IN THE MATTER OF the Panel appointed by the delegate of the Minister for Water pursuant to Part 5, Section 66 of the *Water Act 1989* (**Water Act**) to consider submissions made in respect of Works Application No AN JW1624119 (**Application**) to construct works under section 67 of the *Water Act* on or to a private dam (**Private Dam**) located at 1075 Horseshoe Bend Road, Torquay (**Property**)

PANEL FINDINGS AND RECOMMENDATIONS

PANEL:	Mr Matthew Townsend and Dr Mark Foster (**Panel**)
HEARING DATES	DIRECTIONS: 28 July 2021
	MERITS: 23 and 24 August 2021
ATTENDANCE:	The merits hearing was attended by:
	Melissa Jeal, Panel Secretariat & Southern Rural Water Corporation Secretary
	Andrew Sherman, Russell Kennedy, Legal Counsel for Southern Rural Water
	Hugh Christie, Southern Rural Water General Manager Service Delivery
	Angus Ramsey, Southern Rural Water Acting Manager Groundwater & Rivers
	Phil Cadman, Barrister, representing the Applicant

[redacted]

THE PURPOSE OF THE PANEL

1. The Terms of Reference for the Panel dated 21 June 2021 (**Terms of Reference**) state the purpose of the Panel is to consider submissions made in respect of the Application:

> 4. The purpose of the Panel is to consider submissions made in respect of the Application in response to a requirement to give notice of the Application under section 65 of the *Water Act*.

5. The Panel will consider all submissions and report, provide comment, advice and recommendations to the delegate of the Minister for Water who is to determine the Application—

(**Purpose**)

THE PANEL'S REPORT

2. The Panel must produce a report for the delegate of the Minister for Water, including:

a) a response to the Purpose;

b) an assessment of submissions considered by the Panel;

c) any other relevant matters identified in the Panel's deliberations;

d) a list of persons, agencies or other entities in respect of which submissions, information or comments were received;

e) a list of any other persons or entities consulted or heard; and

f) recommendations as to:

1) whether the Application ought to be approved, approved with conditions or refused;

2) if a recommendation to grant is made, recommendations as to particular conditions to be incorporated in respect of any licence which may be issued for the works and ongoing operation of the dam; and

3) any other recommendations in relation to the application as the Panel thinks fit—

(**Report**).

MATTERS THE PANEL MUST CONSIDER

3. The Panel must consider:

a) all matters required to be taken into account under section 68 of the *Water Act*, namely;

68 Matters to be taken into account

In considering an application under section 67, the Minister must—

(a) have regard to the report of any panel appointed under section 66; and

(ab) have regard to any advice and comments received within the period of 30 days referred to in section 67B(1); and

(b) have regard to any adverse effect that the exercise of rights under the licence is likely to have—

(i) on the drainage regime within the meaning of section 12(1); or

(ii) on in-stream uses of water; or

(iii) otherwise on the aquifer or on the flow of water within the waterway, including effects on the land that forms the waterway or its surrounds; or

(iv) on the implementation of the conservation policy of the government; and

(ba) have regard to the matters mentioned in paragraphs (b) to (n) of section 40(1); and

(bb) give effect to an approved management plan for any relevant water supply protection area; and

(c) consider the likely effects of the escape of water from the works; and

(d) have regard to whether the site of the proposed works is within a heritage river area or natural catchment area within the meaning of the Heritage Rivers Act 1992 and whether there is any restriction on the use of the area under that Act; and

(e) have regard to any other matter that the Minister thinks fit.

b) in particular, matters set out at sub-paragraph (b) to (m) of section 40(1) of the *Water Act*, namely;

(1) In considering an application under section 36(1), the Minister must have regard to the following matters—

(b) the existing and projected availability of water in the area;

(ba) the permissible consumptive volume, if any, for the area;

(c) the existing and projected quality of water in the area;

(d) any adverse effect that the allocation or use of water under the entitlement is likely to have on—

(i) existing authorised uses of water; or

(ii) a waterway or an aquifer; or

(iii) the drainage regime within the meaning of section 12(1); or

(iv) the maintenance of the environmental water reserve in accordance with the environmental water reserve objective;

(e) any water to which the applicant is already entitled;

(g) the need to protect the environment, including the riverine and riparian environment;

(i) the conservation policy of the government;

(j) government policies concerning the preferred allocation or use of water resources;

(jaa) any environment reference standard within the meaning of the Environment Protection Act 2017 and any Order made by the Governor in Council under section 156 of the Environment Protection Act 2017;

(ja) whether the proposed source of water is within a heritage river area or natural catchment area within the meaning of the *Heritage Rivers Act 1992* and whether there is any restriction on the use of the area under that Act ;

(k) if appropriate, the proper management of the waterway and its surrounds or of the aquifer;

(l) the purposes for which the water is to be used;

(m) the needs of other potential applicants;

c) the relevant Australian National Committee on Large Dams (**ANCOLD**) guidelines; and

d) safety of the Property, surrounding properties, buildings and infrastructure, residents, and the public.

THE APPLICATION

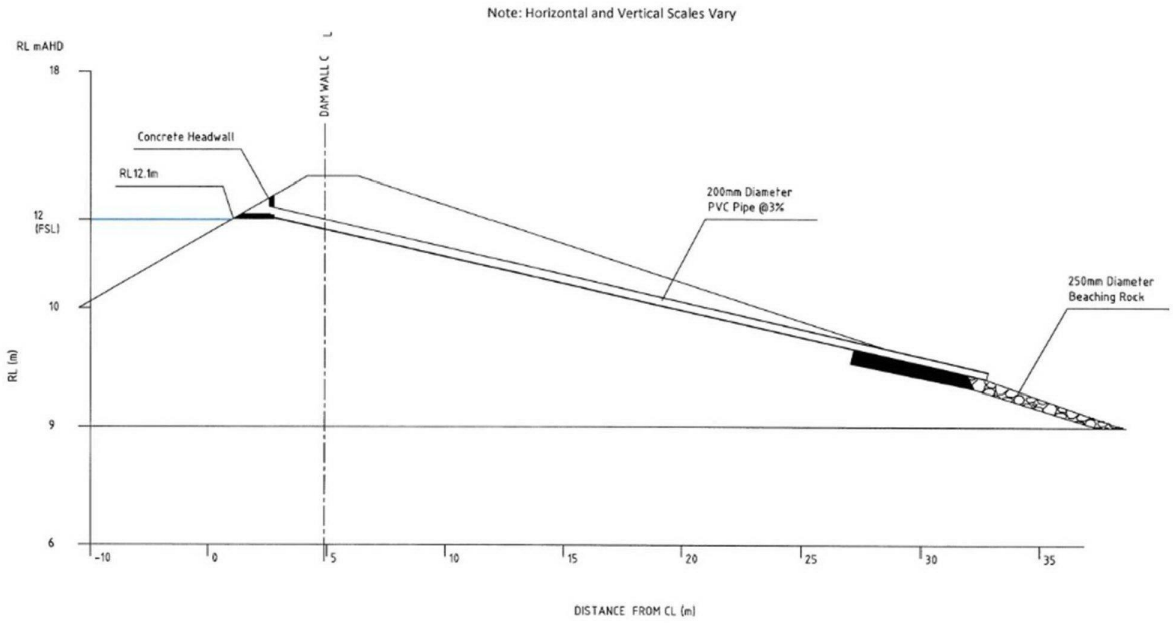
4. The Application for a licence to alter or decommission a dam was made by Mark Tomkinson for Charles Santospirito (**Applicant**) on 8 April 2021.

