ocdl
O'Callaghan Design Ltd
3 Lochiel Rd
Khandallah
Wellington, 6035
Phone: 04 479 0000
Email: ray@ocallaghandesign.nz

KAIAIO IRRIGATION SCHEME MAUNGAROA
TE KAHA

GEOTECHNICAL REPORT ON EARTHWORKS

Prepared for

TE KAHA GROUP

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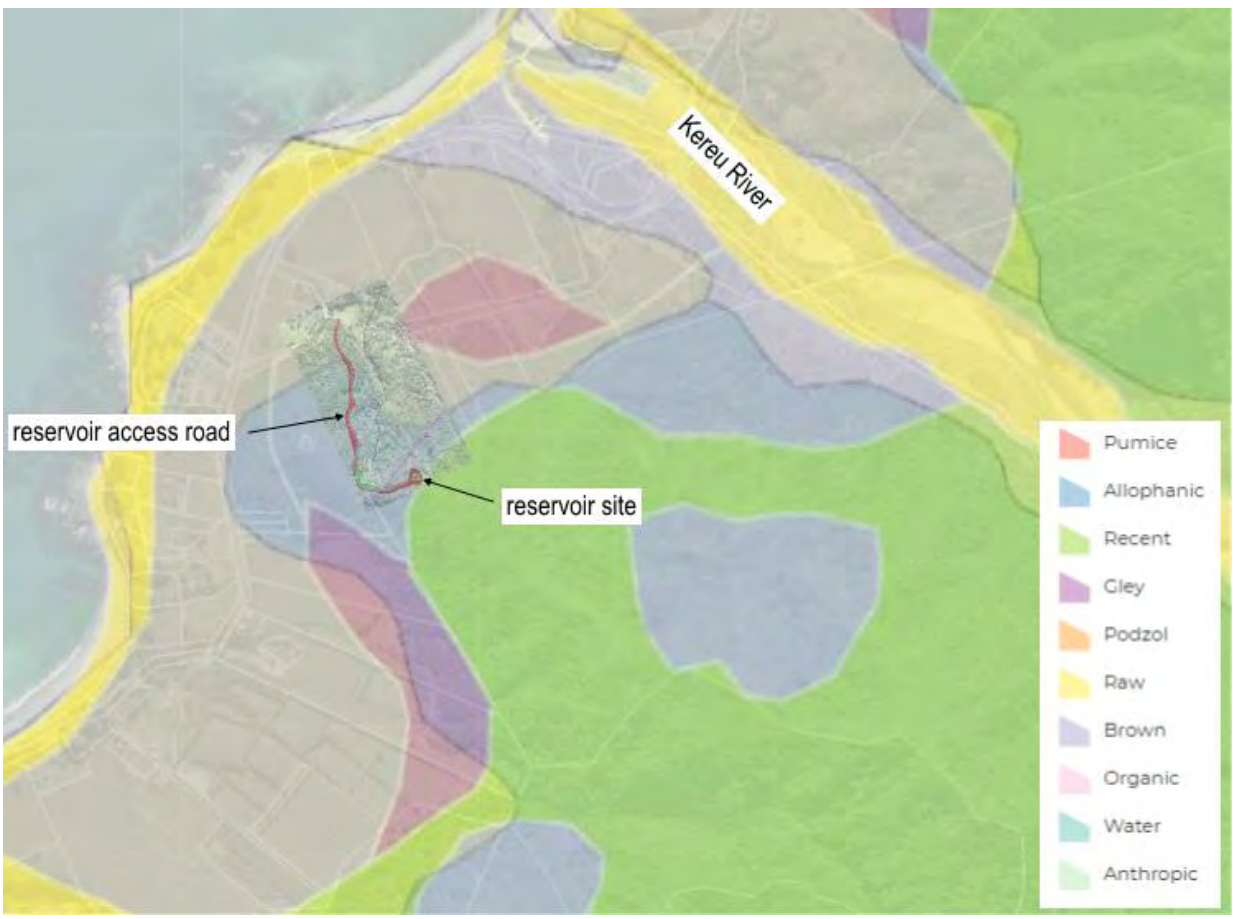
1 INTRODUCTION

