Waimea Community Dam
TDC Council

25 June 2020

Waimea Water

Agenda

1. Covid-19 impact
2. Funding and expenditure
3. Expenditure and progress
4. Safety
5. Environmental
6. Rockfill: The geology challenge
7. Design update
8. Construction update (video)
9. Questions

Meet the WWL Team

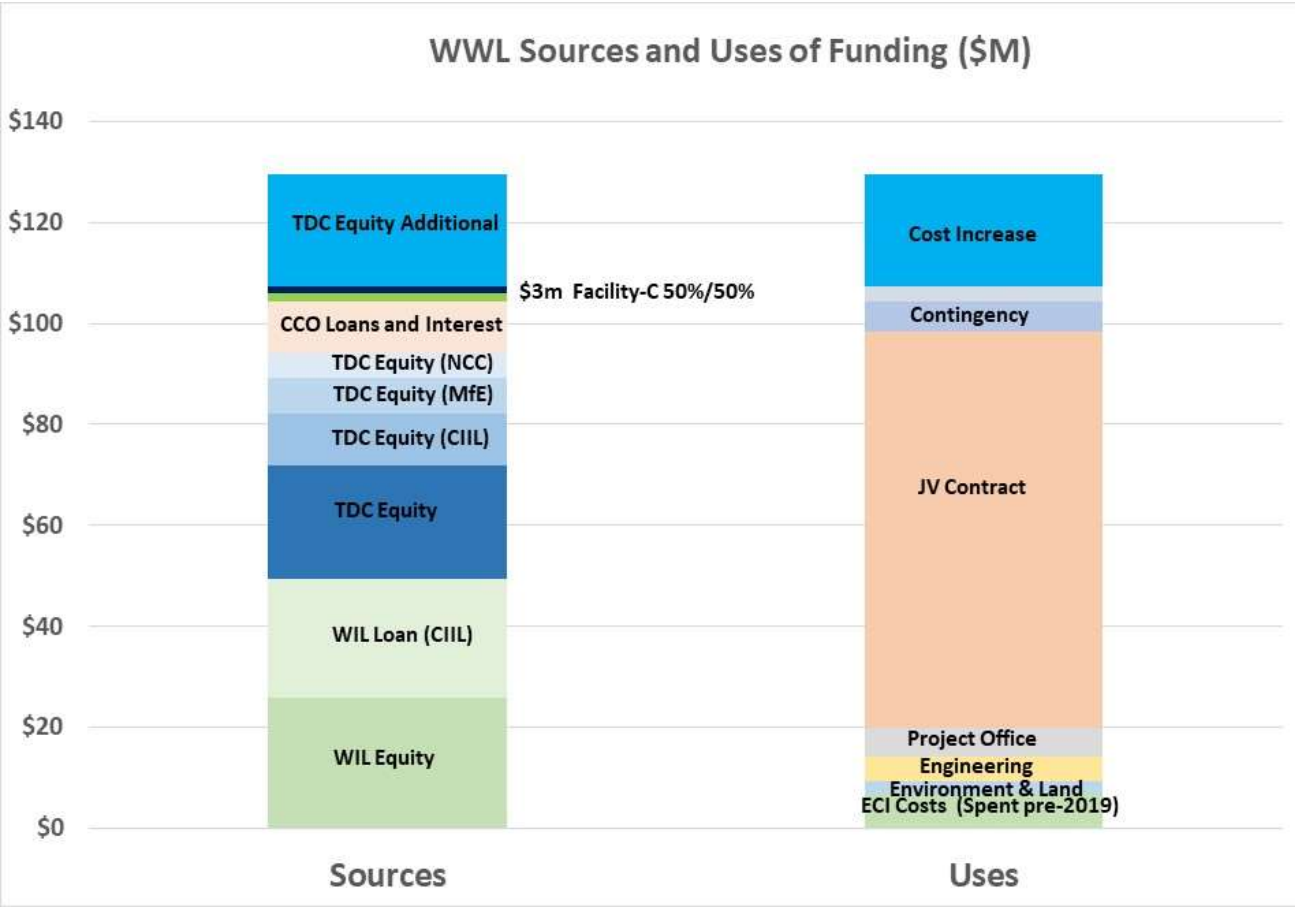
• Designer (PS-1, PS-4)	Damwatch Engineering
• Reviewer (PS-2)	GHD Engineering
• Engineer to Contract	Stantec
• Contractor (PS-3)	Fulton Hogan Taylors
• Quantity Surveyor	Rawlinsons
• Contract Law	Anderson Lloyd
• Programme	CCCL
• Safety	Impac; Intesafety
• Accountant	Findex
• Banker	ANZ
• Auditor	Audit NZ

