

Orange City Council

Suma Park Dam Upgrade

Concept Design

Dam Safety Risk Management
Workshop

14 September 2012

Suma Park Dam Upgrade - Concept Design

AGENDA

- Background
- Project Brief
- Concept Design
- Conclusions
- Questions



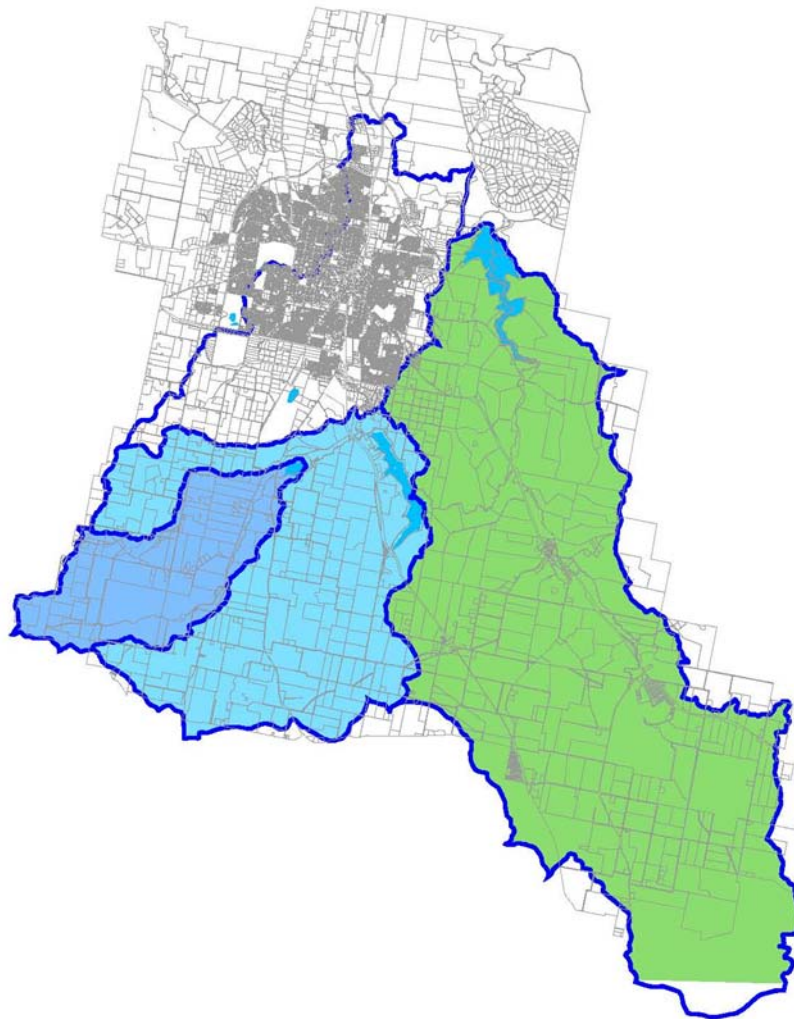
Acknowledgements

- Consultant – Entura
 - Paul Southcott
 - Tim Griggs

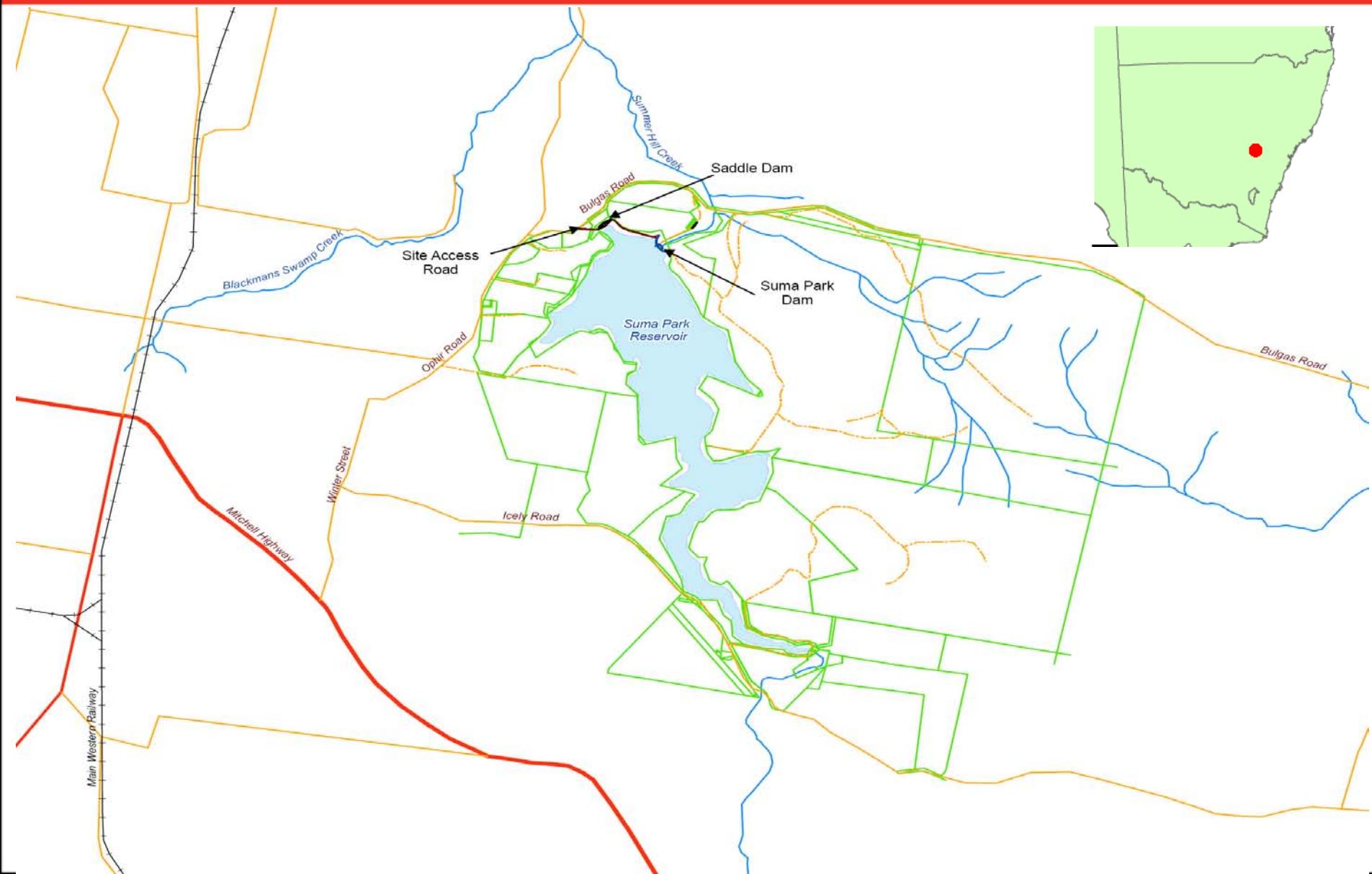
Background

- Catchment details
 - Gosling Creek Dam
 - Spring Creek Dam
 - Suma Park Dam

Area 179 square kilometres



Background





Background



Main Dam



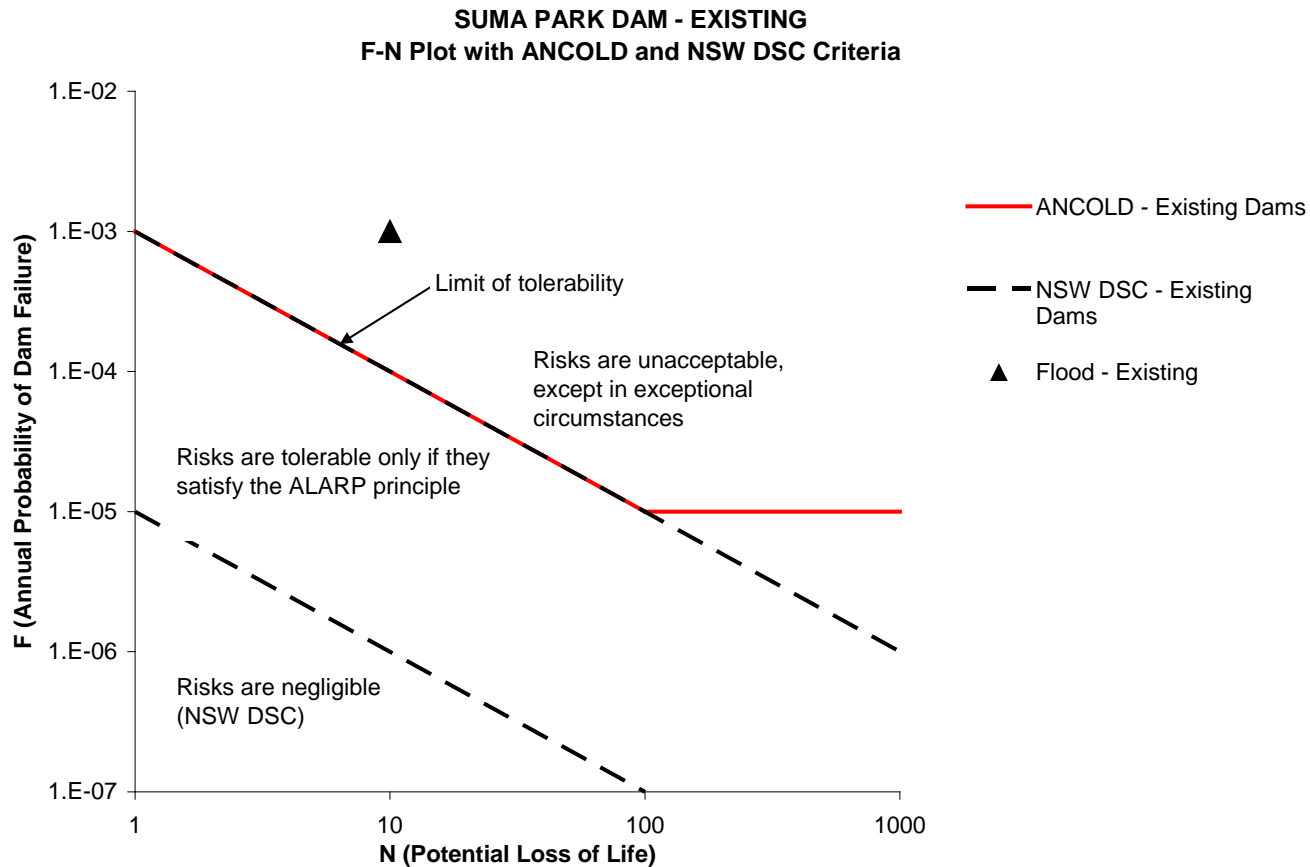
Saddle Dam

Background

- An assessment of the current risk position of the dam has been undertaken.
- The spillway capacity of Suma Park Dam does not meet standards recommended by the NSW Dam Safety Committee (NSW DSC) and the Australian National Committee on Large Dams (ANCOLD) and therefore an upgrade to the dam is planned.

Background

CURRENT RISK POSITION



Project Brief

- Orange City Council engaged Entura in December 2010 for the concept, detailed design and documentation for upgrading Suma Park Dam.
- The engagement is in two parts and consists of:
 - Development of a full Concept Design for the staged upgrading of Suma Park Dam;
