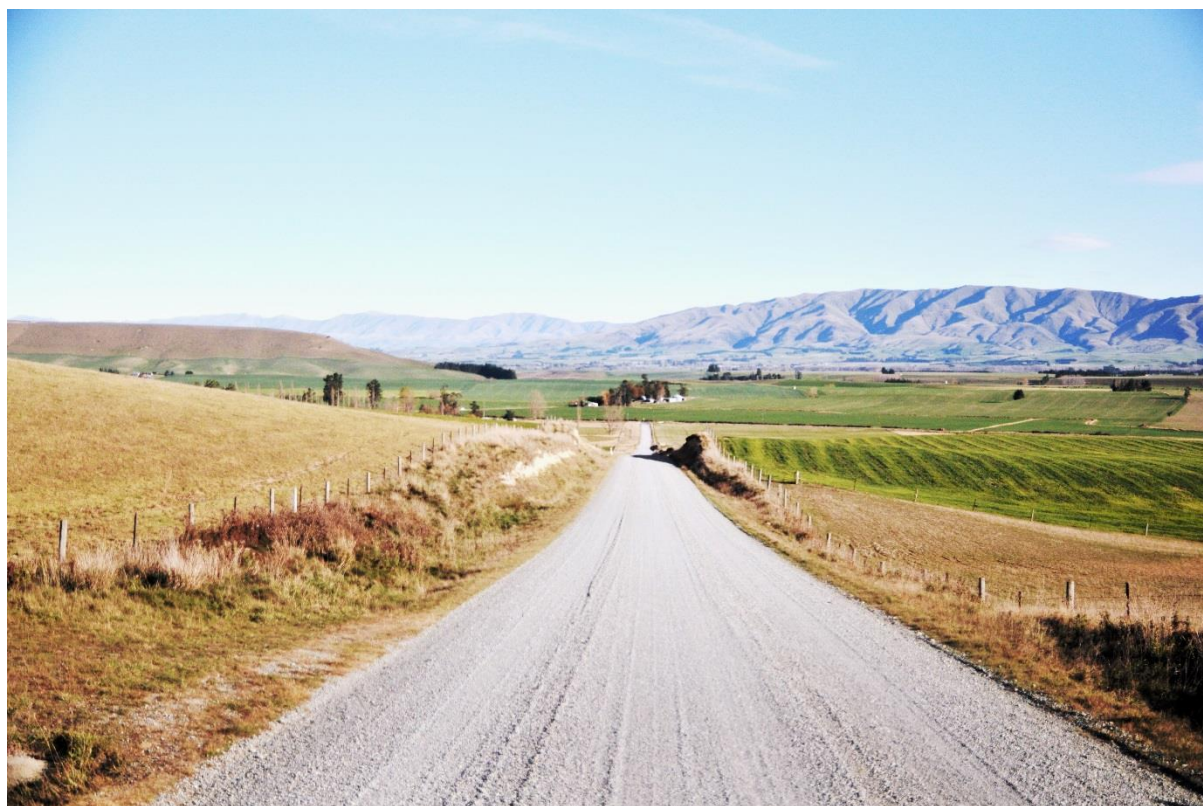


Opuha Dam Downstream Weir Enhancement – Construction Update No. 2



As I mentioned in the my first post, the primary objective of the Opuha Dam Downstream Weir (ODDW) Enhancement is to increase the flood passage capacity of the weir from 120 m³/s to 250 m³/s, prior to commencement of overtopping of the fusible embankment. This increase in flood passage requires modifications to the existing concrete spillway. Refer to my earlier post for a summary of the enhancement works.

Two key considerations for the design and construction of the enhancement works are:

- Managing the flood risk during construction - as the enhancement works are to the concrete spillway, the primary means of passing floods through the weir.
- Maintaining normal operation of the weir pond as much as practical (so minimal impact on hydro generation and environmental releases into the river).

The topic of this post, is the first of these considerations. I will cover the second in a latter post.