5. It was accompanied by a:

a) site plan;

b) spillway plan; and

c) section:



6. The Application was subsequently supported by:

a) a Dam Safety Emergency Plan, prepared by AGT Consulting, Report No: AGT20249-2 Rev 2, dated 9 July 2021; and

b) a Construction Plan dated 24 June 2021.

THE PROPERTY

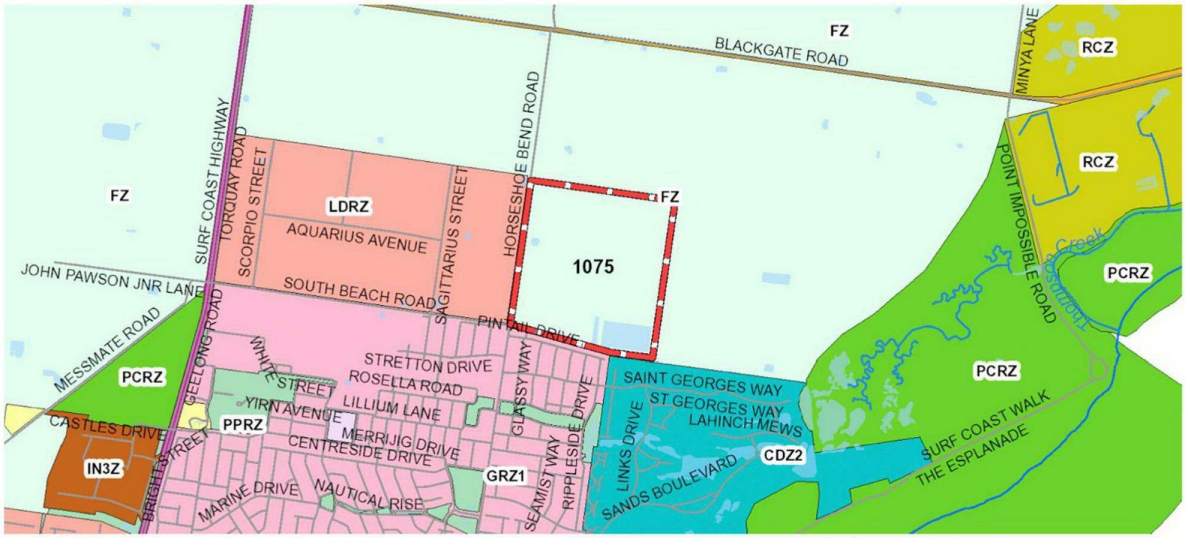
7. The Property is known as:

a) 1075 Horseshoe Bend Road, Torquay;

b) Lot 1 on TP170892; or the land more particularly described in

c) Certificate of Title Volume 9350 Folio 226:

FARMING ZONE (FZ)
SCHEDULE TO THE FARMING ZONE (FZ)

