Preliminary Design Report

Project Name: **Eastern Hills Reservoir**

Project No.: **OPC101031**

Date: **25/01/24**

Our water, our future.

Document Control

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Executive Summary

This report presents the preliminary design for the proposed 15ML potable water Eastern Hills Reservoir, located at the top of Summit Road, Fairfield, Lower Hutt. Following a site selection process including a Multi Criteria Assessment, the new reservoir will be located on an existing Wellington Water site which contains the existing 11.3ML Naenae reservoir. The additional reservoir is required to meet Wellington Water's target levels of service and cater for projected growth in Hutt City. Previous work has identified the preferred site and required capacity of the proposed reservoir.

Scope

The scope of this project is for the reservoir, associated infrastructure on the hill and the delivery pipe crossing the Waiwhetū Stream. The delivery pipe that connects to the existing bulk network, along public roads, starting at the end of Balgownie Grove, is being addressed through a separate project (OPC101676). Previous work has referred to the reservoir as the Lower Hutt Central and Naenae No. 2 reservoir, at the conclusion of the Concept Design it has been renamed the Eastern Hills Reservoir.

The new reservoir is to be a 55m diameter above ground circular reservoir. Supply to the reservoir will be from the Waterloo Water Treatment Plant (WTP), utilising the existing DN750 bulk network pipe which runs up Summit Rd; a connection point existing on this pipe at the intersection of Summit Rd and Farrelly Grove. The reservoir will supply the water network via a new 1.1 km DN750 delivery pipe which is proposed to run north down the side of the hill, crossing the Waiwhetū Stream at the end of Balgownie Grove, connecting to the network at various points. A new scour / overflow line is proposed to run along the same alignment as the delivery pipe down the side of the hill, before discharging into the Waiwhetū Stream; the existing Naenae reservoir overflow will be connected into this line. A DN500 cross-connection between the existing Naenae reservoir and the Eastern Hills Reservoir will be provided to allow for operational flexibility during any shutdowns or maintenance. The Eastern Hills reservoir valves and control equipment will be housed in a new valvehouse connected to the reservoir.

Consenting

A designation is being sought by Wellington Water on behalf of Hutt City Council (HCC) to authorise the construction of the reservoir as it provides several benefits over using a resource consent such as greater flexibility for design changes and protection of the site for future maintenance and operation activities. Based on factors such as the scale of works and the proximity of residential properties the application is likely to be publicly notified. A Notice of Requirement (NOR) is currently being prepared along with supporting specialist assessments including noise and vibration, traffic, ecology, landscape and visual impacts and erosion and sediment control.

A resource consent from Greater Wellington Regional Council (GWRC) is being sought for earthworks, vegetation clearance, the discharge of sediment and stormwater run-off and works in the bed of a stream. Additionally, approvals will be required under the National Environmental Standard for Freshwater Management for constructing specified infrastructure within 100m of a natural wetland. If the effects are determined to be minor or less than minor, then public notification would not be required.

Community & Stakeholder Engagement

For the Eastern Hills Reservoir project, the key stakeholders are identified as: HCC, GWRC, Mana Whenua partners, Regional Public Health, and identified property owners who may be affected.

Engagement with Wellington Water's Mana Whenua partners has been led by Wellington Water and a Cultural Impact Assessment prepared by Taranaki Whānui.

Pre-application meetings have been held with HCC and GWRC, as well as a briefing meeting and information pack for HCC councillors.

Key messages have been created to inform the public about the potential construction of Eastern Hills Reservoir. These messages are being relayed through a multi-layered communications strategy, including social media releases, website development, flyer and letter drop and community drop-in sessions. Two community drop-in sessions have been held; as well as two street events targeting affected residents and an on-line survey.

Procurement

The Eastern Hills reservoir is to be procured through a design and construct (D&C) contract. The contract will be tendered following lodgement of the resource consent and NOR lodgement and awarded following consent and NOR approval. The delivery pipeline from Balgownie Grove will be delivered under a separate contract.

The procurement package is currently programmed to begin construction in mid to late 2024. The critical path task is the NOR approval by HCC, with the currently programmed consenting process taking approximately 11 months.

Two D&C teams were engaged by Wellington Water to assist in the refinement of the preliminary design and provide constructability advice for the Eastern Hills reservoir to ensure a cost effective, buildable design is consented.

Risk

A project risk and opportunity workshop was held on Friday 21 July 2023. The following key risks and opportunities were identified:

Risks:

- Lack of tender price competition, potentially leading to increased costs
- Increased traffic management requirements, potentially leading to increased cost and reputational harm from public impacts.
- Construction vehicle access to site is limited, potentially leading to increased programme and cost.
- Low availability of contractors, their resources and subcontractors, potentially leading to programme delays and increased cost
- Appeals to the NOR and consents, potentially leading to significant programme delays and costs.

Opportunities:

- Disposal of cut in off-site location (alternate project site) to reduce cut material being disposed of to landfill.
- Change site level from 66m to 68m R.L. to reduce earthworks.

Cost

A level 2 cost estimate was prepared during concept design and can be found in the Cost Estimate Report (SharePoint link). The cost estimate was not refined further during preliminary design at the request of Wellington Water.

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1 Introduction

1.1 Purpose

The purpose of this report is to present a preliminary design for a proposed 15 ML potable water reservoir at the top of Summit Road, Fairfield, Lower Hutt. This reservoir would be located on an existing site which already contains the existing 11.3ML Naenae reservoir. The additional reservoir is required to meet Wellington Water's target levels of service and cater for projected growth. Previous work has identified the preferred site and required capacity of the proposed reservoir.

The scope of this project is for the reservoir, associated infrastructure on the hill and crossing the Waiwhetū Stream. The delivery pipe through the urban alignment, starting at the end of Balgownie Grove, is being addressed through a separate project. Previous work has referred to the reservoir as the Lower Hutt Central and Naenae No. 2 reservoir. At the conclusion of the Concept Design, it has been renamed the Eastern Hills reservoir.

The purpose of the preliminary design is to develop the design in sufficient detail to inform the GWRC consent and HCC Notice of Requirement applications and assessment of environmental effects. The project is being procured through a D&C contract and the design will be developed further by the preferred D&C tenderer.

1.2 Background

1.2.1 Wellington Water service goals

Available reservoir storage within the Lower Hutt Central and Taita Water Storage Areas (WSA) does not meet target levels of service. The storage deficit leaves this area vulnerable to bulk water supply interruptions (i.e. source, treatment, pumping and bulk pipeline failures) and there exists potential for unreliable water supply. This will be exacerbated by future development and population growth that will place additional demand on the network.

Additional treated water storage is required in order that Wellington Water can provide reliable services to customers and accommodate future population growth – refer to Wellington Water Activity Brief. The customer outcomes and service goals linked to this activity are shown in Table 1.

Table 1. Customer outcomes and service goals

Primary customer outcome		Outcome 3: Resilient networks support our economy
Primary goal		3.3 We plan to meet future growth and manage demand
Secondary customer outcome		Outcome 3: Resilient networks support our economy
Secondary goal		3.4 We provide reliable services to customers

The project seeks to meet the primary service goal, "We plan to meet future growth and manage demand", through:

- Provision of 15 ML of additional storage, which has considered population growth through to 2049;
- Design of distribution pipework to consider population growth through to 2121.

The project seeks to meet the secondary service goal, "We provide reliable services to customers", through:

- Provision of additional 15 ML of water storage which improves the seismic resiliency of the water network;
- Reservoir size allows for the replacement of the existing Naenae reservoir to take place in approximately 20 years, without significant disruption to service.

1.2.2 Reservoir and Delivery Pipeline Packages

Due to the different consenting and procurement requirements, the Eastern Hills reservoir project has been split into two packages, to be delivered as two separate projects:

Package 1

The scope of Package 1 is to include the Reservoir site and all associated works, the inlet and overflow pipe and the delivery pipe down the hill and across the Waiwhetū Stream. This scope is based on the works which will require the majority of consent applications.

This package would be a design and construct (D&C) procurement method.

Package 2

The scope of this package starts from the delivery pipe termination on the Balgownie Grove side of the Waiwhetū Stream and includes all aspects of the delivery pipe through the carriageway, to the connection at Oxford Terrace.

This package will follow a traditional procurement method, where Connect Water will continue as the designer.

1.3 Project Objectives

The project objectives are (adapted from activity brief November 2020):

- Address the current storage shortfall and ensure sufficient storage for future growth in the Lower Hutt Central and Taita water storage areas (WSA).
    - To ensure disaster resilience of the Lower Hutt Central and Taita WSAs by providing a seismically resilient water supply capable of meeting Wellington Water's target level of service for the WSA of 7 days (day 8 to day 15) supply under a survival and stability state following a significant water supply disruption event.
    - To ensure the Lower Hutt Central and Taita WSAs are operationally resilient by providing sufficient secure, safe, and reliable water storage to supply 48 hours of water to residents, businesses, and critical water users (including the fire service)

under normal operating conditions, based on projected demand with appropriate consideration of population growth.

