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Report

Prince of Wales/Omāroro Reservoir: Raising of Playing Fields Feasibility Study

Prepared for Wellington Water Ltd

Prepared by CH2M Beca Ltd

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Executive Summary

The Prince of Wales/Omāroro Reservoir is a completely buried 35,000 m^3 Concrete Reservoir which will be constructed within the Townbelt, above the upper Prince of Wales Park in Mount Cook. This park has two playing fields, an upper playing field and a lower playing field, primarily used for recreational level club playing. Construction of this large buried reservoir will involve significant volumes of earthworks, both to form the excavation for the reservoir and to backfill and bury the completed reservoir. During the Preliminary Design Stage of this project a large volume of surplus excavated material was proposed to be disposed off-site. This was based on only being able to use the upper playing field for temporary stockpiling of excavated materials plus a small volume of fill placed permanently for some minor reshaping of the field. The temporary stockpile was high (8.5 m) and occupied a large part of the upper playing field.

Wellington Water Limited (WWL) has requested that a feasibility study be carried out to consider whether the volume of material to be removed from site can be reduced to help minimise the impacts of truck movements on residents and users of Rolleston Street. This study is based on using both the upper and lower playing fields for both permanent use of excavated material and temporary stockpiling, rather than just the upper playing field as was the case at Preliminary Design. In addition, the feasibility study has considered sharing the stockpile of material for reuse between the two fields to minimise the impact of this high stockpile on adjacent residents.

Permanently raising the levels of both playing fields to utilise some of the excavated material is considered feasible. Both playing fields would provide a similar playing area and surround to the existing fields and would have a central crest line with surface falls of 1V to 70H each side of the centreline in accordance with general guidelines for playing fields. It is noted neither of the playing fields provide compliant run-off areas and hence the future raised fields are also likely to be non-compliant.

The amount that the lower playing field can be raised is affected by the interaction of this field with the existing Papawai Stream and the bund between the stream and the playing field and also by the height of retaining structure required on the eastern side of the field adjacent to Salisbury Terrace. The proposed scheme raises the field at its centreline to a level nominally lower than the existing bund at the Papawai Stream. The height of the raising at the centreline is in the order of 1 m. The finished field will have falls at 1V:70H to both the east and the west where new swales collect the runoff and convey it to a stormwater system downstream of the clubrooms. This prevents runoff from the field from entering the Papawai Stream and therefore flows down this stream are not changed by this work, which is considered desirable. By keeping the field centreline level lower than the bund and running: a connecting stormwater pipe at the north end of the field, this field can provide attenuation to overflows from Papawai Stream. Currently, flows in the stream which exceed the 10 year design event overflow the existing bund and flow across the existing field and out into Salisbury Terrace. This attenuation on the playing field can mitigate against some of the flooding risk to properties that occurs now.

Retaining is required along the east side of the lower playing field, varying from 1.0 m high up to approximately 4.5 m high. The solution for retaining features timber walls at lower heights and a terramesh wall at greater heights.

The upper playing field is raised by approximately 1 m on each side and up to approximately 1.5 m in the middle. Timber retaining walls will be provided at the east, north and part of the west sides. Stormwater drainage will be as proposed in the Preliminary Design Report (PDR).

The permanent raising of the playing fields can accommodate approximately 16,100 m^3 (in-situ) volume of excavated material, reducing the amount to be disposed off-site from 30,800 m^3 previously to 14,700 m^3 and reducing truck movements from 5,400 to 2,520 approximately.

The material that is stockpiled for reuse to backfill the completed reservoir structure can be shared between the two fields, reducing the height and footprint of the stockpiles. Instead of one large stockpile, 8.5 m high on the upper field, two stockpiles can be provided, between 4 m high (upper playing field) and 5.5 m high (lower playing field), and positioned on the fields in positions away from adjacent properties.

Space is also available on each playing field during construction for stockpiling of topsoil from the fields for reuse, erosion and sediment control measures and for providing parking for adjacent residents on the upper playing field and for light construction vehicles on the lower playing field.

The general arrangement for the playing fields and temporary stockpiles is shown on drawing 6513361-CK-1000 contained in Appendix A.

Care will need to be taken by the Contractor during playing field topsoil stripping and soil handling to maximise soil that can be harvested and to minimise travel over topsoil. Specialist turf machinery would also be required for seedbed preparation and final levelling.

Generally, bulk earthworks on site could be carried out using off-road dump trucks to maximise the load that can be carried from the reservoir site in each trip. These trucks would remain on site for the duration of earthworks activities.

Some existing utilities are affected by the raising of the playing fields. These include a wastewater pipe, some water mains and some 33 kV power cables. Allowance has been included for the existing wastewater pipe that is shown across the lower playing field and one watermain near the centre of the upper playing field to be relocated. Other services are not under the large stockpiles but do receive increased permanent level of cover of up to 1.5 m. There is a risk that these utilities will need relocating and a risk allowance has been identified for these under the field raising option.

Cost estimates have been established for two options and are presented in Appendix B. These estimates provide extra over costs associated with each option in comparison with the original preliminary design cost estimate dated May 2013. The extra over costs for each option are:

1) Raising and Stockpiling on both Upper and Lower Playing Fields $2,189,500 (inclusive of $280k allowance for relocation of HV cables and water mains)
2) Stockpiling on the Upper and Lower Playing Fields only $1,710,500.

There are some significant benefits associated with stockpiling on both fields and further benefits associated with raising the fields to keep more material on site, including reduced truck movements on Rolleston Street, lower height and smaller footprint stockpiles, providing room for displaced resident and worker parking on site, areas for sediment and erosion control, and areas equipment and material storage and onsite offices, upgraded playing field surfaces and enhanced flooding mitigation from the Papawai Stream. These benefits have been considered in Appendix C against the increase in cost in relation to the overall site development and consenting process.

It is important to note neither the Preliminary Design option of stockpiling all fill on the upper field, nor the alternate option of raising and stockpiling on the upper field only, were analysed further under this study. These options would involve more truck movements and are likely to be more expensive than the options that spread the stockpile across both fields.

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Report – Prince of Wales Park – Raising Playing Fields Summary of Benefits/Dis-Benefits

1 Introduction

1.1 Background

The Prince of Wales/Omāroro Reservoir is a completely buried 35,000 m^3 Concrete Reservoir which will be constructed within the Townbelt, above the upper Prince of Wales Park in Mount Cook. The Construction of the Reservoir involves significant volumes of earthworks, with a large excavation required to form the platform for the Reservoir and back filling under, around and over the Reservoir during Construction.

Limitations on the use of the lower playing field for construction activities in the Preliminary Design stage of this project resulted in a large volume of excavated material having to be trucked off-site and some of the excavated material was to be used on the upper playing field for a slight raising of the playing surface. Excavated material that was to be reused for backfilling around the Reservoir was stockpiled on the upper playing field in a high (8.5 m) pile that extended over a large extent of the upper playing field. The balance of the surplus excavated material, approximately 31,000 m^3, was all disposed off-site, using the only road entrance available which is down Rolleston Street.

More recent investigations have identified that Rolleston Street, including the turn into Wallace Street, is unsuitable for truck and trailer vehicles. Limiting the transport to truck units only would effectively double the number of return truck movements along Rolleston Street, having significant impacts on the residents and parking on this street. In addition, the high stockpile on the upper playing field is considered to have significant effects on neighbouring properties.

Due to these issues, a feasibility study into reusing a greater volume of the excavated material on site and changing the stockpile arrangement to reduce the effects of this has been carried out and is outlined in this report. A main change in the design basis between the Preliminary Design stage and this feasibility study is the availability of the lower playing field during Construction. The lower playing field can now be utilised during the Construction phase.

Specifically this study was to consider two options:

1) Raising and Stockpiling on both Upper and Lower Playing Fields; and
2) Stockpiling on the Upper and Lower Playing Fields only.

The following options were not considered for further analysis:

3) Raising and Stockpiling on Upper Playing Field only; and
4) Stockpiling on the Upper Playing Fields only – the Preliminary Design solution.

Neither the Preliminary Design option of stockpiling all fill on the upper field, nor the alternate option of raising and stockpiling on the upper field only, are deemed feasible. This is due to the footprint and height of the necessary stockpile to provide for backfill of the reservoir deemed to have significant visual effects and impacts on adjacent landowners and not allowing space for other construction activities, including parking for workers and displaced residents', sediment and erosion control and other stockpiling of materials (i.e. topsoil), machinery, vehicle, equipment and construction material storage areas, sufficient manoeuvring areas for vehicles accessing and exiting the site, and site management offices.

Therefore options 3 and 4 would very likely need to have a significantly reduced stockpile quantity from that proposed under the Preliminary Design to facilitate practical site development, and ensure RMA consentability. The implications of this are increased disposal offsite of excavated fill and a need to bring additional fill back to site for backfill around the reservoir. Both of these activities will lead to an increase in

truck movements and would likely be more expensive options in comparison to those that spread the stockpile across both fields.

1.2 Integrated Discipline Approach

This feasibility study was carried out by a team of senior personnel covering all relevant disciplines. This was to provide an integrated approach across these relevant disciplines.

This study commenced with a workshop and site visit attended by the following people:

- Project Director — Wayne Estment
- Planner — Matt Trlin
- Civil Engineer — Doug Stirrat
- Stormwater Engineer — Kate Purton
- Geotechnical Engineer — Philip Robins
- Cost Estimator — Barry Calvert

This workshop started with a project briefing by Wayne Estment and Matt Trlin and a review of previous work carried out in the Preliminary Design phase. The team was also provided with some design information related to a separate WWL project related to stormwater works adjacent to and downstream of the lower playing field.

Following this review, the team carried out a site visit at the Reservoir site including both playing fields and the surrounding streets. The site is shown in Figure 1 below.

The site walkover enabled the team to gain an understanding of the proposed sites for depositing some of the excavated material and the issues that would be relevant to the feasibility study. In particular it highlighted the nature of the Papawai Stream and how it relates to the lower playing field.

Figure 1 - Site Location Plan

1.3 Previous Studies

The previous studies that have been considered during the preparation of this report are as follows:

- Hospital Prince of Wales Reservoir Park and Surplus Material Options Assessment Report – (CH2M Beca) July 2012
- Hospital Prince of Wales Reservoir Geotechnical Report – (CH2M Beca) October 2012
- Hospital Prince of Wales Reservoir Geotechnical Report: Addendum – (CH2M Beca) January 2013
- Hospital Prince of Wales Reservoir Conceptual Design Options Report – (CH2M Beca) February 2013
- Hospital Prince of Wales Reservoir – Preliminary Design Report – (CH2M Beca) May 2013
- Salisbury Terrace Stormwater Upgrade – (Calibre) 2016/2017
  - Phase 1 – Prince of Wales Park, Papawai Stream erosion protection
  - Phase 2 – 12 Salisbury Tce Stormwater upgrade
  - Phase 3 – Prince of Wales Park, Playing field Stormwater upgrade in the vicinity of clubrooms.

2 Civil Earthworks and Stormwater

2.1 General

To minimise the amount of surplus material to be removed from site, consideration has been given to raising the finished level of both playing fields. This raising will also give an opportunity for improvements to the drainage and playing surface of the fields.