COVID-19

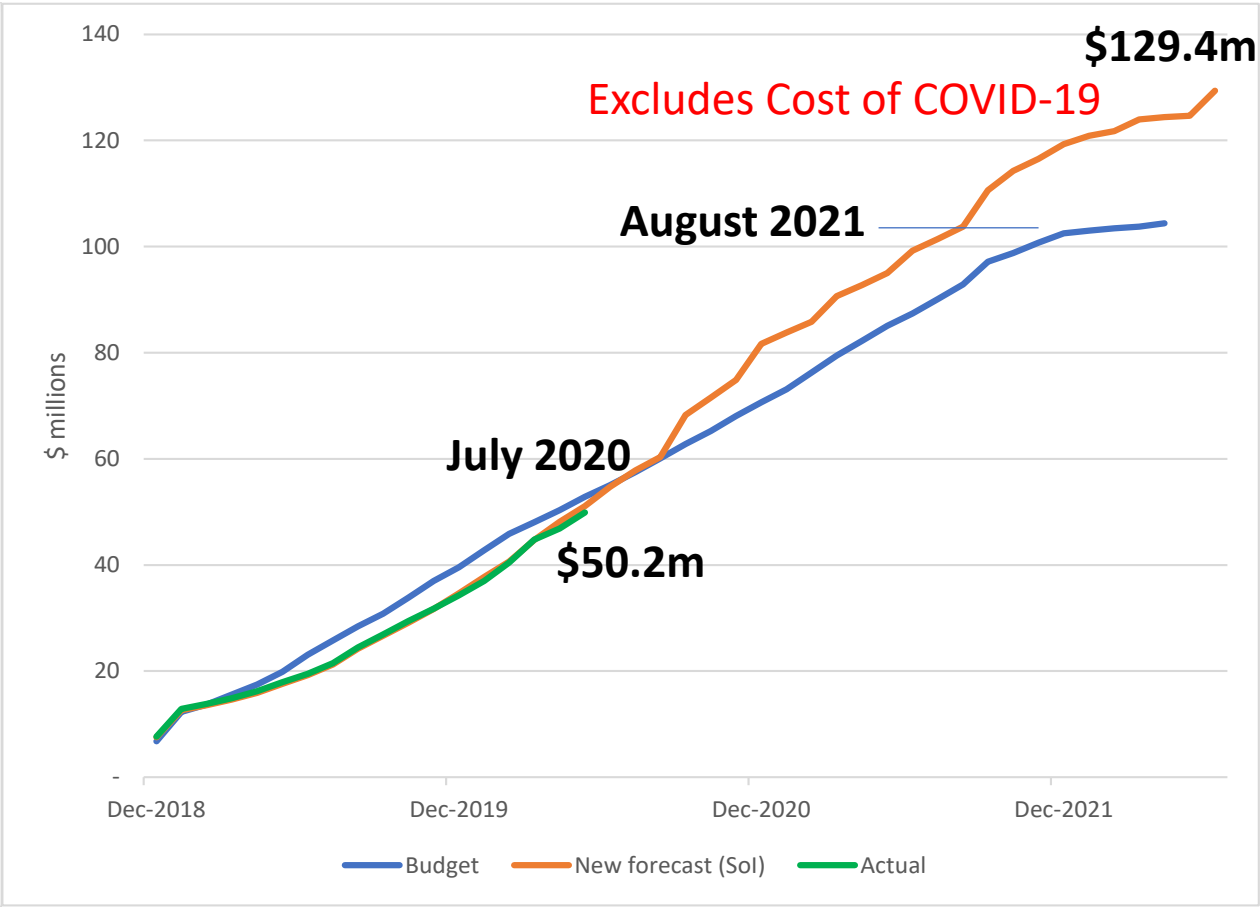
- WWL incurs cost of 5-week Suspension and further delay *(no Force Majeure provision in NZ3910)*
  - Further week delay to remobilize and implement facilities
  - Not covered by insurance
- Productivity impacted on resumption with level-3 / level-2 protocols
  - NZ Construction Industry Standards
- Supply chain constrained and likely to slow project: Spares, parts, equipment
  - Uncertain how international supply chain recovers
- Cost of suspension and recovery to yet be determined
  - Looking to NZ Construction Industry. No precedents
- Impact of COVID-19 to be determined during 2020/21 year per Final SOI