- To deliver a secure, safe, and reliable water storage solution that has a 100-year design life.
- To integrate the chosen solution into the Lower Hutt Central WSA network in a cost-effective manner.

1.4 Scope of Report

This report outlines the preliminary design for a new 15 ML Eastern Hills Reservoir at the selected site adjacent to the existing Naenae reservoir, refer Section 2.3. The scope of the preliminary design covers the following aspects:

- Layout of the new infrastructure within the site.
- Identification of the earthworks required to provide a suitable construction platform and accessways to the proposed reservoir.
- Geotechnical investigation of the proposed site, including a site specific seismic hazard assessment (SSSHA) – This will be referred to as a probabilistic seismic hazard assessment (PSHA) – Geotechnical reports are to be provided separately.
- Any ground or slope stabilisation measures required for the reservoir or associated infrastructure.
- Structural design of the proposed reservoir and associated valvehouse.
- Design of the inlet, delivery and overflow/scour pipelines.
- Identification and design of required connections and integration with the Naenae reservoir for construction and operation, including delivery pipe and overflow/scour pipe connections.
- Consenting strategy. The consents and associated specialist assessments are being prepared in parallel with the preliminary design.
- Procurement strategy
- Engagement with contractors to undertake “Early Contractor Involvement”.
- Construction methodology
- Consultation and approvals
- Communication, stakeholder and public engagement plan
- Critical path programme for the project
- Risk registers, including:
    - Safety in design
    - Project risks

1.5 Exclusions and limitations

Excluded from the preliminary design:

- Cost estimates will not be revised during preliminary design at the request of WWL. Costs will be revised by the preferred D&C contractor.
- Carbon estimates will not be revised during preliminary design as the design has not altered significantly since concept stage.
- Trial shutdown of the Naenae Reservoir has not been undertaken as part of this design. Shutdown plans for connections to the existing network are to be developed by the contractor.
- Location of existing services. No potholing or service location has been undertaken as part of Preliminary Design. This is to be done in detailed design. The alignment of the new cross connection pipe in Farrelly Grove must be confirmed following service location.
- The purpose of this Preliminary Design is to inform the consenting and generally promotes the 'worst case scenario' from a consenting perspective. Buildability and feasibility have been major factors in the decision-making process, however further analysis will be required in detailed design to confirm the proposal.

2 Previous Work

The following previous work has been carried out in relation to the proposed new reservoir at Naenae. The information from these reports is not repeated in this Preliminary Design Report and reference should be made to these reports if more information is required.

2.1 Reference Work

The following work has been completed over the previous years and is referenced throughout the preliminary design and other associated work on the new Naenae reservoir:

- Hutt City Zone Management Plan (Hutt Valley excluding Wainuiomata), Stantec 2020
- Household and dwelling demand by SA2, Sense Partners 2021
- GWRC demographic projections, Sense Partners 2021

2.2 Reservoir Storage Volume Assessment

The Reservoir Storage Volume Assessment produced by Connect Water, dated December 2021, provided an assessment and justification for the storage volume of a proposed new potable water reservoir in the Lower Hutt area. This assessment found that a new 15ML reservoir should be constructed over the 2024/27 period.

In 2023 structural issues with the Gracefield reservoir were identified. Repairs are being undertaken to reinforce the structure, however the repairs are considered temporary with replacement of the reservoir planned to start in late 2027. In September 2023 the Reservoir Storage Volume Assessment was updated to reflect this recent information. The findings of the updated report confirmed the recommendation of a 15ML reservoir to be constructed at the Naenae site over the 2024/27 period.

2.3 Site Selection Report

The Site Selection Report produced by Connect Water, dated June 2022, reviewed potential locations for the construction of the proposed 15ML reservoir. The assessment looked at a variety of locations, narrowing down to 7 long list sites, this was further narrowed down to a shortlist of 3 potential sites: Naenae, Cambridge Terrace and Gracefield. A multi criteria analysis (MCA) was performed on the shortlisted options, primarily looking at environmental, social, technical and financial criteria. The MCA concluded that the preferred location for a new reservoir was the site adjacent to the Naenae reservoir at the top of Summit Road.

2.4 Concept Design report

The Concept Design Report produced by Connect Water, dated March 2023, provided the concept design for the reservoir and associated infrastructure (including the delivery pipeline through the urban alignment). Alongside the Concept Design Report, options reports exploring the reservoir elevation and delivery pipe alignment were produced; the delivery pipe alignment report has been updated as part of the preliminary design, refer to Section 6.

3 Site

3.1 Reservoir Location and Arrangement

The site for the reservoir is adjacent to the Naenae reservoir which is located at the top of Summit Road in Lower Hutt. There are two land parcels which form the reservoir site, and both are owned by Lower Hutt City Council:

- Lot 14 DP 59678 (13.19 ha)
- Lot 35 DP 31233 (1.13 ha)

As part of the Notice of Requirement (Refer Section 14.1), it is proposed that the property boundary between the two lots is adjusted so that the reservoir and associated assets are sited only on Lot 35. C, construction works will still be conducted across both lots. The boundary adjustment will result in Lot 14 reducing in size to 12.41 ha, and Lot 35 increasing in size to 1.90 ha.

The site is predominantly covered in scrubby vegetation; a firebreak/track passes through it where the proposed reservoir would be sited. In addition, there is an existing trig station located within the likely reservoir footprint. The site is sloped; the existing slopes are steep in places.

The Activity Brief requires the new reservoir elevation to match the Naenae reservoir top water and floor levels which are 72.53 m RL and 66.05m RL, respectively (to NZVD 2016 vertical datum). This requires a substantial volume of earthworks to form a platform at the required level.

The proposed location of the reservoir has considered a minimum separation distance (allowed 20m) from the Naenae reservoir for construction and operational needs for the new reservoir, as well as working space allowance to replace the Naenae reservoir in the mid 2040's. The location proposed in this report was predominantly driven by founding the reservoir on competent rock, minimising the ground improvements required. Based on geotechnical findings and structural recommendations, it was not considered practical or cost effective to found the reservoir completely or partially on fill.

A minimum 3m buffer around the reservoir has been allowed for, with no backfill around the walls; this is to provide a buffer for slope stability, as well as providing vehicle access around the outside of the reservoir during and post construction. While the design does not propose the partial backfill around the reservoir, this may be explored in subsequent design phases when looking at minimising earthworks volumes.

The site extends down the ridge line to the north of the reservoir towards the Waiwhetū Stream at the foot of the hill. The overall site includes both the southern and northern banks of the Waiwhetū Stream at the end of Balgownie Grove, this is where the delivery pipe will cross to distribute into the network. On the southern bank of the Waiwhetū Stream, four wetlands were identified by ecological surveys completed by WSP in April and June 2023, and confirmed based on plant DNA samples carried out by Landcare. The proposed construction site will maintain minimum separation of 10m from the edge of the wetlands.

Access to the site is primarily via an existing track from Summit Road; this has a lockable barrier to prevent unauthorised vehicle access, but pedestrian and cycling access is possible. The track is partially metalled up to the roof level of the existing Naenae reservoir, and unpaved thereafter. The

track is to be reinstated at the conclusion of construction, providing access up past the new reservoir.

Construction access for the works adjacent to the stream will also be provided from Balgownie Grove, as there is HCC land from the end of the street down to the stream. A temporary staging bridge across the Waiwhetū Stream shall be established to aid construction of the pipeline down the hill, as well as works on the southern stream bank.

Concern was raised in the site selection report that the Naenae site will present a significant negative impact on the community, as the site is located within a residential area and is frequently used for recreational activities within the Eastern Hills. The mitigation of community impacts is a significant concern in the design of the new reservoir and development of construction methodology.

The recommended location, taking all these factors into account, is shown on the preliminary design drawings included in Appendix A. During the subsequent design stages, it is possible the reservoir may shift, this will be driven by further ground investigations and reducing the earthworks volumes.

The reservoir site is shown below in Figure 1.

Figure 1: Reservoir Site (north up)

3.2 Naenae Reservoir and Network

The existing 11.3 ML Naenae reservoir is a rectangular concrete reservoir constructed in 1946. This reservoir is buried, although the roof was permanently exposed several years ago, and repairs made to cracks. Work is underway at present to permanently expose most of the walls, which have some cracks and leaks, with the intent of improving drinking water safety.

A small control room is constructed as part of the reservoir above a valve chamber and pipe tunnel which leads out to an entry point in private property at 1 Farrelly Grove. The control room contains electrical and SCADA equipment for the reservoir, and also a radio repeater for Hutt City Council. Radio antennae are installed on the roof. Due to issues in the past with contamination in this reservoir, FAC, pH, and turbidity monitoring analysers are installed.

Water flows into the reservoir through a bulk water pipeline from Waterloo WTP which comes up Summit Road. This pipeline is DN750 concrete-lined steel (StCL) pipe; and has a DN600 branch at the intersection with Farrelly Grove, fitted with a DN400 sluice valve. From this valve, a DN600 pipeline enters the No. 1 reservoir through a high-level penetration of the western wall. This inlet pipeline and pipe entry was constructed in 1987. The DN750 end of the tee is terminated in a blank plate as provision for the connection of a future reservoir.