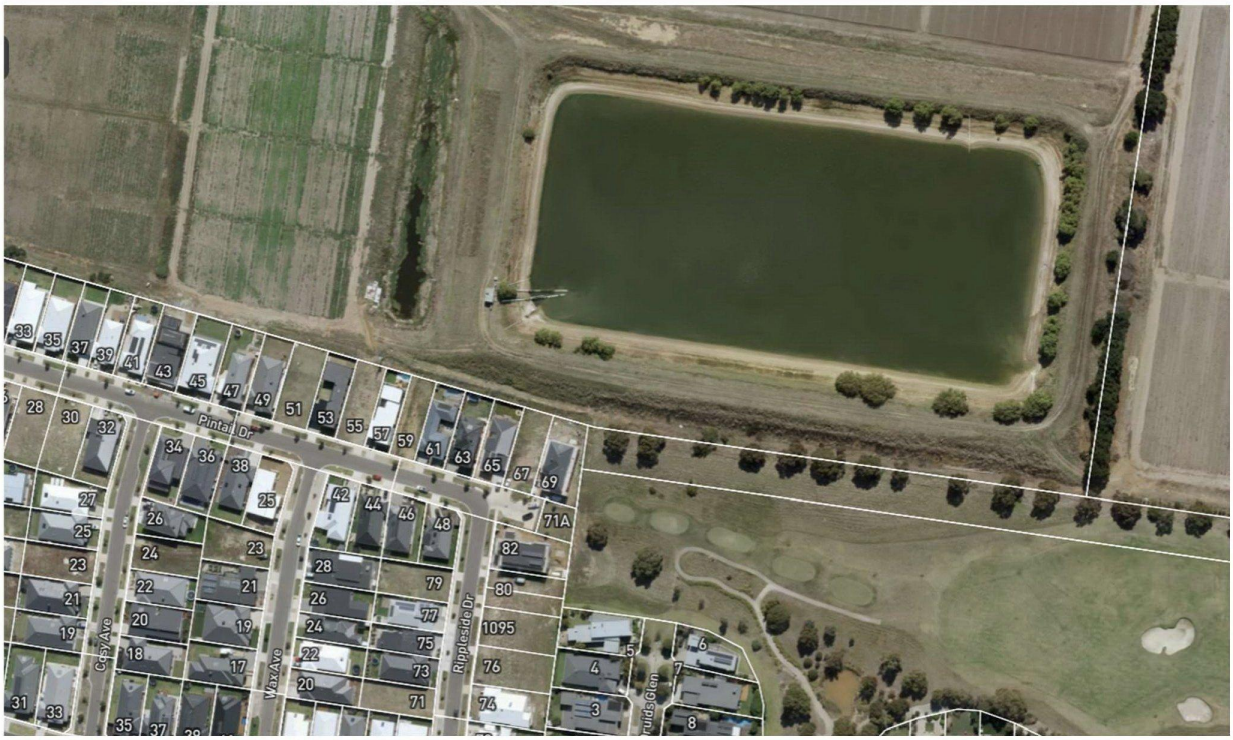


8. The Property is zoned 'Farming Zone' in the Surf Coast Planning Scheme. To the immediate south of the Property, the land is Zoned 'General Residential (Schedule 1)', that has been developed for housing.

THE PRIVATE DAM

9. At the time of the Private Dam's construction in or about 1987, it was surrounded by open, agricultural land. The following photograph, taken in or about November 2009, shows the water body adjacent to a desalination plant and the Sands Golf Course:

10. Over time, land to the south of the Property was rezoned and redeveloped for residential purposes. The following aerial photo was taken on 31 March 2021:



11. The Private Dam is approximately:

a) 260m to 300m long;

b) 150m to 170m wide; with

c) an original crest width of approximately 4m,[1] that has since been widened.

12. The Applicant claims the Private Dam holds 171ML,[2] however, an accurate measurement of the storage floor level of the Private Dam is apparently not possible by reason of uncertainty surrounding the construction of the dam.

THE HEARING

Submissions made prior to the hearing

13. There was one submission in support of the Application and 28 submissions against it. Submissions in opposition expressed concerns including the following:

a) ongoing issues such as flooding;

b) stress caused by the emergency evacuation;

c) risks to physical safety of human life and surrounding properties;

d) ongoing psychological trauma;

e) financial impact, including the devaluation of surrounding properties;

f) lack of integrity of the Private Dam and its systems;

g) the failure to adequately decommission the previous desalinisation plant;

h) satisfactory risk assessments not having been undertaken; and

i) setting a precedent for future license renewal.

14. A list of submitters is set out in Schedule 2 to this report.

Requests for information made on 2 August 2021

15. On 2 August 2021, the Panel asked for further information from the Applicant, more particularly:

a) information about the dam:

1) any historical drawings, reports or photographs that document the original dam construction;

2) any survey showing the location of existing features of the dam (crest, toe, pipework, standpipe piezometer locations) and contour levels of the dam and surrounding land;

---

1 Letter from the Department of Conservation, Forests and Lands dated 15 December 1986.

2 Applicant's submissions at [6].

3) measurements taken at various locations onsite of the depth of the dam below water level, including the gauge height of the storage level at the time the measurements are taken;

4) records of the measured groundwater levels in the standpipe piezometers since they were installed.

b) information about the Existing Pipework:

1) the elevation at which the Old Treatment Plant pipe (which is now capped off) passes through the dam embankment relative to the proposed reduced operating level of EL 12 metres;

2) information and/or sketches disclosing the elevation at which the "sump pipe" (AGT report, 29 January 2021, Section 2.2) passes through the dam embankment relative to the dam crest and the proposed operating storage level of EL12 metres;

3) the pipe material and diameter of the "sump pipe" where it passes through the embankment fill;

4) the internal condition of the "sump pipe" where it passes through the dam fill; and

5) details of any other old or disused pipes that pass through the dam embankment (or pass through the foundation of the embankment).

c) information about the Application:

1) reduced Storage Operating Level

a) the basis for selecting the reduced Full Supply Level of EL 12 metres;

2) proposed Details and Method of Installation of the Spillway Pipe:

a) the drainage pathway for the water that is to pass through the spillway pipe;

b) any hydraulic calculations carried out to determine the proposed pipe diameter to maintain the reduced storage operating level of EL 12 metres if the inflow pumps continue to operate;

3) details of any consideration given to potential blockage of the inlet of the spillway pipe by debris;

4) details of the method of drilling proposed and the precautions proposed to be taken to mitigate potential damage to the embankment fill by the drilling process (such as the fracturing of dam fill that could occur if water or air is used to drill the hole);

5) any design measures proposed to be used to mitigate the potential for seepage and internal erosion of dam material from developing around the outside of the spillway pipe once it is installed;

d) information about the Dam Break Analysis report (ATG, 29 January 2021):

1) modelling output information:

a) output plots for the EL 12 metres storage level case like those shown in Section 4.1 of the report for the EL 14 metres case; and

b) HEC-RAS model output files, if any;

2) dam failure (breach modelling):

a) details of the outcomes of breach modelling for the EL 12 metres storage level case if the failure is assumed to occur immediately behind the properties located on Pintail Drive;

b) details of the sensitivity of the modelling outputs to the estimated breach parameters (breach geometry and breach development time) for the EL 12 metres storage level case;

c) details of the number of properties predicted to be affected by the dam break modelling for the EL 12 metres storage level case; and

d) details of the predicted depth and velocity of water from the dam break modelling at the location of properties along Pintail Drive for the EL12 metres storage level case;

and

e) information about the Dam Safety Review report (AGT, dated 30 Jan 2021):

1) assessment of the level of risk for the EL 12 metres storage level case (as provided for EL 14 metres in Section 1.1, page 8);

2) information about why the historic performance method was used (Section 9.2.2, page 22-24) when the ANCOLD Guidelines on Risk Assessment (ANCOLD 2003, Commentary C7-2) indicates the historic performance method for piping is only applicable for screening and preliminary risk assessments, and in conjunction with event tree methods for detailed risk assessments;

3) further details about the risk assessment (Section 9.2.2, page 25) as currently it only quantifies the risks for piping failure modes;

4) the basis for the estimated potential life loss value (N) (Section 9.2.2, page 25);

5) risk assessment (Section 9.2.2, page 25) based on the risk criteria in the ANCOLD Guidelines on Risk Assessment (2003) including criteria for

societal risk and individual risk and consideration of risks being reduced As-Low-As-Reasonably-Practicable (**ALARP**); and

6) Consequence Category for the dam operating at EL 12 metres assessed under the ANCOLD Guidelines (as provided in Section 10 for EL 14 metres as 'High B').