Funding and expenditure: 31 May 2020

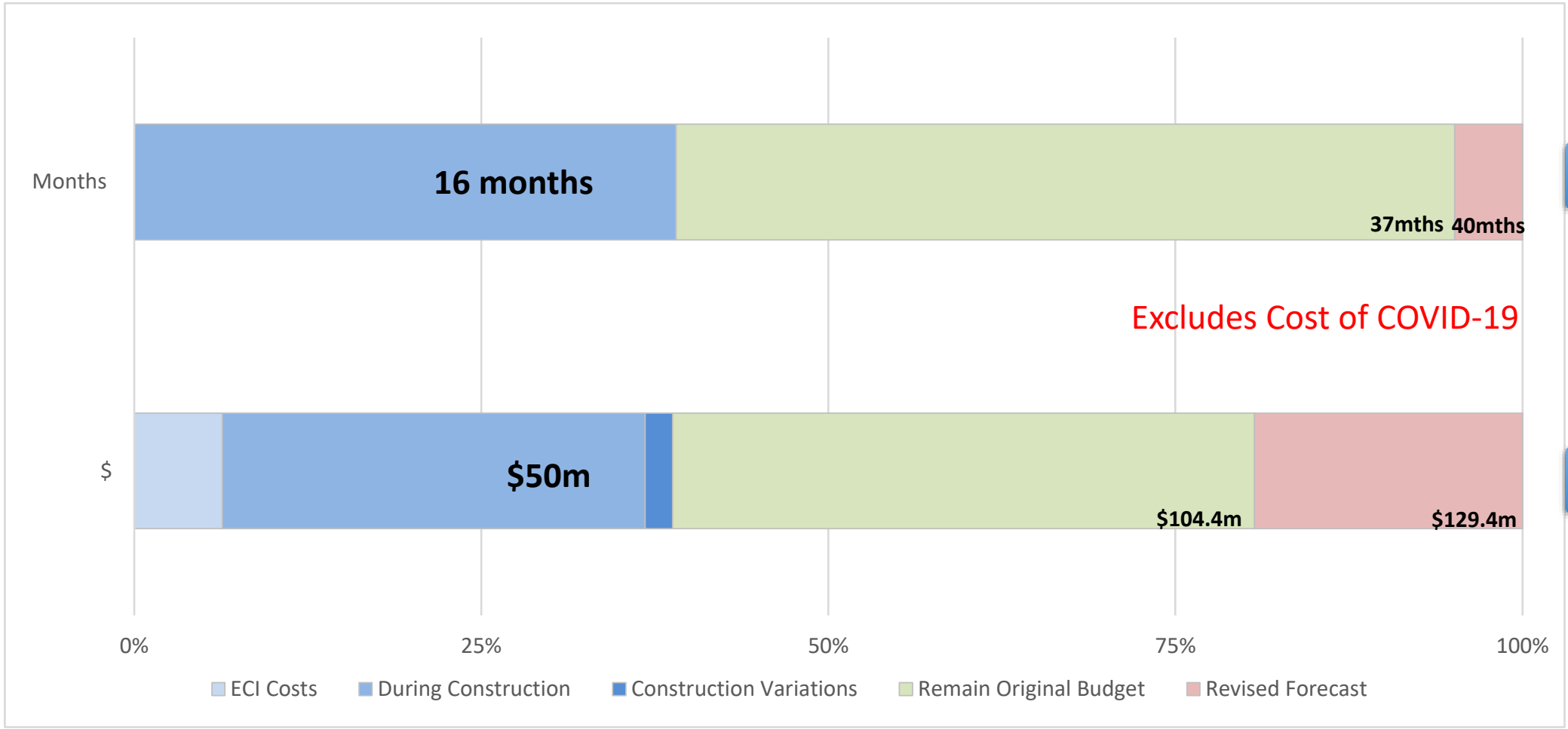
Funding and Spend



Forecast cost & schedule to complete



Expenditure and progress



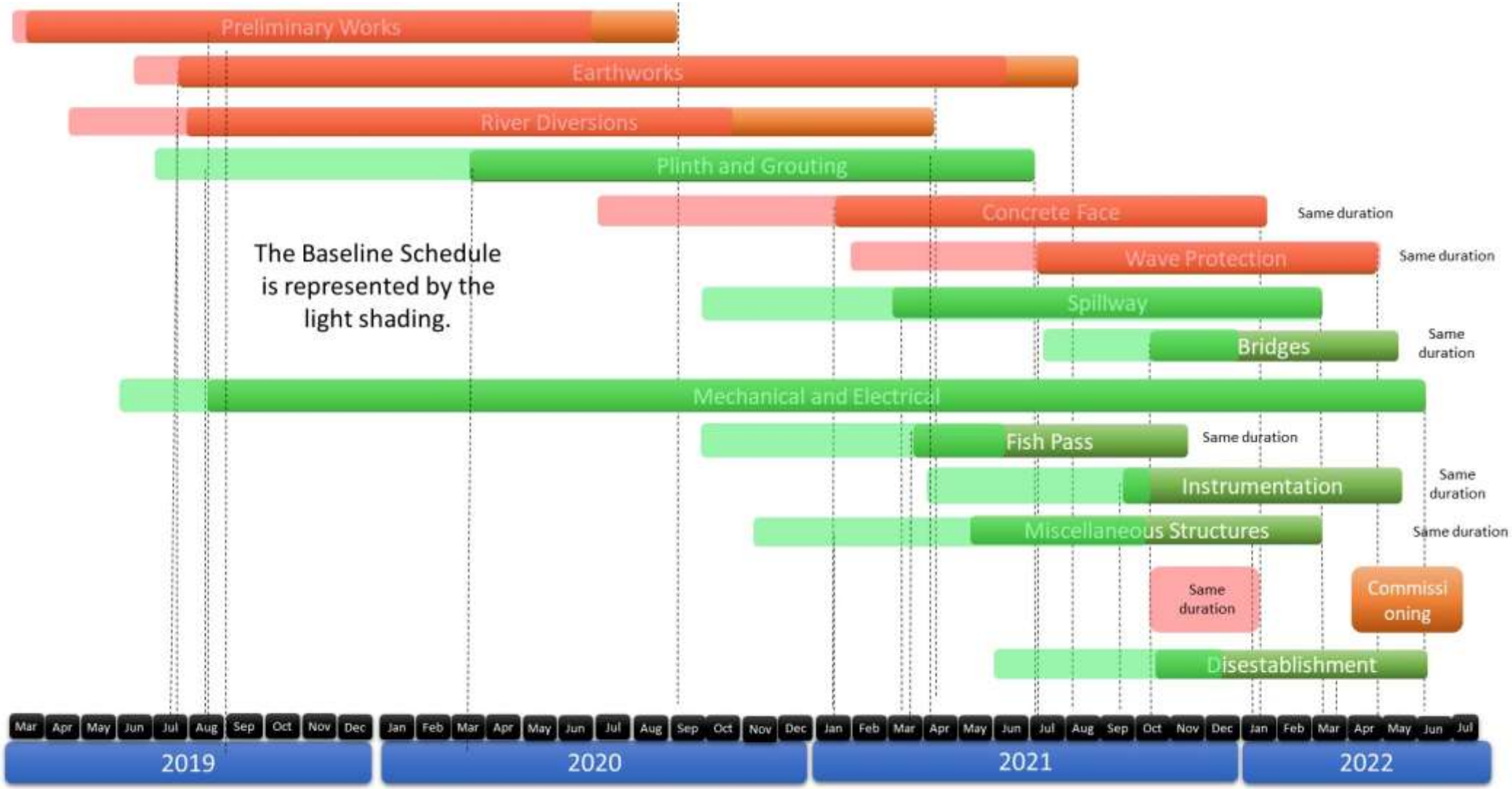
Context (SOI)

Risk	Probable Cost ($)
1. Encountered Conditions	***16.6***
Material for Dam filling	
Voids; Plinth, Starter Dam and Culvert	
Additional Slope Stabilisation	
Other Items at risk	
2. Improved Resilience	
Improve drainage beneath the spillway and modify spillway for encountered topography	
Additional grout curtain, grout specification and plinth modification to reduce risk of seepage beneath dam	
Waterstops and sealing of the joints in the culvert	
3. Under / not budgeted	
Mechanical and Electrical not designed or priced at budget	
Office, overhead and construction engineering underbudgeted	
4. Self-Help / Savings (budget of -$1.8m)	
Bridges, Fibre, Trees	
Total	***26.75***
Contingency	**2.75**
Committed Costs (project budget Dec-19)	**99.9**
Total Expected Cost to Complete	**129.4**

Excludes Cost of COVID-19

Programme: + 6 months = +1 season

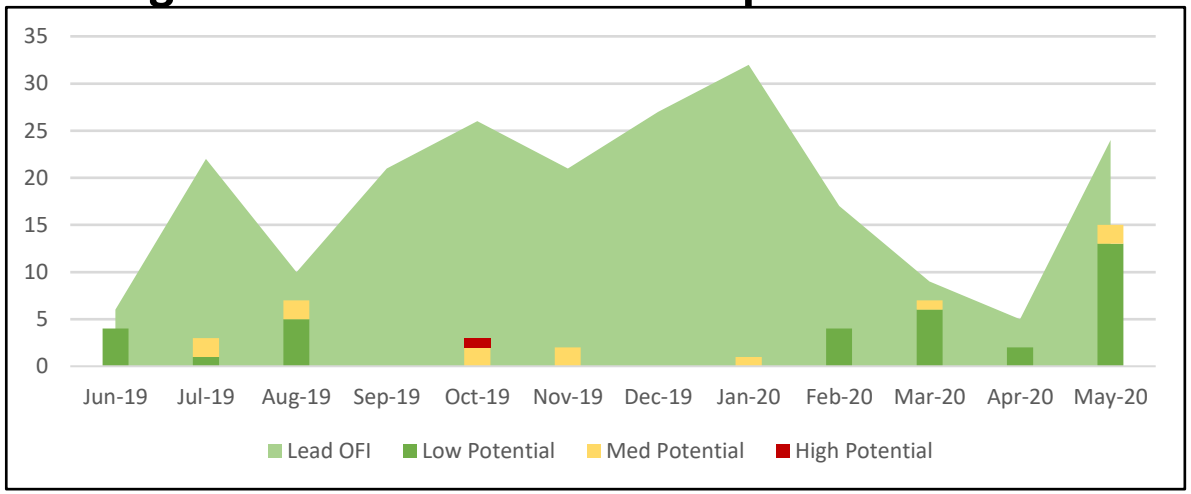
- Currently expect 6 month delay to programme with further risk of slippage
- Exploring and pursuing recovery programme (shift work; defer works)