All other pipes from the reservoir pass out beneath the control room via the valve chamber and DN1800 reinforced concrete tunnel which terminates in a door at 1 Farrelly Grove. The reservoir has a partial dividing wall which enables independent operation when the water level is less than about 40% full. Each half of the reservoir has a DN300 outlet pipe; these combine in the pipe chamber into a DN450 steel pipeline which continues directly down the hill through private properties until it intersects with Summit Rd. Although referred to as an outlet pipeline, it can allow inflow to the reservoir as there are interconnections from the bulk supply mains within the Lower Hutt network which were opened in the past to mitigate pressure losses due to lime solids' deposition in the pipes. These links are still open and water can flow from the network into the No. 1 reservoir under certain conditions. A seismic shutoff valve is fitted to this pipeline.

The Naenae reservoir delivery pipeline has a similar expected remaining life to the reservoir, and it is assumed that this pipeline will remain operational for the remainder of the reservoir's life (expected to be approximately 20 years).

An overflow chamber is provided in the Naenae 1 reservoir with a DN300 riser pipe; this combines with a DN300 drain pipe from each side of the reservoir to enable overflow and drain water to be discharged to the top of a gully off Summit Road. Water from this discharge point flows down the gully where it connects to the Waiwhetū Stream behind 7 Balgownie Grove.

4 Site Investigations

4.1 Survey

Survey was undertaken at the site as part of the Concept Design and was used to develop a digital terrain model of the site. Datums used are:

- Wellington Circuit
- NZGD2000
- New Zealand Vertical Datum 2036

4.2 Geotechnical

In addition to a desktop study, two forms of geotechnical site investigations were carried out at the site:

1. Geophysical testing
2. Boreholes and window samplers

The method and results of these investigations are provided in the Geotechnical Factual Report.

A separate project is currently underway to conduct additional site investigations, seeking to compress the programme by providing the successful D&C contractor with sufficient information to undertake detailed design. The type and location of additional investigations have been determined in conjunction with the ECI contractors. Further details are included in the Interpretive Geotechnical Report.

4.3 Contaminated Soil

A desktop Preliminary Site Investigation was conducted by Connect Water during the concept design finding that it is not considered 'more likely than not' that an activity on the Hazardous Activities and Industries List (HAIL) has historically been, or is currently being undertaken on the site. Soil testing conducted as part of the recent Naenae reservoir upgrade, found that the material is suitable to be used as cleanfill at a Class A landfill.

Further sampling is recommended to be undertaken to provide a greater level of certainty around cost estimating, however it has not been considered necessary for the preliminary design. The soil sampling will be carried out in 2023, prior to issuing the D&C tender documents, to inform the D&C tender pricing.

4.4 Archaeological Assessment

A desktop archaeological assessment was completed by Connect Water as part of the Site Selection Report. The assessment found that there was no recorded archaeological site within 500m of the proposed reservoir location. The risk of finding an archaeological site within the proposed project area was therefore considered to be low.

5 Analysis

This section includes a description of the hydraulic analysis, level of service, design flows and any departures from the code and specifications.

5.1 Hydraulic Analysis

The primary basis for the hydraulic design was undertaken by Connect Water during concept design, and is presented in the Hydraulic Design Basis report.

The proposed inlet and outlet design flows are provided in the table below. The design flow is the flow at which pipes will be designed to not exceed 3 m/km head loss. The temporary design flows are based on Gracefield reservoir being out of service, head loss exceeding 3 m/km is acceptable for these periods.

Table 2: Design flowrates

ID	Pipe	Design Flow (L/s)	Temporary Design Flow (L/s)
1	Common Naenae reservoir inlet	606	745
2	Eastern Hills Reservoir inlet	490	606
3	Common Naenae reservoir outlet (delivery)	642	780
4	Eastern Hills Reservoir outlet	600	642

Consultation with Wellington Water Principal Modeller, Iman Aghamohammadi, led to the incorporation of the reservoir delivery pipe into the Hutt City network model. A report, Naenae No.2 Reservoir – Outlet Configuration Review, was developed by Stantec in consultation with Wellington Water, which concluded the following:

- The delivery pipe is to be sized at **DN750.**
- An additional DN600 connection between the existing Naenae reservoir delivery pipe and the new Eastern Hills reservoir be incorporated into the design. This pipe provides additional redundancy if the new reservoir is taken out of service, or a failure in the existing Naenae reservoir delivery pipe occurs.

  Further consultation with Iman Aghamohammadi on 5 July 2023 adjusted the size of the cross connection to a pipe with an internal diameter of 519mm or similar. Therefore, a **DN500** pipe is recommended.

  This may be reduced during detailed design, should it be proven impractical to construct a pipe of this size. Any change will need to be approved by Wellington Water.

The reservoir inlet was not subject to additional hydraulic modelling. Hydraulic modelling completed during concept design indicated that the expected pressure drop through the existing DN750 pipe would not exceed 3 m/km for the design flowrate of 606 L/s. It is therefore considered that this pipe is sufficiently sized and that any changes in pipe size can be considered when this asset requires renewal.

A summary of pipe sizes is provided in Table 3. These sizes assume StCL is the material selected. Where an alternate material is selected the internal diameter must be equivalent.

Table 3: Pipe sizes

Pipe	Pipe Size
Reservoir inlet	DN750
Delivery pipe	DN750
Delivery cross connection	DN500

5.2 RSWS Departures

The following lists the departures from the Wellington Water Regional Standard and Specifications for Water Services.

5.2.1 Overflow Pipe

The specification requires that the overflow be sized to convey twice the maximum inflow, as the maximum inflow is 745 L/s, this design flow would be 1,490 L/s. A departure from this requirement is requested, to reduce the required design flow to 120% of the maximum inflow and therefore a design flow of **894 L/s**.

The RSWS states that the increased design overflow capacity is to allow for future growth, as the maximum inflow of 745 L/s is based on a 100-year population projection it can be considered that the future growth has been allowed for. This reduces the required pipe size for the overflow and therefore the cost and carbon impact of the overflow line.

5.2.2 Cutoff Walls

Section 4.4.5.7 of the specification requires water stops (cut-off walls) at 5m spacings where pipeline grades are steeper than 1:5.

Given the nature of the surroundings, Connect Water's Concept Report proposed that this spacing was increased to 15m, with a subsoil drain provided in the base of the trench to capture any water that enters the backfilled trench. This shall be discharged into the overflow/scour discharge structure at the foot of the hillside. The intent of this recommendation was to balance the need to prevent material mobilisation, with the construction difficulties posed by the location.

Following conversations with the WWL Design Manager during Preliminary Design, the recommendation has been modified such that cut-off walls are to be constructed at 5m spacings, however the D&C contractor can increase this spacing where an alternate design is shown to prevent the mobilisation of material along the trench; any design would be subject to WWL approval.

5.2.3 Thrust Blocks

Section 6.4.21.1 of the Regional Standard for Water Services states that thrust blocks are required regardless of any joint restraints employed in the pipework, with the exception of changes in direction on PE mains.

For the new pipes between the new valve house out to an including pipe in Farrelly Grove, which include the new CLS DN750 supply pipe and the DN450 delivery pipe (the material for this is to be confirmed during detailed design), Connect Water recommend that thrust blocks not be provided on these pipes at changes of direction. The reason for this is that the pipes will be either concrete lined steel or PE. Both of these pipe systems will have welded joints which are fully restrained against

longitudinal forces. Due to the size of the pipes and high test pressures, any thrust blocks will be quite large which restricts working room on the site. This is to be confirmed during detailed design once final pipe alignment and material are selected.

5.2.4 Delivery Pipe Material

Table 6.4.6.3 of the Regional Standard for Water Services states that where a trunkmain has a nominal internal diameter of 750mm, the preferred material is StCL or DICL. The standard however does allow for PE100 pipes to be used where it is considered StCL or DICL are not suitable for specific technical reasons.

Through engagement with Wellington Water it was considered that due to the slope and location of the buried delivery pipe down the hill, it would be acceptable to construct this pipe in PE100. The selection of pipe material is considered to be driven by construction methodology and the ability to ensure the quality of the installed pipeline, as such both contracting parties were asked to provide comment during the ECI process. Each contracting party selected a different preferred material for construction, which indicates that the selection will likely be driven by the capabilities of the individual contractor. It is therefore left open for the contractor to select a preferred material as part of the D&C process, to ensure the quality of the installation.

5.2.5 Open Channel Freeboard

According to section 4.2.8 of the Regional Standard for Water Services open channels shall have a minimum freeboard of 500mm for the primary level protection flow. The stormwater channels proposed by this preliminary design have a freeboard of approximately 300mm. A secondary flow path into the gully to the north exists at this site. The design freeboard has therefore been reduced to 300mm given that; a secondary flow path exists, the constrained space for installing the channels and that the depth of flow in the channels in a 10-year storm event is less than 100mm. Connect Water recommend that open channel freeboard shall be optimised during detail design and potentially reduced further with the approval of Wellington Water.