 - Stage 1 to achieve appropriate capacity within the dam to safely pass the 1:1M AEP flood (originally was 1:100,000 AEP flood); and
 - Stage 2 to achieve a Negligible Risk level with regard to dam safety.
 - Detailed Design and documentation for Stage 1 upgrading of the dam.

Concept Design

- Preliminary Concept Design
- Hydrology Review
- Geology & Geotechnical
- Main Dam
- Auxiliary Spillway
- Cost Estimate
- Summary of Staged Reduction of Risk
- Construction Program

Preliminary Concept Design

- Undertaken as part of tender for design
- Based on Previous Hydrology Study
- Options for Flood Upgrade Considered:
 - Auxiliary Spillway at Saddle Dam Location
 - Fuse Plug
 - Fuse gates
 - Raise non-overflow sections of main dam
 - Increase width of spillway of main dam
 - Fuse gates at main dam
- Need for Seismic Upgrade Considered



Preliminary Concept Design

PREFERRED UPGRADE

Stage	Details
Stage 1A <i>Main Dam Raising</i>	2.3m raising of the concrete arch dam abutments. This provides an initial reduction in the risk of flood failure and is required to ensure that the Stage 1B fuse plug auxiliary spillway does not initiate until the 1:500 AEP event.
Stage 1B <i>Auxiliary Spillway</i>	Fuse plug auxiliary spillway at saddle dam. 3 bays with stepped design to minimise excavation. Initial bay failure at 1:500 AEP event would not result in loss of storage. In conjunction with Stage 1A allows safe passage of the 1:100,000 AEP flood.
Stage 2A <i>Main Dam Fuse Gates</i>	Fuse gates on concrete arch dam spillway. Lower spillway crest and replace with fuse gates to maintain current full supply level. In conjunction with Stage 1A and Stage 1B will reduce flood risk to a Negligible level.
Stage 2B <i>Seismic upgrade</i>	Seismic upgrade (if required). The current seismic risk position is most likely to be overstated and requires confirmation before a conceptual design can be finalised.

Hydrology Review

- As an input to the Concept Design a hydrology review (July 2011) was undertaken
- The outcome of the hydrology review was that the preliminary concept design for the Stage 1 upgrade to pass the 1:100,000 AEP flood was now able to pass the 1:1M AEP flood.

Geology and Geotechnical

- The results of the previous geotechnical investigations were combined with the additional investigations to provide:
 - Geotechnical parameters for the concept design (provided in the concept design report)
 - Assessment of potential foundation failure modes
 - Analysis of these failure modes indicated all had an adequate factor of safety.

