APEX SUMMIT 2017

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Waitaki Power Station

Tailwater Level Instrumentation Replacement

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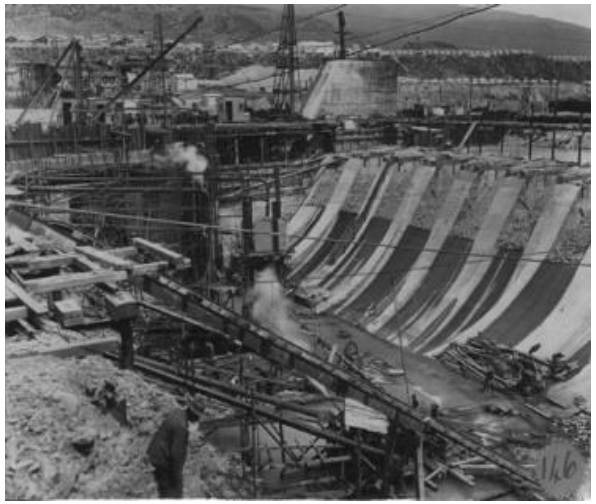
Overview

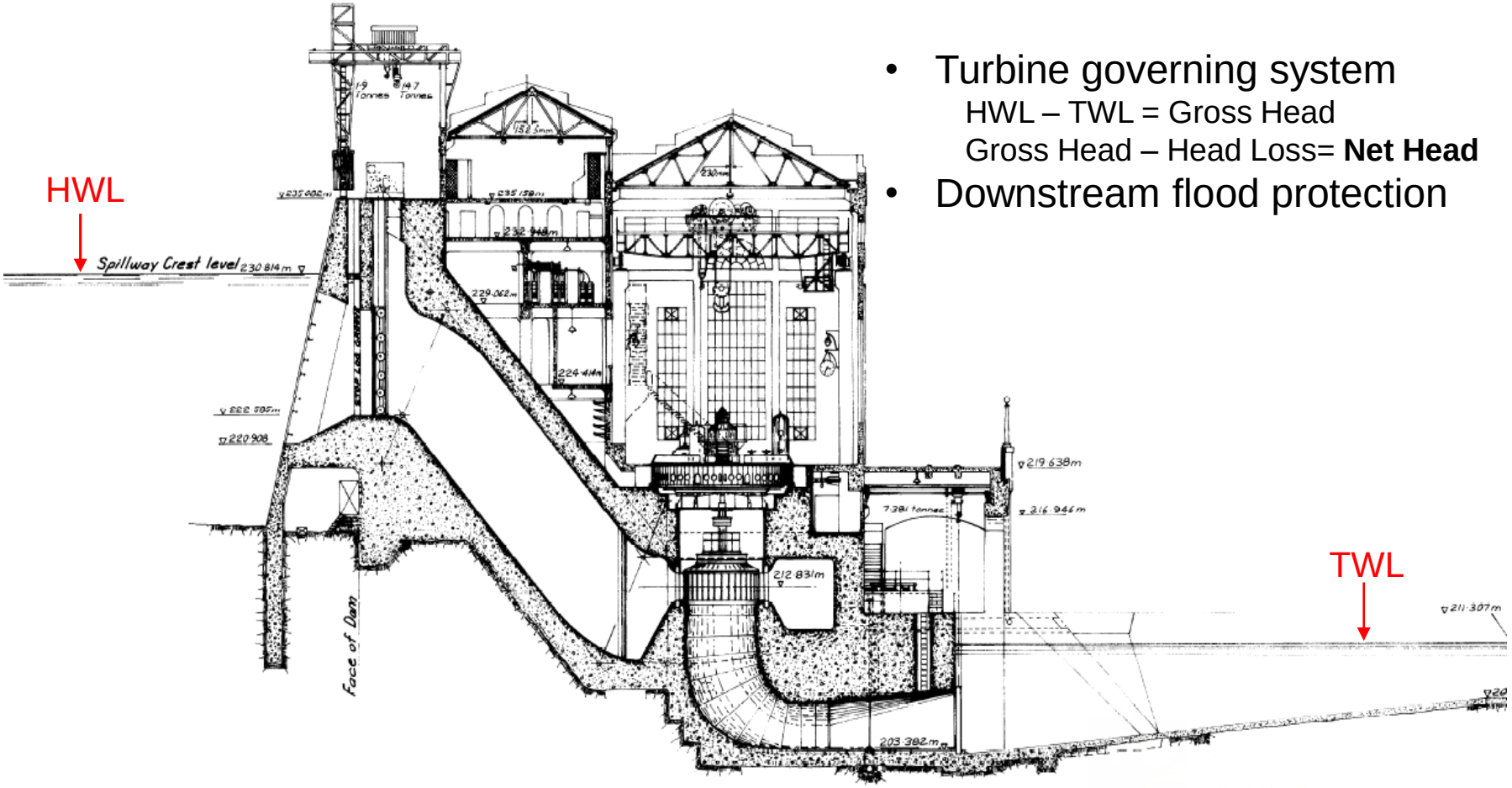
- Waitaki Power Station
- Project Overview
- Detailed Design
- Health and Safety
- Key Learnings

Waitaki Power Station

- First power station on the Waitaki River
- Last ‘manually’ constructed power station
- 1928 - Construction begins
- 1935 – First power generated
- 7 units x 15 MW



What is TWL for?