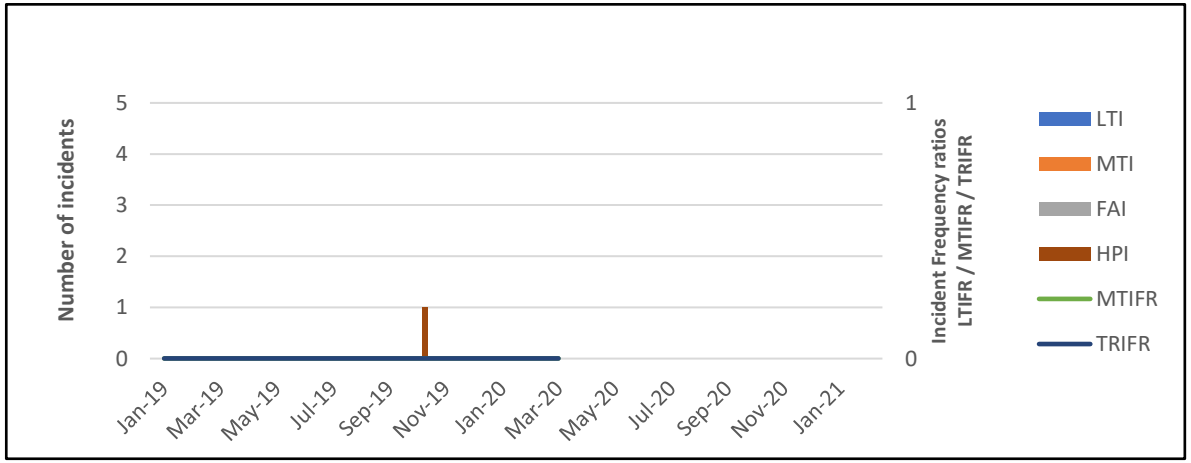
Safety: No injuries to date

Celebrating 500 days injury free

Leading: Contractor Audit and Inspection



Lagging: Accidents, Harm, HPI

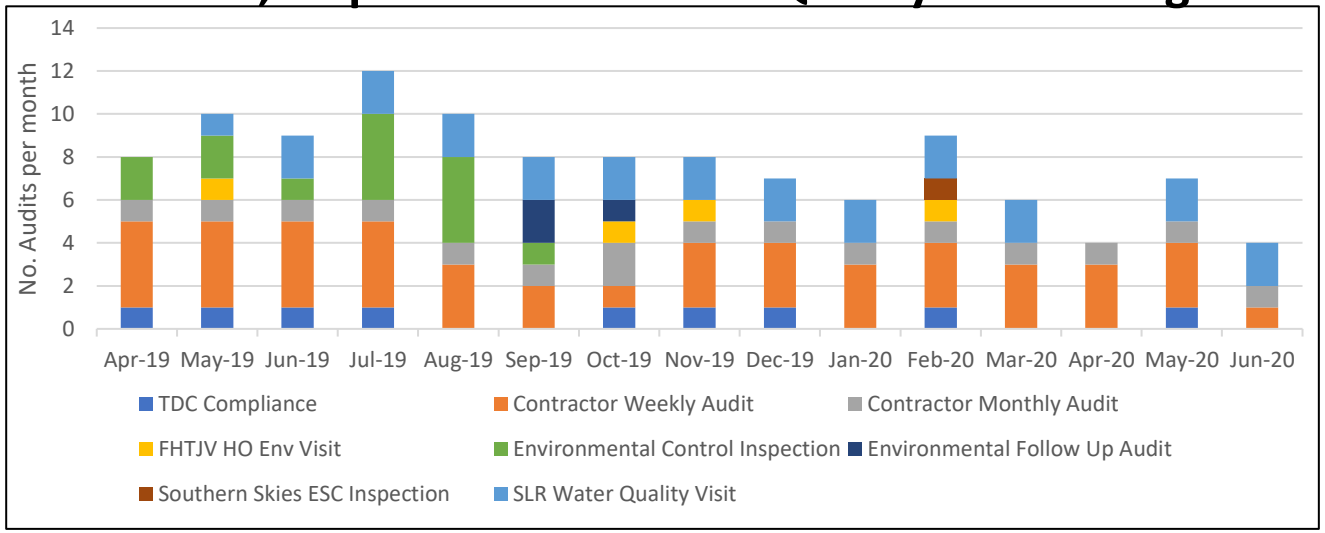


Environmental: Full compliance with consent

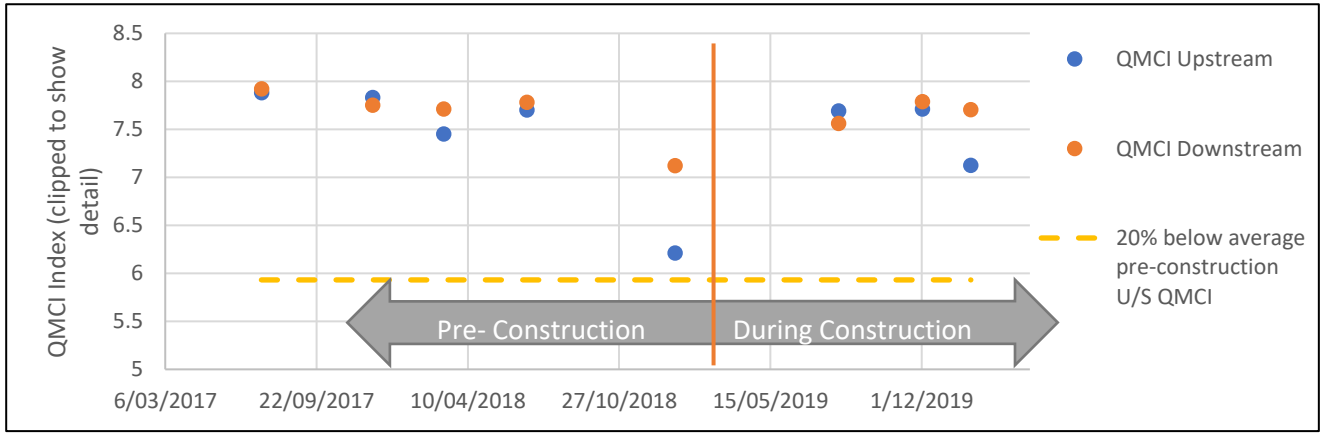
- Approved 5 Environmental Management Plans
  - ✓ Verified
- Approved 9 SCEMPs
  - ✓ Verified

⇒ All required plans for current works in place, certified, verified and functioning