At this stage only limited field survey has been carried out for the lower playing field. This has been combined with available LIDAR data to create a ground model. More thorough survey will be required for preliminary design of the field raising, particularly in relation to confirming whether a compliant playing field can be accommodated on the site.

The resultant arrangement of playing field raising and temporary stockpiles from this study is one possible arrangement. Other arrangements are possible and could be investigated in later design stages.

2.2 Playing fields Assumptions/Basis of Design

The following basis of design has been used for the raising of the playing fields.

- Playing areas to remain the same as the current playing areas.
- The playing fields have a central longitudinal ridge with transverse falls to the edges of the fields at 1V:70H desirable but can be steepened to 1V:50H if required
- A minimum flat area surrounding the playing area of 3 m for the lower playing field and to match the existing for the upper playing field, which in some areas is less than this
- Existing topsoil from the fields will be harvested and stockpiled on site. This process will need to be carried out carefully, to ensure all existing vegetation is killed and removed to ground level and the topsoil is harvested selectively to avoid contamination from underlying subsoil. Travel over topsoil shall be minimised and stockpiles will be limited to 2 m high. This will be respreads on the finished fields to form the playing surface with subsoil drainage installed
- The exposed subgrade should be ripped before starting to place the excavated material to facilitate merging of the imported material
- Topsoil will be re-spread taking care to avoid compaction by trucks transporting the topsoil.

2.3 Subsurface Conditions

The considered basis of design assumptions have been based on the interpreted subsurface ground conditions. No subsurface information has been undertaken on the lower playing field.

The as-built condition of the existing bund around the lower playing field is unknown. To provide a stable earthen structure adjacent to the Papawai Stream, the existing bund may need to be removed entirely or modified although this is considered unlikely under the current design concept.

2.4 Raising of Lower Playing Field

2.4.1 Existing Site

The lower playing field is adjacent to the Papawai Stream on part of its western and northern boundaries, separated from the stream by a low (estimated 0.7 m high) bund. The remainder of the west boundary and most of the southern boundary is formed by slopes up from the field. The eastern side is bounded by a varying height slope/wall down to Salisbury Terrace.

2.4.2 Works by Others

A separate Wellington Water project including works in the lower playing field has recently been designed (by Calibre) and tendered. It includes:

- Erosion repairs and protection in Papawai Stream (adjacent to the clubrooms in the lower playing fields) and channel re-grading works in the Papawai Stream (downstream of the lower playing fields)
- Changes to the pipework around the clubrooms on the lower playing fields connecting to the stormwater network
- A swale along the eastern edge of the lower playing fields discharging to this new pipework
- New kerb and channel and stormwater pipework at the 12 Salisbury Terrace corner.

The proposed swale along the eastern edge of the lower playing field would be superseded by the raising of the lower playing field.

2.4.3 Proposed Raising of Lower Playing field

The concept for the finished ground levels of the raised lower playing field is to have a central longitudinal ridge and to fall at 1V:70H outwards from this centreline towards the east and west, in accordance with the assumptions and basis of design given in Section 2.2 of this report. On the east side a retaining structure will be required along Salisbury Terrace. On the west the filling will be placed against the existing bund beside the Papawai Stream. The amount that the field can be raised is governed mainly by the interaction of the field levels with the bund surrounding the Papawai Stream on the west and north of the field, and also by the height of retaining structure against Salisbury Terrace.

It is understood that the existing bund along Papawai Steam has been sized to contain a 10 year event within the stream, and overtop in larger events. At present this overtopping is onto the lower playing field and then it appears to flow into Salisbury Terrace. We also understand that there should be no increase in flow through the existing culvert under the access track between both playing fields and it is undesirable to modify or replace this culvert.

We have considered four options for the playing field level and drainage in relation to the Papawai Stream as follows:

- Option 1: Existing bund to remain and the field raised to a level higher than the existing bund. In events larger than a 10 year event the flow would be contained within the Papawai Stream, and there would be increased flows in the Papawai Stream downstream
- Option 2: Existing bund to remain and the field raised to a level with the crown of the playing field at existing bund level. In events larger than a 10 year event water would spill onto the fields, and there

would be no increase in the flow in the Papawai Stream. However there would be little or no attenuation of these flows and they would still overflow into the surrounding area

- Option 3: Existing bund to remain and the field raised to a level with the crown lower than the existing bund. In events larger than a 10 year event water would spill onto the fields, and there would be no increase in the flow in the Papawai Stream. The field would provide attenuation of these excess flows which would be discharged into the stormwater system and Papawai Stream downstream of the lower playing field
- Option 4: Existing bund lowered and the field raised (but no higher than the new bund). In events smaller than a 10 year event water would spill onto the fields, decreasing the flow in the Papawai Stream downstream. Flows attenuated by the playing field

In this feasibility study, the chosen option for the lower playing field is Option 3 as described above. The crown of the playing field is raised to approximately 100 mm lower than the existing bund. The field falls at 1V:70H to the east and the west sides. A drainage swale is provided along each side of the field to collect playing field stormwater runoff and these discharge into a new stormwater pipe at the northern end of the field which in turn discharges into the new Salisbury Terrace stormwater system designed by others. A retaining wall is required along the Salisbury terrace side of the playing field, varying in height from one metre up to approximately 4.5 m high.

This option means that flows in the Papawai Stream and through the existing culvert under the access drive between the two fields is unchanged by the raising of the field. No playing field stormwater will drain into the Papawai Stream, upstream of the existing access track culvert. The flow in the stream still overflows the bund at the 10 year event level onto the field. By having the crown level of the field slightly lower than the bund level some attenuation of these higher level flows is achieved with additional benefits to mitigating against flood flows downstream into adjacent roads and properties.

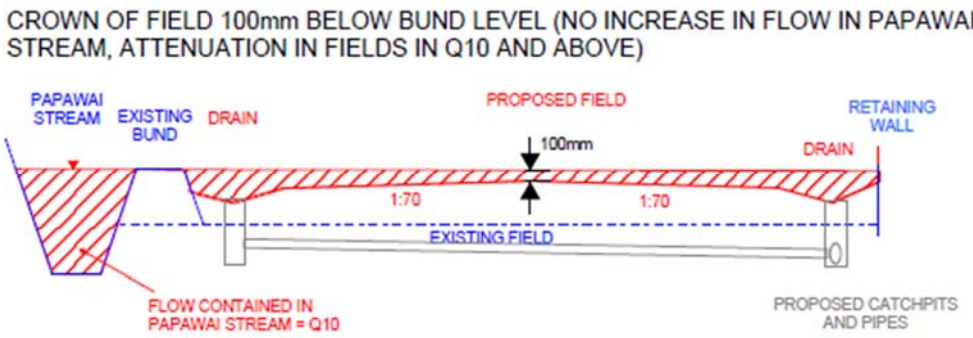
This option is preferred over the other options presented above as it doesn't affect flows in Papawai Stream past the playing field and through the existing culvert and provides some attenuation to higher level flows while still providing for a significant volume of fill to be placed on the playing field.

The volume of fill that can be placed on this field is approximately 8,600 m^3 (bulked volume).

The approximate volume of Stormwater that can be contained on the playing field for attenuation is approximately 3,500 m^3.

Figure 2 below shows an indicative section through the lower playing field to illustrate the proposed raising option.

Figure 2 – Sketch Schematic Diagram of Papawai Stream, Bund and Lower Playing Field



2.5 Raising of Upper Playing Field

The upper playing field is bounded by residential properties to the north, Rolleston Street to the west, a steep slope up to the south and a slope down to the east. The existing field is of relatively small dimensions for a playing field and has limited space around the field in places, most notably at the north-east corner.

The concept for raising this field is to raise it by approximately 1.0 m on the south side against the existing bank. It would then slope up to the centre at 1V:70H and back down again to the north side. This gives a raising of the finished surface by between 1 m and 1.5 m.

Low retaining walls are required along parts of the northern and eastern boundaries.

Stormwater drainage for this field will generally be as proposed in the PDR, with a concrete channel or swale and sumps along the northern and southern edges of the field.

2.6 Playing Field Construction

Reference is made to the previous report, use of Prince of Wales Park playing fields for facilitation of Construction of proposed central business district Reservoir, September 2004, prepared for Wellington City Council by Recreational Services Ltd. This contains a detailed description of methodology for harvesting topsoil, replacement and relevelling which would be expected to apply to this work.

2.7 Raising of Access Track between both Playing Fields

This track will be raised to match the new playing field levels and also to flatten the gradient over the lower part of the existing track.

2.8 Temporary Stockpiling of Material for Reuse

The excavated material that is to be reused for backfill at the Reservoir site is to be stockpiled on site. This can be divided between the upper and lower fields to keep the height of stockpile lower than the 8.25 m required in the PDR.

The drawings in Appendix A show one possible arrangement for these stockpiles. These have been sized to hold the full 25,000 m^3 volume that is required for reuse. The slopes of the stockpiles are 1V:1.5H.

A bulking factor of 1.2 has been assumed, giving a total required volume of storage of 30,000 m^3.

On the upper playing field the stockpile has been limited to 4 m high and with its northern edge kept back from the residential property boundary by 25 m to:

- Reduce the effects of this stockpile on these properties
- Allow space for displaced residents' parking (from Rolleston Street) along the north west edge of the field during construction
- Allow space for the installation and operation of erosion and sediment control measures
- Allow space to stockpile harvested topsoil (no higher than 2m in height) for reuse.

The southern side of the stockpile is approximately 8 m from the toe of the steep bank above the field. This will provide a space for construction vehicle traffic along the southern side of the stockpile.

Flexibility exists within this field configuration to also accommodate areas that may be needed for vehicle manoeuvring, storage of other equipment and materials, and site offices.

The following Geotechnical report was prepared to consider the temporary placement of stockpiled material on the upper playing field:

- Hospital Prince of Wales Reservoir Geotechnical Report: Addendum – (CH2M Beca) January 2013

On the lower playing field the stockpile has been located towards the western side of the field, away from the nearest houses. This stockpile has been kept clear of the existing watermains that run under this field, to avoid loading these services with the stockpile weight. This has also allowed areas to be identified on the lower playing field area that could be capable of accommodating worker parking on site. The height of the stockpile is 5.5 m above the raised field level.

For temporary stockpiling of the upper and lower playing fields only, the requirements under section 2.6 will still be applicable and the following will still need to be undertaken:

- Existing topsoil from the fields will be harvested and stockpiled on site. This process will need to be carried out carefully, to ensure all existing vegetation is killed and removed to ground level and the topsoil is harvested selectively to avoid contamination from underlying subsoil. Travel over topsoil shall be minimised and stockpiles will be limited to 2 m high. This will be respread on the finished fields to form the playing surface with subsoil drainage installed
- The exposed subgrade should be ripped before starting to place the excavated material to facilitate merging of the imported material
- Topsoil will be re-spread taking care to avoid compaction by trucks transporting the topsoil.

2.9 Erosion and Sediment Control

The possible temporary layouts of the fields during construction are shown in Appendix A on drawing 6513361-CK-1000.

These layouts show the space occupied by the stockpiles and a space allowance for erosion and sediment control ponds.