- Turbine governing system
  - HWL – TWL = Gross Head
  - Gross Head – Head Loss= **Net Head**
- Downstream flood protection

Water Level Sites Examples

- Level instrument
- Stilling well
- Control and communication device

Benmore TWL

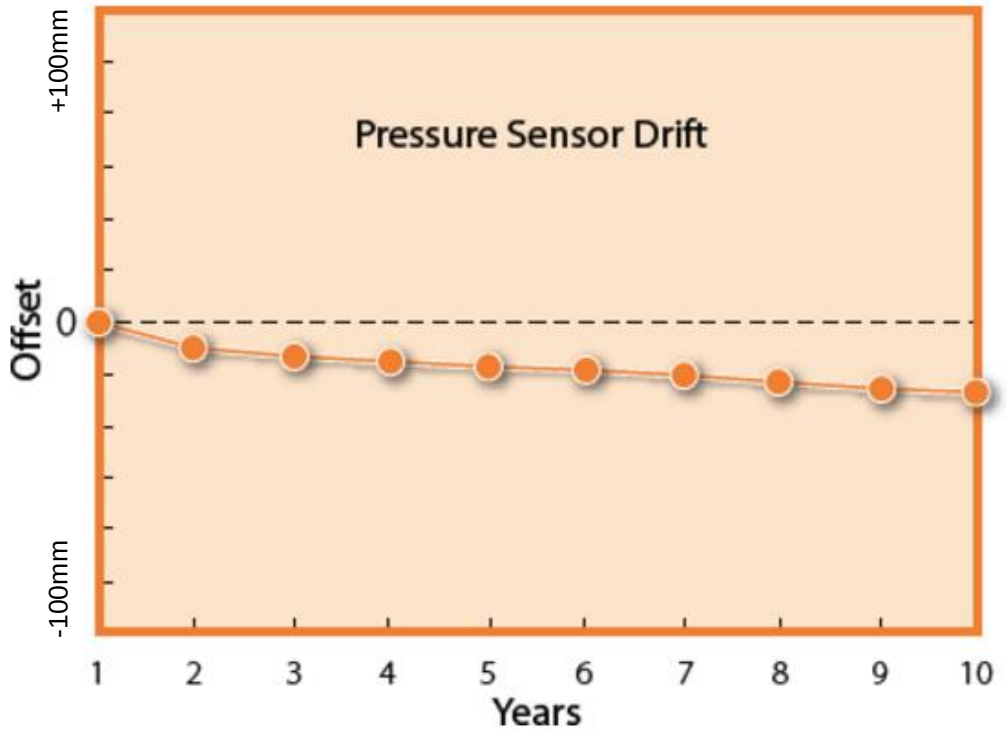
Aviemore TWL

Waitaki TWL

Aviemore HWL

Key Issues

- Pressure transducer – prone to drift
- Level device cannot be maintained
- End of life – installed early 90’s