(**Panel's Request for Further Information**)

16. The following information was also requested from Southern Rural Water:

a) section 80 Direction dated October 2020;

b) any reports related to the investigations which investigate the cause of the October pipe leak incident and associated repair works; and

c) reports of historical inspections of the dam conducted by Southern Rural Water.

17. Southern Rural Water responded to this request on or about 5 August 2021.

Submissions made at the hearing

18. Further submissions were made to the Panel at the Merits Hearing on 23 and 24 August 2021, namely:

a) Andrew Sherman, on behalf of Southern Rural Water;

[redacted]

e) Phil Cadman of Counsel, on behalf the Applicant.

Southern Rural Water's submissions

19. Mr Sherman, legal counsel for Southern Rural Water assisted the Panel in its deliberations. Mr Sherman explained:

> Southern Rural Water cannot take such a position unless or until consideration of the Panel process and Report is taken into account in the final decision of the delegate of the Minister in respect of the Application is made.

20. Mr Sherman was nonetheless able to assist with the following summary of the background to the Application:

a) the Private Dam predated registration requirements:

3.7 When the Dam was built it predated both any requirement for registration of the Dam under the Water Act and the nearby residential subdivision. The Dam was to assist the operation of a flower farm on the Property, initially associated with a section 51 surface-water licence (Winter-fill from Bream Creek) and later also to serve as a water storage for the receipt and distribution of recycled water to both the Property and third-party users.

b) however, when registration of the Private Dam was required, it did not occur:

3.8 When amendments were made to the Water Act requiring the registration of a Dam such as this (under potentially hazardous dam provisions), this Dam was not registered.

c) Southern Rural Water did not object to the creation of the Zeally Sands Estate:

3.9 In 2009 the Planning Scheme was amended to allow residential development up to the boundary of 1075 Horseshoe Bend Road, Torquay. The Dam is located at the boundary of this property, meaning that the amendment allowed houses to be constructed backing on to the dam. That Planning Scheme amendment was referred to Southern Rural Water and Southern Rural Water did not object to the amendment or seek any setback of development from the abuttal to the Dam.

d) upon the decommissioning of the nearby desalination plant, not all pipework was removed or sealed:

3.10 Post 2009, a desalination plant (then located it what become one or more of the new residential lots) was decommissioned, leaving a pipe running through the Dam wall which was not removed or, apparently, adequately blocked. Advice indicates this plant was established to reduce salt levels in the recycled water, apparently installed by and for the benefit of, an entity on behalf of the golf course. …

e) that infrastructure was overlooked in an inspection of the Private Dam that occurred in 2017:

3.12 In 2017 (apparently based on concern of local residents regarding works being conducted on the Dam) Southern Rural Water undertook an inspection of the Dam which required an independent expert opinion in relation to the safety of the Dam wall. That opinion was obtained, confirming appropriate structural integrity of the Dam, noting the report also recommended yearly technical reviews of that structure. The former desalination plant pipe was not discovered.

f) a flooding event occurred on 2 October 2020 and local residents were evacuated out of concern that the Private Dam might collapse:

3.13 On Friday 2 October 2020, Southern Rural Water was advised of a flow from the ground of water on properties in Pintail Drive, including advice that at least 1 resident was forced to pump water from that resident's property. Thereafter Southern Rural Water, in association with DELWP and SES, consulted and action was initiated to:

(a) evacuate local residents from their homes given a concern of Dam failure; and

(b) to reduce the risk of Dam failure Southern Rural Water instructed a reduction in the level of the Dam which took place. By 5.00pm Sunday 4 October 2020 the level was reduced sufficiently to allow residents to return home. …

g) Southern Rural Water imposed interim conditions on the Private Dam to mitigate risk until a longer term solution was developed. In particular, the Private Dam was to be operated at a water level of no greater than 12 metres:

3.15 Southern Rural Water issued a direction under section 80 of the Water Act identifying particular issues and directing the owner of the Property:

(a) to operate the Dam at a water level no higher than "12 metres" (a reduction in height);

(b) by 9 October 2020 establish a methodology to be considered for approval by Southern Rural Water regarding surveillance markers to ensure the Dam remains at the directed safe level;

(c) requiring daily visual inspections and record keeping of the Dam and requiring immediate reporting of seepage to Southern Rural Water;

(d) to maintain a log of the inspections required and provide that to Southern Rural Water weekly;

(e) provide an initial report, by 5.00pm Friday 9 October 2020 by an engineer with dam safety experience to identify further mitigation measures likely to be required.

3.16 Southern Rural Water issued a further Direction under section 80 of the Water Act directing the property owner:

(a) any continued operation of the dam must be at full supply level which is no higher than EL 12 metres as noted in the datum on the site plan in the report of Australian Geotechnical Testing numbered AGTE17463, December 2017 (AGT Report);

(b) no inflow to the dam is permitted other than from the Black Rock Treatment Plant or the drainage sump to the west of the dam;

(c) a daily visual inspection of the dam and dam wall must take place, including taking written and/or electronic records of:

i. details of when, what, how and who carried out, in relation to the inspection itself; and

ii. any changes to the dam wall, including any ponding, seepage, cracking or other changes; and any changes must be immediately reported to the Corporation;

(d) the record of visual inspections as required under must be provided on a daily basis through electronic reporting, as required by the Corporation until otherwise directed by the Corporation;

(e) to maintain the banks of the dam in a manner which allows for easy visual inspection, including regular mowing of the slopes of the banks and keeping the swale drain cleared to facilitate observation of any cracking or seepage;

(f) to notify the Corporation of any likely or actual incident related to the dam or other dam infrastructure that impacts, or has the potential to impact, neighbouring or nearby properties, immediately upon becoming aware of such incident or potential incident;

(g) to procure the completion of a comprehensive report ("Report") and that Report:

i. must include a peer review by an independent expert in dam safety, that expert to be approved by the Corporation;

ii. must include a Dam Safety Review;

iii. must include a Dam Break Analysis;

iv. must include a finalised Dam Safety Emergency Plan;

v. must include an appropriate assessment of failure modes and dam break analysis of both the current operating level and future proposed operating levels;

vi. must include full and complete details of each and every proposed action or work designed to achieve a situation where the dam can be operated without hazard; and

vii. should be in a form so as to support an application for a works licence under section 67 of the Act.

