

Appendix 5: Technical Advice – Hydrology by Hamish Graham

Date	20 August 2025
To	Susannah Black, Principal Consents Planner, Environment Canterbury
From	Hamish Graham, Senior Scientist – Hydrology, Environment Canterbury
Project advice provided for	Genesis Tekapo Power Scheme Renewal
Documents referred to	1. Appendix 2 - Groundwater and hydrology discussion (26 June 2025) Record https://www.fasttrack.govt.nz/_data/assets/pdf_file/0022/8950/Appendix-Two-Groundwater-and-Hydrology-Discussion-26-June-2025-Record71009591.1.pdf 2. Appendix K: Hydrological and hydrogeological analyses 2023 https://www.fasttrack.govt.nz/_data/assets/pdf_file/0014/4532/Appendix-K-Hydrological-and-Hydrogeological-Tekapo-PS-Reconsenting.pdf 3. Appendix G: Electricity sector benefits 2025 https://www.fasttrack.govt.nz/_data/assets/pdf_file/0019/4528/Appendix-G-Electricity-Sector-Benefits-Tekapo-PS-Reconsenting.pdf
Qualifications	I have been in a Hydrology Scientist role since October 2019. Prior to moving into the Hydrology Scientist role, I was in a Groundwater Scientist role (March 2012 to October 2019). I hold the qualifications of Bachelor of Science in Geology, Postgraduate Diploma in Water Resource Management and Master of Water Resource Management from the University of Canterbury. In my current role at CRC, I provide technical advice on resource consent applications relating to surface water quantity, including the impacts of water abstraction on and diversions from waterways.
Code of Conduct	I confirm that I have read and agree to comply with the Code of Conduct for Expert Witnesses contained in the Environment Court Practice Note 2023. This technical report has been prepared in accordance with that Code. In particular, unless I state otherwise, the opinions I express are within my area of expertise, and I have not omitted to consider material facts that might alter or detract from the opinions that I express.

Executive summary/overview

1. Genesis have proposed no changes to the hydrological operation of the Tekapo Power Scheme (TPS) and therefore concluded that the hydrological effects will remain unchanged for Lake Tekapo (Takapō), Tekapo Canal, or the Tekapo River (Takapō River).
2. Due to the impacts of climate change, it is expected that the scheme operations will be required to change over time. Genesis have provided a good assessment of how climate change will impact rainfall, snow days and inflows etc. Whilst there are uncertainties in climate projections there is more certainty of direction of change than absolute projected values.
3. However, Genesis have not assessed how these climate change impacts will impact the TPS operations. Genesis is relying on being able to operate the scheme within the existing operating level range, without providing evidence as to whether this is possible within the various climate change projections. Given the duration of both the current and proposed 35-year consents, it is likely that the effects of climate change will become evident within this period.
4. No consideration has been given to mitigating existing adverse effects associated with the hydrological aspects of the TPS. Potential mitigation could include changing how and when water is released into the Takapō River downstream of the Lake George Scott weir.
5. A brief overview of this advice is provided in Table 1:

Table 1: outstanding areas of contention		
Outstanding area of contention	Reason for significance	Solution
Impacts of climate change on current and future scheme operation	Change in effects of scheme operation on the environment	No direct solution proposed, but supports ensuring sufficient ongoing monitoring of the effects of the Scheme
Impact of scheme on the Takapō River	There are ongoing environmental effect on the Takapō River from operating the scheme	If compensation in the Indigenous Biodiversity Enhancement Programme (IBEP) for residual effects of TPS is insufficient then consider providing flow augmentation to the Takapō River

Agreement with the Applicant

6. I have not provided further discussion for where I agree with conclusions of the Applicant.

Benefits of the project

7. While I acknowledge that the existing environment includes the existing dam and water takes, there are ongoing environmental effects of operating the scheme, namely the reduction in natural flow into the Takapō River. Current flow releases into the Takapō River occur over the Lake George Scott weir generally at times of lake level management during high inflow events. As such there are no hydrological flow benefits of this project on the environment. However, I acknowledge that the provisions of flows in the Takapō River

would impact on the national and regional benefits of the TPS from a renewable energy generation perspective.

Outstanding areas of contention and significance of these.

Discussions with applicant

8. Groundwater and Hydrology expert discussions¹ were held between Genesis and Environment Canterbury Experts on 26 June 2025. Hydrological discussions were focussed on the following:
 - a. How has existing and how will projected changes to Takapō inflows due to climate change affect the Genesis operations within the current operating range.
 - b. How will projected electricity demand change the effect of scheme operations within the present operating range.
 - c. Effects of changes in lake levels caused by climate drivers compared to current operations.
 - d. Effect of Lake George Scott weir spill into the Takapō River changes based on climate change projections used in the application, if the currently consented operation of the scheme were to continue.