Example of Pressure Sensor Drift from the Calibrated Zero Point Over Time

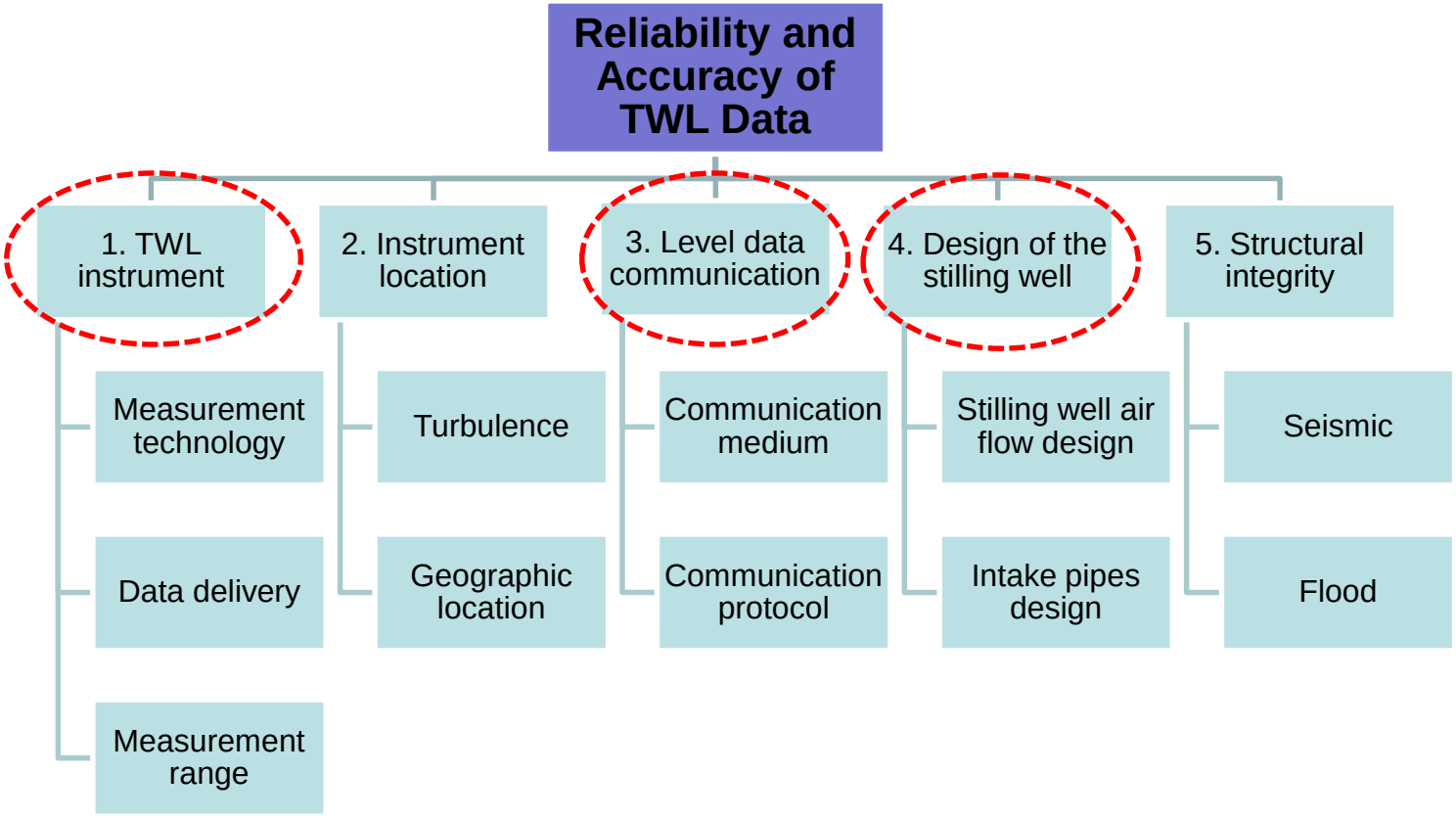
Key Issues – continued

- Poor and unsafe access

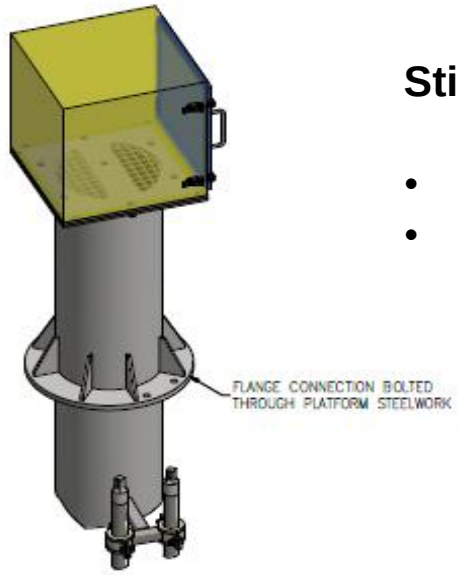
Objectives

1. Reliable and accurate TWL data
2. Easy to maintain
3. Safe access

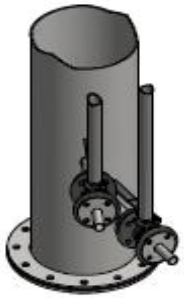
Detailed Design – Objective 1



Detailed Design – Objective 1



STILLING WELL TOP DETAIL
SCALE 1 : 10



STILLING WELL BOTTOM DETAIL
SCALE 1 : 10

Stilling well to intake pipe cross-sectional area ratio

- Maximum rate of change
- Lag less than 1mm

The following relationship may be used to determine the lag for an intake pipe for a given rate of change of stage:

$$\Delta h = 0.01/g \times L/D\ (Aw/Ap)^2 \times (dh/dt)^2$$

where: Δh = lag, in meters

g= acceleration of gravity, in m/s^2

L= intake length, in m

D = intake diameter, in m

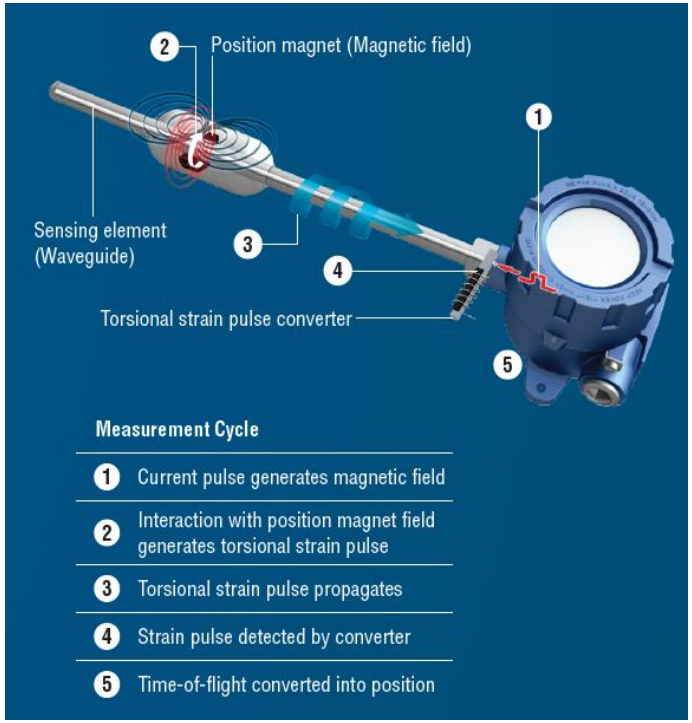
Aw = area of stilling well, in m^2

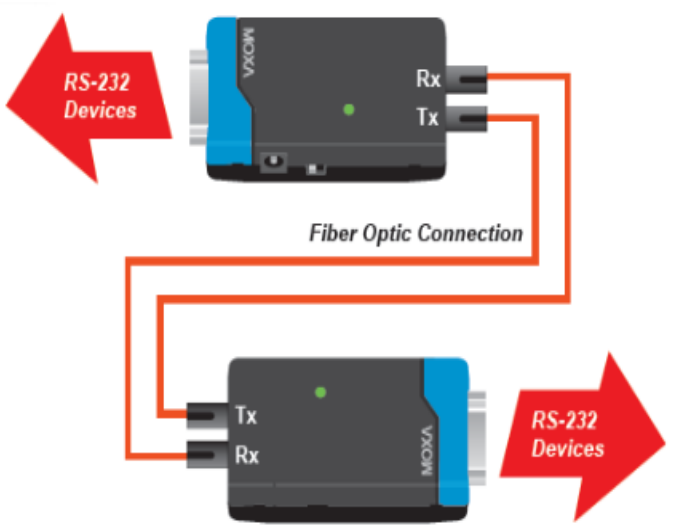
Ap = area of intake pipe, in m^2, and

dh/dt = rate of change of stage, in m/s.

Smith, Hanson, and Cruff (1965) have studied intake lag in stilling-well systems, relating it to the rate of change of stage of the stream and to the various types and sizes of components which are used in the stilling-well intake system.