Flood Management Philosophy

Construction works have been planned and are currently being executed so that the full flood passage capacity of the concrete spillway is maintained throughout the duration of construction. The crest level of the construction cofferdam therefore is at the same height as the ogee crest of the concrete spillway. The existing radial gate in the weir is being used as the diversion during construction.

Considering the following factors, the proposed flood management strategy of allowing overtopping of the concrete spillway during construction is considered acceptable in accordance with required guidelines:

- The concrete spillway is designed for overtopping.
- There is existing erosion protection at the toe of the concrete spillway.
- There is expected to be suitable warning to remove personnel and equipment from the work area prior to a flood.
- The spillway cut down is expected to expose reinforced concrete, mass concrete and underlying rock ('greywacke'). These materials are judged to be relatively erosion resistant, should spilling occur.
- This is with the exception of the existing drainage layer beneath the reinforced spillway slab, which will be exposed on spillway cut down. It was planned to face off this drainage gravel material with site concrete immediately on exposure (as would any inferred erodible rock if encountered).
- The consequences pertaining to overtopping of the concrete spillway during construction are judged to be 'Minimal' as per required guidelines. This assumes adequate warning and preparedness for overtopping.
- The consequences associated with overtopping are primarily financial/operational (i.e. delays to construction, clean up).
- The downstream consequences of overtopping (i.e. environmental impact, risk of loss of life) are no different to the current condition. This is as the spillway would be operating as it is designed to do and has done previously. The capacity of the spillway is not increased until the cofferdam and rock ledge upstream of the spillway is removed.

Flood Management Risk

Significant floods at the weir location occur primarily from the Opuha River catchment. Immediately upstream of the weir is Opuha Dam (refer image below). Opuha Dam serves to attenuate floods through the weir. Construction works have been planned to occur when Lake Opuha levels are historically at their lowest. This is immediately following the irrigation season. Lake levels are currently just below average for this time of year and there is a significant volume of flood attenuation currently available. This currently equates to around 30 MCM (million cubic meters) flood storage.

On this basis, there would be significant warning available at the weir location should a flood occur from the Opuha River catchment occur (i.e. Opuha Dam commences spilling).



Several smaller catchments drain into the weir pond. The diversion works have the ability to pass an approximately 1 in 10 year flood from this catchments, prior to activation of the concrete spillway. The pond provides some flood attenuation capacity and therefore provide adequate warning time prior to a flood.

So the likelihood of the concrete spillway getting activated during construction is likely around a 1 in 10 year flood event. Obviously, watching the weather, Lake Opuha levels and weir pond levels is key component of the risk management plan during construction. As is the appropriate management of pond levels so that it remains as close to operationally normal as possible.

Temporary Works

As I said in my earlier post, the enabling and temporary works have been completed. The mass excavation for the cut down of the concrete spillway crest has occurred over the last couple of weeks. The image below shows the spillway cut down (approximately 2 m), with the digger sitting on top of the cofferdam.