2.10 Earthworks Vehicles

It is expected that the transport of earthworks on the site can be carried out using off-road dump trucks. These trucks would be expected to stay on site for the duration of earthworks.

Materials transported off site will be by single truck units with a volume of 8 m^3.

2.11 Summary of Quantities

The following table summarises the earthworks quantities.

Item	Volume (m^3) (in-situ)	Volume to Dispose (bulked)	No of Trucks (8 m^3 per truck)
Site clearance from reservoir site (assumed 11,000 m^2 by 0.2 m thick)	2,200	2,640	330
Use on site to raise playing fields			
▪ Upper playing field	8,000		
▪ Lower playing field	7,800		
▪ Access track	300		
Stockpile for reuse			
▪ Upper playing field	9,600		
▪ Lower playing field	15,600		
Dispose of surplus off-site	12,500	17,500	2,190
Total	**56,000**	**20,140**	**2,520**

3 Traffic and Parking

All construction vehicles will enter the site using Rolleston Street.

The trucks for transporting excavated material between the Reservoir site and the playing fields would be expected to remain on site during the full duration of the earthworks components of Construction.

A space for traffic to run is provided along the southern side of the stockpile on the upper playing field, keeping traffic away from the houses once the bund is in place. The existing track between both playing fields will be raised using excavated material. This will likely be only wide enough for one way traffic, requiring temporary traffic control on the site during earthworks operations to manage truck movements.

The compacted excavated material will form a running surface for the truck movements. A permanent pavement surface will be provided on completion for ongoing use by WCC maintenance vehicles.

Drawing 6513361-CK-1000 shows the possible arrangement on the playing fields during Construction. Space is available for temporary parking on the playing fields. The lower field can be used for light construction vehicle parking and the upper field can be used for temporary residents parking if available parking is reduced on Rolleston Street.

4 Underground Utilities

Existing utilities cross the upper and lower playing fields, as indicated on the drawings.

On the upper playing field an existing 375 mm and 450 mm watermain and 33 kV power services run along the southern side of the field, with a further 375 mm watermain crossing the field. As in the PDR, the 375 mm (1935) watermain crossing the field will be relocated to along the southern side of the field, due to the stockpile that is proposed to be placed on top of this area. The services along the southern edge of the field will have an additional 1.0 m of fill placed over them. It is assumed that these services will be able to resist the additional load from this fill and that the total depth of cover (approximately 1.9 m) is acceptable for future maintenance purposes.

On the lower playing field there are several water services, the 33 kV power cables, a Stormwater pipe and a wastewater pipe. We have assumed that the wastewater pipe will need to be relocated around the field. This is to provide sufficient space clear of buried utilities for constructing a stockpile of material. The other services are assumed to be left in place, with an increase in fill over the pipes of up to approximately 1.5 m. However, there is a risk that some of these will need relocating given their age and the depth of fill being placed.

5 Risks

The following risks have been identified in relation to this study.

5.1 Utilities

The new cost estimates include for relocating one wastewater pipe that has been identified on the lower playing field. Relocation of one existing watermain was previously allowed for in the Preliminary Design estimate and so is still included in the overall project estimate.

There is a threat that raising of the playing fields will lead to other existing utilities located underneath needing to be relocated or replaced. The level of cover over these services increases by in the order of 1.5 m. A risk allowance of $280k is included within the new cost estimate for the field raising option to cover the relocation of other services including two watermains (375 mm and 450 mm diameter) and Wellington Electricity 33 kV cables.

5.2 Volumes of Fill Placed Permanently on the Playing fields

There is a threat that the volumes estimated in this study for raising the playing fields won't be able to be achieved. While some limited survey has been carried out on the lower playing field to assist in this feasibility study, more survey is likely to be required for detailed design, especially related to designing the retaining wall final geometry and tie-ins to existing ground levels at the access points. Other factors that contribute to this threat include the, effects on neighbours being unacceptable, suitability of excavated material for raising fields (to be confirmed with WCC's Parks team), confirmation of geotechnical suitability of fields to being raised, provision of adequate playing field runoff areas and stormwater detailed design.

5.3 Effects on Neighbours

There is a threat that the raising of the playing fields and construction of retaining walls may have adverse impacts on neighbouring properties, in terms of visual effects and noise during earthworks.

5.4 Effects on Papawai Stream

There is an existing bund between the Papawai Stream and the lower playing fields. In larger events, currently the stream overflows the bund, spilling on the playing fields and the land below. Depending on the relativity of the bund height and the level of the lower playing fields, raising of the lower playing fields could contain larger flows within the Papawai Stream, increasing flows downstream. Increased flows within the stream could cause downstream issues with erosion and capacity. This risk has been mitigated by the chosen option for raising the lower playing field, however this does reduce the volume of excavated material that can be placed on this field.

There is also a threat that this bund may not be able to retain the fill that is placed against it during the raising of the field.

5.5 Interaction with Other Projects

Raising the lower playing fields would modify the drainage along the eastern side of the field. This will supersede the (Calibre design) swale which has been recently tendered.

6 Cost Estimate

6.1 Estimate Summary

Cost estimates have been established for two options and are presented in Appendix B. These estimates provide extra over costs associated with each option in comparison with the original preliminary design cost estimate dated May 2013. The extra over costs for each option are:

1) Raising and Stockpiling on both Upper and Lower Playing Fields $2,189,500 (inclusive of $280k allowance for relocation of HV cables and water mains)
2) Stockpiling on the Upper and Lower Playing Fields only $1,710,500.

There are some significant benefits associated with stockpiling on both fields related to lower height and smaller footprint stockpiles, upgraded playing field surfaces, providing room for displaced resident and worker parking on site, providing areas for sediment and erosion control management, and providing flexibility to accommodate equipment and material storage areas and onsite offices.

There are significant additional benefits associated with also raising the fields to keep more material on site including reduced truck movements on Rolleston Street and enhanced flooding mitigation from the Papawai Stream.

These benefits have been considered in Appendix C against the increase in cost in relation to the overall site development and consenting process.

6.2 Estimate Notes

The estimates should be read in conjunction with the following notes.

6.2.1 Basis of Estimate

The cost estimate is based on the following documentation and information supplied:

- Hospital Prince of Wales Reservoir – Preliminary Design Report – (CH2M Beca) May 2013
- Earthworks Cut-Fill volumes supplied from 12D model
- CH2M Beca Civil drawing 6513361-CK-300 – Appendix A
- Indicative rates supplied by Mexted Performance Playing Surfaces.

6.2.2 Clarifications and Assumptions

- Earthworks measure includes deductions for previous estimate allowances
- Material stockpiled on playing fields is suitable for engineered fill behind new reservoir
- Unless otherwise described all cut and fill quantities are bulked measures
- The estimate contingency is based on the modelled quantities. No additional contingency has been included for errors or omissions in the measure.
- Limited survey has been undertaken to the lower sports field. Earthworks volumes are estimated based on a combination of this survey and available Lidar data
- Rate for disposal at Wellington City Council (WCC) landfill assumes clean fill only. No allowance has been made for undercutting, testing or disposal of contaminated soils
- Assume irrigation not required to playing fields

- Assume concrete dish drain is required to upper playing field as in the Preliminary Design from 2013
- Estimating contingency includes potential for residual cost risk, general errors and omissions (excluding soil quantities) and ongoing design development
- No additional allowance has been made for mitigating site specific safety hazards
- Allowance has been made for normally accepted levels of Health and Safety management, procedures and equipment. Complex procedures or specialist safety needs have not been identified and are not included in this estimate
- Assume unencumbered access to site
- Assumed a traditional procurement route, i.e. fully designed and competitively tendered for a lump sum, fixed price contract, from at least 3 suitable tenderers.

6.2.3 Exclusions

- Goods & Services Tax (GST)
- Traffic Management at intersection of Rolleston and Wallace Streets
- Works outside normal working hours
- Over-excavation required if peaty or contaminated soils are encountered
- Testing, removal, treatment or disposal of contaminated or hazardous substances
- Excavation into rock
- Grounding Improvements other than landscaping
- Construction escalation beyond date of report
- Staged or phased handover or commissioning
- Fast track or accelerated programme
- Works beyond that reasonably foreseeable as consequential to the design documents
- Finance / sales / marketing costs
- Legal / Accounting fees.
- Resource Management Act consenting and approval costs.

6.2.4 Risk Assessment

Although a specific risk assessment exercise involving the Design Team has not been undertaken, the level of contingency included in this cost estimate is judged appropriate for the following risks based on the level of design information available, confidence surrounding potential for residual cost risk, omission and design development, and our professional experience.

The main risks identified at this stage and considered pertinent to this projects costs performance are as follows:

- Relocation of existing services is required under playing fields
- Noise and dust nuisance to neighbours
- Restricted hours of work
- Restricted truck movements down Rolleston Street
- Removal of car parking down Rolleston Street
- Threat of sediment contamination and flooding to local streams and waterways
- Design and/or scope creep

- Delays in tendering and/or commencement of the work
- Market conditions and availability of labour resource
- Inclement weather conditions
- Extended programme.

The design team has however identified two specific risk items for which additional contingency is considered appropriate. These are the risk of needing to relocate all existing services and the risk to the quantity of excavated material that can be used in raising the playing fields due to inaccuracy/lack of survey data for the lower playing field and other constraints including effects on neighbours and retaining walls.

7 Summary and Recommendations

7.1 Summary

This study has been carried out to investigate the feasibility and costs of using both playing fields at Prince of Wales Park during construction of the Prince of Wales/Omāroro Reservoir.

The study shows that it is feasible to use both playing fields as sites where excavated material from the proposed Prince of Wales/Omāroro Reservoir Construction can be deposited permanently. This will achieve two functions. The first is to reduce the volume of surplus excavated material to be trucked off site for disposal by placing on the fields and raising the final levels of these fields. Secondly, it is likely that this work could improve the quality of the playing fields through reconstruction of the fields at a higher level and careful reuse of the topsoil.

During construction the playing fields can be used for temporary stockpiling of surplus excavated material that will be required for backfilling around the reservoir structure. This fill can be shared between the two fields, reducing the height and footprint of the stockpiles and therefore helping to reduce the impacts of a single high stockpile just on the upper field as had been proposed in the earlier Preliminary Design phase when the lower playing field was not available for use. These fields can also provide space for topsoil stockpiling, erosion and sediment control measures and temporary parks for residents of Rolleston Street where existing roadside parks will need to be removed during construction, space for light construction vehicles (eg utility vehicles) to park where they are clear of local streets, worker carparking spaces, and flexibility to accommodate areas required for machinery, vehicle, equipment and construction material storage, sufficient manoeuvring areas for vehicles accessing and exiting the site, and site management offices.

The amount that the playing fields can be raised is governed by a number of factors, including stormwater considerations, retaining wall requirements and the effects on neighbouring properties. For the lower playing field the option shown in this report raises the field to a level where stormwater can drain from the field without increasing flows in the Papawai Stream around the field and the existing culvert under the access track between both playing fields, while also providing an additional benefit of some attenuation of runoff from the Papawai Stream in storm events of greater intensity than the 10 year event when the stream currently overflows onto the field and then into Salisbury Terrace.