Detailed Design – Objective 1





- Magnetostrictive technology
- Digital gauge
- No drifting
- Low maintenance
- ± 1mm accuracy

- Immunity to electromagnetic interference
- Future-proof
- Easy and cheap interface

Detailed Design – Objective 2

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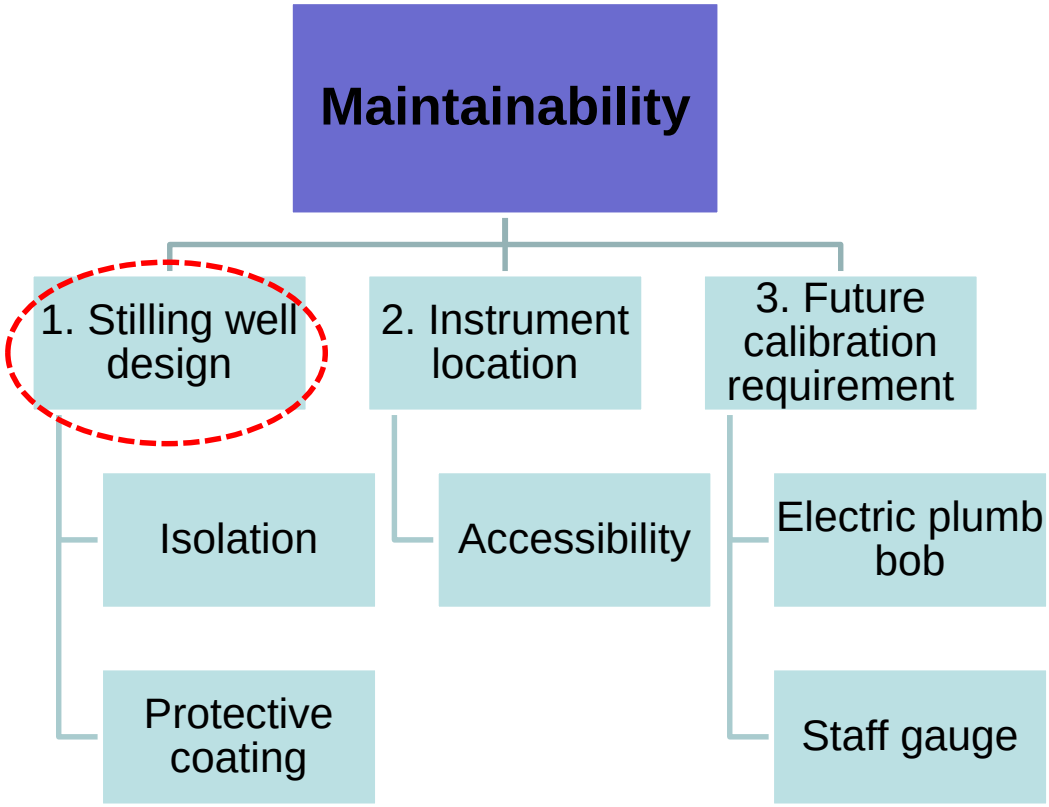
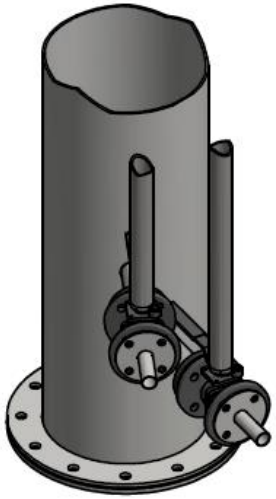
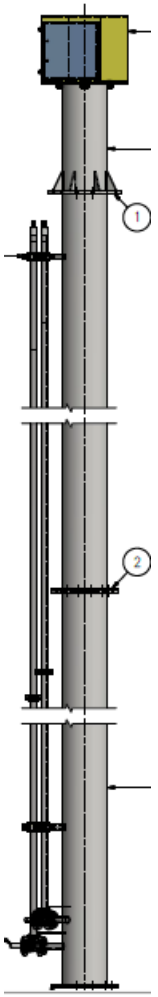


Detailed Design – Objective 2

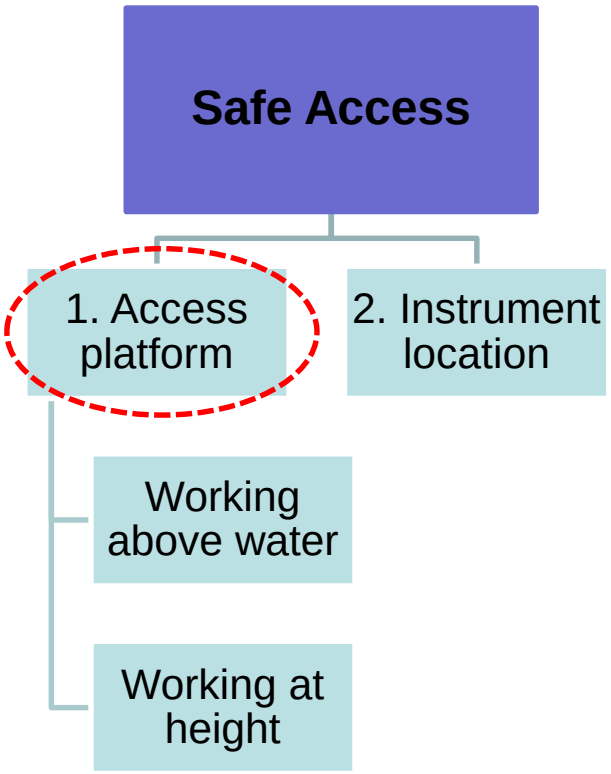
- Abrasive blast to AS 1627 PT9 Grade Sa2.5
- Interzone 954 paint system to 500 microns DFT (Dry Film Thickness)
- Fresh water immersed environment 25-30 yrs



