

BEFORE THE CANTERBURY REGIONAL COUNCIL

IN THE MATTER OF the Resource Management Act 1991

A N D

IN THE MATTER OF Water permit applications by Simons Pass Station Limited and
Simons Hill Station Limited

**STATEMENT OF EVIDENCE OF TITUS LEE SMITH
DATED 12 NOVEMBER 2009**

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INTRODUCTION

1. My name is Titus Lee Smith. I am a Senior Engineer of Riley Consultants Ltd (RILEY), a consultancy with specialist expertise in Geotechnical, Water Resource, and Dam Engineering.
2. My academic qualifications and professional memberships are:
 - Bachelor of Engineering (Civil) Auckland University 2001
 - Master of Engineering Science (Geotechnical) University of New South Wales 2008
 - Chartered Professional Engineer
 - Member of the Institution of Professional Engineers NZ
 - Member of the New Zealand Geotechnical Society
3. I have eight years experience in civil and geotechnical engineering, with water retaining structures, such as dams, canals, pipelines and similar structures being a specialist area of expertise.
4. I have provided advice to various clients throughout New Zealand on safety and costing aspects of dams, canals, and other water retaining structures. Over the last year I have provided advice to Environment Canterbury (ECAN) on consenting, construction, and safety aspects for three dams in the region (Turley Dam, South Canterbury; Amberley wastewater ponds; farm dam, Parnassus) as well as undertaking stopbank investigation and review work at three locations along the Waimakariri River (Jury's Breach section; true left between Baynons Rd and the highway bridge; Twin Lakes). Recent dam projects for private clients include Deep Stream Dam, Otago (investigation and design involvement 2006-2008); Valleyfield Reservoir (design and Engineer to Contract 2007-2008); and, Kintyre Dam (design and Engineer to Contract 2009-ongoing) both in Marlborough. I completed detailed forensic investigation and analysis for pipe construction issues in Christchurch for the city sewer upgrade project at Pump Station 11 (2007-2008) and in Timaru for the MTSR Stage 3 tunnel (2009-ongoing).

5. I confirm that I have read and am familiar with the Code of Conduct for Expert Witnesses in the Environment Court Consolidated Practice Note (2006). I have approached the preparation of this evidence in the same way that I would for the Environment Court. I agree to comply with the Code of Conduct.

PROJECT BRIEF

6. I have been engaged by Pukaki Irrigation Company Limited to provide information on design and construction aspects of the three proposed development options which seek to abstract up to 3.5m³/s of water for irrigation purposes, and to convey the water to the irrigation area(s) which are generally located to the south of Lake Pukaki, east of the Pukaki River. Construction aspects considered include:
- Likely construction plant and procedures
 - Construction duration for components of the works
 - Work in lake beds, river beds and margins
 - Road crossings
 - Cleared/stripped areas and sediment control
 - Earthworks quantities
7. It should be noted that the construction methodologies, timeframes, and techniques discussed in this evidence are based on experience from similar works, but will likely be subject to variation as particular contractors plan and price aspects of the work.
8. As part of the brief to date, I have visited the site, developed and refined abstraction and conveyance concepts, and liaised with Meridian Energy Limited (“Meridian”) over suitable intake types and design standards where modification of existing hydroelectric infrastructure is required. I have received assistance from colleagues at RILEY regarding site geology, Pukaki River hydraulics and scour potential, road crossing detailing and sediment management procedures.
9. RILEY has previously been commissioned by Pukaki Irrigation Co Ltd to provide technical input on aspects of this project. These commissions included:

- May 2005 – Site visit and intake/conveyance option scoping report covering intakes from the Tekapo Canal, Lake Pukaki and Pukaki Canal, and pipe/canal conceptual conveyance alignments.
- December 2006 – Pre-feasibility geotechnical investigation of Pukaki Canal intake/conveyance option including geotechnical mapping and test pitting, laboratory testing, numerical modelling of Pukaki River Scour during dam spill events, and topographic survey between the Pukaki Canal and Pukaki River.
- March 2008 – Site visit and pipe and hybrid pipe/canal conveyance option scoping letter for conveying water from the Tekapo Headpond to south of SH8.
- February 2009 – Construction cost estimation review letter for intake/conveyance works for Tekapo headpond and Pukaki Canal options, including the potential for power generation.
- March 2009 – Conceptual intake drawings for Tekapo Canal option for approval by Meridian Energy.
- May 2009 – Review of aerial topographic survey data of proposed direct pipe alignment between Tekapo Headpond and SH8, and development of a preliminary 3D buried pipe alignment design with associated earthworks considerations.
- June 2009 – Conceptual intake drawings for Pukaki Canal and Lake Pukaki options for approval by Meridian Energy.

