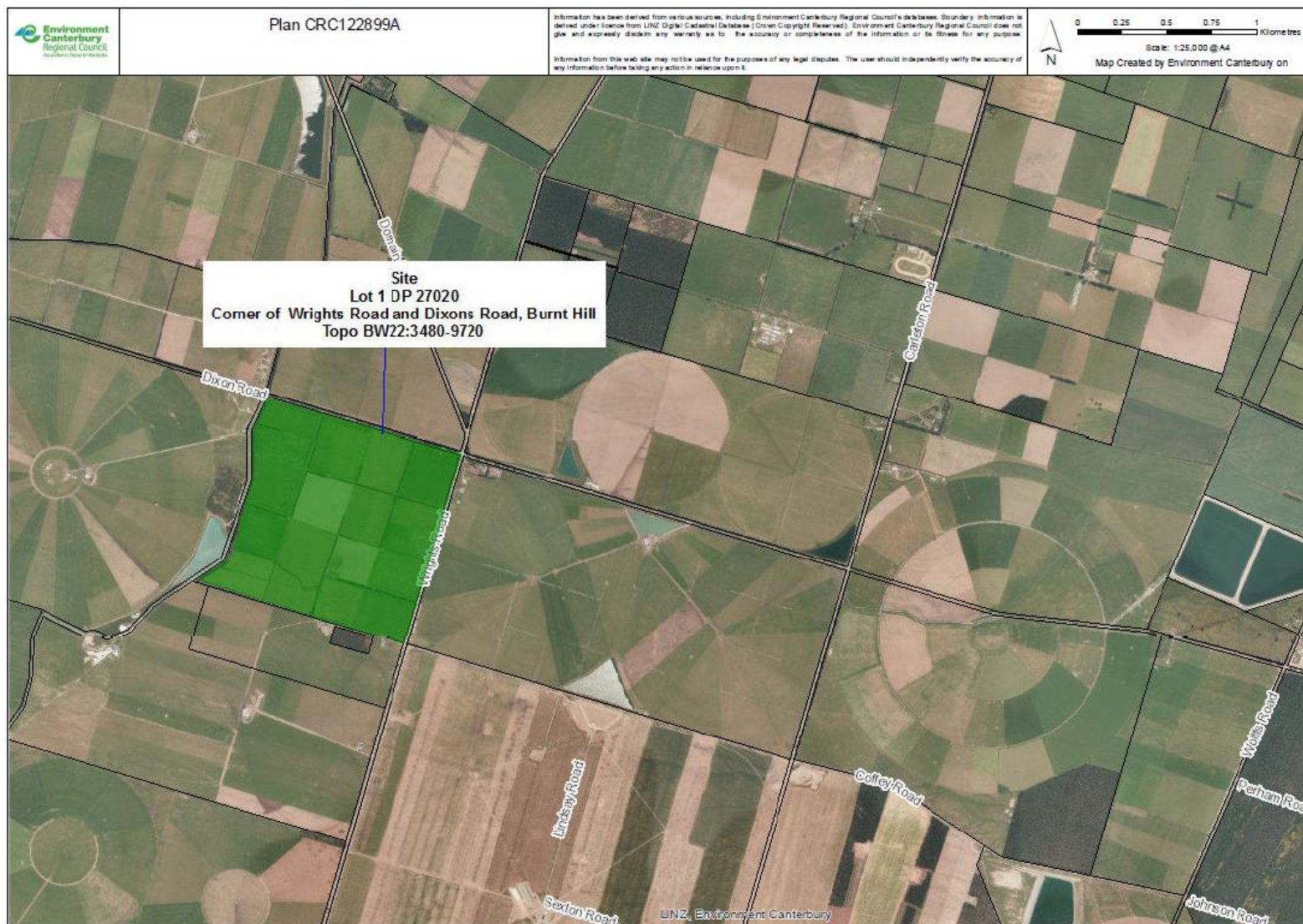
- 22 The Consent Holder shall pay all costs relating to peer reviews or engagement of others to undertake any actions or services required in terms of these conditions.

Lapse date

- 23 The lapsing date for the purposes of s 125 shall be five years from the date the consent is issued.

Advice Note: For the purposes of this consent "certify" "certified" or "certification by the Council" means assessed by Council staff or consultant acting in a technical certification capacity to determine whether the document or matter is consistent with or sufficient to meet the conditions of this consent.

Plan CRC122899A



APPENDIX E

CRC122900 Consent to discharge stormwater to land during the construction of storage ponds and to discharge post-development stormwater (Canterbury Regional Council Consent CRC122900)

Scope

- 1 All activities authorised by this consent shall be undertaken in accordance with the information contained in the Application, the Assessment of Environmental Effects (Waimakariri Irrigation Limited Storage Ponds), and all supporting technical documents and plans as provided to the Canterbury Regional Council, except where inconsistent with these conditions.

Limits

- 2 The discharge shall be only:
 - (a) sediment-laden stormwater during site construction; and
 - (b) post development storm water
 - (c) associated with the construction and operation of the Waimakariri Irrigation Storage Ponds.
- 3 The discharges described in Condition 2 shall only be from the site located at land parcel Lot 1 DP 27020, located on the corner of Wrights Road and Dixons Road, Burnt Hill, at or about map reference Topo BW22:3480-9720, as shown on plan labelled as the "Applicant's Site" on **Plan CRC122900A**, which forms part of this consent.
- 4 The Consent Holder shall be responsible for all the contracted operations relating to the exercise of this consent and shall ensure that all personnel working on the site are aware of the consent conditions, have access to the contents of this consent document and shall ensure compliance with consent conditions.
- 5 Prior to commencement of works the Consent Holder or their agent shall arrange and conduct a pre-construction site meeting between the Canterbury Regional Council and all relevant parties, including the primary contractor. At a minimum, the following shall be covered at the meeting:
 - (a) Scheduling and staging of the works;
 - (b) Responsibilities of all relevant parties;
 - (c) Contact details for all relevant parties;
 - (d) Expectations regarding communication between all relevant parties;
 - (e) Procedures for implementing any amendments;
 - (f) Site inspection; and
 - (g) Confirmation that all relevant parties have copies of the contents of this consent document and all associated erosion and sediment control plans

and methodology.