(h) make an application for a licence to carry out works on the private dam, under section 67 of the Act; or 10.2 cease the operation of the dam and decommission it, this also requires an application under section 67 of the Act.

21. Mr Sherman also summarised the process of notice pursuant to section 65(2) of the *Water Act* that gave rise to the submissions being considered by the Panel:

4.1 The Application under section 67(1A) was made on 8 April 2021 and allocated No. W1624119.

4.2 The Application was advertised in the Geelong Advertiser on 27 May 2021 and was the subject of a letterbox drop to a broad resident group on 31 May 2021 (some 120 addressees) and an email was sent to the Torquay Dam Community Group.

4.3 The Application was also provided to key entities or agencies including the Surf Coast Shire, the Corangamite CMA, Barwon Water, EPA and DELWP.

4.4 There has been no response from any agency, other than DELWP which was received late ...

[redacted]

22. [redacted] prepared a comprehensive presentation explaining the basis on which they opposed the Works Application. More particularly, [redacted] submission included discussion of the:

a) historical and ongoing issues with the Private Dam such as flooding;

b) stress caused by emergency evacuation on 2 October 2020;

c) risk to the physical safety and structural integrity of the Private Dam to surrounding properties;

d) ongoing psychological and emotional trauma caused by the existence of the Private Dam;

e) financial impacts, including the devaluation of surrounding properties;

f) lack of integrity of the Private Dam and its systems;

g) the uncertainty surrounding the decommissioning of the desalinisation plant; and

h) overall inadequacy of the dam and system integrity.

[redacted]

23. [redacted] adopted the content of his pre-hearing submissions and emphasised matters including a suggestion that the Private Dam should be relocated as a condition of the Application.

[redacted]

24. [redacted] adopted their written submissions that had been circulated before the hearing and emphasised that they believed that the Private Dam proposed a significant risk to her family and her property.

25. [redacted] said it was inappropriate for the residential development to have been approved in close proximity to the Private Dam and that if Southern Rural Water would not approve a new Private Dam in its present location, it should not approve further works for the existing structure.

[redacted]

26. [redacted] made further written submissions to the Panel, but was not able to present those submissions in person.

27. She adopted her initial submissions that described:

    a) stress caused by emergency evacuation on 2 October 2020;

    b) her concerns for the physical security and safety of residents;

    c) the ongoing psychological and emotional trauma caused by the Private Dam;

    d) financial impacts of the dam, including the devaluation of surrounding properties;

    e) a concern about a lack of integrity of the dam and its systems; and

    f) uncertainty surrounding the decommission of the previous desalinisation plant.

28. Her further submission provided photographs she said were reflective of ongoing issues of drainage, if not flooding, on her land. She also provided a geotechnical report that she said corroborates her submissions.

The Applicant's submissions

29. Mr Cadman of Counsel also tabled written submissions that explained the basis of the Applicant's case:

    a) the Works Application will have no adverse effect nor relevant effect on the drainage regime, in-stream uses of water, aquifer or flow of water within a waterway:

        14. The Dam is of the "turkey nest" kind and, as noted above, does not lie on a waterway and is filled by pumping from the Black Rock Sewage Treatment Plant. In those circumstances, the Applicant submits that, for the purposes of sub-sections 68(1)(b)(i) to (iii) of the Act, the works will have no adverse effect (and

no relevant effect at all) on any relevant drainage regime, in-stream uses of water, aquifer or flow of water within a waterway. For the purpose of section 68(1)(b)(iv) of the Act, the only effect of the works on the implementation of the conservation policy of the government may be the positive effect that the Dam can continue to purchase recycled effluent water for irrigation, assisting the Black Rock Sewage Treatment Plant to sell its effluent and reducing any potential demand on alternative sources of fresh water.

b) the Works Application will maintain the existing availability of water for irrigation in the area and by continuing the current irrigation arrangements, assist in maintaining the projected availability of water in the area:

15. For the same reasons, the Applicant submits that there are no or minimal considerations relevant to the matters listed at (b) to (m) of section 40 of the Act. In particular, the Applicant says that the only relevant considerations are that;

(a) For sub-section 40(1)(b); that by ensuring the safety of the Dam, the works will maintain the existing availability of water for irrigation in the area and by continuing the current irrigation arrangements, assist in maintaining the projected availability of water in the area;

c) the works will generate employment in the local area;

(b) For sub-section 40(1)(l); the works will facilitate the ongoing business of the Applicant as the purpose for which the water will be used, which provides investment and employment in the local area.

and

d) the Private Dam is otherwise safe:

16. The Applicant notes the further information requested at Direction 15 of the Panel's Directions of 2 August 2021 as going to the considerations regarding the ANCOLD guidelines and general safety associated with the Dam (as referred to in the Terms of Reference quoted at 13(c) and 13(d) above). …

19. The Applicant has operated the Dam safely for many years and has every confidence in the construction and operation of the Dam. The Applicant was greatly concerned by the incident of October 2020 and notes again that it was not the owner of the desalination plant or its pipework, nor was it responsible for decommissioning the desalination plant or the rezoning of adjacent land.

20. In the circumstances, the Applicant considers that the relatively minor works the subject of this Application, in combination with the Applicant's commitment to maintaining a 12 metre level in the Dam, will be more than adequate to ensure the ongoing safety of the Dam. Consequently, the Applicant submits that the Panel ought recommend that a licence to perform the works should be issued.