The upper playing field has been set at a level where timber retaining walls can be used on the north and eastern sides to retain the filled height.

The raising of the playing fields reduces the volume of excess excavated material to be disposed off-site significantly, from approximately 30,800 m^3 (in-situ volume) in the Preliminary Design Report, to approximately 14,700 m^3 (in-situ volume). This equates to 20,140 m^3 bulked volume or 2,520 trucks, compared with 5,400 trucks required in the Preliminary Design Scheme.

Some existing utility services will require relocation as a result of this work. Other utilities including 33 kV power and watermains may require relocation depending on the quality and condition of these utilities.

The cost estimates show that use of both playing fields for stockpiling and other construction activities will increase the overall cost of the project by approximately $1.7m, while the raising of both playing fields would approximately add a further $0.5m. This cost difference between the two options is inclusive of $280k allowance for possible services relocation.

7.2 Recommendations

The following summary of benefits (see also Appendix C) should be taken into consideration when deciding which 'earthworks' option to adopt for future project development:

- Use of the upper and lower playing fields for excavated material stockpiling produces significant benefits for project consentability and site function and operation, versus the preliminary design option of only using the upper playing field for material stockpiling. Benefits are associated with:
  - **Visual effects mitigation**: Reducing the height, footprint and visual impact of upper playing field material stockpiles on local residents;
  - **Reduced truck movements**: Additional space allows for onsite stockpiling of topsoil for reuse, and reduces truck movements associated with offsite disposal and replacement of topsoil that can't be stockpiled on site. Risks are removed of requiring additional truck movements to remove (and later replace) backfill material stockpiles that may be needed to reduce visual impacts, and create space for site operational needs, including parking.
  - **Parking impacts on surrounding streets**: Additional space allows for onsite accommodation of displaced Rolleston Street residents' parking, and onsite accommodation of light utility and worker vehicle parking areas, reducing parking impacts on adjacent streets
  - **Sediment and erosion control**: Additional space allows for installation of sediment and erosion control management and treatment systems;
  - **Site operation and management**: Additional space provides flexibility to accommodate additional machinery, vehicle, equipment and construction material storage areas, manoeuvring areas for vehicles accessing and exiting the site, and site management offices.

  These benefits should be assessed as part of the overall consenting process and considered in relation to the increased costs that are involved.
- The raising of the playing fields produces significant additional benefits of retaining excavated material on site:
  - **Reduced truck movements**: The duration and number of heavy truck movements needed on Rolleston Street to dispose excavated material offsite will be significantly reduced, and
  - **Reduced flooding risk:** The raising and redesign of the lower playing field to attenuate flood events from Papawai stream will significantly reduce flooding risk to Salisbury Terrace residents.

  These benefits should also be assessed as part of the overall consenting process and considered in relation to the increased costs that are involved.

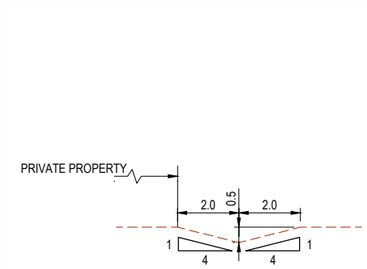
The following recommendations are made:

- Should the project choose to proceed with one of the options making use of both fields we recommend undertaking detailed site survey, geotechnical investigations and stormwater analysis at an appropriate stage of the design process to enable development of a design solution that is acceptable to WCC and users of the field.

Appendix A

Drawings

Drawing Plotted: 02 Jun 2017 9:42 a.m.



GRASS SWALE
1:100

N

D CK-700

APPROXIMATE NEW ACCESS LOCATION

ROLLESTON STREET

TIMBER RETAINING WALL - HEIGHT 1m

POSSIBLE TEMPORARY PARKING AREA

SEDIMENTATION POND

STOCKPILE 3 VOLUME -11000m³ (EXCAVATED MATERIAL)

STOCKPILE 4 VOLUME -1500m³ (TOPSOIL)

STORMWATER DRAINAGE FOR UPPER FIELD AS IN PRELIMINARY DESIGN REPORT

EXTENT OF SITE CLEARANCE

C CK-600

RELOCATE WATERMAIN TO SOUTHERN EDGE OF FIELD

TIMBER RETAINING WALL - HEIGHT 1m

B CK-500

PAPAWAI STREAM

Ø1500 MANHOLE 2m DEEP WITH SCRUFFY DOME DISCHARGE

Ø600 STORMWATER PIPE

GRASS SWALE

EDGE OF FIELD

STOCKPILE- TOP

STOCKPILE 1 VOLUME -18900m³ (EXCAVATED MATERIAL)

STOCKPILE- BOTTOM

STOCKPILE 1 VOLUME -1475m³ (TOPSOIL)

TIMBER RETAINING WALL - HEIGHT 1m

NEW STEPS TO CHANGING ROOM

GRASS SWALE

A CK-400

RELOCATE EXISTING SEWER

Ø1500 MANHOLE 2m DEEP WITH SCRUFFY DOME DISCHARGE TO NEW SALISBURY TERRACE FLOOD PROTECTION STORMWATER SYSTEM (BY OTHERS)

NEW SEWER ALIGNMENT

REVIEW RAMP UP TO FIELD

GRASS SWALE

RETAINING WALL 4
80 DEGREE GREEN TEERRAMESH
(WHERE HEIGHT OF WALL >1m)

SALISBURY TERRACE

Ø300 CULVERT WITH HEADWALLS

NEW MANHOLE

POSSIBLE TEMPORARY PARKING AREA

FEASIBILITY STUDY
NOT FOR CONSTRUCTION

No.	Revision	By	Chk	Appd	Date
A	FOR FEASIBILITY STUDY	KRR	DGS	DGS	31.05.17

Drawing Originator: CH2M BECA www.ch2mbeca.com

Original Scale (A1) 1:500
Reduced Scale (A3) 1:1000

Design	D.STIRRAT	08.03.17	Approved For Construction*
Drawn	R.RIYAZ	08.03.17	
Dsg Verifier			
Dwg Check			Date

* Refer to Revision 1 for Original Signature

Client: Wellington Water

Project: OMARORO RESERVOIR

Title: CONCEPT DESIGN SKETCH STOCKPILES, SEDIMENT CONTROL AND PARKING

Discipline: CIVIL ENGINEERING

Drawing No.: 6513361-CK-1000

Rev.: A

Document No. 6513361-CK-1000.DWG

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DO NOT SCALE

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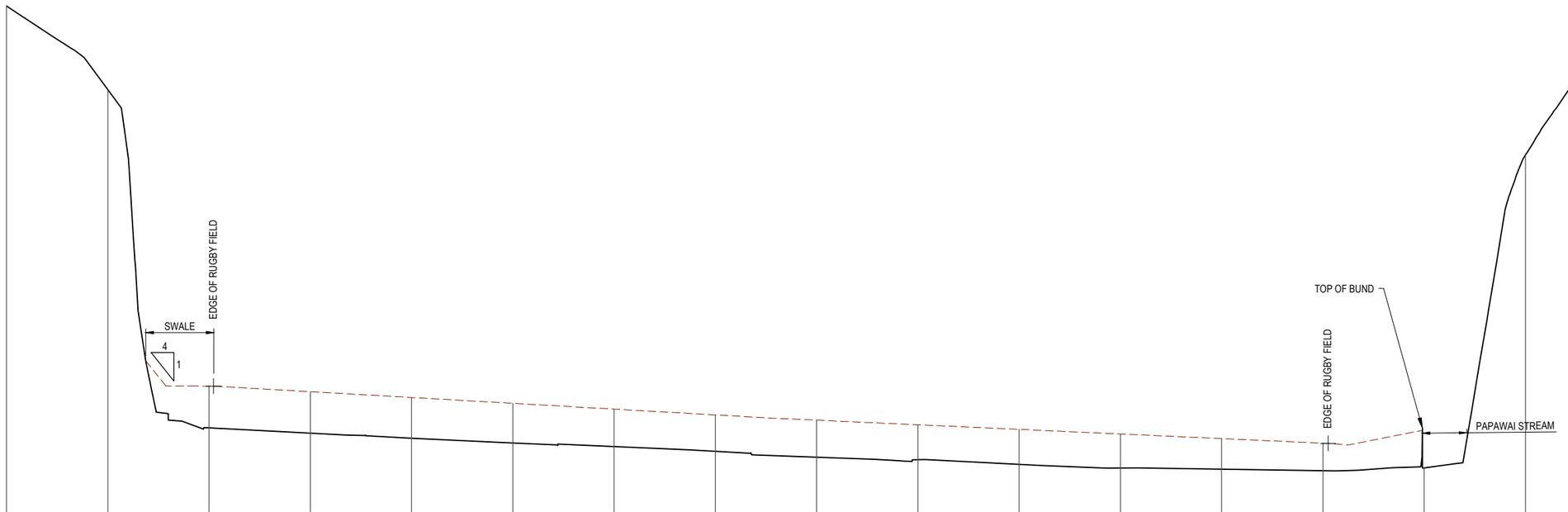


DATUM (m) = 59

FINISHED GROUND LEVEL (m)			61.51	61.40	61.29	61.17	61.06	60.94	60.84	60.75	60.66	60.57	60.48	60.39			
EXISTING GROUND LEVEL (m)	69.01	67.37	60.69	60.58	60.48	60.39	60.32	60.23	60.11	60.06	59.97	59.89	59.87	59.84	59.90	66.07	68.19
DISTANCE (m)	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	156.558

Section A

HORIZONTAL 1:250
VERTICAL 1:50

SECTION A
CK-1000

No.	Revision	By	Chk	Appd	Date
A	FOR FEASIBILITY STUDY	KRR	DGS	DGS	01.06.17

Drawing Originator: CH2M BECA www.ch2mbeca.com

Original Scale (A1) AS SHOWN	Design	D.STIRRAT	01.06.17	Approved For Construction*
Reduced Scale (A3) 1/2 SHOWN	Drawn	R.RIYAZ	01.06.17	
	Dsg Verifier			
	Dwg Check			Date