- 6 During construction, all practicable measures shall be undertaken to minimise discharges of sediment-laden runoff off-site or into surface water.
- 7 The discharge of construction site stormwater shall only take place during the site construction period at the above mentioned site.
- 8 With the exception of the western boundary, no disturbance, earthworks, vegetation removal or other activity capable of altering runoff shall occur within:
 - (a) 6 metres of the northern and eastern site boundaries; and
 - (b) 8 metres of the southern boundary.
- 9 The Consent Holder shall ensure stormwater generated on or over any re-fuelling areas and/or vehicle repair areas is managed such that stormwater entrained with oil/fuels/hazardous substances from these areas is not discharged to groundwater or surface waters without treatment. All exposed surfaces shall be stabilised once works are complete or if they are not to be worked for a period of 14 days or more.
- 10 Erosion and sediment control measures shall be installed before any excavation occurs on-site.
- 11 The Consent Holder shall prepare an Erosion and Sediment Control Plan for the construction in general accordance with the Environment Canterbury Erosion and Sediment Control Guideline (2007). The Plan shall be prepared by a suitably qualified person. This plan shall be submitted to Canterbury Regional Council: Attention: RMA Compliance and Enforcement Manager, no later than three months prior to the start of construction. The Erosion and Sediment Control Plan shall include but not be limited to:
 - (a) A location map including:
 - (i) construction site layout;
 - (ii) soil type within any construction stage;
 - (b) Detailed drawings showing the type and location of sediment control measures, on site catchment boundaries and off site sources of runoff.
 - (c) Specifications and localities of designated sediment control practices with supporting calculations.
 - (d) A programme of works, which includes but is not limited to, a proposed timeframe for the works.
 - (e) Criteria for stabilising exposed surfaces.
 - (f) Siting of activities which have the potential introduce sediment to sensitive area.
- 12 The Consent Holder shall inform the Canterbury Regional Council in writing, Attention: RMA Compliance and Enforcement Manager, at least 30 days prior to the commencement of bulk earthworks for the site.

Certification

- 13 Prior to bulk earthworks commencing for the site, the Consent Holder shall submit to the Manager, a certificate signed by an appropriately qualified and experienced engineer to certify that the appropriate erosion and sediment control measures have been constructed in accordance with the Erosion and Sediment Control Plan and conditions of this consent.
- 14 The Erosion and Sediment Control Plan may be amended at any time during the site construction. Any amendments shall be:
 - (a) Only for the purpose of improving the efficiency of the erosion and sediment control measures; and
 - (b) Consistent with the conditions of this resource consent; and
 - (c) Provided to the Manager, prior to any amendment being implemented.

Spill management and response plan

- 15 The Consent Holder shall take all practicable measures to avoid spills or any other contaminant within the site.
- 16 In the event of a spill of fuel of any other contaminant, the Consent Holder shall clean up the spill as soon as practicable, inspect and clean the stormwater system and take measures to prevent a recurrence.
- 17 Within 24 hours of a spill event greater than 10 litres, the Consent Holder shall inform the Manager, and provide the following information:
 - (a) The date, time, location and estimated volume of the spill;
 - (b) The cause of the spill;
 - (c) The type of contaminant(s) spilled;
 - (d) Clean up procedures undertaken;
 - (e) Details of the steps taken to control and remediate the effects of the spill on the receiving environment;
 - (f) An assessment of any potential effects of the spill; and
 - (g) Measures to be undertaken to prevent a recurrence.

Decommissioning

- 18 Once construction of the site has ceased, decommissioning of sediment and erosion measures shall be undertaken.
- 19 Erosion and sediment control measures shall not be decommissioned until the site is stabilised and the stormwater system for the developed site is functioning.

Post construction

- 20 The vegetation on the embankment areas or the strips adjacent to the races shall be maintained in a healthy and uniform state, with the exception of seasonal

browning off. Maintenance shall include, but not be limited to:

- (a) removal of weeds; and
- (b) re-planting of vegetation where erosion or die-off has resulted in bare or patchy soil cover.

Review

- 21 Either the Canterbury Regional Council and/or the Waimakariri District Council may, annually on the last five working days of May or November, serve notice on the Consent Holder under s 128(1) RMA of its intention to review the conditions of these consents that they have administrative responsibility for the following purposes:
- (a) To review the effectiveness of any of the conditions of the consents in avoiding, remedying or mitigating any adverse effects on the environment from the exercise of the consents and, if necessary, to avoid, remedy, or mitigate such effects by way of further or amended conditions;
 - (b) To ensure that the conditions are consistent with any policies or rules in a regional plan or National Environmental Standard or Regulation that becomes legally effective after the grant of consent;
 - (c) To review the adequacy of, and necessity of, monitoring undertaken by the Consent Holder.

Administrative charges

- 22 The Consent Holder shall pay to the Canterbury Regional Council any administrative charges fixed in accordance with s 36 RMA or any charge prescribed in accordance with regulations made under s 360 RMA and s 690a of the Local Government Act 1974. The administrative charges shall be paid to the Canterbury Regional Council for the carrying out of their functions in relation to the administration, monitoring and supervision of these consents and for carrying out their functions under s 35 RMA.

Other charges or costs

- 23 The Consent Holder shall pay all costs relating to peer reviews or engagement of others to undertake any actions or services required in terms of these conditions.

Lapse date

- 24 The lapsing date for the purposes of s 125 shall be five years from the commencement of this consent.

Definitions

- 25 For the purposes of this consent, the following definitions shall apply to all conditions:

Site construction: means all bulk earthworks and earthworks associated with the construction of the storage ponds.

Earthworks: means the disturbance of land surfaces by blading, contouring, ripping, moving, removing, placing or replacing soil and earth, or by excavation, or by cutting or filling operations.

Bulk earthworks: means major cut/fill/waste works.