30. Mr Cadman called evidence from Mr Amir Farazmand, formerly a Senior Geotechnical Engineer with Australian Geotechnical Testing (AGT) and:

a) author of a Dam Inspection Report and Action Plan dated 21 October 2020;

b) co-author, with Arash Parehkar, a Dam Break Analysis dated 30 January 2021;

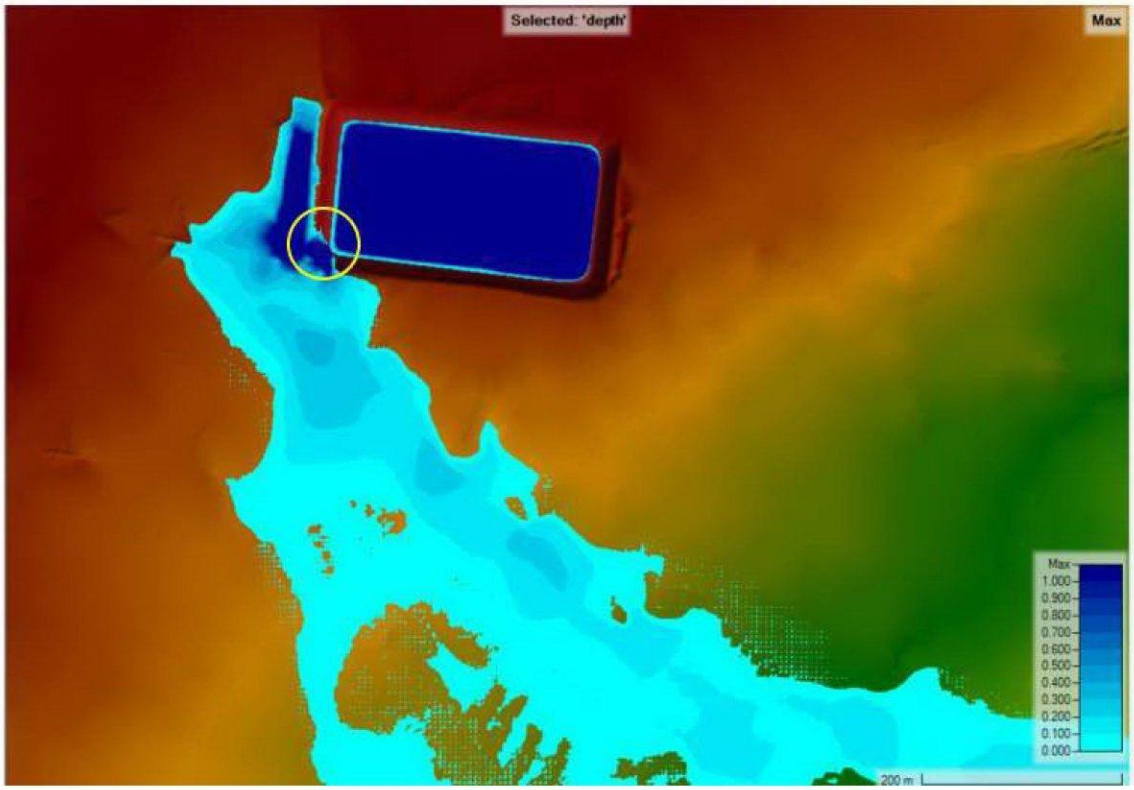
c) author of a Dam Safety Review, dated 30 January 2021.

31. Mr Farazmand spoke to documents that comprised the Application and the Applicant's response to the Panel's Request for Further Information, annexed as Schedule 1. His oral evidence included the following.

a) test results from surrounding bore logs showed no indication that the Private Dam was leaking;

b) modelling Mr Arash Parehkar had undertaken showed that following a failure at the south-west corner of the Private Dam, at a 12m operating level, water proximate to the rear of the residential properties might be deeper than one metre;

Figure 1 - Location of Breach for Operating Level of 12mAHD and Maximum Flood Level



c) in this scenario one dwelling might experience a high volume of water with consequential possibility of human harm;

d) if the Private Dam failed there may be the "inconvenience" of 100mm of water impacting on surrounding properties, but certainly "less than $10 million" of property damage;

e) he recommended that the grass surrounding the Private Dam be kept short so that water seepage or other structural issues might be more apparent; and

f) he also placed weight on the fact that there would be a supervisor on site regularly inspecting the Private Dam and surroundings, if not daily.

ANALYSIS

The information known about the construction of the Private Dam is limited

32. The original design and construction practices for the dam are poorly documented save that we understand that the Private Dam was constructed using scrapers and a dozer and with "good" compaction.[3]

33. The design and construction practices are likely to have been based on the structure, being a farm dam, with low consequences of failure and no potential for loss of life if it did fail.

34. Consequently, there is no evidence of compaction testing being carried out during the original construction of the Private Dam.

35. Past geotechnical investigations of the Private Dam did not include compaction testing of the earth fill materials.[4] There is evidence of variable compaction of earth fill materials from the investigations based on the Standard Penetration Test blow count and variable moisture content of earth fill materials.[5]

There is little information about the modifications since made to the Private Dam

36. There have been modifications to the Private Dam throughout the course of its history, including the installation of pipes through the dam wall.

37. This installation is not recorded, but is likely to have involved excavating a trench through the dam embankment, placing the pipe in the base of the trench and then backfilling with the excavated material. This is partly based on the observation of poor compaction of earth fill around the desalination plant pipe.[6]

38. If correct, the installation of pipes through the dam embankment may have resulted in poor compaction of earth fill both around the pipes and in the trench above the pipe.

39. There are no records of modifications to the Private Dam or accurate locations of the pipework. There is, therefore, the possibility of old pipework or other structural weaknesses or defects that remain hidden and undetected.

40. The "sump pipe" passes through the western embankment at an elevation below the proposed storage water level of RL12 m. There is no information available on the condition of the earth fill surrounding the "sump pipe" and there is no filter protection around the pipe[7].

41. The Panel is concerned that this represents a potential location for internal erosion through the embankment.

42. In summary, the original design and construction practices for the dam are not consistent with those that would be used to construct a dam where there is the potential for loss of

---

3 State Rivers and Water Supply Commission inspection letter January 1987.

4 AGT Dam Safety Review 30 January 2021 (Section 6).

5 Hunter Geotechnical, Dam at 1075 Horseshoe Bend Road, Torquay, 10 December 2020 (Section 3.0).

6 Hunter Geotechnical, Dam at 1075 Horseshoe Bend Road, Torquay, 8 October 2020 (Section 4.1).

7 AGT Dam Safety Review 30 January 2021 (Section 9.2.2).

life if the dam were to fail. There are uncertainties in the knowledge of the Private Dam's structure, reducing confidence in its long-term and safe operation.

The historical performance of the Private Dam

43. There is no evidence of seepage areas through the dam embankment or its foundation. Monitoring records indicate that the groundwater levels at the downstream (outer) toe of the embankment are lower than 3m below natural ground level.[8]

44. The inner faces and outer faces of the embankment appear to have generally performed well. There is evidence of slumping on the eastern embankment upstream slope and bulges in the waterline, together with tension cracking at the crest at two locations on the eastern bank.[9]

45. This suggests localised movements have occurred to the upstream slope of the embankment. Sliding of the upstream slope is unlikely to represent a credible dam failure mode for the lowered storage level condition due to the width of the dam crest and the distance the water level is below the dam crest.