This report has been prepared for Te Kaha Group to assist with the planning, consenting, design and implementation of their proposed irrigation project at Te Kaha. The Kaiaio Irrigation Scheme includes the construction of a reservoir at a height of approximately 100m above sea level, on a ridge system on the western side of the Kereu River and the construction of a pump station with water intake structure at the Kereu River. The construction of the access road to the reservoir and the flat platform for the reservoir will require excavation into the relatively steep hillside as indicated on drawing NZ18013 – D200. The pump station inlet system will require excavation of soils on the riverbank. The earthworks require resource consent from both the Western Bay of Plenty District Council and the WBP Regional Council. This report has been prepared to provide supporting information for the resource consent applications and to guide the design of the earthworks.

2 LOCAL SOIL CONDITIONS

The underlying rock in the Te Kaha area has been classified by the NZ Soil Bureau (1973) as coarse rhyolitic rock. This rock is intact, fine grained and prone to weathering but still stable at relatively steep cut batter slopes. This underlying rock is overlaid with soils of the classifications shown in the diagram below.



As shown in the diagram above, the overlying soils in most of the reservoir access road excavation and in the reservoir site are classified as Allophanic soils. This soil type is typical in volcanic ash soils and has a weak structure when saturated.

Inspection of typical road batters, close to the reservoir access road site, confirm the local soils can stand at relatively steep cut batters if they are vegetated, see insert from the nearby State Highway and from an adjacent driveway cutting.

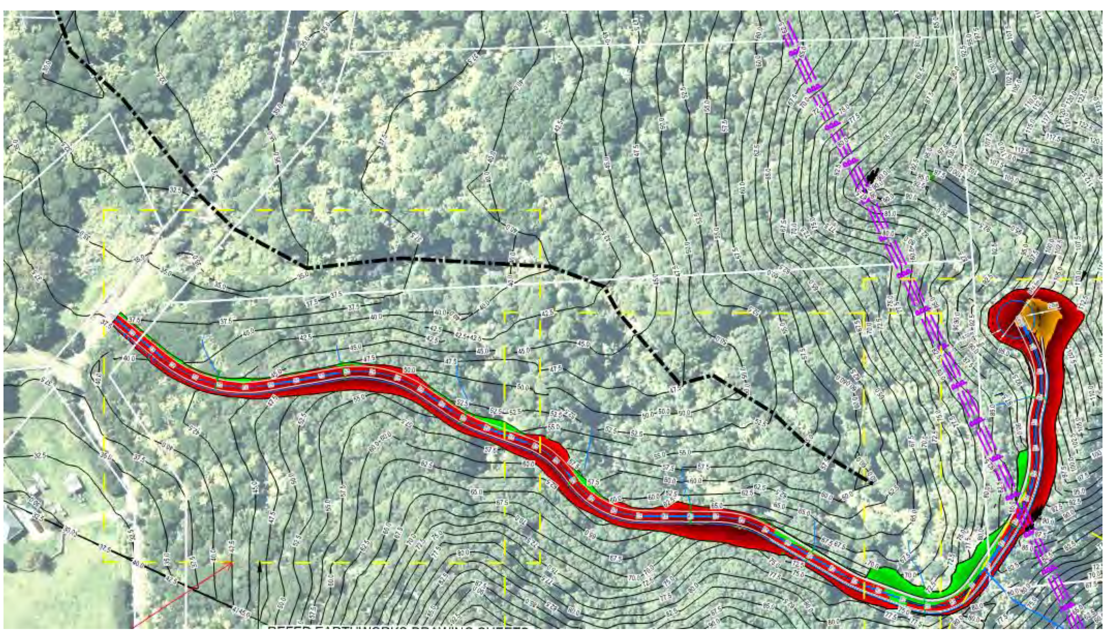
The upper soils have been cut at batter slopes ranging from 1 vertical to 0.5 horizontal (1V:0.5H) to 1V:1H. The stability of the soils is influenced by surface water flow over the batter face and the integrity of the vegetative cover, which can be managed through appropriate design and construction.