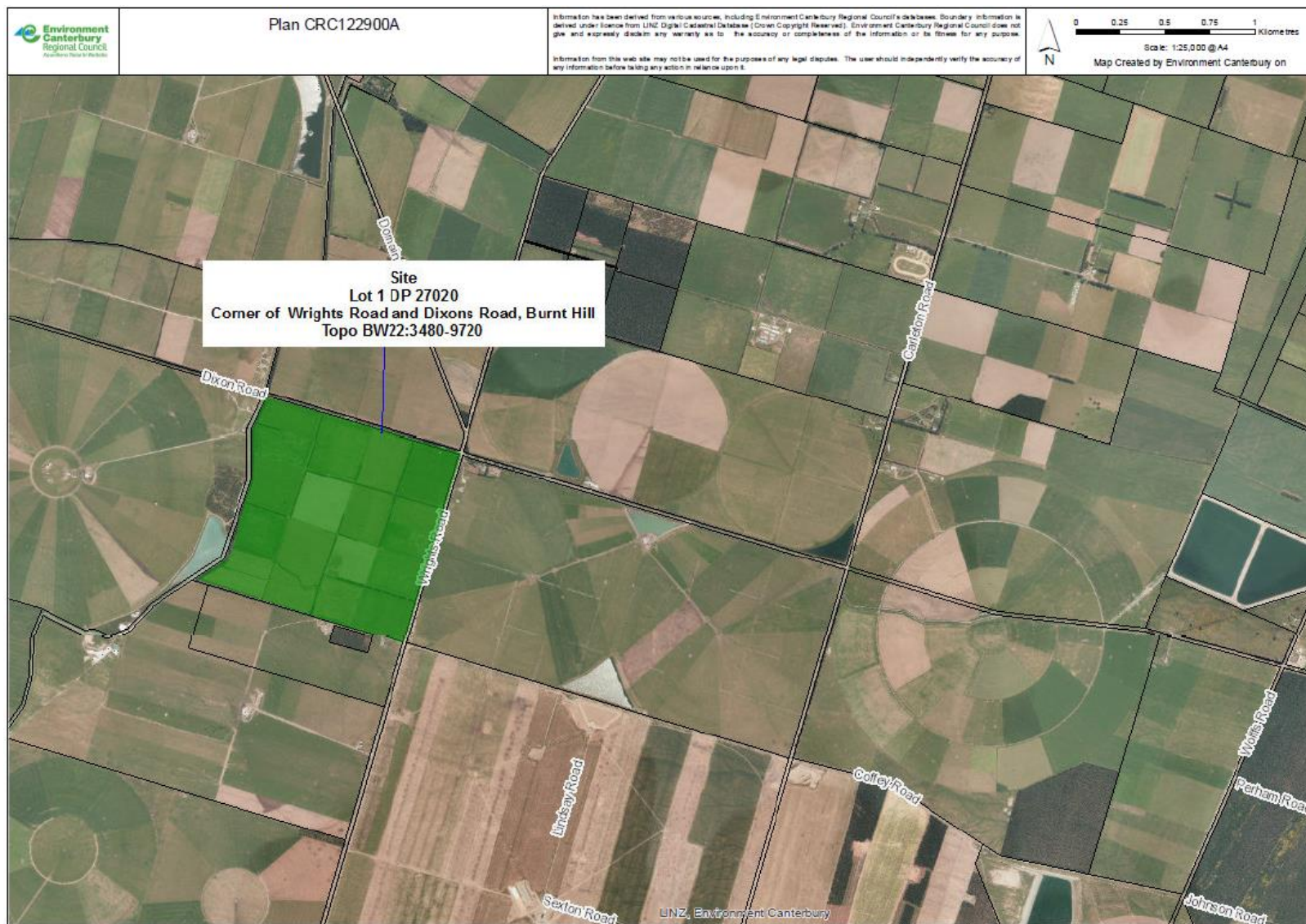
Stabilised: means an area inherently resistant to erosion such as rock (excluding sedimentary rocks), or rendered resistant to erosion by the application of aggregate, geotextile, vegetation or mulch. Where vegetation is to be used on a surface that is not otherwise resistant to erosion, the surface is considered stabilised once 80 percent vegetation cover has been established.

ESCG: means Environment Canterbury, *Erosion and Sediment Control Guidelines for the Canterbury Region*, Report No. CRC R06/23, February 2007.

Manager: means the Canterbury Regional Council, RMA Compliance and Enforcement Manager, or nominated CRC staff acting on the Manager's behalf.

Advice Note: For the purposes of this consent "certify" "certified" or "certification by the Council" means assessed by Council staff or consultant acting in a technical certification capacity to determine whether the document or matter is consistent with or sufficient to meet the conditions of this consent.

Plan CRC122900A



APPENDIX F

RC135478 - to construct, maintain and use storage ponds and associated structures (Waimakariri District Council Consent)

Activity authorised

- 1 Except as required by the subsequent conditions, the Waimakariri Irrigation Storage Ponds shall proceed in accordance with the approved application plans, RC135478, and the information submitted with the application, including the Assessment of Environmental Effects (Waimakariri Irrigation Storage Ponds) and all supporting technical documents and plans as provided to the Waimakariri District Council.

Peer review

- 2 At least 6 months prior to commencing works under this consent, the Consent Holder shall engage, at its cost, an independent peer review panel of at least three suitably experienced and qualified dam design and construction experts. The experts will have qualifications and experience appropriate for the matters that are to be reviewed. In the event that particular skills, not available among the members of the panel, are required, the Consent Holder shall ensure that an appropriately qualified person is engaged to advise the peer review panel, and that Canterbury Regional Council is so informed.
- 3 Appointments to the peer review panel shall be acceptable to the Canterbury Regional Council.
- 4 The expert panel will review and report to the Consent Holder and the Waimakariri District Council, with particular reference to ensuring the safety of the dam, the site investigations, the geotechnical assessment, the choice of dam, the design parameters, the design of the embankments and pond infrastructure, the suitability of the liner, the commissioning process and operation of the ponds, including maintenance and the means of monitoring leakage, the Dam Safety Assurance Plan, and proposals for emergency management.
- 5 Construction of the storage ponds shall not commence until such time as the Consent Holder has presented the Council's District Plan Manager with a written report from the peer review panel, which certifies the design and that all relevant and applicable design and safety criteria, and standards, codes, regulations, and statutory and Good Engineering Practice (including, but not limited to, being consistent with the latest Dam Safety Guidelines issued by the New Zealand Society on Large Dams and the requirements of the Building Act 2004) and any other requirements applicable to the construction, operation, and maintenance of the Waimakariri Irrigation Storage Ponds have been achieved as they relate to:
 - (a) the Consent Holder's dam design,
 - (b) the site investigations,
 - (c) the geotechnical assessment,
 - (d) the choice of dam,
 - (e) the design parameters,

- (f) the design of the embankments and pond infrastructure,
 - (g) the suitability of the liner,
 - (h) the commissioning process and operation of the ponds, including maintenance and the means of monitoring leakage, and
 - (i) the dam safety program and proposals for emergency management as contained within the Consent Holder's Application (see Condition 3 above)
- 6 The certification report shall be submitted to the Council's District Plan Manager at least one month prior to commencing works under this consent.
- 7 In the instance that the independent review panel does not so certify, then the Consent Holder will implement the necessary alterations and/or changes to secure certification before commencing construction of the Waimakariri Irrigation Storage Ponds.

Detailed design geotechnical investigations

- 8 The seismic hazard assessment for the Waimakariri Irrigation Storage Ponds shall be reviewed and, if required, updated by the Consent Holder 3 months prior to commencing further detailed design work or construction, whichever occurs earlier.
- 9 The Consent Holder shall undertake any necessary further geotechnical investigations.
- 10 A report detailing the results of these further geotechnical investigations and updated seismic assessments shall be provided to the Council's District Plan Manager at least 3 months before construction works commence. The report shall be prepared by a suitably qualified person, acceptable to the Canterbury Regional Council, and shall provide details of the geotechnical investigations undertaken and recommendations for remedial works where necessary.