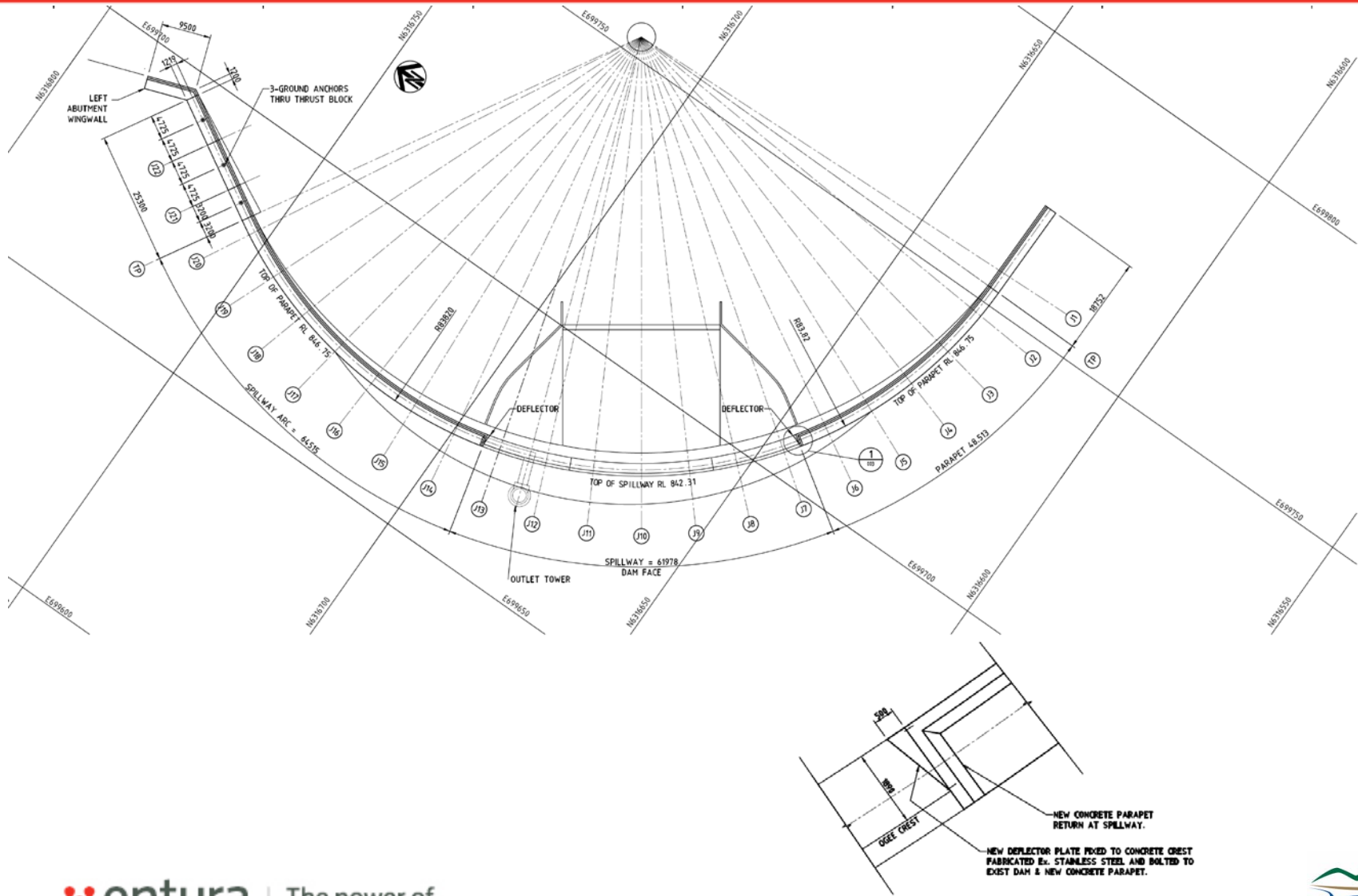
Main Dam

- Upgrades to the main dam considered in the concept design were:
 - Stage 1A Upgrade – Main Dam Raising
 - Stage 2 Upgrade – Seismic