6 Options Assessment

6.1 Summary

As part of the concept and preliminary design there were several option assessments conducted. Table 4: Options assessment summarises the critical assessments.

Figure 2: Delivery pipe alignment options (Options 2b, 3a and 3b only shown up to where all join a common alignment with Option 2a on Waddington Drive)

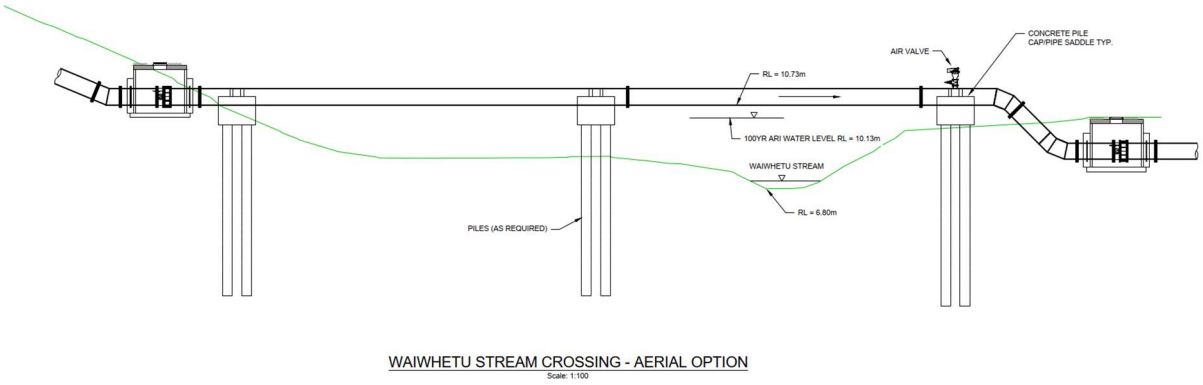


Figure 3: Cross section of aerial stream crossing (not preferred)

Table 4: Options assessment

Issue	Options	Decision
Delivery pipe alignment	**Option 1 – Summit Road:** run the delivery pipe adjacent to the existing inlet pipe down Summit Road and then to the distribution network. **Option 2a – Ridge line to Balgownie Grove:** run the pipe down a ridge on the hill north-east to the end of Balgownie Grove and then to the distribution network. **Option 2b – Ridge line to Waddington Reserve:** run the pipe down a ridge on the hill north-east to the end of Balgownie Grove, traverse west along the true right bank of the stream and onto Waddington Drive, west of 20 Waddington Drive. **Option 3a – Gully to Balgownie Grove:** Raised by both ECI contractors was the potential to run the pipe down the gully where the existing reservoir discharges. The pipe would cross the Waiwhetū Stream near the back of 7 Balgownie Grove, traverse east along the true right bank of the stream and continue up Balgownie Grove. **Option 3b – Gully to Waddington Reserve:** run the pipe down the gully where the existing reservoir discharges. The pipe would cross the Waiwhetū Stream near the back of 7 Balgownie Grove, traverse west along the bank and onto Waddington Drive, west of 20 Waddington Drive. This route was recommended by a member of the public due to concerns regarding the suitability of Balgownie Grove for construction of the delivery pipe. Refer to Figure 2 for pipe alignment options.	Option 1 is not preferred due to the constructability risks and community disruption associated with installing the delivery pipe and scour / overflow pipe along Summit Road, adjacent to the existing inlet pipe. During the ECI process both D&C teams confirmed the constructability risks associated with Option 1, the potential need to realign existing services resulting in service disruptions and the significant disruptions to the Summit Rd community. The ridge line Option 2a/b was preferred over the gully Option 3a/b due to the risk associated with construction on a significantly steeper slope at the top of the gully, the need to traverse a side slope to avoid wetlands and to construct the pipe along the true right bank of the stream. Finally, Option 2a is preferred over 2b due to the constrained space of the true right bank of the Waiwhetū Stream and the need to undertake slope stabilisation along the bank. Option 2b also is expected to result in greater disruption to the public as it is likely private property will need to be accessed to undertake construction. **Option 2a** is the preferred option. Refer to Pipe Alignment Assessment report for detailed options assessment.

Issue	Options	Decision
Reservoir elevation (BWL)	**Option 1:** Eastern Hills reservoir bottom water level (BWL) equals 66.05m, to match the existing Naenae and Gracefield reservoirs, as per the Activity Brief. **Option 2:** raise the BWL of the reservoir to 72.10m, which is higher than the existing Naenae and Gracefield reservoirs.	Option 1 (i.e. matching the existing Naenae 1 TWL and BWL) was confirmed as the preferred option for reservoir elevation. It was considered that the risk to the delivery programme and associated cost risks of Option 2 was too high. Refer to meeting held on October 11 2022 and 13 April 2023. Refer to the reservoir elevation report.
Reservoir elevation (TWL)	**Option 1:** Eastern Hills reservoir top water level (TWL) equals 72.53m, to match the existing Naenae and Gracefield reservoirs, as per the Activity Brief. **Option 2:** raise the TWL of the reservoir to 74.53m but maintain the same BWL of 66.05m, effectively increasing the reservoir volume. Operate the reservoir at the existing Naenae 1 TWL until the Waterloo pumps are upgraded.	Option 1 (i.e. matching the existing Naenae 1 reservoir top water level) was confirmed as the preferred option for reservoir elevation. It was considered by WWL that the benefit of allowing flexibility around the TWL was not worth the additional consenting costs and risk. Refer to meeting held on 29 May 2023.
Naenae 1 overflow and scour	**Option 1:** separate the Naenae 1 reservoir scour/overflow from the Eastern Hills scope and proceed with the Naenae Overflow Activity Brief plan of running a flexible surface pipe down the gully and into the Waiwhetū Stream. This line would be decommissioned and removed upon replacement of the Naenae 1 reservoir. **Option 2:** install the pipe from the Naenae 1 scour/overflow along the access road, rising up to the point where the Eastern Hills Reservoir pipe turns to run down the hill. This would mean that the pipe has a low point at the current Naenae 1 discharge point. **Option 3:** install the pipe from the Naenae 1 scour/overflow at a constant fall before connecting to the Eastern Hills Reservoir pipe. This would require the pipe to follow the contour of the hill, running partially down the side of the hill where the terrain is relatively steep.	Option 2 is preferred due to the constructability and consenting constraints. Option 1 would require an additional discharge consent and additional construction in the gully. Option 3 would require construction on steep terrain and additional earthworks. It was agreed with WWL at a meeting held on 4 May 2023 that a passive drain can be added to the scour line to drain the low-point for option 2. During the ECI process both of the engaged contracting parties confirmed the constructability risks associated with Option 3.

Issue	Options	Decision
Stream crossing	**Option 1:** Aerial crossing of the Waiwhetū Stream with a self-supporting pipe span. This would require piled abutments on each streambank. To comply with GWRC requirements, the invert of the pipe would need to sit a minimum of 600mm above the 100-year flood level of the Stream. The preliminary crossing design considered is presented in Figure 3. **Option 2:** Submarine crossing of the Waiwhetū Stream installed through open trenching, directional drilling or pipe jacking/ramming. The pipe would be encased below the Stream.	Initially the option of the aerial crossing was considered the preferred option due to the potential environmental impacts of a submarine crossing. However, once the pipe elevation and abutment locations were modelled, it was found that there were several significant risks associated with the aerial crossing: • The pipe would be approximately 2m above the northern bank and would be visually unappealing. The pipe would also be elevated 3-4m above the southern bank with large concrete supports. • The bank is used by dog walkers and required to be mowed. The pipe would impede this recreation and increase the complexity of maintenance of the landscape. • Even with barriers being installed the pipe presents a significant health and safety risk. There would be an approximately 4m fall from the top of the pipe to the normal stream level, with a fall from such a height into water presenting a high likelihood of fatality if it were to occur. It would not be possible to keep the pipe above ground and eliminate this risk. • There is a risk of damage to the pipe due to flooding or tampering if above ground. • Potential damage of the aquifer due to piling • Lateral spread of the banks in a significant earthquake has an increased risk of damage to the pipe if the abutments fail. While installation of the pipe under the Stream is considered to carry increased HSE risk during the construction period. It is considered to have lower risk, especially in respect to public safety, to have a submarine pipe.

6.2 Volume optimisation

During the preliminary phase design of the project, it was identified that structural issues were present at the Gracefield reservoir, requiring urgent remediation to keep the reservoir in service. The repairs have been designed, with construction programmed to be completed by the end of 2023. The repairs are considered temporary, allowing for the reservoir to remain operational while a replacement is designed and consented. An activity brief is being developed by Wellington Water which programmes the demolition and replacement of the Gracefield reservoir immediately after the Eastern Hills reservoir becomes operational.