Notification

- 11 The Consent Holder shall be responsible for all the contracted operations relating to the exercise of this consent, and shall ensure that all personnel working on the site are aware of and have access to the contents of this consent document and shall ensure compliance with consent conditions.
- 12 The Council's District Plan Manager shall be notified of:
- (a) the intention to exercise any consent at least three months prior to the commencement of any activities under this consent;
 - (b) no less than 48 hours prior to commencement of the works authorised by this consent;
 - (c) of the intention to complete construction works three months prior to the cessation of construction activity.
 - (d) as soon as practicable of the date that construction activity ceases.

Pond liner

- 13 Subject to the outcome of the peer review, the ponds shall be lined with a membrane of HDPE material, of a minimum thickness of 1.5 mm.

Public access

- 14 Public access to the embankments and storage ponds, and farm animals and unauthorised persons shall be prevented from accessing the ponds and embankments through provision of secure barriers such as fencing and locked gates and/or other such combination of measures that inhibits or prevents access.

Maximum depth of excavation

- 15 Prior to any construction occurring on the site, natural ground level shall be identified and recorded utilising conventional land survey methodology. The maximum depth of excavation shall not exceed 6 metres below that established natural ground level.

Construction

- 16 Construction at the Waimakariri Irrigation Storage Ponds shall:
- (a) when within 150 m of the notional boundary of any dwelling and when the work involves earthmoving or compacting equipment, only occur during the hours of 8:00 am to 5:00 pm Monday through Friday, with no work on Saturdays, Sundays or public holidays; and
 - (b) in all other circumstances, the hours of 7:30 am to 6:00 pm Monday through Saturday, with no work on Sundays or public holidays.

Construction management plan

- 17 The Consent Holder shall prepare a Construction Management Plan for the Waimakariri Irrigation Storage Ponds that seeks to minimise adverse effects during construction, set out the timing, duration and monitoring of works and mitigation measures. The construction management plan shall include the matters set out in the conditions below, and shall be submitted to the Council's District Plan Manager for certification at least three months prior to any activity authorised by this consent occurring on the site.
- 18 Construction work and associated activities shall not occur until the construction management plan has been certified by the Council's District Plan Manager.
- 19 Following certification of the construction management plan and at least one month prior to construction commencing, the Consent Holder shall provide, at no cost, the following material to each residence within 500 m of the site:
- (a) an electronic copy of the resource consents for the Waimakariri Irrigation Storage Ponds;
 - (b) an electronic copy of the certified construction management plan;
 - (c) the name and 24 hr contact details of the administrator of the complaints register; and

- (d) the name and 24 hr contact details of the person nominated by the Consent Holder to supervise the implementation of, and adherence to, the construction management plan.
- 20 Construction work and associated activities shall be undertaken in accordance with the construction management plan certified by the Council's District Plan Manager.
- 21 The construction management plan shall be reviewed by the Consent Holder every three months following the commencement of the construction works. The review shall evaluate the construction management plan, any entries in the complaints register and any monitoring data and communications to, or from, the Waimakariri District Council and the Canterbury Regional Council. The results of the review shall be recorded in writing and sent to the Council's District Plan Manager within two weeks of the review occurring. If necessary, the construction management plan shall be amended to improve its effectiveness in delivering the objectives and matters provided for in these conditions and resubmitted to the Council's District Plan Manager.
- 22 The Construction Management Plan shall include the following matters:
 - (a) The name and 24 hr contact details of the person nominated by the Consent Holder to supervise the implementation of, and adherence to, the construction management plan;
 - (b) The work programme, staging, timing and duration of the works;
 - (c) Earthworks management:
 - (i) Construction works shall be in general accordance with Environment Canterbury's Erosion and Sediment Control Guidelines (2007);
 - (ii) Control of weeds on stockpiled material;
 - (iii) Measures necessary to provide for stormwater disposal and sediment removal;
 - (iv) Inclusion or maintenance of a vegetated strip between earthworks and water races;
 - (v) Siting of stockpiles to avoid sediment-entrained runoff entering races or going off-site and to reduce the risk of fugitive dust emissions;
 - (vi) Avoidance of entrainment of oil, fuels or any other hazardous substances in stormwater, with particular emphasis on re-fuelling areas and repair areas; and
 - (vii) Stabilisation and maintenance of site entrances from public roads;
 - (d) Construction noise:
 - (i) Construction noise shall be assessed and managed in accordance with NZS 6803:1999 "Acoustics – Construction Noise";
 - (ii) A construction noise management plan shall be prepared by the

applicant. In particular, the construction noise management plan shall address:

- (A) how potential noise effects of bund formation will be managed at the nearest residences; and
- (B) how noise monitoring during construction activities that are closest to residences will occur;

(e) Hazardous substances management:

- (i) The storage and containment of hazardous substances on site shall meet all relevant and applicable HSNO standards appropriate for the storage of hazardous substances. All mobile storage containers shall comply with the Hazardous Substances (Tank Wagons and Transportable Containers) Regulations 2004; and
- (ii) The Consent Holder shall hold an accredited Oil Spill Kit on site and all staff and contractors that are handling hazardous substances shall be trained in its operation;

(f) Dust management:

- (i) The construction management plan shall include the requirements, procedures and mitigations methods for dust management, as required by resource consent CRC122899;

(g) Complaints register and non-compliance:

- (i) The Consent Holder shall maintain a complaints register at the site office and make this available to officers of the Waimakariri District Council and the Canterbury Regional Council on request. The Complaints Register shall record the following:
 - (A) Date and time of the incident that has resulted in the complaint;
 - (B) Location of the complainant when the incident was detected;
 - (C) A description of any relevant matters such as, wind speed and wind direction when the effects were detected by the complainant;
 - (D) The possible cause of the incident; and
 - (E) Any corrective action undertaken by the Consent Holder to avoid, remedy or mitigate the effects identified by the complainant, including the time of that corrective action.
- (ii) Unless otherwise stated within these conditions, in the event of any breach of compliance of the conditions the Consent Holder shall notify the Council's District Plan Manager within 48 hours of the breach being detected.
- (iii) Within five days of any breach, the Consent Holder shall provide written notification to that officer, which explains the cause of the breach and if the cause was within the control of the Consent

Holder, steps that were taken to remedy the breach and steps that will be taken to prevent any further occurrence of the breach.