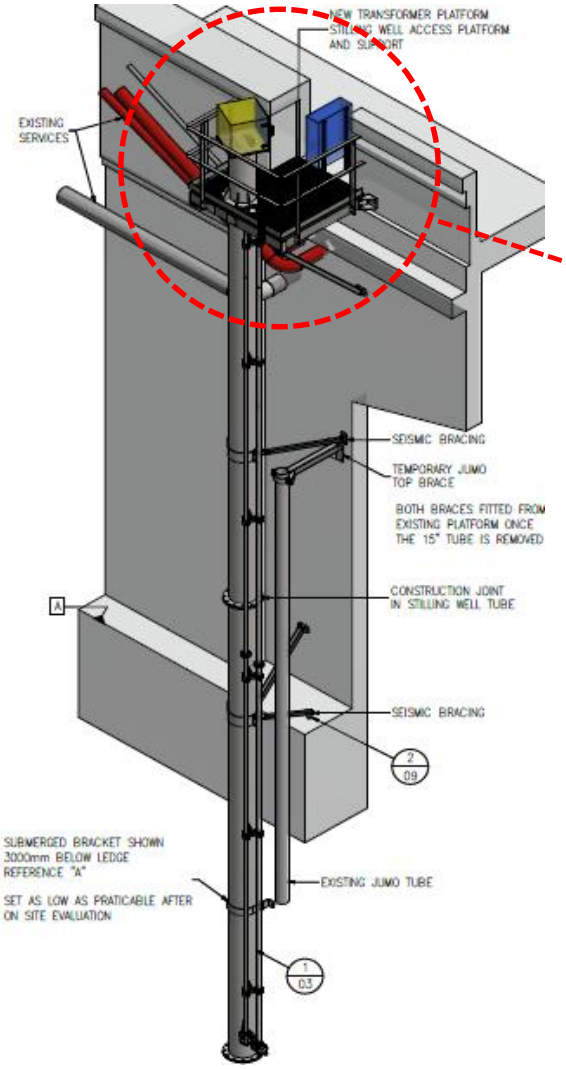


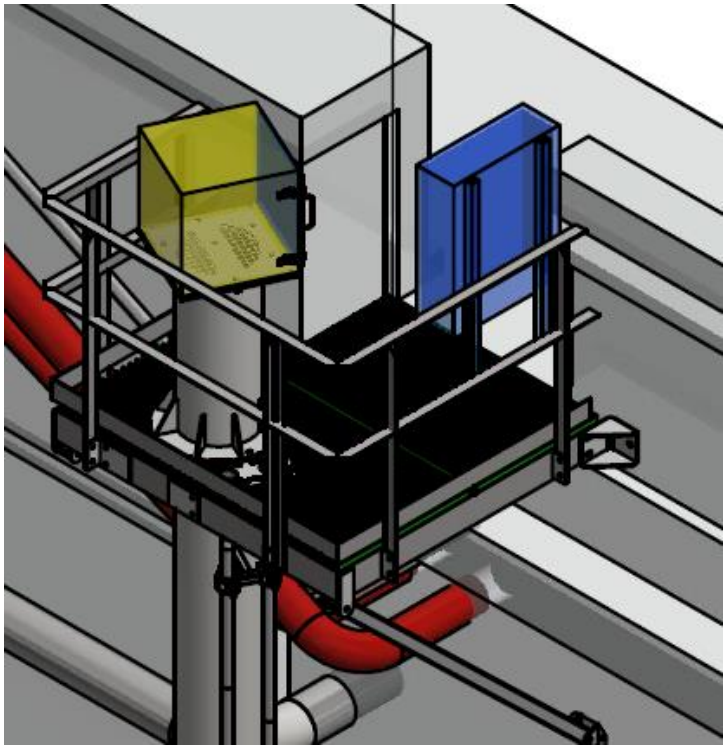
- Ball valves
- Individually actuated
- Annual maintenance and calibration
- Bottom - flange

Detailed Design – Objective 3



Detailed Design – Objective 3





Safety in Design (SiD)

"Consistently provide designs that are safe to construct, operate, maintain and decommission."

Detailed Design – Objective 3

Part of the parapet wall will be removed at Waitaki Power Station.

A very important question must be answered.

Is there any emotional attachment to it?