During the preliminary design update held on May 29 2023, the potential for the optimisation of volumes across the Naenae, Gracefield and Eastern Hills reservoirs was discussed. A high-level assessment performed by Connect Water was undertaken and identified that, it may be possible to reduce the volume of the new Eastern Hills reservoir and therefore the earthworks volume and associated cost. A discussion was held with Wellington Water on August 14 2023 to discuss volume optimisation. The key outcomes were:

- Reducing the diameter of Eastern Hills reservoir and increasing the diameter of Gracefield accordingly, is unlikely to result in significant cost savings as Gracefield still requires a significant cut into the hill.
- There is a level of uncertainty in the replacement volume of the existing Naenae reservoir when it is replaced in the 2040s. Part of the assumed 5ML increase at this site might need to be spread across the other reservoirs.
- The most effective means of optimising storage against cost and disruption across the three sites is to reduce the footprint and increase the top water levels. This changes the operational philosophy of the network and requires enabling works on the network and at Waterloo WTP to access the storage at the increased elevation.
- Additional recommendations are to be included in the Gracefield Reservoir Replacement Activity Brief, included exploring the option of lowering the BWL at Gracefield and Naenae to increase potential volume for a given footprint, and assess potential Naenae replacement volume as part of any upgrades to Gracefield reservoir.
- Based on the condition of Gracefield reservoir there is a need to maximise new storage as soon as possible; if Gracefield reservoir was taken out of service prior to a new reservoir being constructed, there is a significant risk to the resiliency to the wider potable water network across the Hutt Valley. As increasing the TWL will require additional investigations to confirm the feasibility and network implications, this will push out the programme and increase risk of failure at Gracefield.

In September 2023 the Reservoir Storage Volume Assessment was updated to reflect the changes to Gracefield reservoir replacement timeline, concluding the following:

- A new reservoir is required to mitigate existing storage deficit and enable the replacement of the existing reservoirs. While Gracefield requires replacement as soon as practicable, Eastern Hills will need to be in operation prior to Gracefield being taken out of service.

- The assumed replacement volume of the Naenae reservoir may not be possible considering the site constraints, meaning additional volume may be required at Gracefield to offset this. This should be taken into consideration when briefing and designing Gracefield replacement.
- It is not recommended that the size of the proposed Eastern Hills reservoir be reduced, as there are too many unknowns with respect to the potential replacement storage volumes at Gracefield and Naenae. The proposed Eastern Hills reservoir will need to be constructed to provide additional system capacity prior to taking the Gracefield reservoir out of service for replacement.

7 Early Contractor Involvement

7.1 Overview

The reservoir component of the works ("Package 1") will be delivered as a design and construct (D&C) package in conjunction with the Aotea Reservoir project. The successful Aotea D&C contractor will be invited to price the Eastern Hills Reservoir to secure this additional works package.

During the Eastern Hills preliminary design stage, the two short-listed Aotea reservoir tenderers were engaged by WWL to provide constructability advice. The Aotea Tenderer's involvement in the Eastern Hills Reservoir project carried a 4% weighting on the Aotea reservoir tender.

The two D&C contractor teams were provided design information and asked to provide their construction methodologies and provide general constructability feedback on the concept design. This was used to make amendments to the preliminary design to improve constructability and to lessen the expected environment effects, as far as reasonably practicable. This feedback was also used to develop the construction methodology.

7.2 Workshops

There have been three workshops with the ECI teams:

1. Workshop 1 – Project introduction, team introductions and defining the ECI process. Fielded initial contractor queries about the project. Further requests for information issued by the contractor post workshop 1.

2. Workshop 2 – Presentation of preliminary pack by the ECI teams, outlining how they are approaching the design aspect and the key considerations from a construction perspective. High level conversation around specific questions asked of the contractor. Opportunity for contractor to ask more specific questions of the design team and WWL.

3. Workshop 3 – Prior to the presentation contractors will have issued the final ECI pack. The contractor teams presented their proposed designs and construction methodologies, identifying key risks and areas for consideration. Opportunity for the design team and WWL to question aspects of the pack and seek clarification.

7.3 ECI Outcomes

After the third workshop the design team determined the design and potential methodologies to be consented, trying to keep flexibility for the successful D&C contractor. This methodology drew from both contractor methodology statements, as well as work already undertaken by the design team. A meeting was held with WWL stakeholders on May 29, 2023, to discuss the proposed preliminary design prior to engaging technical specialists for the consent application.

Table 5 summarises some of the key constructability and design issues raised as part of the ECI process.

Table 5: Key ECI Outcomes

Issue	Summary of ECI outcomes	Status
Gully fill	While both D&C teams considered the volume of excavated fill a significant risk, only one D&C contractor considered the gully fill to be a cost-effective means of disposing of fill. Initially it was recommended that the gully near the foot of the hill be filled however the impact this would have on adjacent wetlands ruled it out as an option. Near the head of the gully was considered a viable option by one of the contractors, however they did note that there was significant cost risk with ensuring stability of the fill slope and significant stability risks during construction; this was consistent with key risks identified by the other D&C team. These cost and construction risks, as well as consenting risks[1] associated with the work, means that gully filling is not being considered as part of the design. This does not preclude the successful D&C team from seeking a separate consent for the filling of a gully.	Consider post-consent (separate consent required).
Reservoir configuration	D&C teams considered multiple tanks (2 or 3), but operational complexity outweighs any potential savings in earthworks. D&C teams also considered square reservoirs, but structural and operation complexity mitigated any potential earthworks savings	Closed
Reservoir burial	Both D&C teams considered partial burial of the reservoir, noting that there is potential for a reduction in earthworks volumes. Asymmetric burial was ruled out due to the increased structural complexity likely mitigating any potential benefits from reducing cut volume. It was also considered impractical to stockpile material on or off site in large volumes to bury at the end of the works. One D&C team considered an elevated construction platform, sunken down to the reservoir floor level and then backfilled uniformly around the reservoir. While the preliminary design does not reflect this proposal, the intent of the consent application is to allow for this to be an option.	Consider post-consent. Connect Water to allow for within any application.
Reservoir material	Considered steel tank but does not comply with durability requirements. Reinforced concrete preferred.	Closed
Reservoir elevation	Both D&C teams considered increasing the elevation of the reservoir, however as discussed in Section 6, this was ruled out by WWL.	Closed
Further geotechnical site investigations	D&C teams provided mark-ups of further site investigations. The mark-ups have been reviewed by the Connect Water geotechnical team and quotes are being sought.	Connect Water to pursue

[1] There is a new National Policy Statement (NPS) on Indigenous Biodiversity which limits development within a Significant Natural Area. This comes into effect on 4 August and means consent for the gully fill option would be very difficult to obtain.

Issue	Summary of ECI outcomes	Status
Delivery pipe route	D&C teams considered the potential routes for the delivery pipe and overflow pipe down the hill. Both contractors concluded that the route down Summit Rd presented significant risk in construction and did not consider it a practical option. An additional option of down an adjacent gully, where the existing reservoir currently drains to, was considered by both contractors however only one team put this forward as a preferred option. The risk associated with construction on a significantly steeper slope at the bottom of a gully, was considered too high to recommend this option as part of the preliminary design.	Closed
Installation of above ground pipe	It was recommended by one of the D&C teams that approximately the final third of the downhill section of the delivery and scour / overflow pipelines are installed above ground. This was identified as the preferred option due to the difficulty in trenching along the steepest parts of the ridge, at grades up to 45° and it was noted that an above ground pipe would have greater seismic resilience than a below ground. Discussions held with Wellington Water raised concerns with an above ground pipe and that the preference was for a below ground pipe; citing the following reasons that: • Whether the pipe is installed above ground or below ground, significant works are required to enable works down the alignment. A clear access way would still be required for vehicle tracking, which would involve the vast majority of the vegetation removal and earthworks. • Heavy construction vehicles for the installation of the pipes would still be required to track up and down the alignment. This involves excavators, loaders, cranes and other vehicles for carting material. • Seismic resilience may be reduced having an above-ground pipe, as it could be susceptible to slope failure below the pipeline. There was not a consensus from both contractors, that it would not be possible to construct the pipeline underground. Both options have construction risks that need to be carefully managed by experienced crews.	Closed
Delivery pipe material	Each team preferred a different material, PE100 or StCL. Material selection down the hill seems likely to be contingent on the capabilities and preferred construction methodology of the contractor and therefore no pipe material, with the exception of the bulk inlet main, will be defined in the preliminary design.	Consider post-consent.

Issue	Summary of ECI outcomes	Status
Relocation of valvehouse	Both D&C teams considered separating the valvehouse from the structure of the reservoir, allowing for room within the valvehouse for equipment associated with the future replacement of the Naenae reservoir. While the preliminary design does not reflect this proposal, the intent of the consent application is to allow for this to be an option.	Consider post-consent. Connect Water to allow for within any application.
Trenchless technology	Both teams assessed the feasibility of directional drilling. Not ruled out but has many risks, such as impact on the Waiwhetū aquifer, and requires further site investigations. Not preferred at this stage. Other trenchless methods, such as pipe jacking or ramming, were not recommended by the ECI contractors. Pipe jacking and ramming is considered impractical for the alignment down the hill; however, it may be considered for the stream crossing.	Not preferred, can be considered post-consent.