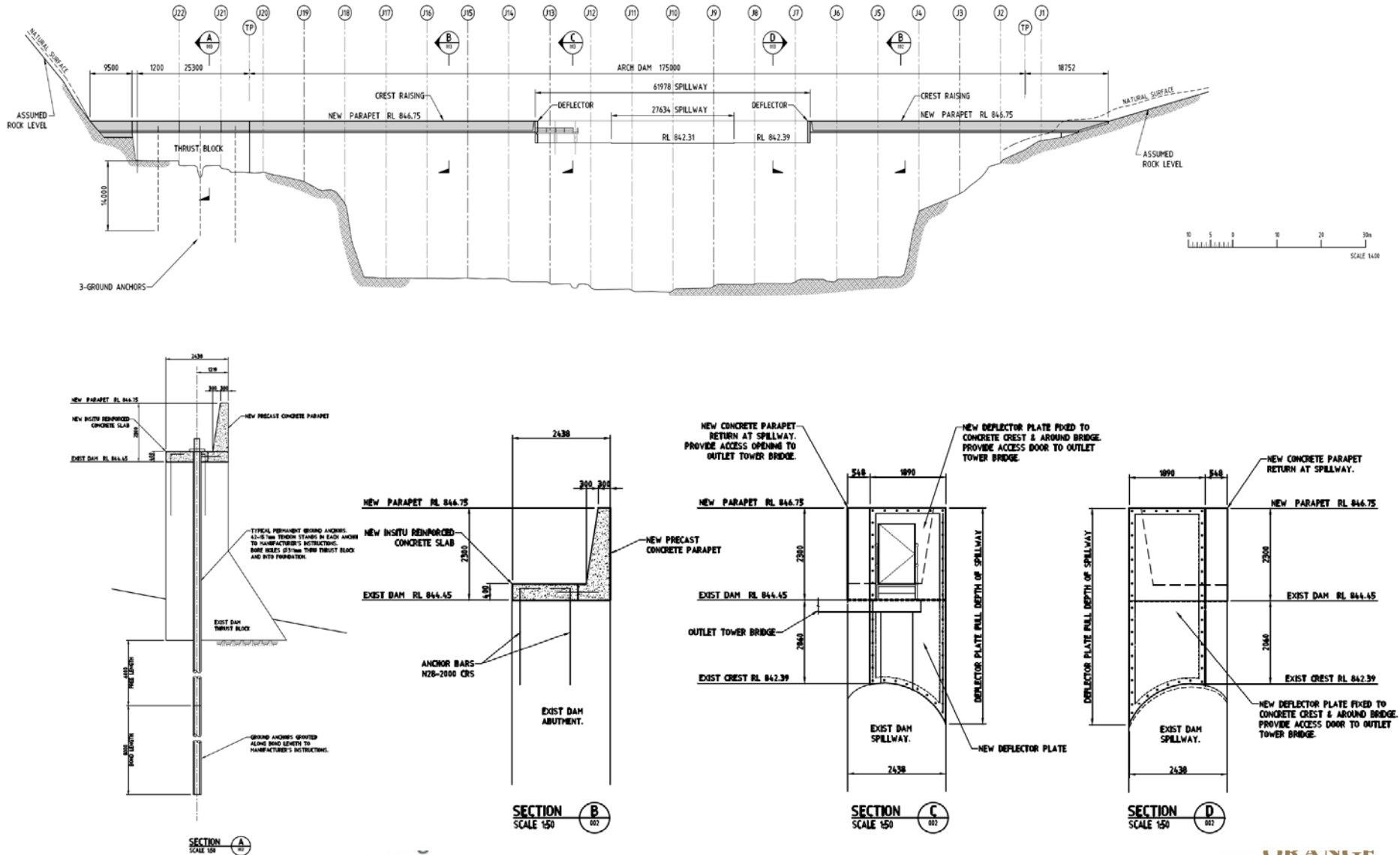
Stage 1A: Main Dam Raising

- Key points of the Stage 1A Upgrade design are summarised below:
 - Hydraulic analysis
 - Structural analysis (FEA)