The local soils at the pump station intake area have been inspected and are shown in the photograph below:

The brown soils overly lens of fine gravel, which would have been deposited by river action. There is exposed bedrock close to the surface adjacent to the proposed pump station site. This has resulted from the river scouring the overlying soils.

3 PROPOSED RESERVOIR RELATED EARTHWORKS

The proposed earthworks associated with the construction of the access road and the reservoir platform are shown by the insert below (from drawing NZ18013 – D200).

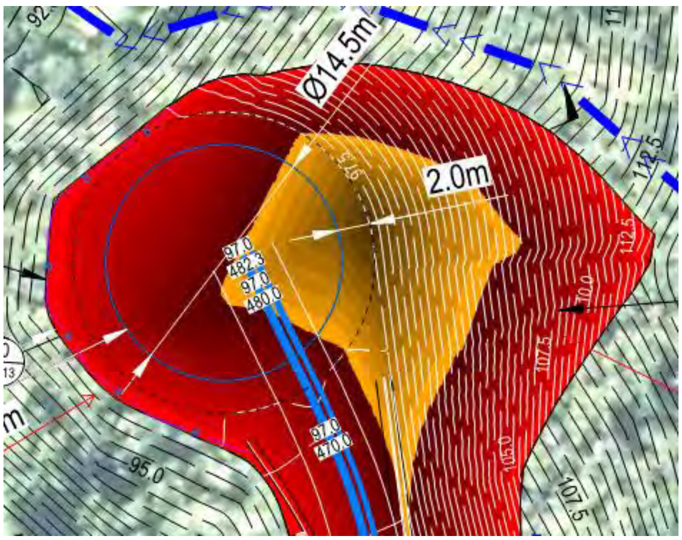


The access and reservoir platform earthworks are shown in more detail in the resource consent drawings NZ18013 – D210 – 212. The access road will require a sidling cut up to approximately 5m deep and the reservoir platform will require an excavation of up to 8.5m deep below existing ground level, as shown on drawings NZ18013 – D220 – D222.

The resulting cut batter on the up-hill side of the access road will be up to approximately 8m high at its maximum, although it is more typically 3 – 4m high. The highest section of batter behind the reservoir will be up to 16m high.

There is minimal filling proposed as part of the access road construction due to the steepness of the land but there are still small pockets of proposed fill (green areas) as shown on the drawings.

An insert of the reservoir excavation area is shown by the insert below. The orange area is the area of cut exceeding 5m below existing ground (measured vertically).



4 SOIL INVESTIGATIONS AT THE RESERVOIR SITE

Hand auger tests were carried out at the reservoir site to confirm the depth of overlaying soils and the nature of the soils. These tests confirmed the presence of the allophanic brown to orange ash loam soil, with modest moisture content and moldable in the hand, extending to a depth of 3 - 4m below the surface. Below the soil layer was rock which could not be penetrated with a hand auger.

The soils investigation also included inspection of the cut batters on an old power pylon track that was constructed along a similar alignment of the proposed reservoir access road, near the saddle. The old track is clearly visible on the ground for 100 -200m in length and it is only the fact that is does not extend on up the ridge system from the saddle that makes it of limited value for re-use as part of the reservoir access road construction. The old track has cut batters of 2 – 3m on the uphill side in places and these batters reveal soft brown volcanic origin soils at a batter slope of approximately 1V:0.75H.

The site tests and the visual inspection of the soils in the area confirm the presence of soft soils overlaying reasonably competent rhyolite rock.

5 RECOMMENDED DESIGN PARAMETERS ASSOCATED WITH THE RESERVOIR

<u>Reservoir Site</u>

The reservoir site is near the top of the ridge system and so there is very little stormwater catchment area above the proposed cut batter site. This is helpful as it reduces the risk of the exposed cut batter becoming saturated from surface water beyond the top of the cut.

The underlying rock at the reservoir site is expected to be intercepted at a depth of 3 – 4m. The rock is expected to be stable at a batter slope of 1V:0.75H and a batter slope no steeper than this should be adopted for the design of the earthworks within rock.

It will be difficult to re-establish vegetation on the expose cut rock because the batter slope is too steep to support a topsoil overlay and the rock is moderately resistance to plant root systems establishing. However, securing an overly of brush matting over the exposed rock will assist with the propagation of vegetation to some degree.