- (h) The construction management plan shall specify that in the event of any disturbance to koiwi tangata (human bones) or taonga (treasured artefacts), the Consent Holder shall immediately follow the Accidental Discovery Protocol set out in Appendix 3 of the Mahaanui Iwi Management Plan (attached to this consent as **Attachment 1 RC135478**), and shall include the protocol in the construction management plan.
- 23 The Consent Holder may commence construction activities in accordance with the Construction Management Plan unless the Waimakariri District Council advises the Consent Holder within 20 working days of receiving the Construction Management Plan that it refuses to certify the Construction Management Plan on the grounds that it fails to meet the requirements of these conditions in relation to an activity and provides reasons why that view is held.
- 24 Should the Waimakariri District Council refuse to certify the Construction Management Plan in accordance with these conditions, the Consent Holder shall submit a revised Construction Management Plan to the Waimakariri District Council for certification as soon as is practicable. The certification process shall follow the same procedure as outlined above.
- 25 Once certified the Construction Management Plan may be varied by the Consent Holder. The certification process for a Construction Management Plan variation shall follow the process outlined above. Construction activities subject to the variation shall not commence until the variation has been certified by the Waimakariri District Council.
- 26 All activities in furtherance of this consent, both on and off the site, shall be undertaken in accordance with the Construction Management Plan.

Landscape management plan

- 27 The Consent Holder shall submit a Landscape Management Plan for the Waimakariri Irrigation Storage Ponds that seeks to minimise risks to the ponds, provide indigenous biodiversity and mitigate visual effects. The Landscape Management Plan shall include the matters set out in the conditions below, and shall be submitted to the Council's District Plan Manager for certification at least two months prior to the first filling or partial filling of the storage ponds with water.
- 28 The Consent Holder will consult and liaise with MKT before finalising the Landscape Management Plan to provide an opportunity for MKT to put forward any cultural issues it may wish the Consent Holder to consider for inclusion within the Landscape Management Plan.
- 29 The first filling or partial filling of the storage ponds with water shall not occur until the Landscape Management Plan has been certified by the Council's District Plan Manager.
- 30 The landscaping of the storage ponds and associated activities shall be undertaken in accordance with the Landscape Management Plan certified by the Council's District Plan Manager.
- 31 The Landscape Management Plan shall include the following components, but not be limited to:

- (a) Planting, maintenance and management strategy (following a dam safety audit) that is generally in accordance with the recommendations provided by Edge Landscape Projects Limited in their visual impact assessment dated April 15 2013 and the addendum to that report dated October 2013, any addendums necessary to mitigate adverse environmental effects. Planting on the embankments shall predominately include grassland vegetation or where deemed appropriate (following a dam safety audit) indigenous grass species may also be used; and
 - (b) Development and implementation of an annual monitoring plan for the Eyrewell Scientific Reserve shall be undertaken to detect change in health or species composition due to a change in soil moisture. This monitoring shall be undertaken for the first five years of pond operation, and if no changes are detected, then a recommendation from a suitably qualified person of whether further monitoring is necessary shall be submitted to Council.
- 32 All activities in furtherance of this consent shall be undertaken in accordance with the Landscape Management Plan.

Bonding of Construction, Operation, Maintenance, and Remediation

- 33 The Consent Holder shall construct, maintain, operate, repair, and remediate the works authorised under these consents.
- 34 To secure Condition 33, the Consent Holder shall, during the construction, operational, maintenance, and remediation phases, in relation to this consent, provide and maintain in favour of the Waimakariri District Council, a bond or bonds on terms and conditions satisfactory to it in all respects.
- 35 All bonds shall be in a form generally used by a bank or insurance company registered to conduct business in New Zealand and approved by the Waimakariri District Council.
- 36 The bonds shall apply to construction as well as providing cover for operational, maintenance, and reinstatement phases and works relating to this consent, and shall provide that the Consent Holder shall be liable and remain liable for meeting the lesser costs (including any contingency and GST) of:
 - (a) Completion costs; or
 - (b) Operation and maintenance costs; or
 - (c) Costs for reinstating land affected by the construction, including making safe and mitigating any adverse effects arising from the work undertaken during construction.
- 37 The bond shall be divided into three component parts, providing a bond for construction, operation and maintenance, and reinstatement.
- 38 The payment of the bond quantum by the Consent Holder shall be guaranteed by a Guarantor acceptable to the Waimakariri District Council.
- 39 The Guarantor shall bind itself to pay up to the bond quantum for the carrying out and completion of all obligations of the Consent Holder under the bonds.

- 40 If the Consent Holder is unable at any time to arrange a Guarantor for the quantum of the bonds as determined in accordance with these conditions, or the Guarantor provided is unacceptable to the Waimakariri District Council, the Consent Holder shall provide a cash bond or bonds for the required quantum.
- 41 The bonds shall be executed at least four months before the commencement of any construction works associated with this consent, and may be renewed from time to time in accordance with this condition, and shall remain in place for the duration of this consent.
- 42 The Consent Holder shall not exercise this consent or continue to exercise this consent until the bond or bonds or varied bonds have been executed by the Consent Holder and Guarantor and are acceptable in all respects to the Waimakariri District Council and are deposited with the Waimakariri District Council.
- 43 The bonds may vary from time to time, but at any given time shall be sufficient to cover the lesser of the estimated costs of completion (including any contingency and GST), operations and maintenance, and remediation and reinstatement, and/or compliance with all conditions:
- 44 In the event of the Consent Holder and the Waimakariri District Council not reaching agreement on the initial or subsequent bonds and their amounts, they will be assessed by a suitably qualified and experienced independent bond assessor appointed by the Waimakariri District Council, and the decision of that person shall be final and binding.
- 45 The amount of the bonds will then be reviewed and reassessed by the Consent Holder and the Waimakariri District Council every 12 months from the date the initial bond amount was lodged.
- 46 During the construction, operation, maintenance, and reinstatement phase of the Scheme, a scope of works planned for each phase will be provided by the Consent Holder to the Waimakariri District Council, both prior to setting the initial bond amounts, and again at each annual reassessment and six months prior to any change in phase, to assist in setting the bond amounts.
- 47 The Consent Holder shall meet the full and reasonable costs of providing any bonds, including legal advice to the Waimakariri District Council, the costs of preparation of the bonds and any substitute bond, and the costs of any bond assessor engaged to resolve the appropriate quantum of the initial bond to be provided or any varied bond on review and reassessment.
- 48 If at any time the amount of the bonds are varied, then the Consent Holder and guarantor approved by the Waimakariri District Council, shall within 30 working days of notification to the Consent Holder of the varied bond amount, execute and lodge with the Waimakariri District Council a new bond for the varied amount or the additional amount required in excess of the existing bond.
- 49 At all times the Consent Holder shall comply with the terms of the bond or bonds or varied bond(s).
- 50 Should the Consent Holder not agree with the bond quantum determined in accordance with these conditions then the matter shall be referred to arbitration in accordance with the provisions of the Arbitration Act 1996.