Stage 1A: Main Dam Raising



Stage 1A: Main Dam Raising



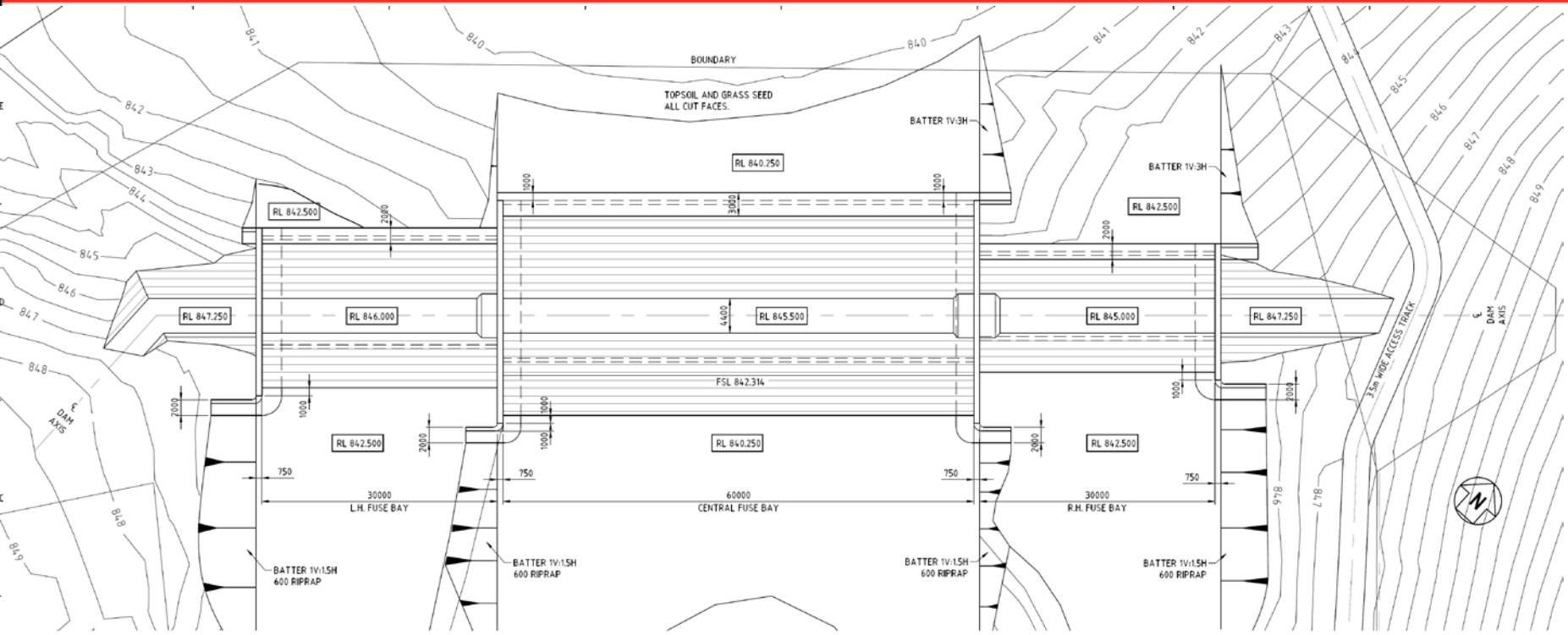
Stage 2: Seismic

- The finite element model developed for the Stage 1A upgrade was also used to assess the requirement for a Stage 2 upgrade (for earthquake loading).
- The outcome of the analysis was the dam was stable post-earthquake and no seismic upgrade is warranted.

Auxiliary Spillway

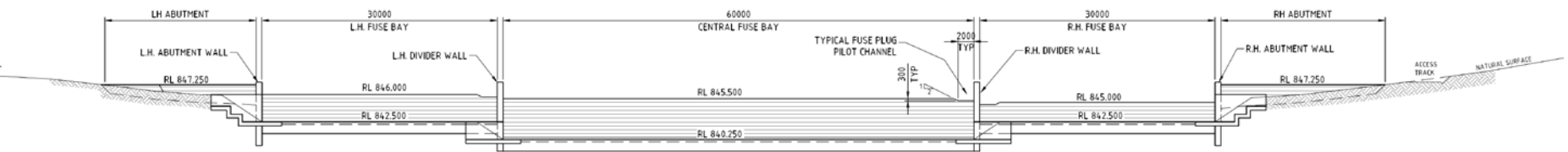
- Upgrades at the saddle dam area considered in the concept design where:
 - Stage 1B – Auxiliary Spillway
 - Preliminary concept design for fuse plug spillway was progressed to a full concept design.
 - Alternative option of fuse gates was re-considered at a preliminary level.