Lead: Audit, Inspection and Water Quality monitoring



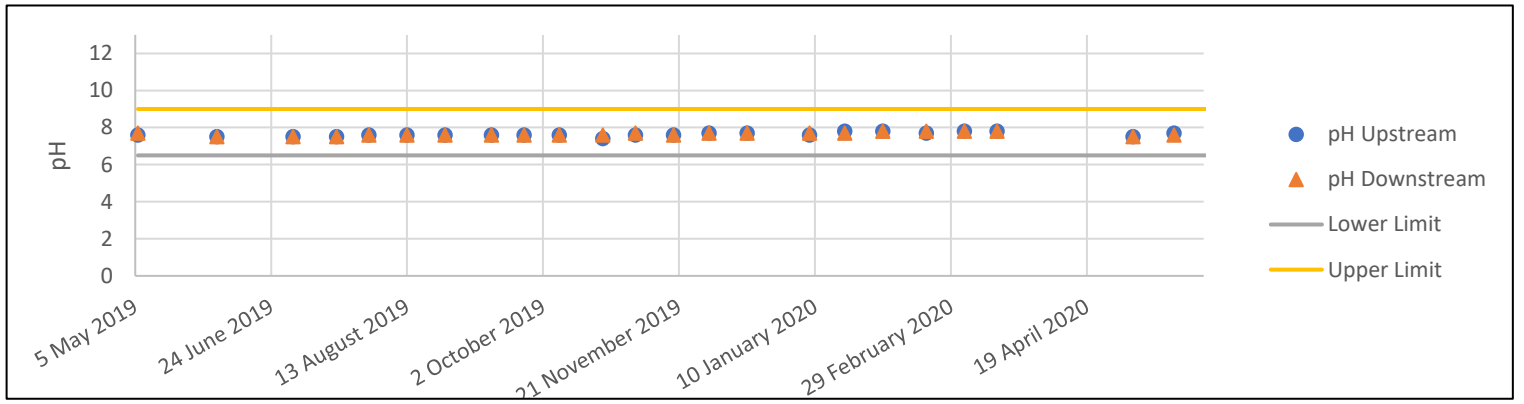
#42 River Health Indicator: Quantitative Macroinvertebrate Community Index



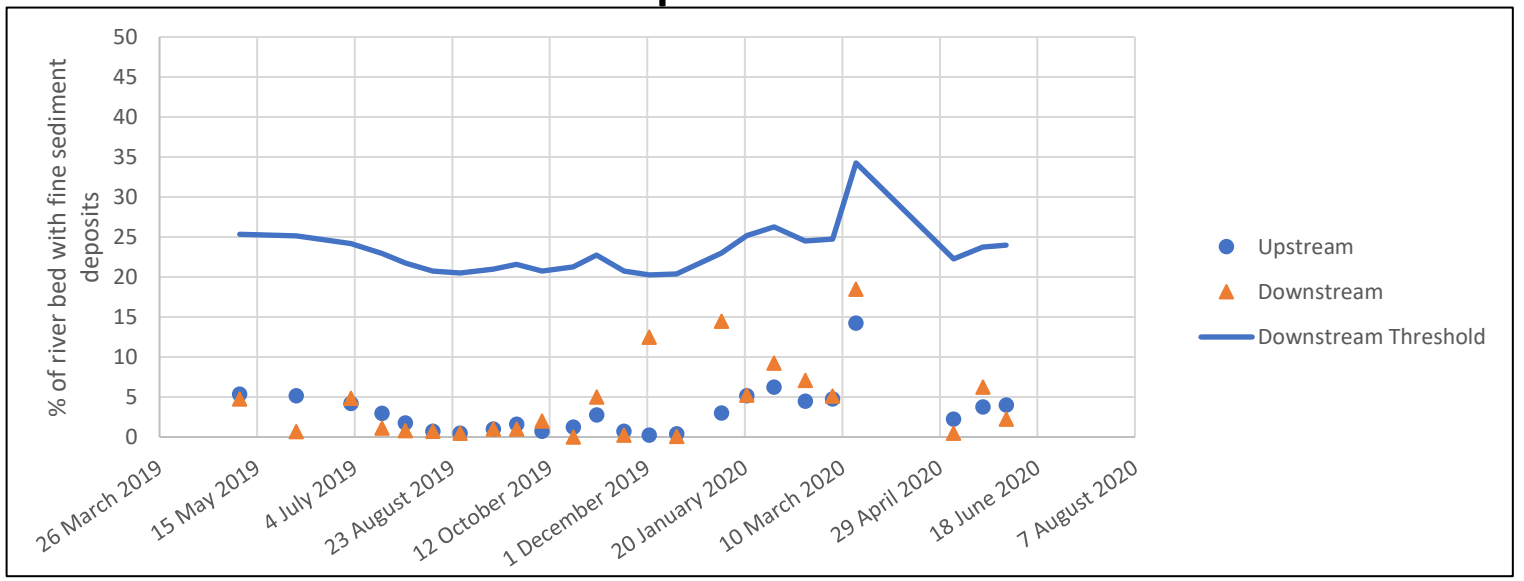
Environmental: Full compliance with consent

Independent ecologist verifies river health indicators

#45 River Health Indicator: pH



#44 River Health Indicator: Deposited Fine Sediment



Rockfill: The Geology Challenge

- Embankment trials late December 2019 and early January 2020 identified Rock degradation

Expected and Needed

Less broken down– Free draining

Discovered

Heavily broken down– Not free draining

Rockfill: The Geology Challenge

- Discovering more argillite (mud / siltstone) (~70%) and less greywacke (sandstone) than expected
- Greywacke (sandstone) dispersed amongst predominant argillite. Difficult to salvage. *(VIDEO)*
- Fissile argillite showing tendency to break along insipient foliations

➢ Spillway Excavation: *"May yield a minimum of 350,000 m3 of rock that will consist of slightly weathered to weathered (Class 1 & 2) greywacke." (2014).* ⟹ Predominantly fissile argillite

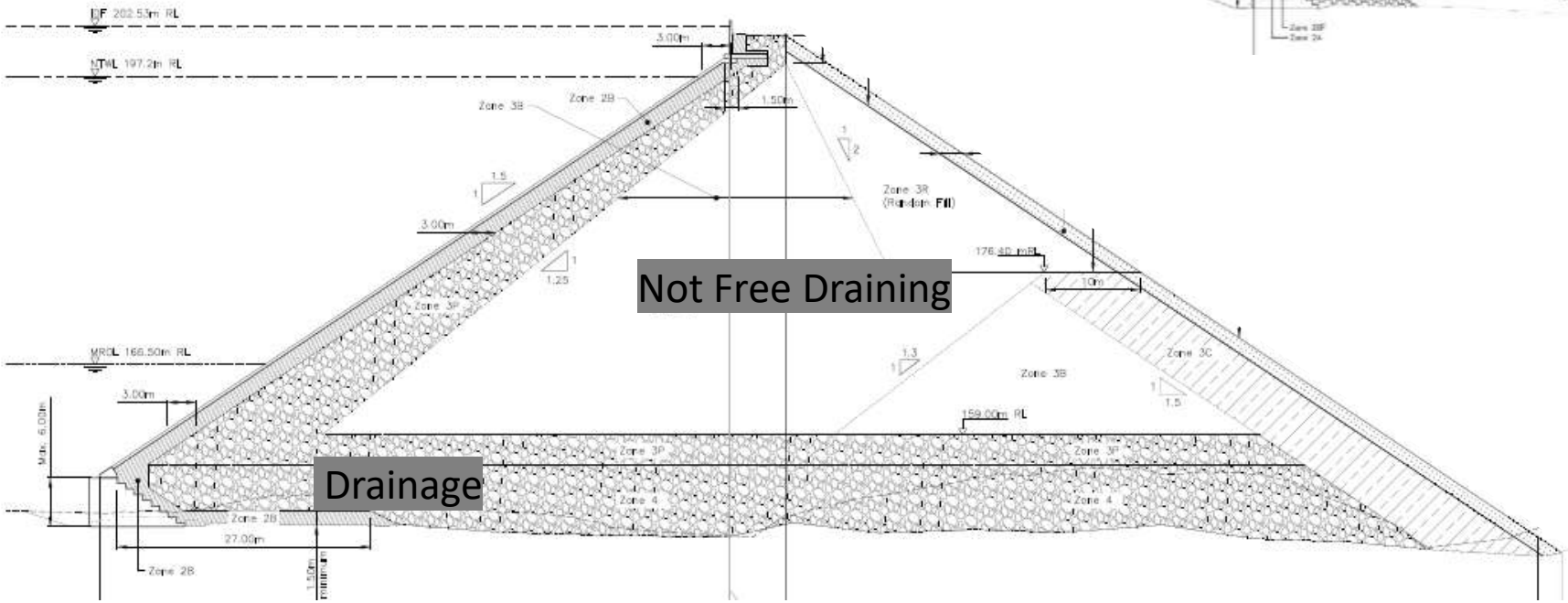
➢ Need to find suitable drainage material from alternative sources (cost)