- 51 Arbitration shall be commenced by written notice by the Consent Holder to the Waimakariri District Council advising that the amount of the bond is disputed. Such notice to be given within 14 days of the bond sum being set. If the parties cannot agree upon an arbitration within 7 day of the notice of arbitration, then an arbitrator shall be appointed by the President of the Institution of Professional Engineers of New Zealand. Such arbitrator shall give an award in writing to the parties within 30 days after his or her appointment, unless the parties agree otherwise. The Consent Holder shall bear the full and reasonable costs of the parties in connection with the arbitration. Pending the outcome of the arbitration, the current bond and bond sum continue in force. However, the bond quantum shall be adjusted in accordance with the arbitrator's decision.

Insurance

- 52 The Consent Holder shall, at its costs, at least three months prior to construction commencing and at all times thereafter, have in place public liability insurance on terms acceptable in all respects to the Waimakariri District Council.
- 53 The insurance provided under this condition must be sufficient to cover all reasonable insurable contingent risks associated with the operation of the Waimakariri Irrigation Storage Ponds, including offsite impacts to third party property, including any assets, infrastructure or otherwise of the Waimakariri District Council, associated with any reasonable foreseeable failure of any part of the proposed ponds, together with a reasonable provision for reconstruction and reinstatement; and the proceeds of the insurance policy shall be applied for those purposes only.
- 54 The terms of the insurance policy shall provide for the following:
- (a) The Waimakariri District Council shall be an additional insurance party and should be able to enforce its terms;
 - (b) At least three months prior to construction commencing and at all times thereafter the Consent Holder shall ensure that the Waimakariri District Council has written confirmation that the insurance required by this condition is in place.
 - (c) The Consent Holder shall ensure that the insurer is required to copy all relevant information regarding the insurance policy to the Waimakariri District Council. This obligation includes an express term that the insurer must immediately the Waimakariri District Council of any non-performance of the terms of the insurance by the Consent Holder.
 - (d) In the event of any nonperformance of any term of the insurance policy, the Waimakariri District Council shall be given the opportunity to rectify that non-performance before the insurance policy is cancelled.
- 55 The Consent Holder will, at its cost, prior to arranging the insurance policy, obtain advice from a person qualified and experienced within the insurance industry to determine the limit of indemnity and coverage provided for by this insurance policy. In providing that advice, that person is to ensure the purpose of the policy is met, which is to provide coverage and protection in sufficient quantum to compensate for losses in the instance of a failure of the works authorized under this consent to third parties. Third party property and damage includes, but is not limited to:
- (a) houses, buildings and fences;

- (b) possessions that may be damaged, including motor vehicles;
 - (c) the repair and/or replacement of households, farms, and businesses, their contents, stock (including animals);
 - (d) the repair and/or replacement of landscaping, including and allowing for costs of cleanup, restoration of land, structures, and natural environment;
 - (e) plus provision for temporary costs to the community, including temporary accommodation;
 - (f) loss of profit for any affected businesses and farms; and
 - (g) any damage to, and repair of, the assets and infrastructure of the Waimakariri District Council.
- 56 A copy of the advice relating to the insurance policy will be provided to the Council's District Plan Manager at the Waimakariri District Council for review and comment, and any comments and suggestions that are provided to the Consent Holder will be taken into account and provided for within the insurance policy.
- 57 The limits of indemnity and coverage and terms of the policy are to be reviewed by the Consent Holder at least every three years, and if that review results in amendment or alteration to the insurance cover, then agreement of the Waimakariri District Council to any such amendments or alterations will be required.
- 58 If the parties cannot agree on the terms of insurance cover, the coverage, or indemnity value, the dispute shall be referred to arbitration, applying the arbitration condition above as appropriate.

Bore holes

- 59 Prior to earthworks commencing, and subject to the detailed design geotechnical investigations, for the purpose of confirming underground site conditions, the Consent Holder shall drill bore holes to a depth to be confirmed below ground level within the site, and shall provide a record of the results to the Council's District Plan Manager.

Community and cultural liaison

- 60 The Consent Holder shall appoint and distribute contact details for a community liaison officer, who shall actively engage with the local community, including ECESS and Maahanui Kurataiao Limited (MKT) on behalf of Te Ngai o Tuahuriri Runanga, before, during, and after significant project construction activities, and shall be the known point of contact to raise any matters that may arise during construction of the Waimakariri Irrigation Storage Ponds.
- 61 The Consent Holder shall also establish and publicise a project telephone number, so that any member of the public may raise matters or make an enquiry regarding construction of the Waimakariri Irrigation Storage Ponds.

Construction liaison group (CLG)

- 62 The Consent Holder shall, 6 months prior to construction commencing and annually thereafter, during the construction period, advertise a public meeting for the purpose of facilitating the establishment of a CLG in order to consult with

representatives of the community during the construction period. As a minimum, the Consent Holder shall invite the following interested parties to participate in the CLG:

- (a) Maahanui Kurataiao Limited (MKT) on behalf of Te Ngai o Tuahuriri Runanga
- (b) ECESS
- (c) Canterbury Regional Council and Waimakariri District Council
- (d) Landowners in the vicinity of the Waimakariri Irrigation Storage Ponds

63 The CLG shall be conducted in a manner of good faith and have the following objectives:

- (a) Facilitating information flow between the Consent Holder and the community regarding the implementation and environmental effects of the activities authorised by these consents (including new information, results of monitoring, and studies relevant to such effects);
- (b) Identify any issues of concern that arise during the construction period of the Waimakariri Irrigation Storage Ponds.
- (c) Identify or discussing appropriate measures to address issues raised;
- (d) Making recommendations for the Consent Holder to consider in relation to any issues identified in terms of (b) above.