Overall Project Plan

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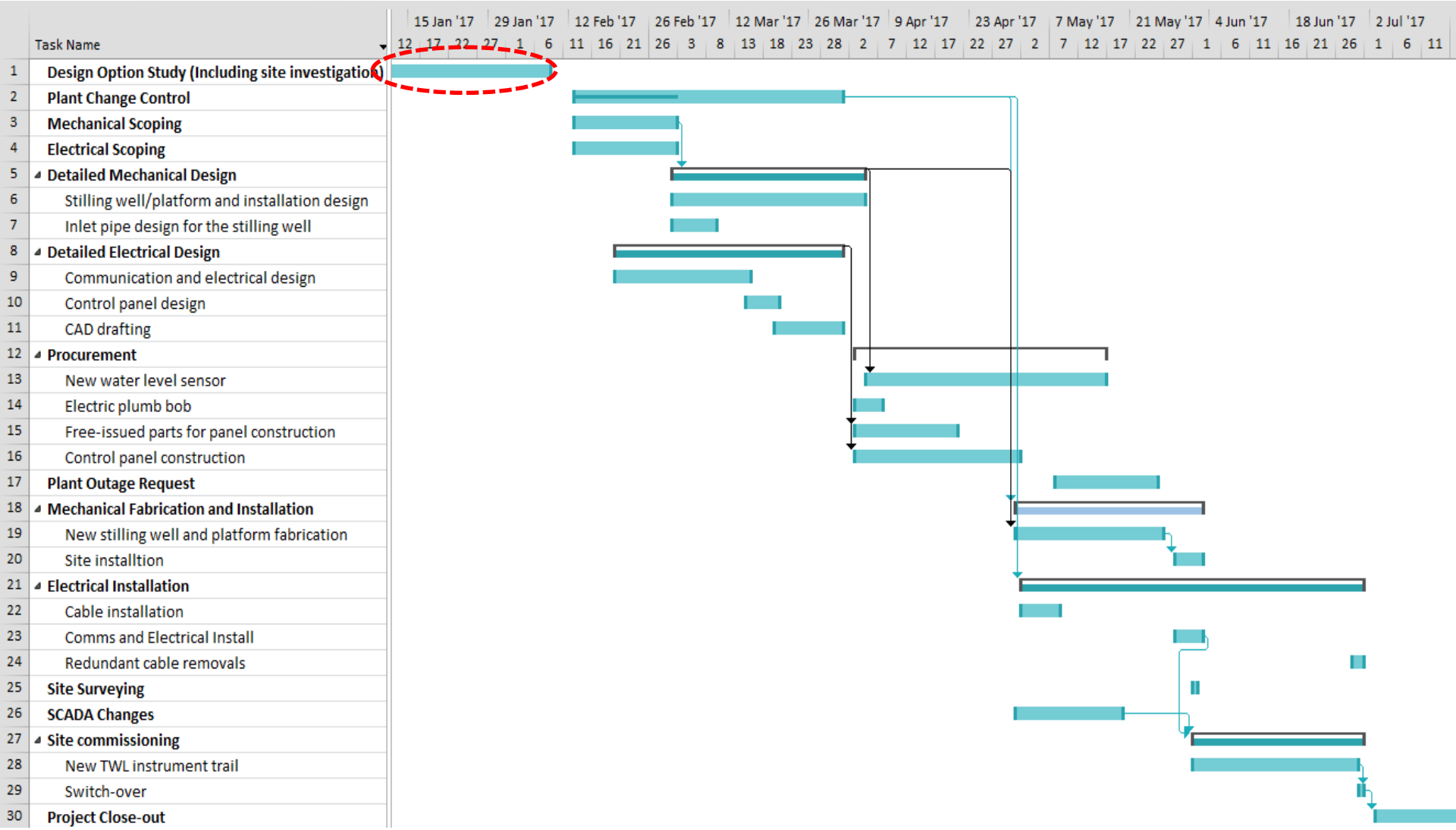