8 Design

8.1 Design Standards

The primary basis of design is the Wellington Water Regional Standard for Water Services and the Regional Specification for Water Services.

8.2 General Design Considerations

8.2.1 General Requirements

Wellington Water lists its general requirements for reservoirs and potable water piping in the Regional Specification for Water Services v3.0. This document was published in December 2021 and is to be read in conjunction with the Regional Standard for Water Services v3.0.

In general, the new reservoir and associated pipework will comply with requirements of these documents.

8.3 Geotechnical

8.3.1 Ground Conditions

The site is predominantly underlain by Wellington Greywacke sandstone and siltstone. Investigations show the rock has a relatively deep weathering profile with the upper approximately 12 m to 16 m comprising very weak to extremely weak, highly to residually weathered rock that could also be described as stiff to hard clay with remnant rock fabric.

Below 16 m, the rock is generally moderately to highly weathered and weak with closely spaced joints, becoming less weathered and stronger with depth but containing weaker argilite beds and sheared zones of unknown persistence.

8.3.2 Stability of Natural Slopes

The natural ridge side slopes vary between 28° and 40° and are locally steeper in areas typically at the heads of gullies. Analysis of the natural ridge slopes below the cut platform for the tank and below the new eastern pipe alignment shows slope failure in the weak to extremely weak rock through the upper 10 m to 16 m of the ground profile is possible in a 500-year return or greater return period earthquake. There is no evidence of deep-seated instability on the ridge slopes at the site and deep-seated defect controlled or, persistent shear zones or weak beds is considered unlikely.

The extent of instability and magnitude of movement generally increases with increasing ground shaking intensity. It is possible that slope failure could undermine areas around the perimeter of the tank in strong earthquakes with return periods in excess of 500 to 1,000 years.

To meet the tanks SLS 2 and ULS seismic performance requirements, slope stabilisation soldier piles are included around parts of the tank circumference where there is a risk of loss of support to the outer ring beam and tank floor in strong earthquakes. These 1200 mm diameter bored reinforced concrete piles are spaced 3.6 m apart so the soils arch between and are retained by the soldier piles.

The piles are embedded a few meters into competent rock below ground that could move in strong earthquakes and have an in ground reinforced concrete capping beam that ties the piles together at the top and back to piles in stronger rock at each end. The piles and capping beam are independent of the tank foundations but are designed for loads imposed on them by the tank. The number and depth of piles can be refined after the additional site investigations have been carried out with the final arrangement confirmed following mapping of the base of the excavation.

Evacuation of sections of track around the tank is possible in earthquakes with return periods exceeding about 500 years. If this occurs, reinforced fill could likely be used to reinstate access around the tank.

A drainage blanket will be installed under the tank to intercept leaks before they seep into the rock beneath affecting stability of the slopes and bearing capacity. Additionally, persistent and open defects in the rock may be chased and filled with bentonite or clay to further reduce the risk of increased water pressures developing in defects that could cause instability beneath the tank.

8.3.3 Earthworks

Cut Slopes

The tank is positioned on a cut platform that is up to 20 m below existing ground and set back from the natural slopes. An integrated approach has been taken in the design of the cut slopes to balance performance requirements, environmental effects and cost. The philosophy is to cut the slopes to a suitably flat angle to remain stable under normal conditions and such that any failure in the storms or large earthquakes do not prevent the tank from meeting its performance requirements.

Minor rockfall and shallow failures in severe storms or earthquakes are considered acceptable on the basis that the area will not be occupied for the vast majority of time, the accessway between the toe of the cut and the tank will absorb energy from rock fall and accommodate minor failure and can be cleared within days or weeks after the event without affecting service.

The design has considered rock mass failure mechanisms, defect-controlled failures, composite mechanisms and rockfall. The permanent earthworks are designed with cut slopes of 1H:1V, flattened to 1.5H:1V where the rock is residually to completely weathered. Cuts will be rounded at each end to blend into the natural landscape and prevent fretting in these areas. The extent of rounding of slopes will be confirmed following additional investigations and mapping of the excavation.

Sub-horizontal drains will be installed to drain persistent water bearing defects. The persistence and nature of defects and the rock mass will only be confirmed when the platform is excavated. The locations and orientation of drains should be confirmed during the excavation. Provision is made for flattening the slopes, local stabilisation of weaker areas of rock with rock bolts and mesh or shotcrete as necessary to meet the projects performance requirements.

Excavation

The majority of greywacke expected to be encountered in the excavation will be moderately to completely weathered and moderately strong to extremely weak with closely spaced defects. MacGregor et al (1994) indicates that the limiting shear wave velocity beyond which ripping is often difficult is 2000 m/s. Shear wave velocities measured in the downhole shear wave testing and MASW testing across the site show shear wave velocities are in the area of excavated rock are typically below 750 m/s, well within in the range of rippable rock. We expect most of the rock can be

excavated through hard digging. Ripping may be required for the less weathered and stronger rock in deeper parts of the excavation.

Suitability of Cut for Fill

Most of the cut material is expected to be disposed of off-site. The single dry density – water content test carried out suggests the soils are about 5% wet of optimum moisture content for standard compaction. The suitability of the material for use as fill on other projects will depend on the project requirements. The excavation should be kept as dry as possible to maximise the useability of excavated soil and rock. Further investigations will enable better assessment of material suitability.

Fill

Quantities of fill, up to 4 m high may be required outside of the tank foundation. The fill will be benched into the natural slopes with batters of 2H:1V. Where necessary to blend into the landscape, slopes will be steepened to 1H:1V with geogrid reinforcement.

8.3.4 Tank Foundations

The tanks shallow foundations will comprise concrete ground beams with a ground bearing concrete floor between ground beams. An ultimate bearing capacity of 600 kPa has been calculated assuming stiff to hard clay foundation soils and vertical compressive loads on shallow footings at least 0.3 m below ground level. A geotechnical strength reduction factor of 0.5 is adopted for preliminary design.

The weight of the tank is completely compensated by the weight of soil and rock that will be removed from the site for construction of the tank platform. Settlement of less than 25 mm across the footprint has been calculated using the estimated.

8.3.5 Pipe Alignment

Delivery Pipeline

No active instability has been identified along the delivery pipe route, however further investigations are planned to enable detailed assessment. Based on our current knowledge of ground conditions, there is potential for the pipe to be significantly damaged by slope instability in earthquakes with return periods greater than about 500 years. Installing the pipe 1-2m deep, in moderately to highly weathered rock below surficial colluvium, residual to completely weathered rock will reduce its susceptibility to damage from slope instability.

Stream crossing

At the base of the ridge, the pipe crosses under the Waiwhetū Stream. There have been no site investigations to date, but ground conditions are expected to comprise alluvial silts, clays and sandy, silty gravels underlain by weathered Wellington greywacke. Upper aquifer piezometric levels are expected to correspond approximately to stream level. The Hutt aquifer, with artesian pressure could be present below the stream.

The current proposal is to install the pipe in an open trench through the alluvial soils. Dewatering will be necessary for construction below stream level. Further investigations are needed to assess the best method for trenching and dewatering. Open trenching with over-pumping of the stream and dewatering from sumps in the base of the excavation or perimeter well points may be possible. However, sheet piling could be necessary to maintain stability of the excavation and mitigate the extent of groundwater lowering and associated settlement.

There is a risk of heaving and instability of the base of the excavation if artesian pressures are present below the stream bed. If this is the case, wells could be installed into the aquifer to temporarily and locally reduce pressure on the base of the aquiclude.

8.4 Structural

8.4.1 Structural Scope

A circular prestressed precast concrete reservoir has been adopted for Eastern Hills Reservoir, as such structures are considered to have a number of inherent advantages:

- Circular reservoirs are particularly efficient at resisting the internal hydrostatic loads from the water through hoop tension effects.
- The use of post-tensioned tendons within the wall panels imposes a net hoop compression effect in the wall, counteracting the water loads as well as 'closing' the joints between the panels, thereby maintaining a water-tight structure.
- Precast elements allow fabrication of wall panels and roof beams offsite, offering increased quality control in the factory plus a potentially reduced construction time.

The following items have been considered in the preliminary design of Eastern Hills Reservoir:

- Precast wall panels and pilasters, including:
  - Horizontal post-tensioning
  - Vertical prestressing
- Roof units
- Columns
- Central roof ring beam
- Column ring beam footing
- Wall ring beam footing
- Base slab

The following items are required, however have been excluded from the preliminary design:

- Specific design of connections between structural members – i.e. wall/base slab connections, wall/roof beam connections etc.
- Pipework and accessibility penetrations through the base slab, roof slab and wall panels of the reservoir and valvehouse
- Attachments to the reservoir and valvehouse – i.e. internal and external access stairs on the reservoir, handrails around the perimeter of the reservoir and valvehouse roofs, security measures such as fencing and bollards.