64 The Consent Holder shall assist the CLG to fulfil its objectives by, amongst other things:

- (a) Arranging an appropriate venue in the area for the meetings of the CLG and meeting any other reasonable costs of the meetings;
- (b) Appointing a community liaison officer with authority to represent it on the CLG and ensuring the community liaison officer attends all of the formal meetings of the CLG;
- (c) Ensuring that a representative of the company responsible for the construction of the Waimakariri Irrigation Storage Ponds under contract with the Consent Holder attends all meetings;
- (d) Providing information to the CLG about progress in relation to the Waimakariri Irrigation Storage Ponds, including the environmental effects of the Waimakariri Irrigation Storage Ponds and compliance with consent conditions and development of any and all management plans;
- (e) Being prepared to discuss the environmental effects of the Waimakariri Irrigation Storage Ponds, any concerns in relation to human health and safety, and any complaints from the local community, including provision of further information and identification of appropriate measures to address issue raised;

65 The Consent Holder shall use its best endeavours to ensure its meetings with the CLG are held as follows:

- (a) At least once every 3 calendar months during the construction period unless requested by the CLG that the meeting be less frequent and one meeting 6 calendar months prior to construction of the Waimakariri Irrigation Storage Ponds commencing and one meeting 6 calendar months following completion of construction.

An advisory note

It is anticipated that the CLG will appoint a chair from amongst its members, and will develop and agree on its Terms of Reference at its first meeting.

Water Storage Commissioning Plan

- 66 The Consent Holder shall prepare a Water Storage Commissioning Plan for the Waimakariri Irrigation Storage Ponds that seeks to minimise risks from the initial filling of the ponds, in accordance with NZSOLD (2000) New Zealand Dam Safety Guidelines (Appendix 10). The Water Storage Commissioning Plan shall include the matters set out in the conditions below, and shall be submitted to the Council's District Plan Manager for certification at least two months prior to the first filling or partial filling of the storage ponds with water.
- 67 The first filling or partial filling of the storage ponds with water shall not occur until the Water Storage Commissioning Plan has been certified by the Council's District Plan Manager.
- 68 The commissioning of the storage ponds and associated activities shall be undertaken in accordance with the Water Storage Commissioning Plan certified by the Council's District Plan Manager.
- 69 The commissioning Water Storage Commissioning Plan and monitoring of the first filling of each component of the ponds;
 - (a) The commissioning and testing of control structures and systems, pumps, and monitoring systems; and
 - (b) Methods outlining surveillance of the ponds during commissioning and reporting requirements to the Waimakariri District Council.
- 70 All activities in furtherance of this consent shall be undertaken in accordance with the Water Storage Commissioning Plan.

Dam safety assurance plan

- 71 The Consent Holder shall submit a Dam Safety Assurance Plan prepared and produced by a suitably experienced and qualified engineer as defined by the "Building Dam Safety Regulations 2008" for the Waimakariri Irrigation Storage Ponds that seeks to minimise risks from the ongoing operation of the ponds in accordance with the NZSOLD (2000) New Zealand Dam Safety Guidelines (Appendix E). The Dam Safety Assurance Plan shall include the matters set out in the conditions below, and shall be submitted to the Council's District Plan Manager for certification at least two months prior to the first filling or partial filling of the storage ponds with water.
- 72 The Dam Safety Assurance Plan will be peer reviewed by the independent peer review panel.

- 73 The first filling or partial filling of the storage ponds with water shall not occur until the Dam Safety Assurance Plan has been certified by the Council's District Plan Manager.
- 74 The operation of the storage ponds and associated activities shall be undertaken in accordance with the Dam Safety Assurance Plan certified by the Council's District Plan Manager.
- 75 The Dam Safety Assurance Plan shall be reviewed by the Consent Holder every twelve months, for the first two years of operation following the initial filling of the storage ponds, and thereafter every five years coinciding with Comprehensive Safety Reviews and also whenever a trigger event, as identified in the Dam Safety Assurance plan, occurs. The review shall evaluate the Dam Safety Assurance Plan, the results of any inspections and any monitoring data and communications to or from the Waimakariri District Council and the Canterbury Regional Council. The results of the review shall be recorded in writing and sent to the Council's District Plan Manager within one month of the review occurring. If necessary, the Dam Safety Assurance Plan shall be amended to improve its effectiveness in reducing the risks and the matters in the conditions below, be further subjected to peer review by the independent peer review panel and resubmitted for certification by the Council's District Plan Manager.
- 76 The Dam Safety Assurance Plan shall include the following components:
- (a) Procedures and processes for dam operations, routine monitoring and inspections;
 - (b) Emergency procedures, including emergency responses, dam drawdown, early warning systems for the community and integration with Council and emergency services;
 - (c) Requirements for (annual) structural integrity and maintenance inspection by a suitably qualified person and reporting;
 - (d) Requirements for post-event (earthquake or similar event) structural integrity inspection by a suitably qualified person and reporting.
 - (e) Include a monitoring system capable of reliably and accurately detecting signs of threats to dam safety.
 - (f) Specifies an organisation approach that efficiently records processes, and evaluates and reports observations of the dam's performance.
 - (g) Includes trigger levels for observational results that are considered to require action;
 - (h) Includes a strategy of mitigation and actions to be undertaken in the even the specified trigger levels are exceeded;
 - (i) Provide for the reporting to the Council's District Plan Manager any trigger level exceedance and actions taken to address such exceedance;
 - (j) Provide for the immediate inspection of the dam and its associated components and accessory structures as soon as practicable after any earthquake with an intensity of VII (Very Strong) on the Modified Mercalli Scale is experienced at the Waimakariri Irrigation Storage Ponds.

77 The Consent Holder shall comply with the Dam Assurance Safety Plan at all times.

Emergency action plan

78 Prior to activities commencing on the site, the Consent Holder shall engage a professional engineer with experience in management of large dams with an assessed potential impact category to prepare an emergency action plan (EMP), to ensure appropriate management of the risk associated with any uncontrolled abnormal or excessive flow releases from the dams.

79 The EMP shall be prepared in consultation with the Civil Defence Emergency Management Group, including the Waimakariri District Council and the Canterbury Regional Council, and will, as far as practicable, be consistent with any Civil Emergency Management Group Plan governing the Regional Council District and the Waimakariri District pursuant to the Civil Defence Emergency Management Act 2002.

80 The EMP shall contain as a minimum:

- (a) Maps of land areas modelled as being potentially subject to inundation in the event of abnormal or excessive flow release and contact details for people resident within those areas, where they can be ascertained;
- (b) Contingency plans for alerting people within the identified areas of inundation and relevant Civil Defence authorities of the risk of such events;

81 Three months prior to storage pond filling, a copy of the EMP shall be provided to the Canterbury Regional Council, the Waimakariri District Council, the Christchurch City Council, the Canterbury District Health Board, the NZ Police, the NZ Fire Service, and the NZ Transport Agency for their information. Any input to the EMP those organisations provide will be taken into account within the EMP by the Consent Holder.

82 The Consent Holder shall review the EMP periodically, timed to coincide with a review of the Civil Emergency Management Group Plan referred to above.