Design: Rezoning embankment to manage geology

- ❖ Expect less harder class-1 material
- ❖ Testing in early 2020 identified breakdown on compaction

⇒ Increase drainage layers

⇒ Alternatively source drainage rock



Design: Spillway modified for improved resilience

Design modifications due to recent learnings from international spillway incidents *(international standards)*

⇒ Oroville (right) failure due to poor drainage and anchoring detailing *(pressure beneath fn velocity)*

⇒ Whaley Bridge (UK) no drainage and poor slab detailing combined with poor maintenance

Modifications for resilience (requested by CIIL):

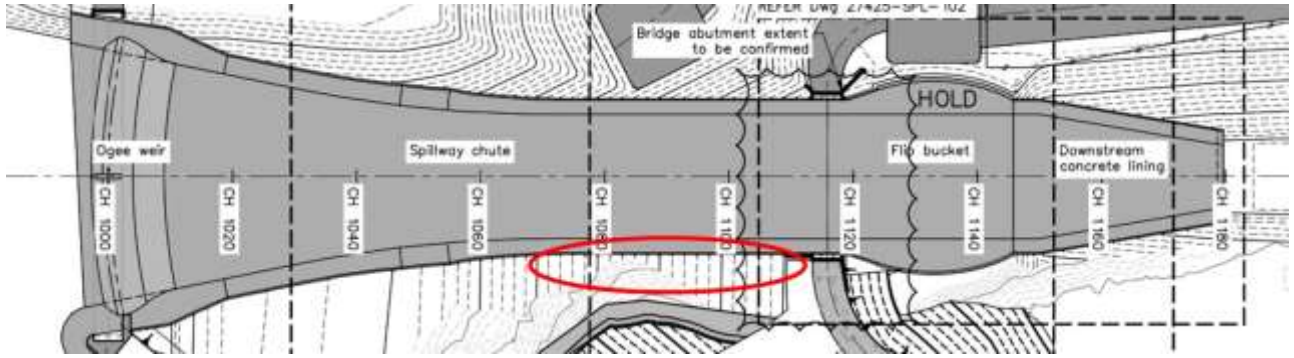
⇒ Drainage reviewed and upgraded

⇒ Anchoring design reviewed and upgraded

Additional modifications driven by topography and encountered geology.

Design Update

- ✓ Spillway:
  - Redesigned with vertical walls to mitigate topography / geology risks RHS
  - Increased drainage per recent standard
  - Completed and peer reviewed