Outstanding areas of contention

9. Following expert discussions, I still have concerns remaining around the lack of information provided in the application around the potential impact of climate change projections on current and future scheme operations (8a and c above).

Significance of these matters

10. The Genesis application documents use all four Representation Concentration Pathways (RCPs) to describe the potential range of impacts of climate change on the environment. These are RCP 2.6 (low emission pathway), 4.5 (moderate emission pathway), 6.0 (moderate-high emission pathway) and 8.5 (high emission pathway). Genesis have not gone on to assess what this means for their TPS operations.
11. Understanding current impacts of climate change over the 35-year duration of the current consent would have been useful to help assess future impacts of climate change. During the expert discussions Genesis held the position that “*the existing climate since Genesis commenced exercising consents for the Tekapo PS in 2011 have been very small. It would be hard to detect climatic changes over such a short period beyond the natural variations.*”²

¹ Appendix 2 - Groundwater and hydrology discussion (26 June 2025) Record https://www.fasttrack.govt.nz/_data/assets/pdf_file/0022/8950/Appendix-Two_-Groundwater-and-Hydrology-Discussion-26-June-2025-Record71009591.1.pdf

² Appendix 2 - Groundwater and hydrology discussion (26 June 2025) Record https://www.fasttrack.govt.nz/_data/assets/pdf_file/0022/8950/Appendix-Two_-Groundwater-and-Hydrology-Discussion-26-June-2025-Record71009591.1.pdf

12. Whilst I agree that potential climate change impacts between 2011 and present would likely be too hard to detect², assessing potential changes between 1991 (when the current scheme operating ranges were consented) would have potentially identified some changes that would have provided value in understanding future climate change risks.
13. Section 4.1.3 of Appendix K (Hydrological and Hydrogeological report)³ includes an overview of projected climate change impacts on the environment. There is a thorough assessment of how climate change projections might impact rainfall, snow days and lake inflows etc. However, these climate change projections should have been taken a step further and used to assess the potential impacts on the TPS itself.
14. Climate change is projected to result in a decrease in summer inflows and increase in winter inflows for Takapō³. The magnitude of these projections differ depending on the RCP used.
15. While the TPS has maximum consent limits (lake operating range and rate of diversion), changes in climate³ and energy demand⁴ may drive a different environmental impact to current operations. For example, lake levels may be closer to the maximum or minimum operating range more frequently than current operations.
16. Genesis has a risk framework they operate to for managing the lake level for electricity generation requirements and appear to be relying on space in scheme capacity to accommodate changes to climate and energy demand. No assessment appears to have been made to verify this.
17. Paragraphs 13-16 leave the following questions:
 - a. How will projected changes to Takapō inflows due to climate change impact the generators operations within their operating range?
 - i. Will water be taken closer to the maximum rate more often compared with current operations?
 - ii. Will lake levels more frequently, or for longer durations, approach maximum or minimum levels compared to current operations?
 - iii. While I acknowledge that the Waitaki Water Allocation Plan provides the operating range, understanding the above matters ensures that the effects of the application are properly understood.ii
18. Overall, there is a lack of assessment of the impact of climate change on future scheme operations and how this might modify the environmental effects of the TPS (albeit within the currently consented framework).

Solutions and/or Conditions sought

19. Genesis is not proposing any changes to the existing (currently consented) operation of the scheme. As such, Genesis state the hydrological effects will remain unchanged, and no hydrological mitigation is proposed.

³ Appendix K: Hydrological and hydrogeological analyses 2023
https://www.fasttrack.govt.nz/_data/assets/pdf_file/0014/4532/Appendix-K-Hydrological-and-Hydrogeological-Tekapo-PS-Reconsenting.pdf

⁴ Appendix G: Electricity sector benefits 2025
https://www.fasttrack.govt.nz/_data/assets/pdf_file/0019/4528/Appendix-G-Electricity-Sector-Benefits-Tekapo-PS-Reconsenting.pdf

20. No minimum flows are proposed by Genesis for the Takapō River and the existing agreement for recreational spills is intended to continue. These agreed recreational spills and any spills occurring when the lake is full will continue to be the only times that the Takapō River flows.
21. While acknowledging the current values of the Takapō River, if the Hearing Panel is not satisfied with the compensation proposed by Genesis, then consideration could be given to ongoing water release over the Lake George Scott weir into the Takapō River as a mitigation to ongoing hydrological effects of Genesis' scheme operations. This could involve:
- a. Periodic flushing flows downstream Lake George Scott weir; or
 - b. Permanent spill into Takapō River via Lake George Scott weir; or
 - c. Both permanent spill into the Takapō River via Lake George Scott weir and additional periodic flushing flows.
22. At this stage, no specific recommendation in relation to flows is made, as these potential mitigations would need to consider a range of other advice including water quality and ecology, avifauna, herpetofauna, wetlands/vegetation.