* Refer to Revision 1 for Original Signature

Client: Wellington Water

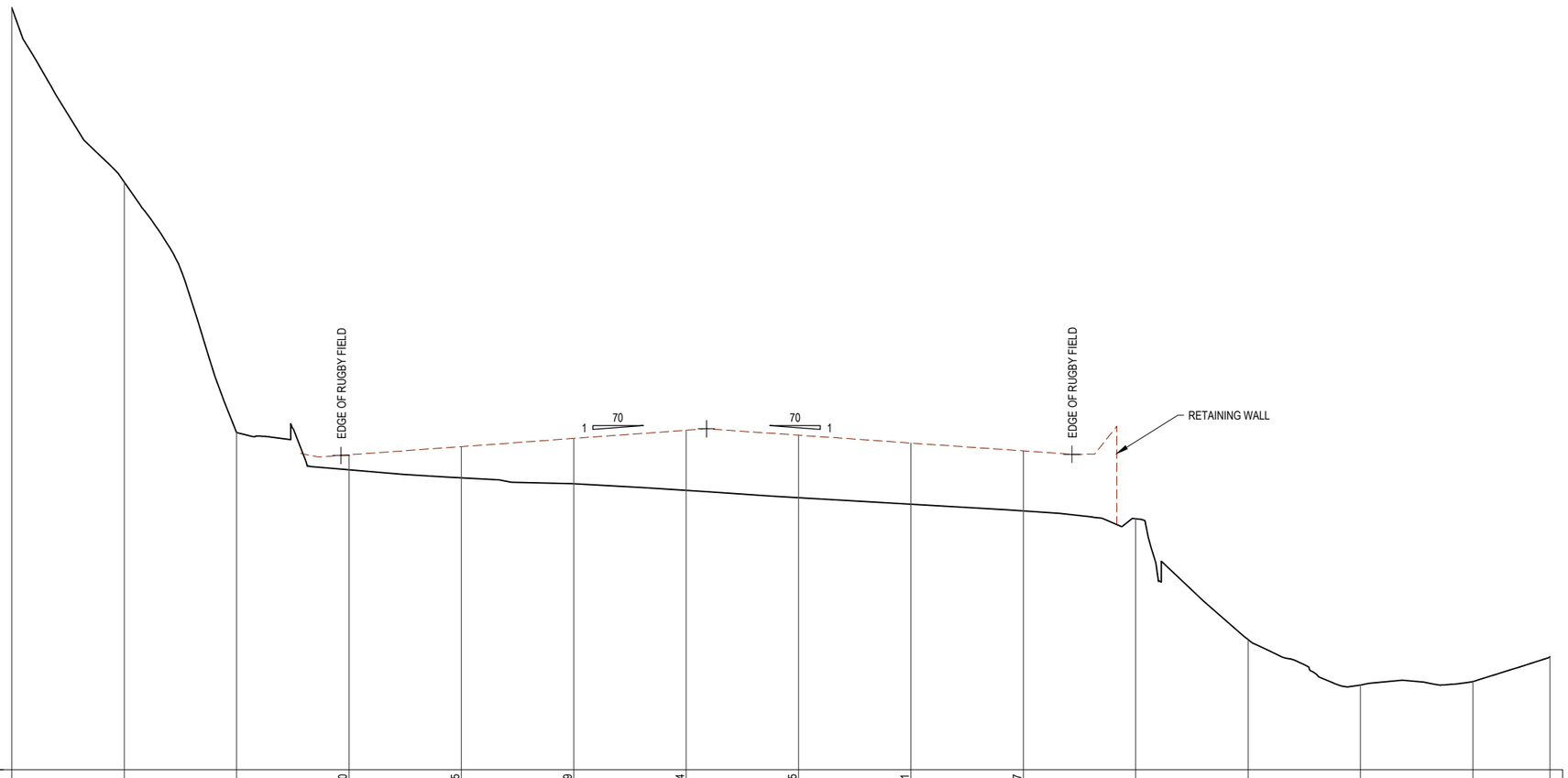
Project: OMARORO RESERVOIR

Title: CONCEPT DESIGN FIELD RAISING SECTIONS SHEET 1

Discipline: CIVIL ENGINEERING

Drawing No.: 6513361-CK-400

Rev.: A



DATUM (m) = 55															
FINISHED GROUND LEVEL (m)				60.60	60.75	60.89	61.04	60.95	60.81	60.67					
EXISTING GROUND LEVEL (m)	68.55	65.45	61.00	60.34	60.19	60.09	59.97	59.84	59.72	59.60	59.47	57.32	56.51	56.57	57.01
DISTANCE (m)	0	10	20	30	40	50	60	70	80	90	100	110	120	130	136.858

Section B
HORIZONTAL 1:250
VERTICAL 1:50

SECTION B
CK-1000

No.	Revision	By	Chk	Appd	Date
A	FOR FEASIBILITY STUDY	KRR	DGS	DGS	02.06.17

Drawing Originator: CH2M BECA www.ch2mbeca.com

Original Scale (A1): AS SHOWN
Reduced Scale (A3): 1/2 SHOWN

Design	D.STIRRAT	02.06.17
Drawn	R.RIYAZ	02.06.17
Dsg Verifier		
Dwg Check		

Approved For Construction* Date
* Refer to Revision 1 for Original Signature

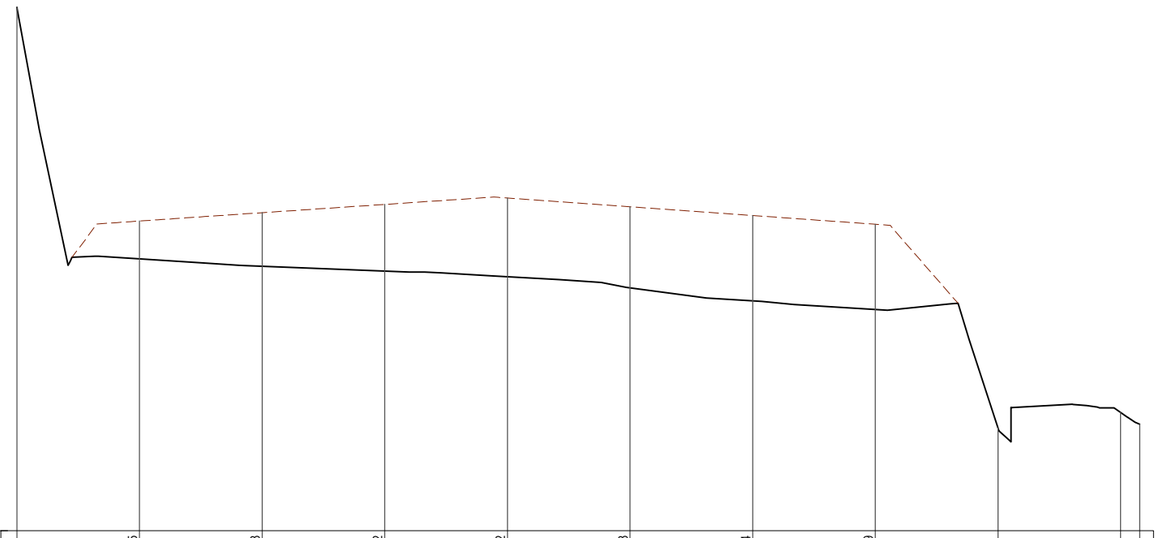
Client: Wellington Water

Project: OMARORO RESERVOIR

Title: CONCEPT DESIGN
FIELD RAISING SECTIONS
SHEET 1

Discipline: CIVIL ENGINEERING
Drawing No.: 6513361-CK-500
Rev.: A

Document No. 6513361-CK-500.DWG



DATUM (m) = 64												
FINISHED GROUND LEVEL (m)		69.05	69.18	69.32	69.42	69.28	69.14	68.99				
EXISTING GROUND LEVEL (m)	72.53	68.43	68.31	68.23	68.14	67.96	67.75	67.60	65.68	65.93	65.73	
DISTANCE (m)	0	10	20	30	40	50	60	70	80	90	91.558	

Section C
HORIZONTAL 1:250
VERTICAL 1:50

SECTION C
CK-1000

FEASIBILITY STUDY
NOT FOR CONSTRUCTION

No.	Revision	By	Chk	Appd	Date
A	FOR FEASIBILITY STUDY	KRR	DGS	DGS	02.06.17

Drawing Originator: CH2M BECA www.ch2mbeca.com

Original Scale (A1) AS SHOWN
Reduced Scale (A3) 1/2 SHOWN

Design	D.STIRRAT	02.06.17	Approved For Construction*
Drawn	R.RIYAZ	02.06.17	
Dsg Verifier			
Dwg Check			Date

* Refer to Revision 1 for Original Signature

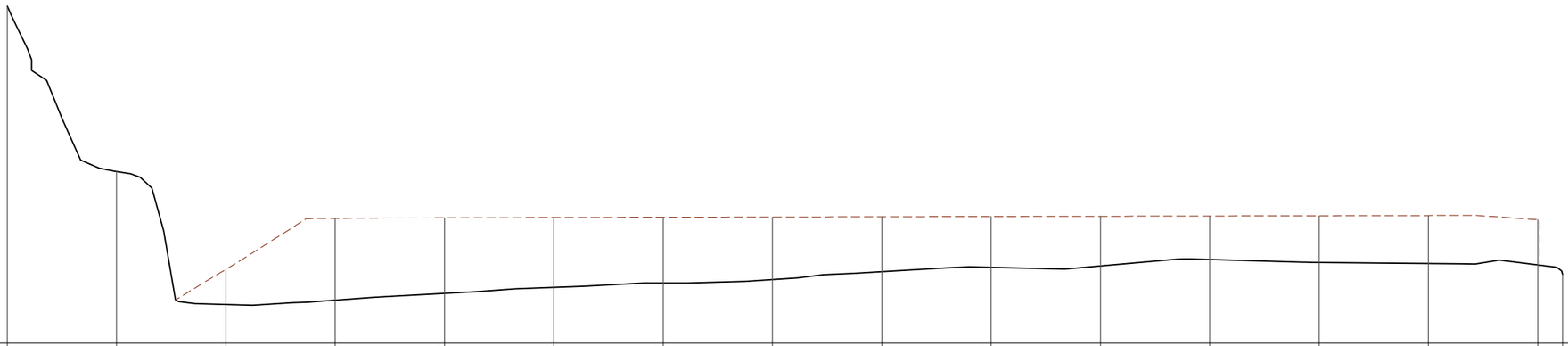
Client: Wellington Water

Project: OMARORO RESERVOIR

Title: CONCEPT DESIGN
FIELD RAISING SECTIONS
SHEET 3

Discipline: CIVIL ENGINEERING
Drawing No.: 6513361-CK-600
Rev.: A

Document No. 6513361-CK-600.DWG



DATUM (m) = 67

FINISHED GROUND LEVEL (m)			68.35	69.28	69.29	69.30	69.30	69.31	69.31	69.32	69.32	69.33	69.33	69.33	69.26							
EXISTING GROUND LEVEL (m)	73.16	70.14	67.71	67.79	67.91	68.02	68.10	68.16	68.31	68.39	68.41	68.53	68.48	68.46	68.43	68.26						
DISTANCE (m)	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	142.267						

Section D
HORIZONTAL 1:250
VERTICAL 1:50

SECTION D CK-1000

FEASIBILITY STUDY
NOT FOR CONSTRUCTION

No.	Revision	By	Chk	Appd	Date
A	FOR FEASIBILITY STUDY	KRR	DGS	DGS	02.06.17

Drawing Originator: CH2M BECA www.ch2mbeca.com

Original Scale (A1) AS SHOWN
Reduced Scale (A3) 1/2 SHOWN

Design	D.STIRRAT	02.06.17	Approved For Construction*
Drawn	R.RIYAZ	02.06.17	
Dsg Verifier			
Dwg Check			Date