8.4.2 Structural Design Parameters

The following parameters have been adopted for the structural design of the reservoir:

Reference Standards:

- AS/NZS 1170.0:2002 Structural design actions – General principles
- AS/NZS 1170.0:2002 Structural design Actions – Permanent, imposed and other actions
- NZS 1170.5:2004 Structural design actions – Part 5: Earthquake actions – New Zealand
- NZS 3101:2006 Concrete structures standard
- NZS 3106:2009 Design of concrete structures for the storage of liquids
- Regional Standard for Water Services v3.0 (December 2021)

Design Criteria:

- Design Life (Durability) 100 Years
- Design Life (Strength) 100 Years
- Importance Level 4
- Annual Exceedance Probability (AEP) 1/2500 ULS
  1/1000 SLS2
  - Serviceability Limit State Crack Width Limitation 0.2 mm
  - Water Tightness Class 1
  - Water Depth 6.5 m to top water level (TWL)

Roof Loads:

The roof is designed to support the following imposed loads:

- General roof live load 0.25 kPa
- Roof work platform area 1.0 kPa, covering an additional load from men and equipment

Seismic Loads:

In accordance with the Wellington Water Regional Design Standard (section 3.7.6.3) a site-specific hazard analysis has been conducted for the reservoir (referred to within this report as a probabilistic seismic hazard assessment).

The results of the PSHA were not available for the concept design of the reservoir, and hence a seismic hazard coefficient (Z) of 0.60 was adopted. This value of 0.60 for the hazard factor was a 50% increase over the current NZS 1170.5 value and was considered a good compromise between

allowing some additional seismic loads within the design, but not so much so as the design becomes unnecessarily conservative.

With the results of the PSHA now available, it can be seen that generally there will be a greater increase to the seismic demands (when compared to NZS 1170.5) than originally thought, at nearly 3 times larger than the codified value for a peak ground acceleration. Based on this the preliminary design of Eastern Hills reservoir was updated to adopt a seismic hazard coefficient (Z) of 1.0, based on Class B soil class.

Materials:

- Unit weight of concrete — 24 kN/m^3
- Unit weight of water — 9.81 kN/m^3
- Concrete Grade — 65 MPa (precast wall panels)
50 MPa (other precast elements)
40 MPa (cast in-situ reinforced concrete)
- Cover to reinforcement — 50 mm (minimum)
- Reinforcement steel grade — 500 MPa
- Prestressing and post-tensioning strands — 15.2 mm super strand, 1840 MPa
35% assumed maximum loss of ultimate prestressing force

8.4.3 Reservoir Design Loading

Load Combinations

Load factors used in the design of the walls and foundation were as follows:

Ultimate Limit State (ULS):
$1.2G + 1.2F_{lp}$
$G + E_{ULS} + F_{lp}$

Serviceability Limit State (SLS):
$G + F_{lp} + F_p$
$G + F_{lp} + F_p + E_{SLS}$

Load factors used in the design of the roof were as follows:

Ultimate Limit State (ULS):
$1.35G$
$1.2G + 1.5Q$

Serviceability Limit State (SLS):
$G + Q + F_p + F_T$

Notes
G = Dead, Q = Live, E = Earthquake, F_{lp} = liquid pressure, F_p = Prestress, F_t = temperature

Reservoir Arrangement

- Volume — 15,000 m^3
- Shape — Circular

• Internal Diameter	55 m
• Wall Height	7.5 m (top of perimeter foundation to roof slab)
• Water Depth	6.5 m
• Nom. Freeboard	1 m
• Main Structural Form	Precast post-tensioned reinforced concrete
• Roof and Support Structure	– **Outer units**: 500 mm deep single-tee precast panels (spanning from walls to central roof ring beam), with 100 mm thick insitu reinforced concrete topping slab. – **Inner units:** 500 mm deep single-tee (or double-tee) precast panels (spanning between the central roof ring beam), with 100 mm thick insitu reinforced concrete topping slab. – Roof supported on the walls and a central reinforced concrete column and ring beam arrangement
• Walls and Wall Foundation	– 72 No. precast pre-stressed concrete panels, 7.5 m high, with insitu stitch joints between panels – 6 No. pilasters, 7.5m high, anchoring horizontal post-tensioning tendons. – Horizontal post-tensioning tendons in walls. Each tendon consists of a bundle of 15.2 mm super strands within a cement-grouted ribbed steel galvanized duct. – Panels reinforced vertically each face by layers of pre-stressed 15.2 mm super strands with conventional reinforcement in the horizontal direction. – 3 m wide x 0.6 m deep reinforced concrete ring beam footing located centrally beneath wall units and internal columns
• Internal Columns and Column Foundation	– 12 No. 600 mm x 600 mm precast reinforced concrete columns arranged in a circular configuration. – Precast roof ring beams 1000 mm deep, 600 mm wide with 400 mm deep and 150 mm wide corbel on both sides of the beam (at the bottom) arranged between columns with an insitu stitch between each beam
• Floor Slab	– Reinforced concrete slab, cast in-situ, 250 mm thick.

	– Design to consider the need to position a crane on the slab during the construction of the reservoir
• **Valvehouse / Control Building**	– Reinforced concrete slab and valvehouse walls, cast in-situ, 400 mm thick. – 200-series reinforced blockwork walls for control building, supporting reinforced concrete roof slab.

8.4.4 Geotechnical Assumptions

The following geotechnical design parameters have been adopted for the structural design:

- The platform will be constructed entirely in open cut and founded on moderately strong, moderately to completely weathered Greywacke without unfavourable and persistent defects affecting the stability of the platform or cut slope. There is a possibility that areas of residual soils at the gully heads need to be undercut and backfilled with structural fill. Defects in the rock will be mapped as the earthworks progress and micro piles or rock anchors installed if necessary to stabilise the platform beneath the reservoir.

- A drainage blanket will be installed under the tank to intercept leaks before they seep into the rock beneath affecting is stability. Additionally, persistent and open defects in the rock may be chased and filled with bentonite or clay to further reduce the risk of increased water pressures developing in defects that could cause instability beneath the tank.

- The foundations will comprise concrete ground beams with a ground bearing concrete floor between ground beams. An ultimate bearing capacity of 800 kPa for vertical compressive loads on shallow footings at least 0.3 m bgl (completely weathered, moderately strong rock – closely spaced joints with minimal joint infill). A geotechnical strength reduction factor of 0.5 shall be adopted.

- Settlement of less than 25 mm across the footprint considering the high stiffness of the rock foundation and because the net increase in load on the platform is likely negligible (weight of rock excavated is greater than the weight of the tank).

- Permanent cut slopes of 1H:1V, flattened to 1.5H:1V in the upper 3 m portion of the slopes where the rock is expected to be more completely or residually weathered and weaker than deeper rock. If potentially unstable areas or rock are identified, the slope may need to be cut flatter or rock bolts and shotcrete installed to stabilise the cut slope.

8.5 Civil

8.5.1 Earthworks

A substantial amount of cut earthworks is required to create a platform for the proposed reservoir. In addition, there is an existing firebreak/track which runs through the platform location, which will be removed but must be reinstated on completion of the project. This track is already fairly steep, so additional earthworks are required to connect to it without creating an excessively steep grade. The design is to route this track up the eastern batter of the main earthworks which reduces the total earthworks volume compared to grading the track out from the southern side of the platform.

The access road from Summit Rd will be graded to a maximum slope of 1:6. The connection to the firebreak/track is graded at a slope of 1:3, this track is not expected to be used for maintenance vehicles.

The preliminary design and contractor ECI feedback proposes to remove the cut material from the site. This will comprise loess and soft rock. It is expected that the vast majority of material will be able to be removed by ripping, and that blasting will not be required to affect the excavation works; although a breaker may be required in small isolated areas. The estimated volume of cut for the reservoir platform, valvehouse and access track is 83,000 m^3. Approximately 7,000 m^3 of material is estimated to be removed for the construction of the delivery and scour pipe within the reserve.

The cut to waste of excavated material will be a significant expense for the project, exacerbated by the challenging site access and space to turn around truck and trailers. There is a risk that a greater volume than anticipated needs to be excavated to achieve a larger construction platform or due to discovery of poor ground conditions.

8.5.2 Firebreak and Emergency Access Road

There is an existing fire break and access track that passes through the proposed reservoir site. The track is currently used for recreation purposes by the public. This track will need to be closed throughout the duration of the construction work due to the constrained site and need to maintain safe separate from the general public.

The access track width varies from 4-5 m to match the width of the existing track.

Fire and Emergency New Zealand (FENZ) was consulted in May 2023 regarding the closure of the existing firebreak during construction. They do not need access to the track during construction – refer to section 14.4.

8.5.3 Maintenance Access

The access road up to the reservoir from the end of Summit Rd, is to be finished as compacted hardfill suitable for fire and emergency vehicles which may need to access the reservoir in the event of an emergency. Heavy vehicle access, such as crawler cranes, may be required for maintenance activities however this is likely to be an infrequent occurrence.

The maintenance access road around the reservoir is to be finished with asphalt.