DESCRIPTION OF PROPOSED WORKS

10. The three development options are indicated on drawing 05805/3-01 and generally incorporate:

Option 1 an intake from the Tekapo Canal headpond, with a buried piped conveyance around 8.9 km length south to the irrigation area.

Option 2 an intake from Lake Pukaki near the left abutment of the Pukaki Dam, with a buried piped conveyance around the dam and for an additional 2.1 km adjacent to the Pukaki River, followed by canal conveyance to the irrigation area.

Option 3 an intake from the Pukaki Canal, with canal conveyance to the escarpment of the Pukaki River, a buried pipe below the Pukaki River bed, followed by canal conveyance to the irrigation area.

OPTION 1 – INTAKE FROM TEKAPO CANAL HEADPOND

11. The intake location is on the south side of the Tekapo Headpond near the transition to the Tekapo Canal. The site has been selected as it allows the intake works to be entirely founded in natural ground (as opposed to earth fill) reducing the risk any seepage related issues associated with the work. The original resource consent application indicated the intake would be located further to the west. However Meridian subsequently requested that the site be moved to the current location so that the intake and pipe were located well away from the Tekapo Headpond fill embankment. The conceptual intake and road crossing layout, developed through consultation with Meridian is indicated on drawing 05805/3-08 attached as Appendix 1. Construction is likely to involve:
- Closure of the Tekapo Canal Road for a period of around 10-15 working days
 - Excavation of the pipe trench, which is located above maximum water level within the Tekapo Canal.
 - Installation and concrete encasement of the 1.2 m diameter pipe beneath the road
 - Re-contouring and re-surfacing of the road to accommodate the 0.81 m increase in level at the pipe location.
 - Installation of the pre-fabricated intake pipe including flared inlet section and intake screen within the canal.
12. The earthworks quantities associated with the intake and road crossing are in the order of 70 m³.
13. The pipe between the intake location and the irrigation area is around 8.9 km in length, and 1.2 m in diameter. It will be buried with a minimum cover of 0.5 m, with topsoil and vegetation reinstated afterward. The total earthworks quantity associated with the pipe installation is estimated to be around 70,000 m³. This estimate has been derived from aerially obtained 5 m ground contours of the pipe alignment, and a preliminary pipe vertical alignment design.

14. Anticipated construction plant and practices will vary depending on the final pipe type selected. However they will generally include excavation of the pipe trench (around 1.5 to 4 m deep) with a hydraulic excavator, transport and installation of the pipe, backfill, re-spreading of topsoil and grassing.
15. The pipe alignment intersects State Highway 8. Drawings showing how the pipe will pass beneath the road have been submitted for NZTA (formerly Transit NZ) approval (refer 05805/4-01 to 04 attached). Installation of the pipe beneath the road will require the road to be reduced to one lane for 1 to 2 weeks. The effects of the construction work on traffic are considered to be minor.
16. I understand that NZTA approval for the concept design has been obtained.
17. One ephemeral stream crossing is required along the pipe alignment, south of the road crossing. It has been reported by local landowners that flow within the stream is rare, and only occurs during heavy rainfall events or snow melt. Any flow in the stream will be temporarily diverted and/or pumped past the pipe trench excavation during construction. An appropriately sized sediment pond will be constructed adjacent to the water course, and all diverted water will pass through the pond prior to being discharged back to the stream. The stream bed will be reinstated to its original level and geometry, with erosion protection appropriate to the natural stream bed used, if required.
18. The total construction duration for option 1 intake and pipe conveyance is anticipated to be around four months.