* Refer to Revision 1 for Original Signature

Client: Wellington Water

Project: OMARORO RESERVOIR

Title: CONCEPT DESIGN
FIELD RAISING SECTIONS
SHEET 4

Discipline: CIVIL ENGINEERING
Drawing No.: 6513361-CK-700
Rev.: A

Document No. 6513361-CK-700.DWG

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Appendix B

Cost Estimates

Prince of Wales/Om āroro Reservoir

170530 Stockpiling on Upper & Lower Playing Fields

Code	Description	Quantity	UOM	Rate	Total
	ROUGH ORDER OF COST ESTIMATE FOR OPTION TO STOCKPILE ON UPPER AND LOWER PLAYING FIELDS				
	2nd Option to deleted costs associated with permanently raising the fields Extra Value over Preliminary Estimate for Prince of Wales Reservoir dated May 2013 1st Estimate: 30 March 2017 by Barry Calvert 1st Review: 30 March 2017 by Kobus Beukes 2nd Option Estimate: 19 April 2017 by Barry Calvert				
	Basis of Estimate Earthworks Cut-Fill volumes supplied from 12D model - received 27/3/17 CH2M Beca civil drawing 6513361-CK-300 dated 8/3/17 CH2M Beca draft report "Omaroro Reservoir - Prince of Wales Reservoir: Raising of the Upper/Lower Sports Field Options" dated 17/3/17 Indicative rates supplied by Mexted Performance Sports Surfaces Matt Trlin email 19/4/17 Assumptions and clarifications below.				
	Clarifications and Assumptions Earthworks measure includes deductions for previous estimate allowances Material stockpiled on sports fields is suitable for engineered fill behind new reservoir Unless otherwise described all cut and fill quantities are bulked measures The estimate contingency below assumes the correctness of the modelled quantities supplied by the engineer. No additional contingency has been included for errors or omissions No survey has been undertaken to lower sports field. Therefore soil volumes are estimated based on LiDAR data only Rate for disposal at WCC landfill assumes clean fill only. No allowance has been made for undercutting, testing or disposal of contaminated soils Assume no additional irrigation is required to sports fields over and above the allowance of $18,750 made in the original estimate Assume concrete dish drain now required to upper sports field Assume 30T dump trucks with 16m3 capacity operating on steep site between reservoir site and sports fields Assume 8 m3 tipping truck to landfill with round trip of 40 mins, between the hours of 9am and 3pm only MSE walls measured over vertical face, 3.0 m wide Estimating contingency of 12% includes potential for residual cost risk, errors (excluding those relating to soil measures) omissions and ongoing design development No additional allowance has been made for mitigating site specific safety hazards				
	Exclusions Goods & Services Tax (GST) Traffic Management at intersection of Rolleston and Wallace Streets Works outside normal working hours Relocation of high voltage cables and water supply pipes under both sports fields Over-excavation required if peaty or contaminated soils are encountered Excavation into rock Grounding Improvements other than landscaping Construction cost escalation beyond date of estimate Staging or phased handover Fast track or accelerated programme Building & Resource consent fees and charges Works beyond that reasonably foreseeable as consequential to the design documents Testing, removal, treatment and disposal of contaminated or hazardous substances Works outside normal working hours				
	Risk Items Although a specific risk assessment exercise involving the Design Team has not been undertaken, the level of contingency included in this cost estimate is judged appropriate based on the level of design information available, confidence surrounding potential for residual cost risk, omission and design development, and our professional experience The main risks identified at this stage and considered pertinent to this projects costs performance are as follows: Lack of accurate survey information to lower field Relocation of remaining existing services is required under sports fields Noise and dust nuisance to neighbours Restricted hours of work Restricted truck movements down Rolleston Street Removal of car parking down Rolleston Street Threat of sediment contamination and flooding to local streams and waterways Design and/or scope creep Delays in tendering and/or commencement of the work Market conditions and availability of labour resource Inclement weather conditions Extended Programme				
	ESTIMATE				
	Physical Works:				
1	Earthworks				
2	Playing Surfaces & Fences				
3	Retaining Walls				
4	Drainage				
	Preliminaries:				
5	Contractors Preliminaries and General				
6	Off-site Overheads and Profit				
	Project Base Estimate				
	Professional Fees:				
7	Design Costs				
8	Consenting & Tendering				
9	Construction Monitoring				
	Contingencies:				
10	Estimating Contingency based on percentage used in Option R1.0 Prelim Estimate				
11	Contract Contingency based on percentage used in Option R1.0 Prelim Estimate				
	Project Expected Estimate				
	PREVIOUS ESTIMATE				
12	All inclusive deduction for related earthworks items included in the Preliminary Estimate				
	EXPECTED EXTRA VALUE ESTIMATE				

Prince of Wales/Omāroro Reservoir

170530 Stockpiling on Upper & Lower Playing Fields

Code	Description	Quantity	UOM	Rate	SubTotal	Factor	Total
1	**EARTHWORKS**						
	Revisions to Earthworks Scope						
1.1	Bulked measure for strip 200 thick topsoil and vegetation over area of disturbed ground and dispose off site excl. tip fee	2,640	m3				
	Check on above rate using truck journey figures from engineer. Comparison OK	330	trips				
1.2	Extra Over item 1.7 for tip fees (per cb/m) - assumes clean fill disposal rate	2,640	m3				
1.3	Extra over solid measure cut only from reservoir site - revised measure from 12D model. Cut rate is from Prelim Estimate	7,943	m3				
1.4	Removal of existing park fencing on both sports fields	282	m				
1.5	Strip off topsoil 150 thick from upper field and stockpile on-site [ref. item 2.1]	8,000	m2				
1.6	Strip off topsoil 150 thick from lower field and stockpile on-site [ref. item 2.2]	10,000	m2				
1.7	Remove mature trees from NE corner of lower field to make way for new MSE walls	3	no				
1.8	Bulk measure trucked from reservoir site to shaped stockpile on upper field	13,129	m3				
1.9	Bulk measure trucked from reservoir site to shaped stockpile on lower field	19,255	m3				
1.10	Bulked measure trucked from reservoir site to lower field access track, spread and compacted	400	m3				
1.11	Bulked measure from reservoir disposed off-site incl tip fee	31,000	m3				
	Check on above rate using truck journey figures from engineer. Comparison OK	3,875	trips				
1.12	Engineered back fill to reservoir from stockpile on upper field	13,129	m3				
1.13	Engineered back fill to reservoir from stockpile on lower field	19,255	m3				
1.14	Temporary perimeter fencing to upper & lower fields during construction - assume 52 weeks	810	m				
1.15	Rounding						
	Total for Earthworks						
2	**PLAYING SURFACES & FENCES**						
2.1	Indicative pricing from Mexteds for spraying, stripping & re-surfacing of upper playing field incl. drainage & topsoil	8,000	m2				
2.2	Indicative pricing from Mexteds for spraying, stripping & re-surfacing of lower playing field incl. drainage & topsoil	10,000	m2				
2.3	Allowance for preparing cricket wicket block on lower field	1	LS				
2.4	New chainlink fence approx 2.4 m high to perimeter of upper sports field	217	m				
2.5	New chainlink fence approx 2.4 m high to eastern side of lower sports field	65	m				
2.6	New chainlink fence approx 1.2 m high to eastern side of lower sports field	56	m				
2.7	Option for irrigation on upper field	8,000	m2				
2.8	Option for irrigation on lower field	8,000	m2				
2.9	Rounding						
	Total for Playing Surfaces						
3	**RETAINING WALLS**						
	All retaining wall items deleted						deleted
4	**DRAINAGE**						
	Lower Field						
4.1	1500 dia manhole 2.0m deep with scruffy dome lid and outlet stub	2	no				
4.2	300dia Class 2 stormwater drain (assumed) 0-2.0m deep between manholes and under access road	75	m				
4.3	Relocation of 150dia PVC sewer drain	151	m				
4.4	Temporary sedimentation pond for lower field	235	m3				
4.5	Form earth swale to edges of lower field	310	m				
4.6	Swale planting	310	m2				
	Upper Field						
4.7	Temporary sedimentation pond for upper field	382	m3				
4.8	Form concrete swale to southern & northern edge of upper field	202	m				
4.9	Rounding						
	Total for Drainage						
12	**ALL INCLUSIVE DEDUCTION FOR RELATED EARTHWORKS ITEMS INCLUDED IN THE PRELIMINARY ESTIMATE**						
	Deletions from Prelim Estimate May 2013:						
12.1	Item 1.3 - Temporary fencing aound construction site (upper field) - allows for use of existing park fence duringconstruction	300	m				
12.2	Item 3.1 - Strip and dispose off-site topsoil 150 thick over area of playing field [8,300 m2]	1,245	m3				
12.3	Item 4.3 - Removal and off-site disposal of vegetation over area of disturbed ground	5,000	m2				
12.4	Item 4.5 - Soil from bulk excavation to stockpile on upper field - trucking costs only	25,000	m3				
12.5	Item 4.6 - Soil from bulk excavation trucked off-site, including an allowance of $14.13/m3 for the landfill fees	5,500	m3				
12.6	Item 4.7 - Bulk excavation to waste (landfill)	25,000	m3				
12.7	Item 10.1 - Engineered backfill (to reservoir) from stockpile (on upper field)	25,000	m3				
12.8	Item 13.1 - topsoil reinstatement of upper field excl. subsoil drainage [1,245 m3]	8,300	m2				
12.9	Contractors Preliminaries and General						
	Professional Fees:						
12.10	Design Costs						
12.11	Consenting & Tendering						
12.12	Construction Monitoring						
	Contingencies:						
12.13	Estimating Contingency based on percentage used in Option R1.0 Prelim Estimate						
12.14	Contract Contingency based on percentage used in Option R1.0 Prelim Estimate						
12.15	Rounding:						
	Total for Earthworks						