Stage 1B – Auxiliary Spillway – Fuse Plug Option

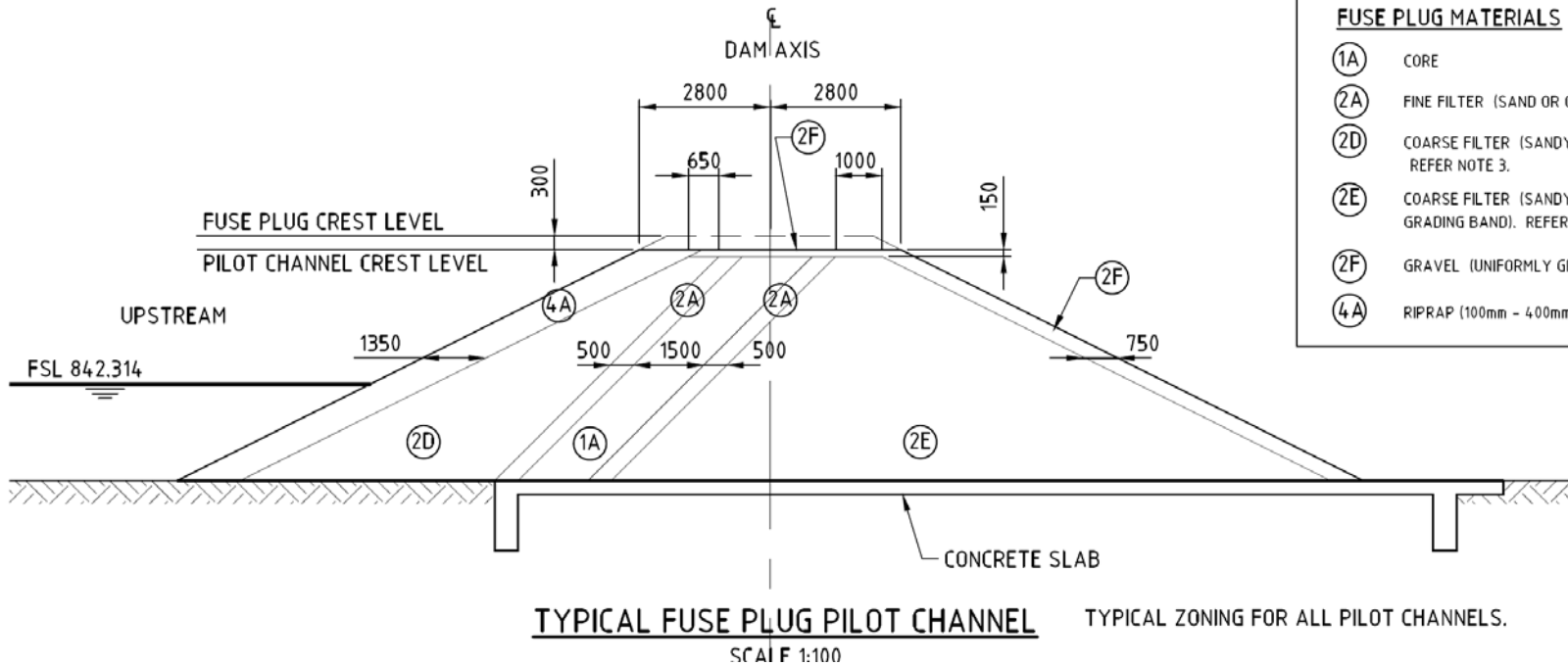


AUXILIARY SPILLWAY - PLAN
SCALE 1:250

TO SUMA PARK DAM



Stage 1B – Auxiliary Spillway – Fuse Plug Option



FUSE PLUG MATERIALS

- ①A CORE
- ②A FINE FILTER (SAND OR GRAVELLY SAND). REFER NOTE 3.
- ②D COARSE FILTER (SANDY GRAVEL, WIDE GRADING BAND). REFER NOTE 3.
- ②E COARSE FILTER (SANDY GRAVEL OR GRAVEL, NARROW GRADING BAND). REFER TO NOTE 3.
- ②F GRAVEL (UNIFORMLY GRADED 19mm TO 37.5mm).
- ④A RIPRAP (100mm - 400mm, D₅₀ = 250mm).

Stage 1B – Auxiliary Spillway – Fuse Gate Option



Fuse gate option footprint compared to fuse plug option

Cost Estimates

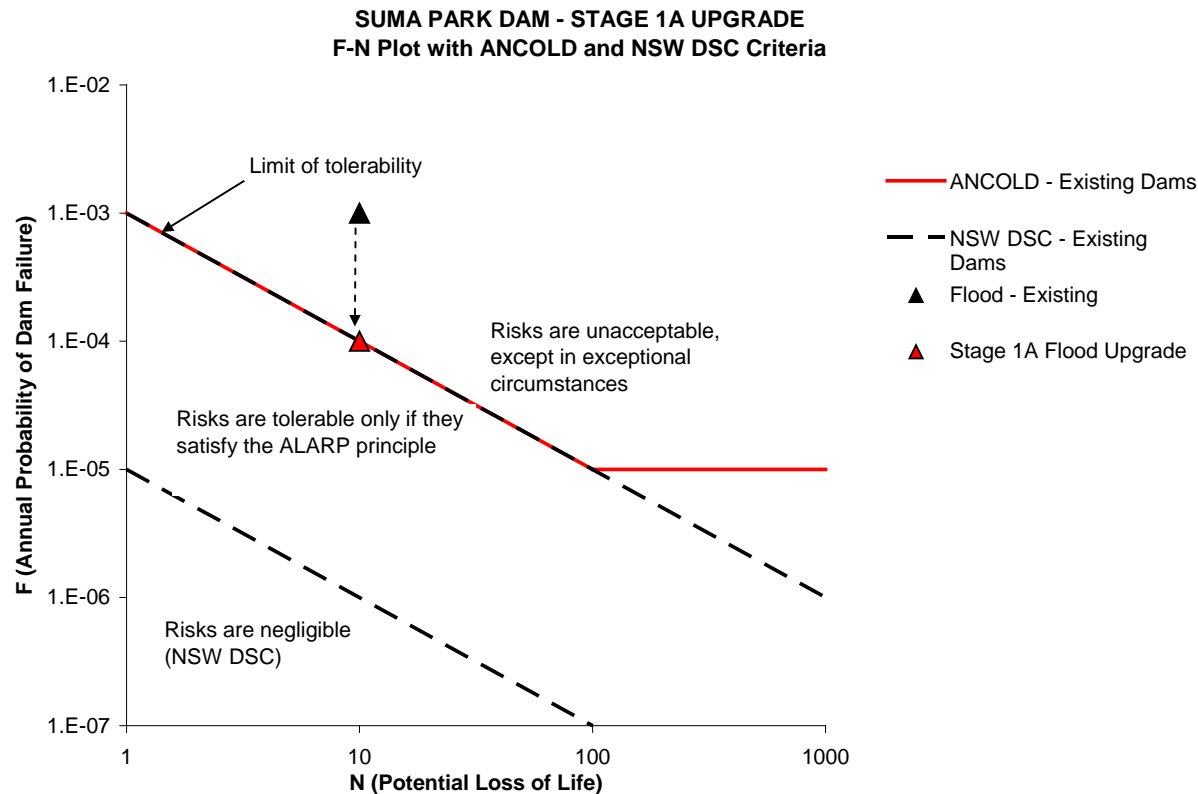
- Construction cost estimates were developed for the Stage 1A and Stage 1B upgrades.