83 All activities in furtherance of this consent shall be undertaken in accordance with the EMP.

Construction Traffic Management Plan

84 The Consent Holder shall, no less than 60 working days prior to any construction work commencing, engage a suitably qualified and experience traffic engineer to prepare a Construction Traffic Management Plan (CTMP) in conjunction with the CMP for certification by the Council's District Plan Manager, to certify that the CTMP meets the objectives set out below and related recommendations contained within the Consent Holder's resource consent application.

85 The objective of the CTMP shall be to ensure that the traffic generation during the construction phase is effectively managed so that increases in traffic volume are safely accommodated within the existing roading network.

86 All activities in furtherance of this consent, both on and off the site, shall be undertaken in accordance with the CTMP.

Construction plans

- 87 At least 1 month prior to the date upon which the Consent Holder intends to commence activities, as notified under these conditions, the Consent Holder shall provide to the Waimakariri District Council detailed engineering plans that have been peer reviewed and certified by an appropriately qualified and experienced engineer acceptable to the Waimakariri District Council.
- 88 Within 12 months of the date of construction activities ceasing, as notified under these conditions, "as built" detailed engineering plans shall be provided to Waimakariri District Council.
- 89 All activities in furtherance of this consent shall be undertaken in accordance with the construction plans.

Certification procurement

- 90 The Consent Holder shall procure certification from a suitably qualified and experience dam construction expert that the design of the dam and its construction are in accordance with good engineering practice, including being consistent with the Dam Safety Guidelines issued by the New Zealand Society on Large Dams and the requirements of the Building Act 2004. This certificate shall be submitted to the Council's District Plan Manager at least 2 months prior to the first filling of the dam reservoir.

Certified management plans to be held on site

- 91 A copy of the certified versions of all relevant management plans shall be kept on the site, and the Consent Holder shall ensure that all key personnel are made aware of each plan's contents.

Review

- 92 The Waimakariri District Council may, annually on the last five working days of May or November, serve notice on the Consent Holder under s 128(1) RMA of its intention to review the conditions of these consents that they have administrative responsibility for the following purposes:
- (a) To review the effectiveness of any of the conditions of the consents in avoiding, remedying or mitigating any adverse effects on the environment from the exercise of the consents and, if necessary, to avoid, remedy, or mitigate such effects by way of further or amended conditions;
 - (b) To ensure that the conditions are consistent with any policies or rules in a regional plan or National Environmental Standard or Regulation that becomes legally effective after the grant of consent;
 - (c) To review the adequacy of, and necessity of, monitoring undertaken by the Consent Holder;
 - (d) requiring the adoption of the best practicable option to remove or reduce any adverse effect on the environment; or
 - (e) complying with the requirements of a relevant rule in an operative district plan; or
 - (f) collecting data about the exercise of the consent.

Administrative charges

- 93 The Consent Holder shall pay to the Waimakariri District Council any administrative charges fixed in accordance with s 36 RMA or any charge prescribed in accordance with regulations made under s 360 RMA and s 690a of the Local Government Act 1974. The administrative charges shall be paid to the Waimakariri District Council for the carrying out of their functions in relation to the administration, monitoring and supervision of these consents and for carrying out their functions under s 35 RMA.

Other charges or costs

- 94 The Consent Holder shall pay all costs relating to peer reviews or engagement of others to undertake any actions or services required in terms of these conditions.

Lapse date

- 95 The lapsing date for the purposes of s 125 shall be 5 years from the commencement of this consent.

Advice Note: For the purposes of this consent "certify" "certified" or "certification by the Council" means assessed by Council staff or consultant acting in a technical certification capacity to determine whether the document or matter is consistent with or sufficient to meet the conditions of this consent.

Accidental Discovery Protocol (CRC ADP Modified after WDC 30 September 2014)

- 1 In the event of any discovery of archaeological material:
 - (a) the Consent Holder shall immediately:
 - (i) Cease earthmoving operations in the affected area and mark off the affected area; and
 - (ii) Advise the Canterbury Regional Council of the disturbance; and
 - (iii) Advise the Heritage New Zealand Pouhere Taonga of the disturbance.
- 2 If the archaeological material is determined to be Kōiwi Tangata (human bones) or taonga (treasured artefacts) by the Heritage New Zealand Pouhere Taonga, the Consent Holder shall immediately advise the office of the appropriate rūnanga/ Kaitiaki Rūnanga (office contact information can be obtained from the Canterbury Regional Council) of the discovery.
- 3 If the archaeological material is determined to be Kōiwi Tangata (human bones) by Heritage New Zealand Pouhere Taonga, the Consent Holder shall immediately advise the New Zealand Police of the disturbance.
- 4 The Consent Holder will also consult the Kaitiaki Rūnanga on any matters of tikanga (protocol) that are required in relation to the discovery and prior to the commencement of any investigation.
- 5 If kōiwi Tangata (human remains) are uncovered, in addition to the steps above, the area must be treated with utmost discretion and respect, and the kōiwi dealt with according to both law and tikanga, as guided by the Kaitiaki Rūnanga.
- 6 Work may recommence if Heritage New Zealand Pouhere Taonga (following consultation with Kaitiaki Rūnanga if the site is of Māori origin) provides a statement in writing to the Canterbury Regional Council, Attention: RMA Compliance and Enforcement Manager that appropriate action has been undertaken in relation to the archaeological material discovered. The Canterbury Regional Council shall advise the Consent Holder on written receipt from Heritage New Zealand Pouhere Taonga that work can recommence.

Advice Note: This may be in addition to any agreements that are in place between the Consent Holder and the Papatipu Rūnanga. (Cultural Site Accidental Discovery Protocol).

Advice Note: Under the Heritage New Zealand Pouhere Taonga Act 2014 an archaeological site is defined as any place associated with pre-1900 human activity, where there is material evidence relating to the history of New Zealand. For sites solely of Māori origin, this evidence may be in the form of accumulations of shell, bone, charcoal, burnt stones, etc. In later sites, artefacts such as bottles or broken glass, ceramics, metals, etc., may be found or evidence of old foundations, wells, drains, tailings, races or other structures. Human remains/kōiwi may date to any historic period.

Advice Note: It is unlawful for any person to destroy, damage, or modify the whole or any part of an archaeological site without the prior authority of Heritage New

Zealand Pouhere Taonga. This is the case regardless of the legal status of the land on which the site is located, whether the activity is permitted under the District or Regional Plan or whether a resource or building consent has been granted. The Heritage New Zealand Pouhere Taonga Act 2014 provides for substantial penalties for unauthorised damage or destruction.