Prince of Wales/Omāroro Reservoir

170530 Raising and Stockpiling on Upper & Lower Playing Fields

Code	Description	Quantity	UOM	Rate	Total
	ROUGH ORDER OF COST ESTIMATE FOR OPTION TO RAISE AND STOCKPILE ON UPPER AND LOWER PLAYING FIELDS				
	Extra Value over Preliminary Estimate for Prince of Wales Reservoir dated May 2013				
	Estimate Date: 30 March 2017				
	Estimated by: Barry Calvert				
	Reviewed by: Kobus Beukes				
	Amended: 30 May 2017 by RH & BC				
	Amendments: 20% risk allowance associated with raising lower field, new power and water mains, and solid fence to lower field				
	Basis of Estimate				
	Earthworks Cut-Fill volumes supplied from 12D model - received 27/3/17				
	CH2M Beca civil drawing 6513361-CK-300 dated 8/3/17				
	CH2M Beca draft report "Omaroro Reservoir - Prince of Wales Reservoir: Raising of the Upper/Lower Sports Field Options" dated 17/3/17				
	Indicative rates supplied by Mexted Performance Sports Surfaces				
	Volumes updated 30-May as a result of lower field survey				
	Assumptions and clarifications below				
	Clarifications and Assumptions				
	Earthworks measure includes deductions for previous estimate allowances				
	Material stockpiled on sports fields is suitable for engineered fill behind new reservoir				
	Unless otherwise described all cut and fill quantities are bulked measures.				
	The estimate contingency below assumes the correctness of the modelled quantities supplied by the engineer. No additional contingency has been included for errors or omissions.				
	Rate for disposal at WCC landfill assumes clean fill only. No allowance has been made for undercutting, testing or disposal of contaminated soils.				
	Assume irrigation not required to sports fields				
	Assume concrete dish drain now required to upper sports field				
	Assume 30T dump trucks with 16 m3 capacity operating on steep site between reservoir site and sports fields				
	Assume 8 m3 tipping truck to landfill with round trip of 40 mins, between the hours of 9am and 3pm only				
	MSE walls measured over vertical face, 3.0 m wide				
	Relocation of high voltage cables and water supply pipes under both sports fields added May17				
	Estimating contingency of 12% includes potential for residual cost risk, errors (excluding those relating to soil measures), omissions and ongoing design development				
	No additional allowance has been made for mitigating site specific safety hazards				
	Exclusions				
	Goods & Services Tax (GST)				
	Traffic Management at intersection of Rolleston and Wallace Streets				
	Works outside normal working hours				
	Over-excavation required if peaty or contaminated soils are encountered				
	Excavation into rock				
	Grounding Improvements other than landscaping				
	Construction cost escalation beyond date of estimate				
	Staging or phased handover				
	Fast track or accelerated programme				
	Building & Resource consent fees and charges				
	Works beyond that reasonably foreseeable as consequential to the design documents				
	Testing, removal, treatment and disposal of contaminated or hazardous substances				
	Works outside normal working hours				
	Risk Items				
	Although a specific risk assessment exercise involving the Design Team has not been undertaken, the level of contingency included in this cost estimate is judged appropriate based on the level of design information available, confidence surrounding potential for residual cost risk, omission and design development, and our professional experience				
	The main risks identified at this stage and considered pertinent to this projects costs performance are as follows:				
	Lack of accurate survey information to lower field				
	Relocation of remaining existing services is required under sports fields				
	Noise and dust nuisance to neighbours				
	Restricted hours of work				
	Restricted truck movements down Rolleston Street				
	Removal of car parking down Rolleston Street				
	Threat of sediment contamination and flooding to local streams and waterways				
	Design and/or scope creep				
	Delays in tendering and/or commencement of the work				
	Market conditions and availability of labour resource				
	Inclement weather conditions				
	Extended Programme				
	ESTIMATE				
	Physical Works:				
1	Earthworks				
2	Playing Surfaces & Fences				
3	Retaining Walls				
4	Drainage				
	Preliminaries:				
5	Contractors Preliminaries and General				
6	Off-site Overheads and Profit				
	Project Base Estimate				
	Professional Fees:				
7	Design Costs				
8	Consenting & Tendering				
9	Construction Monitoring				
	Contingencies:				
10	Estimating Contingency based on percentage used in Option R1.0 Prelim Estimate				
11	Contract Contingency based on percentage used in Option R1.0 Prelim Estimate				
12	Risk allowance in the event HV cables & water mains will require relocation	1	LS		280,000
	Project Expected Estimate				
	PREVIOUS ESTIMATE				
13	All inclusive deduction for related earthworks items included in the Preliminary Estimate				
	EXPECTED EXTRA VALUE ESTIMATE				
14	Option to construct 2.4 m high timber paling fence in lieu of 2.4 m high wire chainlink fence to lower field	121	m		
	EXPECTED EXTRA VALUE ESTIMATE INCLUDING TIMBER FENCE OPTION				

Prince of Wales/Omāroro Reservoir
170530 Raising and Stockpiling on Upper & Lower Playing Fields

Code	Description	Quantity	UOM	Rate	SubTotal	Factor	Total
1	**EARTHWORKS**						
	Revisions to Earthworks Scope						
1.1	Bulked measure for strip 200 thick topsoil and vegetation over area of disturbed ground and dispose off site excl. tip fee	2,640	m3				
	Check on above rate using truck journey figures from engineer. Comparison OK.	330	trips				
1.2	Extra Over item 1.7 for tip fees (per cb/m) - assumes clean fill disposal rate	2,640	m3				
1.3	Extra over solid measure cut only from reservoir site - revised measure from 12D model. Cut rate is from Prelim Estimate	7,943	m3				
1.4	Removal of existing park fencing on both sports fields	282	m				
1.5	Strip off topsoil 150 thick from upper field and stockpile on-site [ref. items 2.2 & 2.3]	8,000	m2				
1.6	Strip off topsoil 150 thick from lower field and stockpile on-site [ref. items 2.2 & 2.3]	10,000	m2				
1.7	Remove mature trees from NE corner of lower field to make way for new MSE walls	3	no				
1.8	Bulked measure trucked from reservoir site to upper field, spread, shaped and compacted to required levels ready for new playing field surface	8,900	m3				
1.9	Bulked measure trucked from reservoir site to lower field, spread, shaped and compacted to required levels ready for new playing field surface	8,580	m3				
1.10	Bulked measure trucked from reservoir site to lower field access track, spread and compacted	400	m3				
1.11	Bulk measure trucked from reservoir site to shaped stockpile on upper field	11,000	m3				
1.12	Bulk measure trucked from reservoir site to shaped stockpile on lower field	18,000	m3				
1.13	Bulked measure from reservoir disposed off-site incl tip fee	16,903	m3				
	Check on above rate using truck journey figures from engineer. Comparison OK.	1,810	trips				
1.14	Engineered back fill to reservoir from stockpile on upper field	11,000	m3				
1.15	Engineered back fill to reservoir from stockpile on lower field	18,000	m3				
1.16	Temporary perimeter fencing to upper & lower fields during construction - assume 52 weeks	810	m				
1.17	Rounding						
	Total for Earthworks						
2	**PLAYING SURFACES & FENCES**						
2.1	Indicative pricing from Mexteds for spraying, stripping & re-surfacing of upper playing field incl. drainage & topsoil	8,000	m2				
2.2	Indicative pricing from Mexteds for spraying, stripping & re-surfacing of lower playing field incl. drainage & topsoil	10,000	m2				
2.3	Allowance for preparing cricket wicket block on lower field	1	LS				
2.4	New chainlink fence approx 2.4m high to perimeter of upper sports field	217	m				
2.5	New chainlink fence approx 2.4m high to eastern side of lower sports field	65	m				
2.6	New chainlink fence approx 1.2m high to eastern side of lower sports field	56	m				
2.7	Option for irrigation on upper field	8,000	m2				
2.8	Option for irrigation on lower field	8,000	m2				
2.9	Rounding						
	Total for Playing Surfaces						
3	**RETAINING WALLS**						
	Upper Field						
3.1	Timber retaining walls up to 1.5m above GL	165	m				
3.2	MSE walls, measured over face elevation area	0	m2				
	Lower Field						
3.3	Timber retaining walls up to 1.5m above GL	137	m				
3.4	MSE walls, measured over face elevation area - rate is for Duramesh System by Cirtex	200	m2				
3.5	Rounding						
	Total for Retaining Walls						
4	**DRAINAGE**						
	Lower Field						
4.1	1500 dia manhole 2.0m deep with scruffy dome lid and outlet stub	2	no				
4.2	300dia Class 2 stormwater drain (assumed) 0-2.0m deep between manholes and under access road	75	m				
4.3	Relocation of 150dia PVC sewer drain	151	m				
4.4	Temporary sedimentation pond for lower field	235	m3				
4.5	Form earth swale to edges of lower field	310	m				
4.6	Swale planting	310	m2				
	Upper Field						
4.7	Temporary sedimentation pond for upper field	382	m3				
4.8	Form concrete swale to southern & northern edge of upper field	202	m				
4.9	Rounding						
	Total for Drainage						
13	**RISK ALLOWANCE IN THE EVENT HV CABLES & WATER MAINS WILL REQUIRE RELOCATION**						
13.1	Uncover & remove 2 no. 33 kV cables from trench	270	m				
13.2	Relocate 2 no. 33 kV cables to new trench	282	m				
13.3	New 33 kV cable required	12	m				
13.4	Cable jointing	4	no.				
13.5	Allowance for isolation & earthing incl switching circuit, + reconnection & as-built's	1	sum				
13.6	Uncover & remove 2 no. water mains from trench	261	m				
13.7	Relocate 375 mm water main to new trench	289	m				
13.8	New 375 mm main	28	m				
13.9	Relocate 450 mm water main to new trench	289	m				
13.10	New 450 mm main	28	m				
13.11	Allowance for disconnection and reconnection	2	no.				
13.12	Rounding						
	Total Risk Allowance						
14	**ALL INCLUSIVE DEDUCTION FOR RELATED EARTHWORKS ITEMS INCLUDED IN THE PRELIMINARY ESTIMATE**						
	Deletions from Prelim Estimate May 2013						
14.1	Item 1.3 - Temporary fencing aound construction site (upper field) - allows for use of existing park fence duringconstruction	300	m				
14.2	Item 3.1 - Strip and dispose off-site topsoil 150 thick over area of playing field [8,300 m2]	1,245	m3				
14.3	Item 4.3 - Removal and off-site disposal of vegetation over area of disturbed ground	5,000	m2				
14.4	Item 4.5 - Soil from bulk excavation to stockpile on upper field - trucking costs only	25,000	m3				
14.5	Item 4.6 - Soil from bulk excavation trucked off-site, including an allowance of $14.13/m3 for the landfill fees	5,500	m3				
14.6	Item 4.7 - Bulk excavation to waste (landfill)	25,000	m3				
14.7	Item 10.1 - Engineered backfill (to reservoir) from stockpile (on upper field)	25,000	m3				
14.8	Item 13.1 - topsoil reinstatement of upper field excl. subsoil drainage	8,300	m2				
14.9	Contractors Preliminaries and General						
	Professional Fees:						
14.10	Design Costs						
14.11	Consenting & Tendering						
14.12	Construction Monitoring						
	Contingencies:						
14.13	Estimating Contingency based on percentage used in Option R1.0 Prelim Estimate						
14.14	Contract Contingency based on percentage used in Option R1.0 Prelim Estimate						
14.15	Rounding						
	Total for Earthworks						

Appendix C

Report – Prince of Wales Park – Raising Playing Fields Summary of Benefits/Dis-Benefits

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Report

Prince of Wales Park- Raising Playing Fields Summary of Benefits/ Dis-Benefits

Prepared for Wellington Water Ltd (Client)

By CH2M Beca Limited

6 June 2017

Revision History

Revision Nº	Prepared By	Description	Date
A	Matt Trlin		31/5//2017
B	Matt Trlin	Addition of benefit of material reuse to scenario 2	6/6/2017

Document Acceptance

Action	Name	Signed	Date
Prepared by	Matt Trlin		6/6/2017
Reviewed by	Richard Hickman		6/6/2017
Approved by	Richard Hickman		6/6/2017
on behalf of	CH2M Beca Limited		

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2 Summary of Feasibility Study 1
3 Benefits/Dis-Benefits 2

1 Introduction

CH2M Beca have prepared a report *Prince of Wales/Omāroro Reservoir: Raising of the Playing Fields Feasibility Study* (the feasibility study) for Wellington Water Limited (WWL).

This brief report summarises the findings of the feasibility study and discusses the benefits and dis-benefits of raising the upper and lower Prince of Wales playing fields.

2 Summary of Feasibility Study

The feasibility study considers whether the volume of excavated material from the proposed Prince of Wales/Omāroro Reservoir site requiring off-site disposal can be reduced to help minimise the impacts of truck movements on residents and users of Rolleston Street.