46. The Panel has heard that the October 2020 pipe leakage incident was caused by leakage through a disused pipe that had not been adequately sealed when the former desalination plant was decommissioned. The works to cap the desalination pipe and lower the storage level, effectively eliminates the re-occurrence of leakage through the pipe.

47. However, there is uncertainty whether there are other hidden or undetected pipes may still exist below the storage level which could lead to a similar incident in the future.

48. The Private Dam appears to have performed adequately to date as a water retaining structure. However, the satisfactory performance of the dam to date, does not necessarily indicate that the Private Dam is safe.

49. There are potential mechanisms whereby deterioration, long term deformation of the embankment and changes in seepage conditions within the embankment or its foundation could adversely impact on dam safety. There are inherent uncertainties in predicting the safe operation of a pre-existing dam which was designed and constructed as a farm dam. These typically do not have the same engineering controls—such as compaction control and testing, foundation preparation and treatment, and embankment filters—that would normally be included in a dam where there is the potential for loss of life if the dam were to fail.

The risk presently posed by the Private Dam

50. The assessed Consequence Category for the dam with the water storage level at RL12m is High C. This assessment was based on an estimated Population at Risk in the order of 10 to 100 and a severity level of Minor.[10]

---

8 Evidence by Mr Farazmand.

9 Hunter Geotechnical, Dam at 1075 Horseshow Bend Road, Torquay, 8 October 2020 (Section 4.4).

10 Additional information presented to the Hearing, ANCOLD Consequence Categories Rev 2.

51. The ground levels along the rear fence of the houses on Pintail Drive are at RL9.5m to RL10.3m.[11] With storage level maintained at RL12m, the dam wall would retain 1.7m to 2.5m depth of water above natural ground level. This represents the depth of water that could be released if the dam were to fail.

52. If a dam failure (breach) were to occur in the western bank or the south-western corner bank, then water would be expected to flow towards the south, initially through the properties located on Pintail Drive and The Zeally Sands development.

53. Dam break modelling for the scenario where the dam is assumed to fail at the south-western corner with storage water level at RL12m found the estimated depth and velocity of flows do have the potential to cause life loss within the properties immediately below the dam.

54. The estimated loss of life for the south-west corner failure scenario is in the range of 1 to 5.[12] The flows resulting from dam failure beyond those properties is estimated to be less than 0.3m deep. Flows of this depth would not pose a risk to life, but would be capable of causing damage to property and infrastructure. The estimated number of properties that could potentially be affected by dam failure outflows is in the range of 300 to 400.[13]

Would the proposed works make the Private Dam safe?

55. The key consideration for the Panel is whether the proposed modification works in the Application would make the dam safe based on the evidence provided. There are two possible approaches for evaluating the safety of existing dams where there is the potential for loss of life if the dam were to fail:

    a) a Standards Based Assessment — considering whether the dam complies with good industry practice, represented by ANCOLD Guidelines, international design standards and published literature; and

    b) a Risk Based Assessment — considering whether the risks posed by the dam are tolerable as defined by the ANCOLD Guidelines on Risk Assessment (ANCOLD 2003) tolerable risk criteria.

56. The ANCOLD Guidelines on Risk Assessment (**ANCOLD 2003**) state either approach can be used to assess whether a dam is safe.

57. The Private Dam as proposed in the Application has been demonstrated to meet most Standards Based Assessment acceptance criteria, but not all. The Private Dam would not be consistent with good industry practice for a dam with a High C Consequence Category for the following reasons:

    a) inadequate controls for spillway discharge, due to potential for blockage of the spillway pipe;

    b) inadequate internal erosion controls for the embankment, in terms of the level of compaction of earth fill and no filter protection;

---

11 Survey plan provided by the Applicant in Panel Hearing.

12 Applicant's response to Panel Hearing request for information (Item 15-e-4).

13 Evidence by Mr Farazmand.

c) inadequate internal erosion controls for the "sump pipe" that penetrates through the western embankment, in terms of the degree of compaction of earth fill around the pipe and no filter protection;

d) trees located on the embankment and proximity of trees to the downstream toe of the eastern embankment; and

e) inadequate internal erosion controls for the proposed spillway pipe, in terms of no filter protection around the pipe and unreliable method of sealing around the outside of the pipe.

58. Reducing the operating level of the storage and installing a spillway, as proposed in the Application, would reduce the dam safety risks posed by the Private Dam. The reduction in risk would be achieved by a combination of:

a) reduced potential for loss of life if the Private Dam to fail; and

b) reduced probability of the embankment failing.

59. A detailed risk assessment has not been completed for the proposed dam configuration. The assessment that has been completed only considers the RL14m water storage level configuration.[14] This assessment indicated the risks posed by the dam plot within the "unacceptable" region of the ANCOLD risk criteria[15].

60. The Application and supporting documents have not provided sufficient detail or justification to assess whether the proposed modifications to the dam would satisfy ANCOLD Risk Guidelines for societal and individual risk, nor demonstration that risks have been reduced to be As Low As Reasonably Practicable (**ALARP**).

61. There is inherent uncertainty in evaluating the level of risk for this dam as it was originally constructed as a farm dam, and as such, there are minimal records of design or construction, and no records of subsequent modifications to the dam.

62. In the opinion of the Panel, a detailed risk assessment and ALARP assessment would likely show that additional engineering controls would be required to achieve a tolerable level of risk for a storage water level of RL12m. This would likely comprise modified spillway arrangement, filter protection around all pipe penetrations, filter protection for the embankments which pose a risk to life and property if they were to fail, and removal of trees and tree roots from the embankment.

CONCLUSION

63. In conclusion, there is insufficient information provided in the Application, supporting documents and evidence from the Panel Hearing to assess whether the proposed modifications to the Private Dam would satisfy the ANCOLD Guidelines.

64. Due to its uncertain provenance and history, the Private Dam does not have the engineering controls to achieve a tolerable level of risk. To incorporate such engineering

---

14 AGT Dam Safety Review 30 January 2021.

15 ANCOLD Chart submitted by the Applicant in the Panel Hearing.

controls into this dam would involve considerable expense and may possibly cost as much as it would to build a new dam.