Stage	Description	Estimated Cost
Stage 1A	Main Dam Raising	\$ 2.70 M
Stage 1B	Auxiliary Spillway – Fuse Plug Option	\$ 5.40 M
	Auxiliary Spillway – Fuse Gate Option	\$ 5.45 M

- As the auxiliary spillway options are of similar cost it is recommended that they be developed further in the detailed design stage to select a preferred option.
- Estimates indicative only (May 2011)

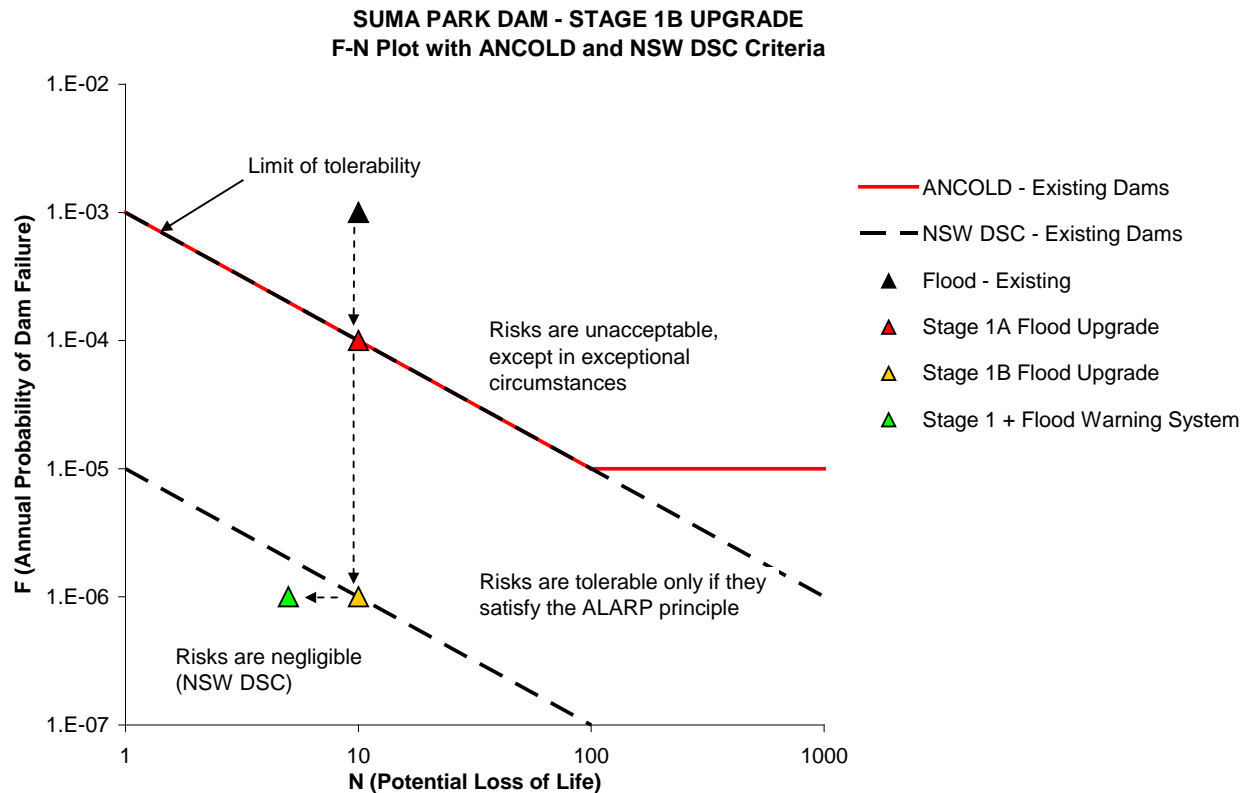
Summary of Staged Risk Reduction

- Stage 1A upgrade reduces the probability of overtopping the abutments to 1:10,000 AEP (not considering possible saddle dam failure).



Summary of Staged Risk Reduction

- Stage 1B upgrade reduces the probability of overtopping the abutments to 1:1M AEP.
- An effective flood warning system (to be developed by Council) further reduces risk to a Negligible level.



Conclusions

- An upgrade consisting of raising the main dam abutments in conjunction with an auxiliary spillway at the saddle dam location will allow Suma Park Dam to be upgraded to a Negligible risk level.
- A concept design has been developed for a staged upgrade that provides flexibility in terms of timing, capital allocation and contractor selection.
- Alternative options for the auxiliary spillway upgrade (fuse plugs or fuse gates) are recommended to be developed further in the detailed design stage to select a preferred option.
- A seismic upgrade of Suma Park Dam is not considered to be warranted.

Other issues

- Options assessment for raising FSL 1m or 2m including revised cost estimates (June 2011)
- Report to Council (November 2011)
- Project re-scoped for raising FSL
- Impact of raising dam on secure yield required to be assessed given that licence conditions may be modified and additional environmental flows from the dam may be required
- Eflows study commenced January 2012. Final report due 28 September 2012 after which Council will decide on whether to raise or not raise FSL

Program

- Eflows Study September 2012
- Assuming Council decision is to raise spillway 1 metre
 - Concept design December 2012
 - Environmental approvals (including land acquisitions) April 2013
 - Detailed Design and contract documents May 2013

Questions