OPTION 2 – INTAKE FROM LAKE PUKAKI

19. The conceptual intake and road crossing layout, developed through consultation with Meridian is indicated on drawing 05805-3-AUG-1 and JUL-2. Due to challenges associated with maintenance of the submerged intake and pumps within the highly turbid lake water, a flexible/removable coupling has been allowed around the minimum seasonal lake level, so that temporary raising/detaching of the submerged intake components can be easily achieved. Historical records indicate the mean lake level in October is around RL 524m for the period 1979 to 2008. It is therefore intended that the flexible/removable coupling will be set at RL 525m, and that lake bed earthworks will only occur above this level. Below this level, only prefabricated units will be used which will rest on the lake bed and be removable for inspection and maintenance. Construction is likely to involve:

- Installation of a buried pipe within the lake bed down to around RL 525m. This would be completed near the end of winter, when lake levels are at their seasonal lowest. Trench excavation and pipe installation to this level would be completed by hydraulic excavators in the dry, above lake water level to minimise the potential for sediment discharge into the lake. The lake bed would be reinstated over the buried pipe, in character with the surrounding area.
 - Installation of the pre-cast concrete connection structure at RL 525 which will allow pivoting and/or disassembly of the submerged intake and pump section, which extends to around RL 516.
 - Construction of a booster pump shed on the lake shore above RL 535.5m
20. The time period for construction work in the lake bed is estimated at one month, which would be timed to coincide with the minimum seasonal lake level, typically in the period July to October. The volume of earthworks within the lake bed is estimated at 450m³. Any excess material resulting from installation of the pipe will be removed from site and incorporated into the conveyance canal earthworks.
21. To satisfy Meridian safety requirements, the pipe will cross State Highway 8 within natural ground outside the dam abutment. Drawings showing how the pipe will pass beneath the road have been submitted for NZTA approval. Installation of the pipe beneath the road will require the road to be reduced to one lane for 1 to 2 weeks. The effects of the construction work on traffic are considered to be minor.
22. The pipe will then descend into the Pukaki River valley for a distance of around 2.1 km, before rising up the terrace and discharging into an open canal as indicated on drawing 05805/3-JUN-1. The pipe will be buried, except as it ascends the river terrace where it will be installed above ground on pedestals.
23. The open canal conveyance alignment to the nominal centre of the irrigation area has not been investigated in detail. However, it is broadly similar to that of option 3, but translated north by several hundred metres. It is inferred that the canal will generally pass through low permeability soil deposits, and is not likely to require lining. Typical canal cross sections for conveying approximately 3 cumecs are indicated in drawing 05805/1-5 for unlined, earth lined and HDPE lined options. The comments in Option 3 regarding this section of canal are applicable (points 29 to 33).

24. The total construction duration for option 2 intake and conveyance is anticipated to be around 6 months. The canal earthworks are anticipated to take around 3 to 4 months.

OPTION 3 – INTAKE FROM PUKAKI CANAL

25. Apart from the Pukaki River bed, construction is generally outside publicly accessible areas.
26. The conceptual intake layout, developed through consultation with Meridian is indicated on drawing 05805/3-JUN-2. Minimal earthworks are associated with the intake, which is likely to involve:
- Excavation of the pipe trench, which is located above maximum water level within the Pukaki Canal.
 - Installation and concrete encasement of the 1.2m diameter pipe across the access track at the canal edge.
 - Re-contouring and re-surfacing of the access track to accommodate the 0.66 m increase in level at the pipe location.
 - Installation of the pre-fabricated intake pipe including flared inlet section and intake screen within the canal.
27. The intake pipe discharges into an open canal around 2km long for conveyance across to the true right bank of the Pukaki River. The canal will be formed using cut/fill balanced earthworks, likely incorporating a range of machinery such as excavators, trucks, a grader, water truck, compactor etc. The canal formation width varies between around 12 and 25m, and a machinery access/turning corridor 10m wide adjacent to the canal will need to be allowed during construction. The total earthworks quantity associated with this section of canal is estimated at 43,000 m³ on the basis of terrestrial-based survey of the alignment. It is likely the canal will require an HDPE plastic liner over this section, as suitable earth lining material has not been identified nearby.