65. In the absence of a defensible demonstration of dam safety, the Panel concludes the risk to life and property should be eliminated by modifying the dam such that the storage water level is not able to rise above the natural ground level. The ground level at the north-west corner of the dam is RL 9.5 m. Water would be stored within the storage below ground level, but the dam walls would not retain water. This means the walls of the Private Dam would not be capable of failing and releasing stored water downstream.

66. The most reliable method for reducing the storage water level to RL9.5m would be to remove a portion of the eastern dam wall (with a base width of at least 5m) down to RL 9.5m, and to provide a collection drain to convey water away from downstream properties if the storage pumps are accidently left running.

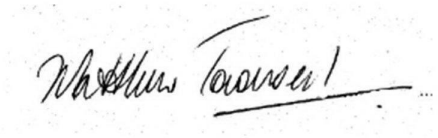
RECOMMENDATIONS

67. The Panel recommend that the Application be approved with the following conditions:

a) the storage water level of the Private Dam be reduced to ground level (RL9.5m) to eliminate the risk of dam failure to the properties and occupiers along Pintail Drive;

b) achieve the design intent in a) by removing a portion of the eastern dam wall (with a base width of at least 5m) down to RL 9.5m, and provide a collection drain to convey water away from downstream properties if the storage pumps are accidently left running; and

c) the relocation of pipework and pumps, or construction of diversion bunds, such that surface water flows from ruptured pipework or pump system does not impact on neighbouring properties.



Matthew Townsend, Independent Panel Member & Chair

Dr Mark Foster, Independent Panel Member

30 September 2021

Response to Report Comments

Project: Santospirito Torquay Dam
Revision:
Date:
Reviewers: **Responder:** Amir Farazmand (AGT)

Peer Review				Consultant Response			Comment on response		
Item	Item	Comment Date	Peer Review Comment	Responder's Name	Response/Action for Resolution	Date	Comment	Date	Closed (Y/N)
1	15-a-3	12-Aug-21	Measurements of depth of the dam below water level	Amir	The depth is estimated based on the historical dam drawing indicating 3m excavation into natural ground	09-Aug-21			
2	15-a-4	12-Aug-21	Measured groundwater levels in the standpipe piezometers since they were installed.	Amir	Link to OnsDrive folder provided includes also daily inspection sheet (reduced intervals after first 6 months to weekly)	30-Jan-21			
3	15-b-2	12-Aug-21	elevation of "sump pipe" relative to		Elevation to be surveyed.				
4	15-b-3	12-Aug-21	pipe material and diameter of the		PVC pipe 150mm				
5	15-b-4	12-Aug-21	internal condition of "sump pipe"		This pipe is currently blocked at both ends and not visible				
6	15-b-5	12-Aug-21	Any other old or disused pipes		No other pipes was observed during two visits and confirmed by the client.				
7	15-c-1	12-Aug-21	basis for selecting the reduced Full		Based on the results of Dam break model and as agreed with the SRW engineers				
8	15-c-2	12-Aug-21	hydraulic calculations to determine the proposed pipe diameter		Spreadsheet provided, please note the dam has no natural catchment and spillway is only to cope with pumped water of 25 Lit/sec				
9	15-c-3	12-Aug-21	consideration given to potential		Carry out inspection of the pipe prior to starting the pump. If the start is automated, provide a low point on				
10	15-c-4	12-Aug-21	method of drilling proposed and the		Only auger drilling has been or will be undertaken. There is no rock in the foundation requiring air or				
11	15-c-5	12-Aug-21	mitigate the potential for internal		The standpipe is installed above the reservoir level and therefore no seepage is expected unless for very				
12	15-d-1-a	12-Aug-21	output plots for the EL 12 metres		Output and Hec-Ras Model are provided.				
13	15-d-1-b	12-Aug-21	HEC-RAS model output files		Results are provided now for RL14, and RL12 with two breach cases (in 20min and in 1min).				
14	15-d-2-a	12-Aug-21	breach modelling for the EL 12 if the		This is modelled for RL12 breach case for the breach occurs in the southwest coroner behind Pintail				
15	15-d-2-b	12-Aug-21	details of the sensitivity of the		3 cases of breach modelling are currently carried out for RL14 and RL12 and the results seem to be				
16	15-d-2-c	12-Aug-21	details of the number of properties		The dam break model shows the extent of the properties being flooded for the RL14 report. These are				
17	15-d-2-d	12-Aug-21	Predicted depth and velocity of water		The output is provided for various times after the breach.				
18	15-e-1	12-Aug-21	level of risk for the EL 12 metres		The dam break model shows the risk is significantly low with the flood level for the area being mostly less				
19	15-e-2	12-Aug-21	historic performance method for		In addition to historic performance Emerson class test is carried out to assess the piping potential.				
20	15-e-3	12-Aug-21	further details about the risk assessment (currently only quantifies piping failure)		"Dam Safety Review Report No: AGTE20249-3 Rev1" and also "AGTE17463 The Dunes Torquay - 1075 Horseshoe Bend Road, Torquay" include piping, flooding, slope stability and liquefaction risks. Nevertheless, considering the type of the dam and its geometry, piping is the main risk to be considered as the other risks even though assessed are significantly low.				
21	15-e-4	12-Aug-21	Basis for the estimated potential life		Various methods such as USBR and UNICIV reports (University of NSW) was considered for estimating				
22	15-e-5	12-Aug-21	Risk assessment (Section 9 .2.2,		As part of the risk assessment for the dam the societal risk can be assessed and communicated with the				
23	15-e-6	12-Aug-21	Consequence Category for the dam		This is now carried out for RL12. We believe the new hazard category is "Significant".				

Supplied Documentation			
Ref No.	Title	Author	Date
AGTE20249	The Dunes Dam Torquay	AGT	09-Oct-20
AGTE20249-1	The Dunes Dam Torquay	AGT	21-Oct-20
AGTE20249-2	DSEP Torquay Farm Dam	AGT	30-Nov-20
AGTE20249-3	Torquay Farm Dam Safety Review	AGT	27-Nov-20
AGTE20249-4	Torquay Farm Dam - Dam Break	AGT	26-Nov-20
AGTE20249-3	AGTE20249-3 Torquay Farm Dam	AGT	30-Jan-21
AGT20249-2	DSEP Simplified AGTE20249-2	AGT	09-Jul-21