Design Update: Other items

Mechanical and Electrical

- ❖ Not designed or priced at commencement of work

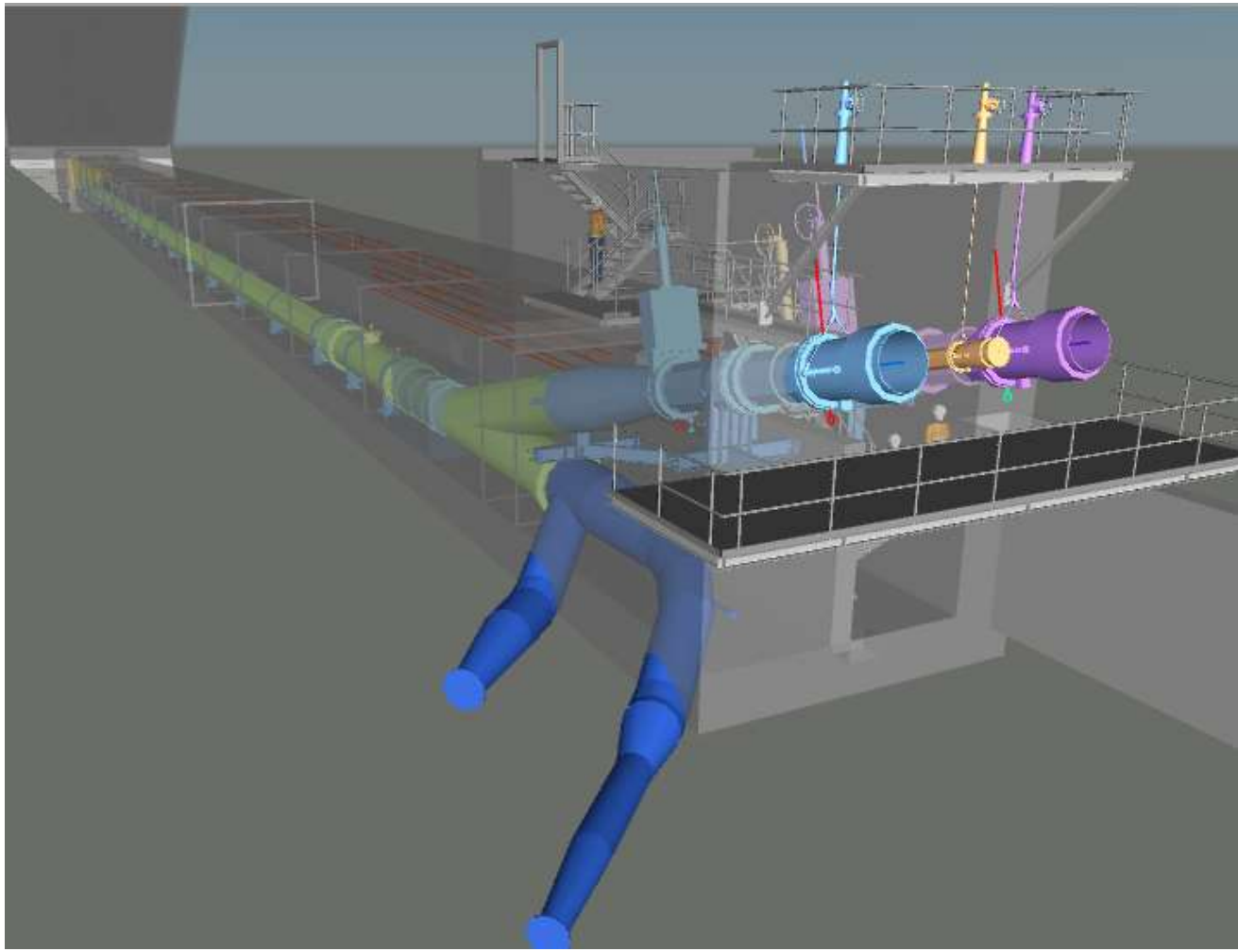
⇒ Provision Sum challenged

⇒ To be priced ~3rd Quarter 2020

- ▪ Progressing detailed design

⇒ Switch to single outlet pipe aiming to realise cost savings

⇒ Modifications for future hydropower installation



Power Generation: Opportunity

Enlarge Reservoir / Powergen

- Fuse Gate to utilise 2.3m / 5m of flood reservoir
- Activate in event of large flood say 1:10,000 yr AEP (55% - 70% of PMF 1094 m3/s)
- + 1.5Mm^3 storage to ~15Mm^3 (15%)

  ⇒ Storage increases powergen utilisation

  ⇒ Increase resilience to droughts / growth / demand

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Construction Update

Diversion Culvert: ~80% complete

- ✓ Completed Floor
- ✓ 12/17 wall & roof sections completed
- ➢ Expect to complete by Aug and divert river September 2020

Construction Update: Forming LHS Plinth

- ✓ Foundation treated and site blinding concrete complete
- ✓ Commenced forming plinth

Construction Update: Preparing RHS Plinth

- ✓ Foundation treatment and treatment underway

Construction Update: Spillway

- Spillway cut underway
  - ➢ Exposed first 20 m section of foundation
- ❖ Uncovering significantly weathered foundation that will require treatment
- Close to cliff edge
  - ✓ Supports change in design to self-supporting vertical walls, rather than a liner
  - Will evaluate extent of any edge support