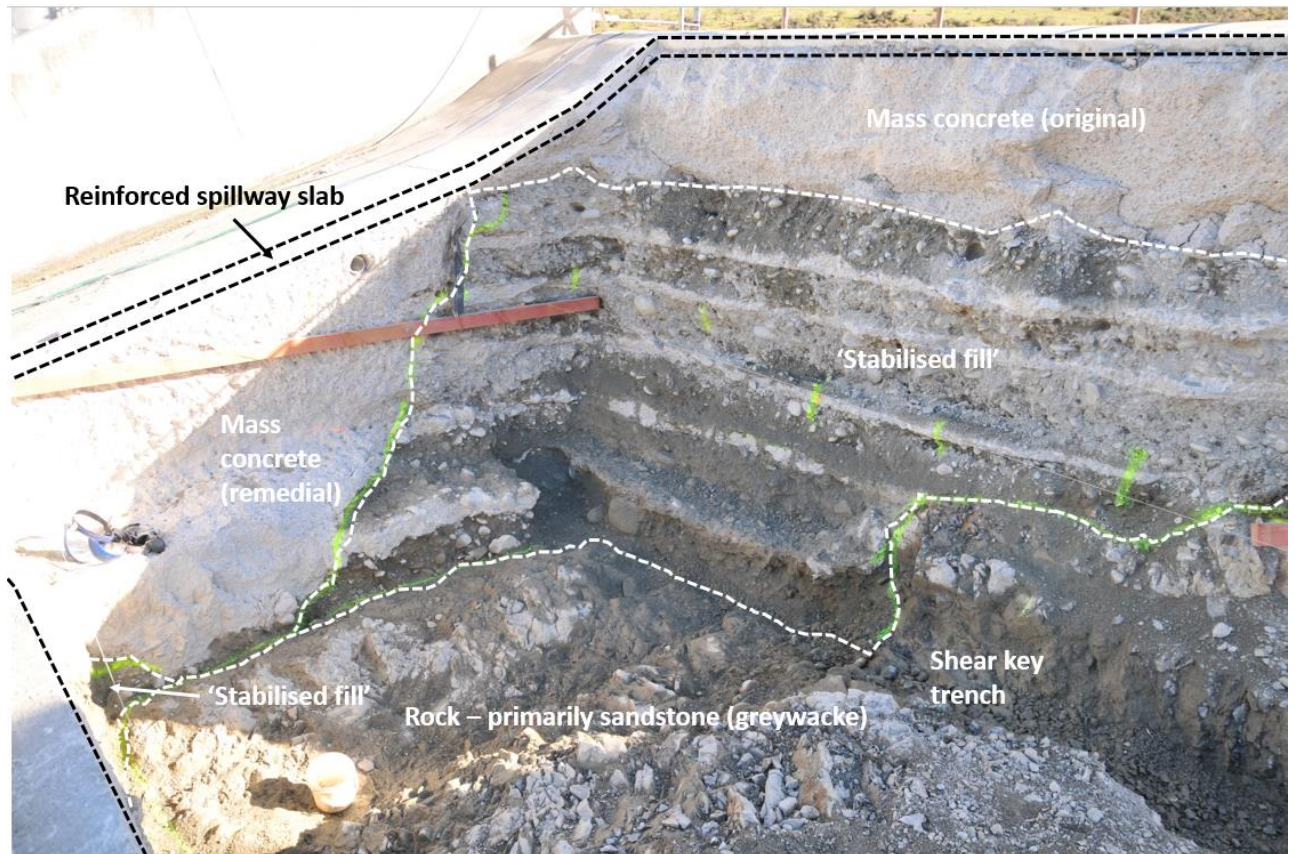


Below is a nice image showing a section through the left side of the concrete spillway. It shows the ogee crest formed on mass concrete, with the reinforced spillway slab sitting on a thin drainage gravel on top of 'greywacke' rock. The left training wall is behind, with the fusible embankment in the background.



Below is an image of the right side of the concrete spillway. This is the location where a section of the spillway crest is being used as part of the cofferdam during construction. It will be demolished at the end of the works, and the concreting upstream of the newly installed gate completed at this time. I will do a more detailed post on this later, as part of the construction sequencing.

As you can see, the spillway is not founded directly on rock in this location. 'Stabilised fill' (as known at the time of original construction) has been used beneath the weir. At left, mass concrete has been used where the weir had been undermined and part of the stabilized fill eroded out. The ogee crest is again formed by mass concrete, beneath the reinforced spillway slab.



As detailed above, allowing the concrete spillway to still be used during construction if required, was based upon exposing materials judged erosion resistant. It was planned to seal the drainage gravel beneath the slab with concrete and this has been completed. This can be seen in the image below, at the far right of the image below the existing spillway reinforced slab.



The 'stabilized fill' has also been temporarily sealed off with concrete, just in case spilling was to occur. As can be seen below.



Summary

A significant amount of thought and planning has gone in to managing the risk posed by flooding during construction of the weir enhancement. This includes the timing of the construction works, the completed temporary works, surveillance of weather and pond levels. Like all things in engineering, all of this effort for something which hopefully doesn't eventuate!

Thank you for reading.

- Owner: Opuha Water Limited
- Contractor: Breens Construction Company
- Designer: MWH Global
- ETC: Tim Anderson