The original preliminary design concept for the Prince of Wales/Omāroro Reservoir, May 2013, provided only for the upper Prince of Wales Park playing field to be used for material stockpiling during reservoir construction. All excavated material not required for backfilling and burying the reservoir would be disposed offsite. This scenario gave rise to a very large stockpile of material that was deemed to have significant visual impact on adjacent landowners. Additionally, the size of the stockpile meant there was insufficient space for other necessary construction activities.

It was determined that a feasible scenario involving stockpiling on the upper Prince of Wales Park playing field must have a significantly reduced stockpile volume/height from that proposed under the preliminary design. The implications of this were increased disposal offsite of excavated fill and a need to bring additional fill back to site for backfill around the reservoir. Both of these activities would have lead to an increase in truck movements to/from site and hence increased costs.

The feasibility study therefore established concepts for two new scenarios:

- Scenario 1: Stockpiling on the Upper **and** Lower Playing Fields only:

  Using both the upper and lower Prince of Wales Park playing fields for stockpiling excavated material, required for reservoir backfilling and burial, and topsoil stockpiling during construction. Remaining excess excavated material would be disposed off-site.
- Scenario 2: Raising **and** Stockpiling on both Upper **and** Lower Playing Fields:

  Using both the upper and lower Prince of Wales Park playing fields for stockpiling excavated material, required for reservoir backfilling and burial, and topsoil stockpiling during construction **plus** using excess excavated material to permanently raise both fields. Any remaining balance of excavated material would be disposed off-site.

The study includes a comparison of the estimated costs of these scenarios ‘over’ the original 2013 preliminary design cost estimate.

The extra ‘over’ costs for each scenario are estimate at:

- Stockpiling on the Upper and Lower Playing Fields only: $1,710,500.
- Raising and Stockpiling on both Upper and Lower Playing Fields: $2,189,500 (inclusive of $280,000 allowance for relocation of HV cables and water mains).

The estimated cost difference between the two scenarios, that is the additional cost to raise both fields rather than just use them for stockpiling, is approximately $480,000. This is inclusive of a

$280,000 risk allowance for possible relocation of HV cables and water mains that could be associated with field raising.

Raising the levels of both playing fields to utilise some of the excavated material is considered feasible.

Additional works and related additional costs required to support field raising include:

- Earthworks:

  Additional earthworks design, survey, and onsite earthwork activity required to raise and prepare field surfaces for playing surface reinstatement.
- Lower playing field drainage:

  Additional subsurface drainage design and construction works required within the lower playing field, to support field raising, and the function of this redesigned field as a new flood attenuation area for a 1:10yr return flood event (10% chance of annual exceedance) within the Papawai stream catchment.
- Retaining Walls:

  Design and construction of retaining walls on both the upper (approximately 1m high) and lower fields (1.5- 4.5m high) required to support raised field surfaces.
- Provision for service relocation:

  Provision of a risk allowance for the possible relocation of HV cables and water mains, which may be required as a result of field raising. The need for this work would be determined in conjunction with production of final detailed designs for the sports fields.

Cost savings associated with a reduction in the volume of excess excavated material requiring off-site disposal have been provided for in this assessment.

3 Benefits/Dis-Benefits

In addition to the monetary costs associated with both scenarios, there are a number of benefits and dis-benefits that should be recognised and considered with each scenario.

These benefits and dis-benefits are outlined for each scenario in the following tables.

It is noted that all the benefits and dis-benefits associated with scenario 1 (using the upper and lower fields for stockpiling only) also apply to scenario 2 (involving the raising and stockpiling on both fields).

Scenario 1: Benefits and Dis-benefits of Stockpiling on the Upper and Lower Playing Fields

Matter	Benefit / Dis-Benefit	Who	Benefit/Dis-Benefit Explanation
Reduced visual effect of material stockpiles	Benefit	Rolleston Street Residents	Use of both fields allows material stockpiled for reservoir backfilling and burial, to be shared between the two fields, reducing the height and footprint of material stockpiles that would be required if only the upper playing field was used. Instead of one 8.5 m high stockpile on the upper field, two smaller stockpiles can be provided at a height of between 4 m high (upper playing field) and 5.5 m (lower playing field), and positioned on the fields in positions away from adjacent properties.
Temporary resident parking	Benefit	Rolleston Street Residents	A number of residential carparks on Rolleston Street will need to be closed during the construction period to enable heavy truck access to the reservoir site for construction. Use of both fields will allow space to be set aside on the upper field to provide temporary parking for displaced Rolleston Street residential parking. Use of both fields would also allow space to be set aside on the lower field for temporary car parking for site workers. This will ensure that workers don't use existing car parking on Rolleston Street and surrounding streets, reducing parking impacts associated with construction activity.
Reduced heavy vehicle movements	Benefit	Rolleston Street Residents	Use of both fields would allow sufficient space to be set aside on both fields to stockpile harvested top soil from the playing fields for reuse, reducing the amount of material that needed to be removed from the site for disposal and the import of new topsoil required for field resurfacing.
Flexible worksite area for construction activities	Benefit	Contractor	Use of both fields would provide additional space for construction and site management activities. This includes space to not only accommodate stockpiling of harvested topsoil from the fields for reuse (above), but to establish and operate erosion and sediment control measures, provide additional space for vehicle manoeuvring and equipment, vehicle and construction material storage, and temporary parking of light construction vehicles on the lower playing field.
Playing surface and field drainage enhancements	Benefit	Sports field users	Using the sports fields for construction activities will require both fields to be re-leveled, shaped and restored/rehabilitated to at least their existing condition, post construction. An improved field surface profile, and improved field side drainage, will likely result in better playing field surfaces, with improved drainage performance, and greater utility of these surfaces.
Visual, dust and noise effects	Dis-benefit	Salisbury Terrace Residents	Use of both fields would however extend the construction footprint of the site. Impacts of construction activities (including visual, noise, and dust) would potentially be brought closer to residents of Salisbury Terrace (in the absence of appropriate mitigation of construction effects).
Field closure:	Dis-benefit	Field users	Use of both fields will result in the additional closure of the lower fields to all field users for the duration of the reservoir development.

Scenario 2: Additional Benefits and Dis-benefits of Raising and Stockpiling on both Upper and Lower Playing Fields:
(Additional Benefits/ Dis-benefits to Scenario 1)

Matter	Benefit / Dis-Benefit	Who	Benefit/Dis-Benefit Explanation
Reduced heavy vehicle movements	Benefit	Rolleston Street Residents	**Upper field:** Using some of the excess spoil from the reservoir excavation site to raise the upper field by between 1-1.5 m will allow the re-use and storage on site of approximately 8,000 m^3 of material (unbulked). This will reduce the number of heavy truck movements on Rolleston Street during the reservoir site excavation period by around 1,400 return movements, or 2,800 total movements. This will reduce construction effects along Rolleston Street associated with heavy vehicle traffic movements, such as noise and vibration, and reduce safety risks associated with heavy vehicle movements. **Lower field:** Using some of the excess spoil from the reservoir excavation to raise the lower field (including access track) in accordance with the option outlined in the feasibility study (field raising is linked to the height of the bund on the lower field) will allow the re-use of around 8100 m^3 of material (unbulked), also reducing the number of heavy truck movements on Rolleston Street during the reservoir site excavation period by around approximately 1,420 return movements, or 2,840 total movements. This will further reduce construction effects associated with heavy vehicle traffic movements, such as noise and vibration, and reduce safety risks associated with heavy vehicle movements. **Combined**: Raising both fields (including access track modification) would retain approximately 16,100 m^3 of excavated material onsite, reducing material to be disposed offsite to 14,700m^3 (in situ volume). Return truck movements along Rolleston Street (also allowing for top soil retention on site in Scenario 1) would be reduced from approximately 5,400 anticipated under the preliminary design option to approximately 2500. A combined field raising scenario would result in a **significant reduction** in heavy truck movements along Rolleston Street over the duration of reservoir construction.
Reduced Flood Risk	Benefit	Salisbury Terrace Residents	Raising of the lower field allows a more holistic approach to be taken to the existing flooding and scour issues along the Papawai Stream. Currently Papawai stream, during flood flows, overtops a bund on its eastern bank on to the lower field and flows across the southern end of the field and onto Salisbury Terrace, causing flooding issues for local residents.

Scenario 2: Additional Benefits and Dis-benefits of Raising and Stockpiling on both Upper and Lower Playing Fields:
(Additional Benefits/ Dis-benefits to Scenario 1)

Matter	Benefit / Dis-Benefit	Who	Benefit/Dis-Benefit Explanation
			The proposed profile for raising the lower field would continue to allow flood flows to spill onto the lower field, but water would be held in the re-profiled field design on the field to attenuate excess flows before discharging to new swales along the edges of the field, into a new stormwater pipe at the northern end of the field and then to the Salisbury Terrace stormwater system (currently being upgraded). This is expected to result in a **significant benefit** associated with reduced flooding of Salisbury Terrace residential properties.
Flood drainage improvements:	Benefit	Papawai Stream	As noted above raising of the lower field allows a more holistic approach to be taken to the existing flooding and scour issues along the Papawai Stream. Flood flows down the stream itself have also scoured a large area of bank near the changing sheds at the northern end of the lower field. The proposed profile for raising the lower field along with changes to field drainage would allow flood flows to be held on the field, in the re-profiled field design, to attenuate excess flows before discharging to new swales along the edges of the field, into a new stormwater pipe at the northern end of the field and then to the Salisbury Terrace stormwater system (currently being upgraded). This is expected to result in the improved management of flood flows into Papawai stream potentially reducing stream scouring.
Excavated material reuse, reduced excavated material disposal to landfill	Benefit	Wellington community, Environment	Reuse of excavated material to raise both fields (including access track modification) would retain approximately 16,100 m^3 of excavated material onsite, significantly reducing the distance excavated material needed to be physically transported (versus the option of disposal) and the volume of excavated material requiring disposal at the landfill. Reuse of excavated materials for field raising also facilitates a range of significant short term and long term ancillary benefits (outlined above) associated with reduced heavy traffic for excavated material disposal, and improvements to field drainage and reduced flooding risk to the local community.
Privacy	Dis-benefit	Residences adjoining playing fields, Salisbury Terrace Residents	Raising the playing field surfaces is expected to give rise to some concerns amongst some adjacent residents around reduced privacy associated with a modest increase in field elevation. Privacy issues may be able to be mitigated with planting and landscaping.

Scenario 2: Additional Benefits and Dis-benefits of Raising and Stockpiling on both Upper and Lower Playing Fields:
(Additional Benefits/ Dis-benefits to Scenario 1)

Matter	Benefit / Dis-Benefit	Who	Benefit/Dis-Benefit Explanation
Visual effect of retaining wall:	Dis-benefit	Residences adjoining playing fields, Salisbury Terrace Residents	A 1 m timber retaining wall will be required along the north, east and part of the west side of the upper field. A 1.5- 4.5 m high retaining wall will be required along the eastern edge of the lower field. While the upper retaining wall will be on the south side of adjoining residential properties, it will be a new structure and could have some effect on some outlooks over the adjoining park areas. The retaining wall on the east side of the lower field will effect outlooks over this area for some residents. Mitigation landscaping could be applied to soften and offset this impact, particularly once planting is established.