28. A pressurised pipe or syphon is proposed to convey the water beneath the Pukaki River bed. The pipe will be installed with around 4m cover below the river bed, and protected with heavy rock such as that making up the existing river bed. Note that since the construction of the Pukaki Dam, the Pukaki River flows only when releases from the Pukaki Spillway occur, such as scheduled recreational releases, flood events or in an emergency. Pondered water is present at times in the riverbed immediately below the dam, likely contributed by groundwater seepage. Pondered water is generally not observed downstream of the proposed syphon location. It is likely that a small amount of water is passing within the riverbed as groundwater, and that seepage will be encountered in the syphon installation trench. The pipe will be buried apart from where it ascends the prominent terrace on the true left of the river, where it will be installed above ground on pedestals.
29. The flow then enters another canal section, which extends around 5.7 km to the nominal farm centreline. Initially, this canal is cut into the upper portion of the Pukaki River terrace, which it follows downstream around 500 m before attaining the terrace level and directing east toward the irrigation area. This initial section of the canal is estimated to require around a 25,000 m³ cut volume. This initial section of canal will be HDPE lined to ensure canal seepage does not negatively impact on the stability of the over steepened river terrace.
30. Pre-feasibility level geotechnical investigation of the canal alignment indicates that for most of its subsequent alignment the canal passes through low permeability ground, and will not require lining. The alignment crosses three unnamed ephemeral streams, two of which will be culverted beneath the canal fill, and the irrigation flow piped beneath the third. It has been reported by local landowners that flow within the stream is rare, and only occurs in the during heavy rainfall events or snow melt. In each instance, appropriately sized sediment control works will be installed at stream crossings for the duration of work in the stream bed and margins. Earth fills estimated to be around 20,000 m³ in volume will be required at the two culverted stream locations. The envisioned fill height for the culverted stream crossings is estimated to be up to 5m, on the basis of the published 1:50,000 topographic map for the area.

31. The canal width, construction corridor, methodology and machinery will be similar to that for the section to the true right of the Pukaki River. For the 5.7 km length of canal, the total footprint area of the earthworks is around 110,000 m², and earthworks volume around 120,000 m³ in addition to the culvert fills and terrace cutting volume already noted. Earthworks will be completed using a cut-fill balance approach, so that exporting or importing of fill materials will be minimised.
32. The total construction duration for option 3 intake and conveyance is anticipated to be around 6 months. The canal earthworks are anticipated to take around 3 to 4 months.
33. Ponds within the canal are indicated in the proposed works. Some operational storage will be required for start-up and shutdown of the canal, due to the delay between abstraction rate changes at the intake and their effect at the eastern (downstream) end of the canal. It is anticipated that this operational storage will be provided by either the widening of the canal near its eastern end or the provision of small ponds within the canal. The length and width of the widened section is subject to confirmation during final design, and will be determined on the basis of the operating characteristics of the irrigation infrastructure installed as well as modelling of the effect the delay between operational intake abstraction rate changes and flow rate at the end of the canal

GENERAL

34. Sediment control will be in accordance with Environment Canterbury Erosion and Sediment Control Guidelines 2007. For both canal and pipe earthworks, three levels of sediment control are anticipated:
 - At the Pukaki River and ephemeral stream crossings, specific clean water diversions will be installed and off stream decant structures constructed to intercept silt generated by work within stream beds and margins.
 - At areas likely to encounter concentrated overland flows during flood events, or adjacent to natural channels, silt fences will be deployed.
 - For sections of canal located away from overland flow channels, areas of exposed soil are to be limited during construction and progressive stabilisation of completed fill surfaces by grassing undertaken.

35. For general trenching associated with pipe installation, specific silt control works are not considered necessary. However, excessive open trench lengths shall be avoided, and backfilling around installed pipes completed progressively to minimise the area and time.
36. An establishment and storage area will be required for each of the proposed conveyance options. Such areas will generally be located out of site from the State Highway, and will incorporate appropriate bunding and environmental protection works where fuel storage and machine maintenance is to be carried.
37. Earthworks carried out during dry weather in summer months are likely to generate dust. Due to the remoteness of the site, dust is not considered to pose a significant nuisance to people, or hazard to the environment.

Titus Smith

12 November 2009