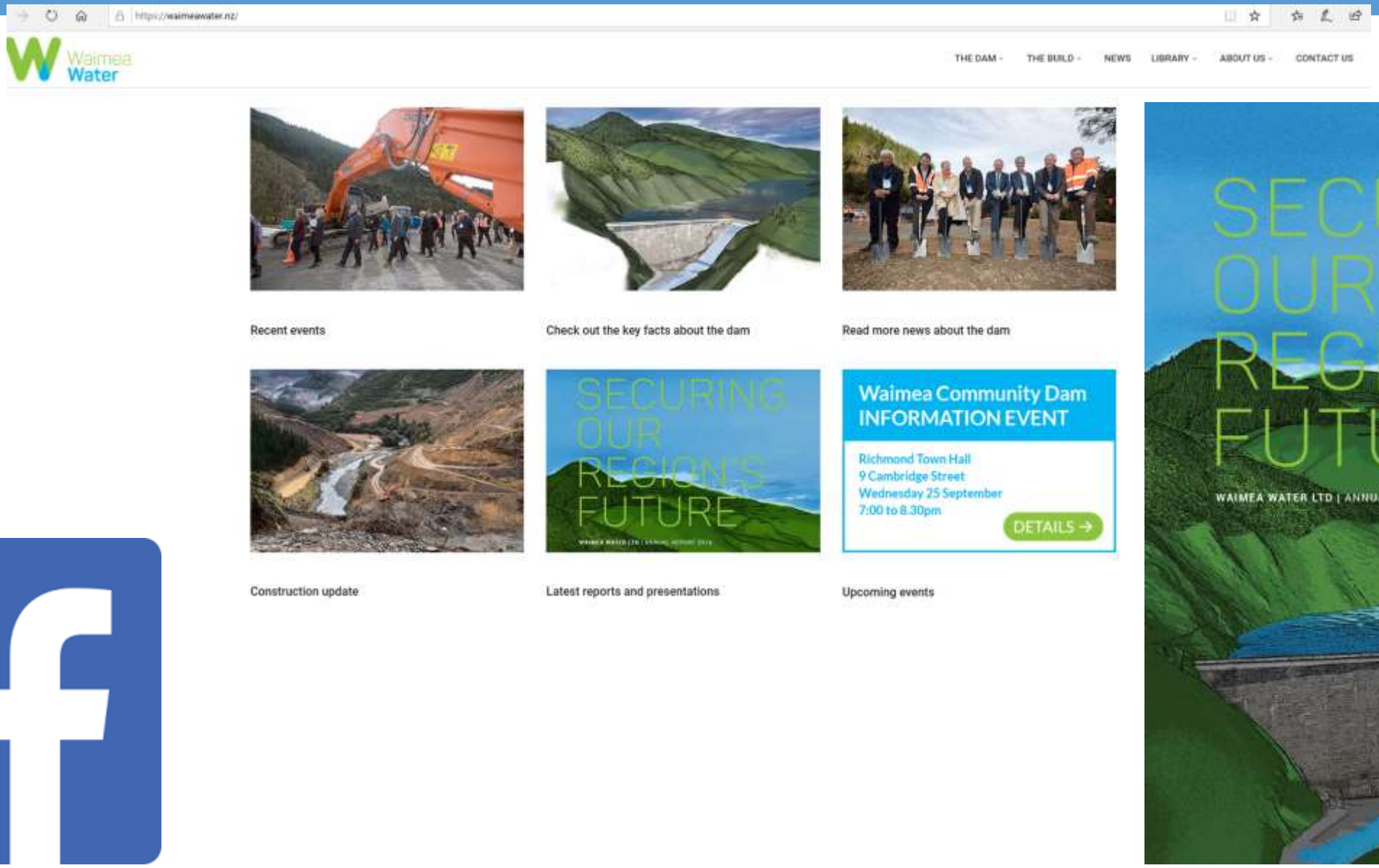
Construction Issues: Unexpected Voids

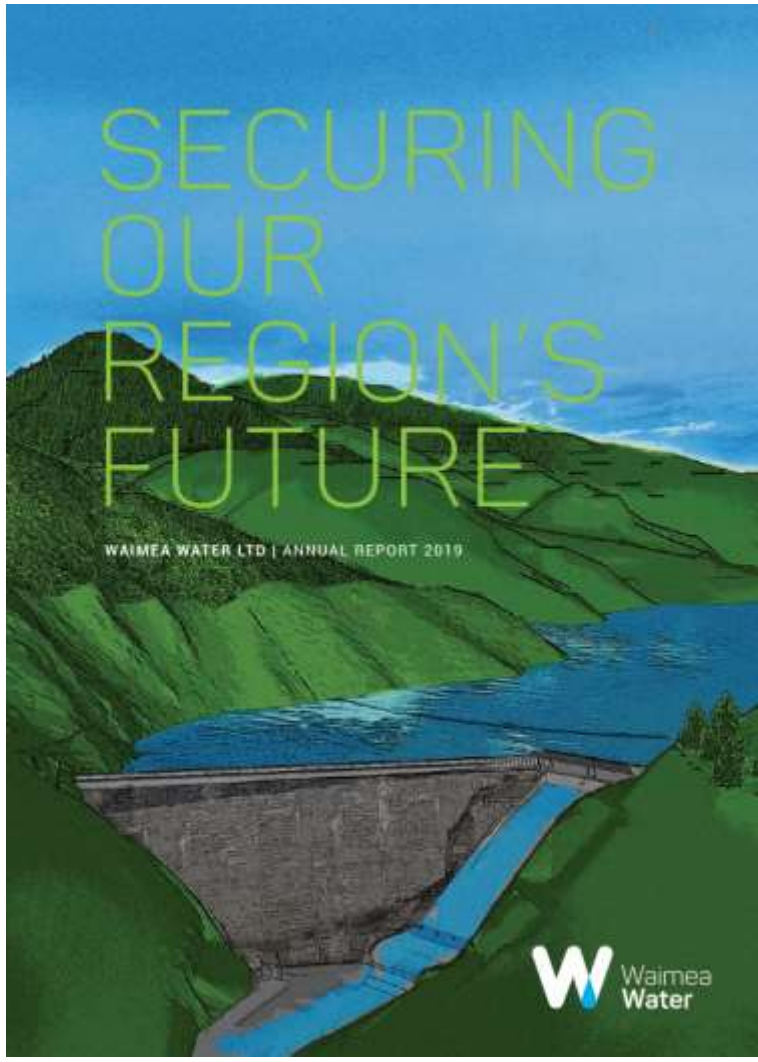
- ❖ >1000 m3 concrete
- ✓ LHS & Culvert done
- ❖ RHS, Spillway and starter dam to do

Closing: By the numbers

Task	Total Quantity	Unit
Vegetation Clearance	85	Hectare
Excavation	633,000	m^3
Fill	430,000	m^3
Cut to Waste	311,000	m^3
Material Processing	120,000	m^3
Concrete	22,000	m^3
Reo Steel (bars)	3,900	t
Reo Steel (mesh)	10,000	m^2
Anchors	4,200	No.
Concrete Face	10,000	m^2

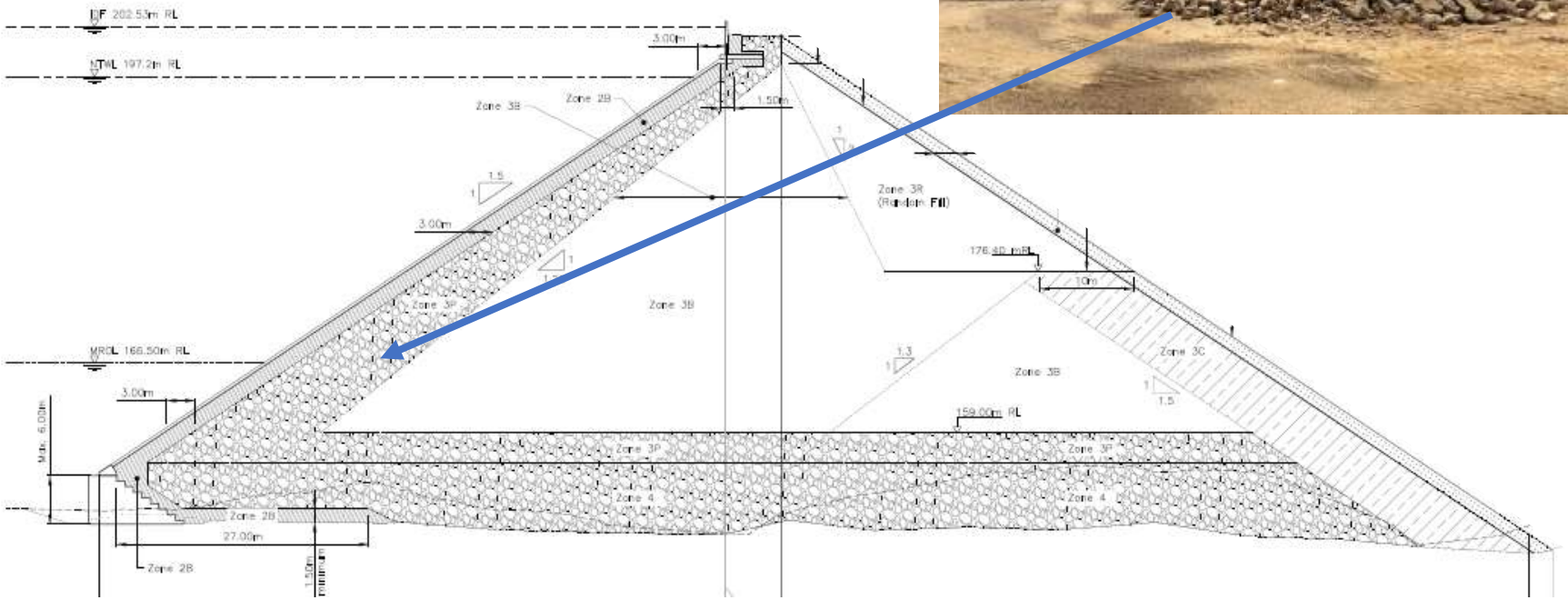
More Information





17 Dec 2019: Rezoning embankment to manage geology

- ❖ Expect less harder class-1 material
- ❖ Experiencing more fines
- ⇒ Increase drainage layers with
- ⇒ Processed (screened) out fines



Design: Geosynthetic membrane

Replace concrete face with Geosynthetic membrane

⇒ Improved **resilience** to settlement and seismic (elasticity), benefit accentuated by softer rock

⇒ CO2, Cost and Schedule **savings**

⇒ Easy to repair; performance warranty

⇒ Testing demonstrates expected life 50-100 years (robust to UV)

⇒ Meets EU and International standards for Health and Environmental impacts

Carpi Ltd: Installed

- 54 New Dams since 1988 (26 larger than Waimea)
- 142 Retrofitted Dams since 1970 (63 since 2010)
- Used on Tekapo Canals (2013 / 2014)