The overlying soils are expected to be stable at a cut batter of 1V:0.75H. However, the cut batter behind the reservoir is over 10m high and the upper part of the batter will be in the softer soils, which are more prone to slumping and/or scour until a good vegetation cover is established. Securing a brush matting on these soils at this batter slope, high above the base of the cut, will be difficult and have associated health and safety plan implications. In addition, it will be difficult to carry out any notable remedial batter reshaping if there is slumping of the exposed batter in the soils in the initial years until a good soil cover is established and the risk of slumping dropping on to the reservoir below is undesirable. Therefore, we recommend that the design adopts a batter slope of 1V:1H in the upper soils adjacent to the reservoir so that the risk of instability and associated remedial works is minimised. The exposed cut batter in the soils should be protected by revegetation immediately after construction, with a brush matting placed on the cut batter and enhanced seeding propagation used.

<u>Reservoir Access Road</u>

The excavation for the reservoir access road is expected to be intercept rock at a depth of 3 – 4m. The rock is expected to be stable at a batter slope of 1V:0.75H and a batter slope no steeper than this should be adopted for the design of the earthworks.

As for the rock exposed at the reservoir site, it will be difficult to re-establish vegetation on the expose cut rock because the batter slope is too steep to support a topsoil overlay and the rock is moderately resistance to plant root systems. However, securing an overly of brush matting over the exposed rock will assist with the propagation of vegetation.

The overlying soils are expected to be stable at a cut batter of 1V:0.75H. The cut batter adjacent to the reservoir access road is typically 3 – 4m high. Securing a brush matting on these soils at this batter slope, will be feasible due to the typical limited height. In addition, it will not be difficult to carry out any notable remedial batter reshaping if there is slumping of the exposed batter in the soils in the initial years until a good soil cover is established and nor are there any notable consequences of minor slippage of parts of the batter if it did occur in an extreme weather event. Therefore, we recommend that the design adopts a batter slope of 1V:0.75H in the upper soils as the risk of instability and associated remedial works is minimal and it is desirable to minimise vegetation disturbance. The exposed cut batter in the soils should be protected by revegetation immediately after construction, with a brush matting placed on the cut batter and enhanced seeding propagation used.

We note that it is proposed to incorporate some relatively small fills in isolated sections of the access road to achieve a suitable horizontal geometry of the road and to avoid the road “day-lighting” the saddle. The excavated material will be suitable for the proposed constructed fills. As the fills are relatively small and given the desire to minimise the area of vegetation clearance, we consider a fill bater of 1V:1.5H can be used on this site, with the rock and soil blended fill material, provided appropriate compaction is achieved and suitable stormwater control is in place to prevent surface water from the road spilling over the fill batter.

6 PROPOSED EARTHWORKS AT THE PUMP STATION SITE

The construction of the pump station with the water intake structure requires the formation of an access drive down to the river edge, at the intake, to maintain the intake screens. The access drive is shown in the consent drawings (NZ18030 – PW 70) as below;

The construction of the intake structure will be carried out inside a sheet-pile coffer dam and so batter slopes are irrelevant because the soils are supported by the sheet-pile structure. The driveway down to the intake structure will have a cut batter on the landward (north) side that will slope up to the pump station compound platform, which is expected to be at a level of approximately RL7m. This cut batter will be predominantly in the upper soils, typical of that shown in the photograph in Section 2. This cut batter should be formed at a batter of 1V:1H to achieve a stable batter slope up to the pump station compound.

7 SUMMARY

The above assessment sets out our opinion on the various geotechnical and earthworks matters. We consider the recommended design batter slopes will achieve a suitable stability for the cut and fill batters. The local soils are suitable for the proposed design. The design and construction details need to provide appropriate stormwater control, as indicated on the plans attached to the resource consent application and the revegetation of the exposed cut batters in the upper soil layers needs to achieve a suitable vegetation cover to protect the exposed surfaces from scour.

Ray O'Callaghan
CPEng (No 57868)
Engineering Director
O'Callaghan Design Ltd