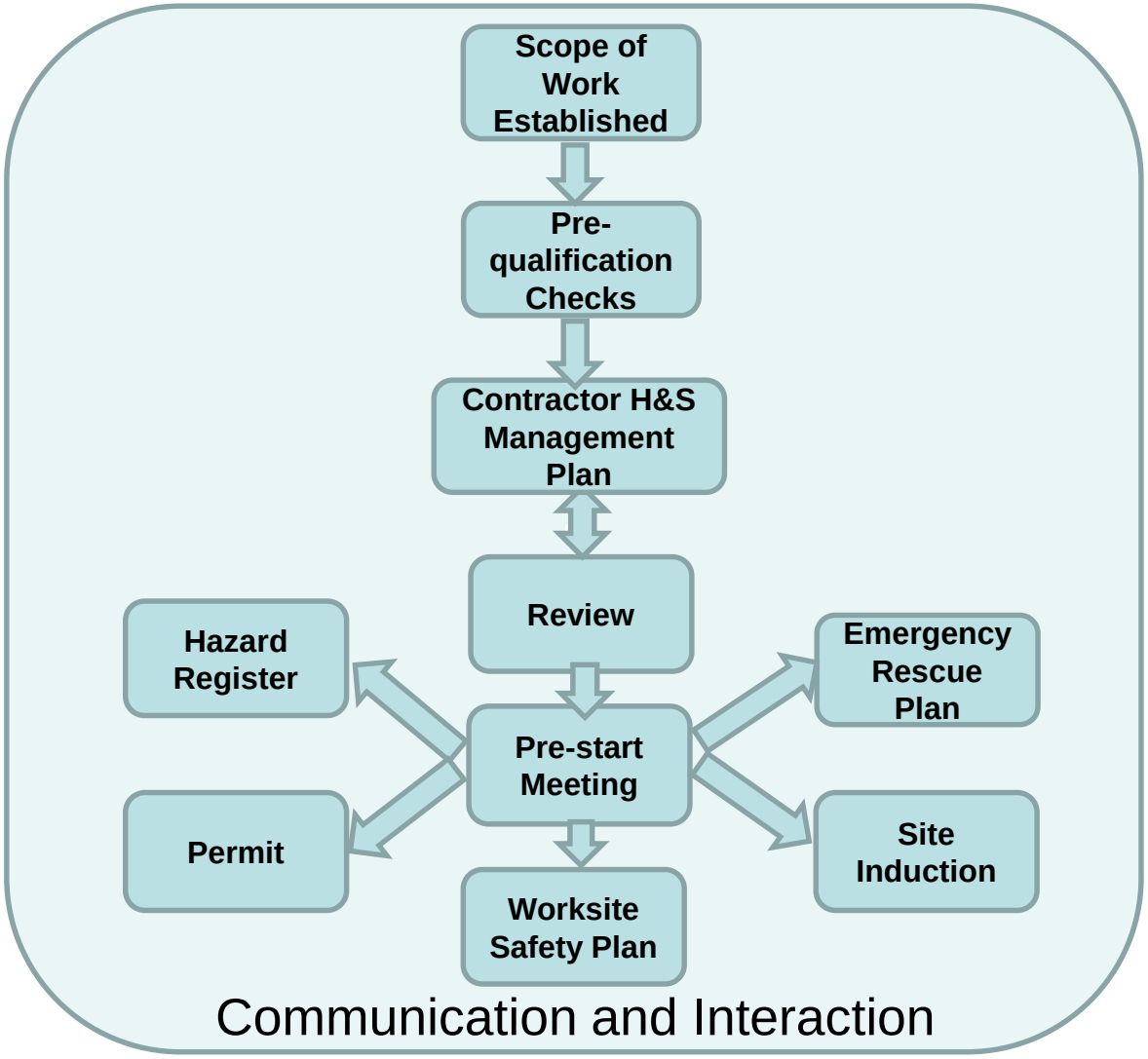
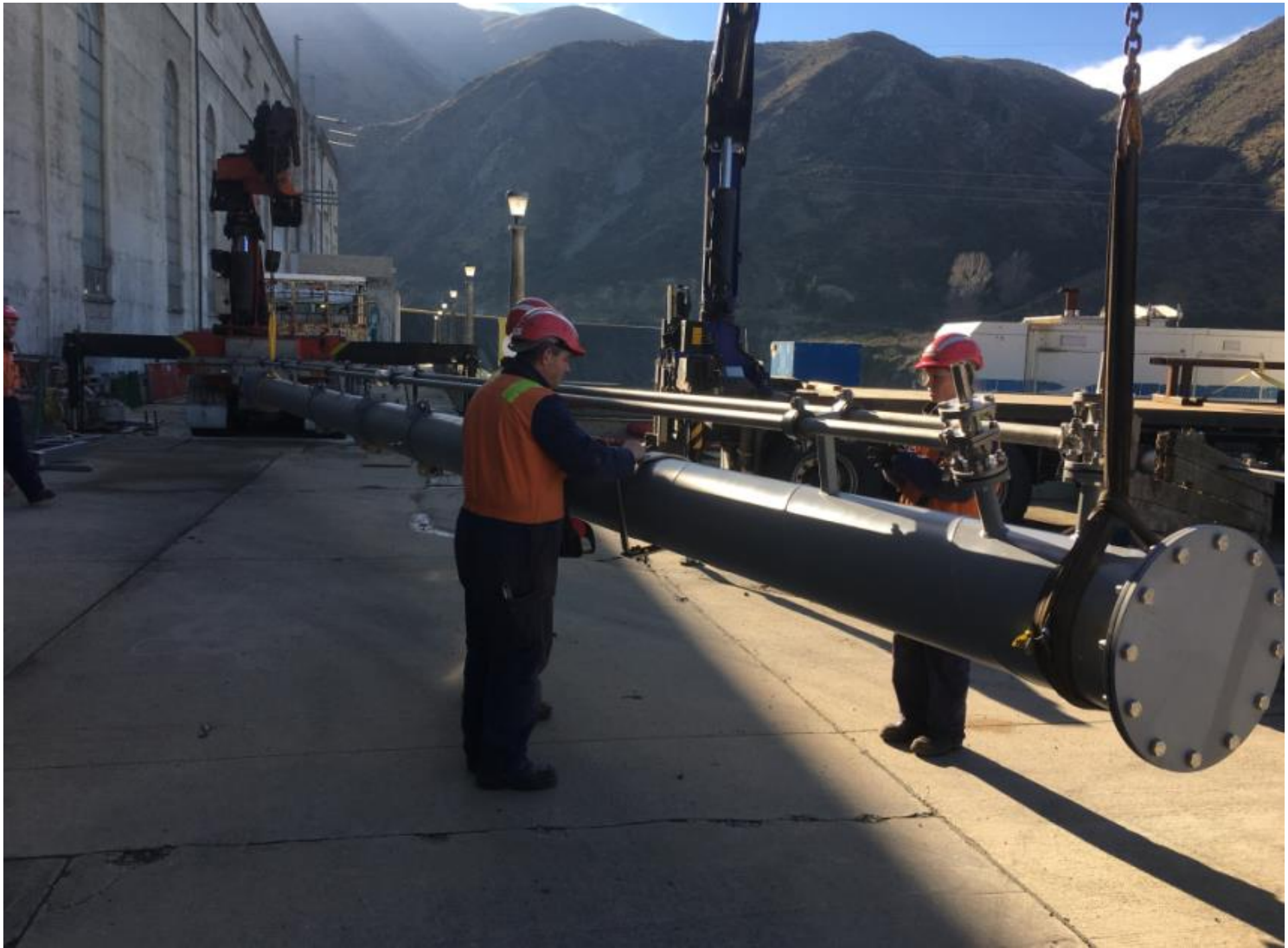


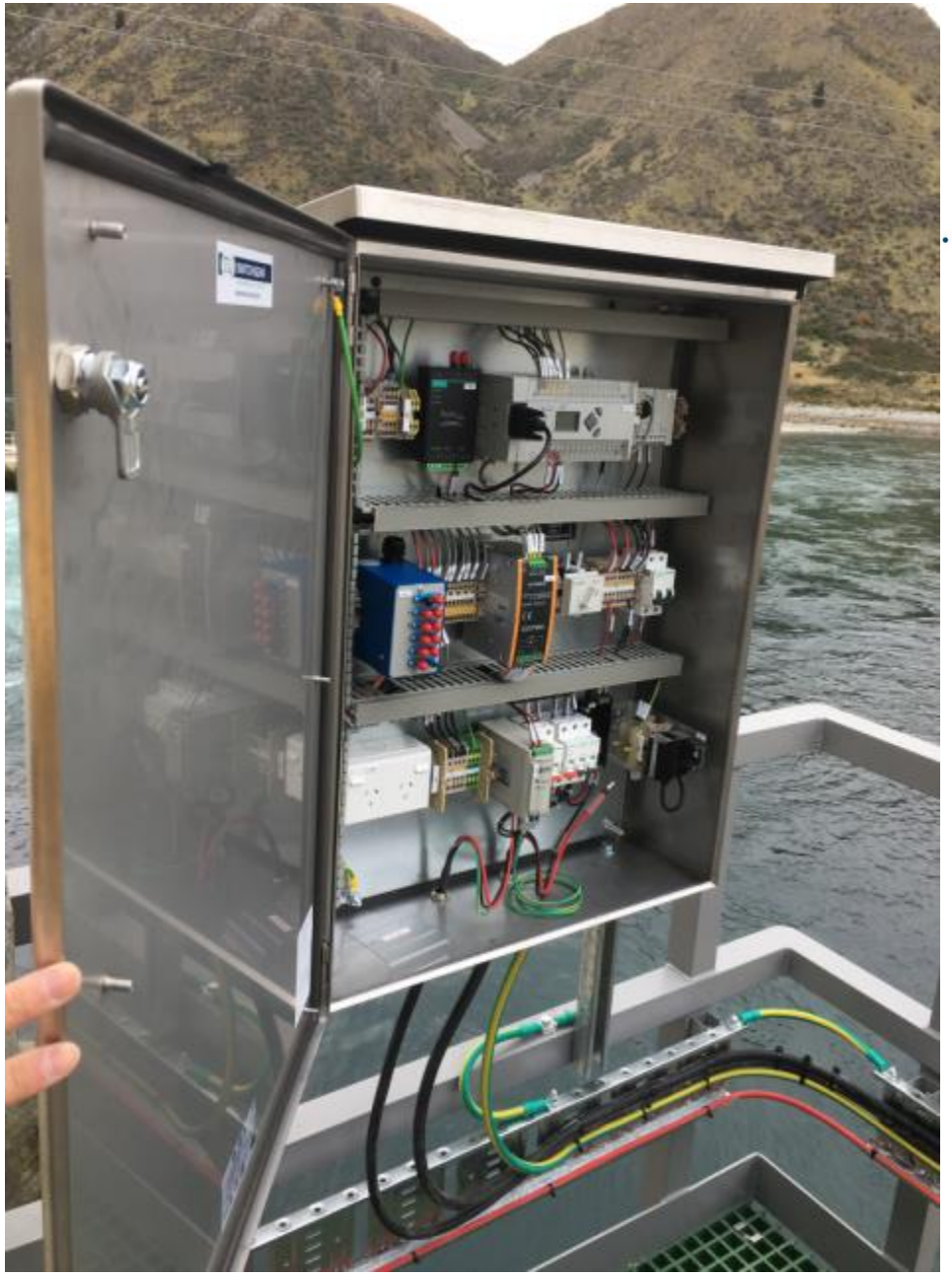
Health and Safety

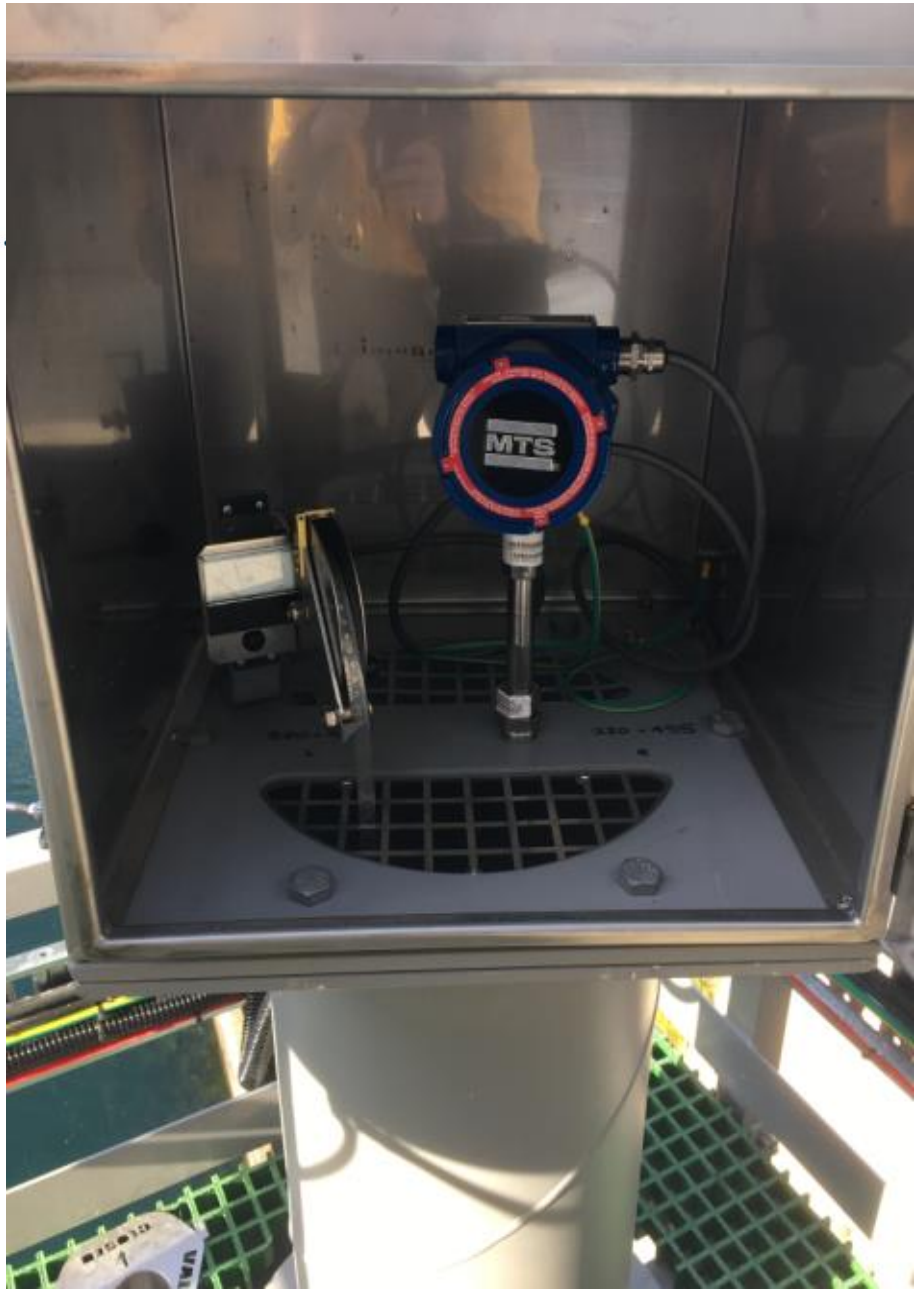


Health and Safety is a collaborative and continuous practice!


No fishing



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Key Learnings

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- Think holistically. Reliable data is more than the digital information. Remember that the system must be physically robust too.
- Define scope, budget, and time.
- Communicate with all project stakeholders
- Identify risks up front
- Health and Safety is a collaborative and continuous practice

Questions or Suggestions?

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