8.5.4 Site Stormwater

During Construction

A separate erosion and sediment control plan (ESCP) is being prepared as part of the consent application. Refer to section 9.3.3 for the erosion and sediment control principles.

Reservoir site

The long-term site stormwater has been designed in accordance with WWL standards to a 10% primary level of service. This level of service was discussed with Tim Strang from Wellington Water on the 21 July 2023. The design incorporates open channels and piping to convey flow and, where possible, discharge this to the Waiwhetū Stream via the new reservoir scour pipe. Stormwater from and adjacent to the existing Naenae Reservoir shall be conveyed by open channels and an outlet pipe to the gulley near the Summit Rd site entrance. It is recommended that a flexi flume be installed on the outlet pipe to mitigate any erosion in the gulley.

Stormwater channels around the reservoir are to be the on the outside perimeter of the maintenance road, i.e. the road is to be graded so water falls away from the reservoir.

Balgownie Grove

Due to restrictions on the alignment of the delivery pipe and Waiwhetū Stream crossing, a clash occurs with the discharge of the Balgownie Grove stormwater. It is recommended that the existing stormwater, from the manhole HCC_SW007159, be rerouted as shown on drawing W004 in Appendix A. A new manhole will be required adjacent to the delivery pipe valve chamber, the delivery pipe scour will discharge into this manhole.

8.5.5 Existing Trig Station

There is an existing 4th order trig station located on the reservoir site (refer to Figure 4). This station is within the boundary of the site earthworks. This trig station would need to be relocated as part of the project, prior to physical works beginning on site. Consultation with Land Information New Zealand (LINZ) regarding the relocation of this station has been undertaken. Their preferred relocation point is to install a mark at the head of the cul-de-sac at Farrelly Grove, backup option is at the boundary of 19/21 Summit Road. The relocation should be undertaken prior to physical works on the reservoir beginning.

Figure 4: Trig Station

8.6 Pipework / Mechanical

The pipework and mechanical equipment is to comply with the RSWS, any requested departures from the RSWS are presented in Section 5.2. Flowrates and pipe sizing is discussed in Section 5.1 and the Naenae No.2 Reservoir – Outlet Configuration Review. Refer to the P&ID, drawing C007, for detail on the piping and equipment.

8.6.1 Inlet

The design flowrate for the common inlet of **606 L/s** feeding both reservoirs is based on 2121 population projection. Based on this flowrate the existing DN750 bulk water supply pipeline pipe up Summit Rd is sufficiently sized and therefore there is no need to replace this pipe as part of the Eastern Hills Reservoir scope.

The inlet pipe to the Eastern Hills reservoir will be connected to the existing DN750 concrete lined steel pipeline just past the branch which presently feeds the Naenae 1 reservoir. At present there is a dead end plate fitted onto the end of the pipe, which will require being cut off with the new pipe connected via a Gibault joint – refer to drawing W008 for the connection detail. From here, the inlet pipe alignment will follow the access road to the Eastern Hills Reservoir, before entering the reservoir valvehouse.

It is proposed that the new pipe is a DN750 concrete lined steel pipe, the pipe size will reduce at the point of connection to the Eastern Hills Reservoir valvehouse to a DN600 pipe. A connection point will be provided on the DN750 section for a future Naenae reservoir replacement, as well as a butterfly valve to allow for connection to be made without the interruption of supply.

Within the valvehouse, the inlet pipe will be DN600 StCL, with flanged butterfly valves for isolation and interconnections. The inlet pipe will then come upwards through the reservoir floor, and be laid across the floor, supported on concrete plinths to the far side of the reservoir where it will terminate in a high-level riser and return as required by the RSWS.

The pipe material within the reservoir to the inlet riser is proposed to be DN600 stainless steel, connected with flanges. This will terminate in T-type riser similar to that installed recently at the Omāroro reservoir. The tee is to be located at 60% of the reservoir TWL and direct flow at a 60° downward angle. Further CFD modelling may be required at detailed design to confirm adequate turnover of the reservoir is achieved.

8.6.2 Outlet and Delivery

The design flowrate for the dedicated Eastern Hills Reservoir outlet is **600 L/s**, this is based on the 2050 projection as modelled by the Wellington Water Network team and is when the Naenae 1 reservoir is expected to be replaced. It is proposed that the outlet will commence with a 900mm diameter entry in the reservoir floor, fitted with an ‘X’ shaped vortex inhibitor, before transitioning to a DN600 StCL pipe through the valvehouse.

Outside the valvehouse, the pipe will increase to DN750; outside of the valvehouse this line is referred to as the delivery pipe. A DN750 tee with butterfly valve is provided for the cross connection from the Naenae reservoir, this is sized to allow for the future connection of the Naenae reservoir replacement. Refer to Section 8.6.3 for more information on the cross connection and Section 8.7 for more information for the downhill section of the delivery pipe.

8.6.3 Delivery Cross Connection

A DN500 cross connection between the delivery pipes of the existing Naenae and proposed Eastern Hills reservoirs is to be constructed, refer section 5.1. Due to limited space down Farrelly Grove for a new DN500 pipe, we recommend replacing a short section of existing DN150 StCL main. The DN40 Farrelly Grove and DN150 upper Summit Road mains would require reconnection to the new DN500 cross connection. A private connection at the top of Summit Road would require reconnection, however it would need to be confirmed if this pipe is currently in use.

At the connection to the Naenae reservoir delivery pipe, a DN450 gate valve will be provided on the cross connection. This valve, when closed, allows Farrelly Grove and the top of Summit Road to be supplied with water during the Naenae reservoir replacement. A DN750 butterfly valve will be provided at the connection to the new Eastern Hills delivery pipe. This valve, when closed, allows for the removal of a spool and connection of the Naenae reservoir replacement delivery pipe.

A DN450 gate valve is provided on the Naenae reservoir delivery pipe, downstream of the cross connection. Due to the delivery pipe being near end of life and aligned under multiple properties, this valve allows for the Naenae reservoir to be able to supply the network should a failure on this line occur.

8.6.4 Overflow

The design overflow rate for the reservoir is **894 L/s,** refer section 5.2.1. An overflow riser will be installed inside the reservoir with a tapered entry, 75mm above the design top water level. This will connect to a pipeline cast into the floor beneath the reservoir before exiting via the valvehouse. The scour/drain pipe will connect into this line within the valvehouse. The overflow pipe connects from the valvehouse and to a manhole where the Naenae reservoir scour, Section 8.6.6, connects to the new overflow before the pipe goes down to the Waiwhetū Stream.

A hydraulic assessment, using the nomograph in A3-2 of the RSWS, sized the pipeline from the valvehouse to the manhole at DN600. This sizing assumes a 1:40 slope and that the pipe flows 80% full, with some air entrainment; differences in material selection are considered to be negligible.

A non-return valve will be installed on the combined line to prevent reverse flow or vermin entry up the overflow pipeline. It is proposed that this will be a wafer check valve, which is a cost-effective option for a non-critical component.

Refer to Section 8.10 for further information on the overflow / scour pipe down the hill.

8.6.5 Scour/Drain

The RSWS requires that a drain is provided that allows the reservoir to be completely drained in 24 hours. For the proposed 15 ML reservoir, this requires an average flowrate of 174 L/s. A DN400 scour/drain is proposed for this reservoir.

A sump located near the centre of the reservoir so a minimum 1:100 grade can be provided to it from the entire floor surface. The sump will be fitted with a stainless steel or FRP safety grating, and the drain pipe will then run out the valvehouse where two DN400 sluice valves, separated by a spool piece for a level transmitter will be installed. From there, the drain will connect into the DN600 overflow pipe before exiting the valvehouse.

Wellington Water Operations stated through Safety in Design process that when scouring the reservoir the scour valve would be slowly opened while monitoring the flow. It would be opened as far as possible whilst ensuring the outfall in the Waiwhetū Stream is not causing the stream water to turn ‘cloudy’. Flow control is to be assessed further through HAZOP.

8.6.6 Naenae Reservoir Scour

In order to reduce scouring of the gully where the existing Naenae reservoir overflow / scour line discharges to, a new pipe will be installed connecting to the new overflow / scour pipe for the Eastern Hills reservoir. The alignment of this pipe has gone through several options, refer Section 6, however the proposed option is an inverted siphon arrangement where a new pipe is connected at the top of Summit Road and up the access track to the Eastern Hills reservoir. The Naenae overflow /

scour will connect to the Eastern Hills Reservoir pipe at a manhole prior to the common pipe traversing down the hill to the Waiwhetū Stream. This manhole will be used for dosing (de-chlorinating) the scoured water.

In order to achieve the inverted siphon two manholes on the existing line in Farrelly Grove will need to be replaced with pipe. A drain point will be provided at the low point near the intersection of Summitt Road and Farrelly Grove. This will ensure any water left in the line will be drained.

8.6.7 Valves and equipment

It is proposed to use double-flanged butterfly valves for the DN600 valves within the valvehouse which is in accordance with the RSWS. These will offer a significant cost saving compared to sluice valves and be operable from floor level. Sluice valves would require that a walkway structure is provided to enable them to be operated from the top using a valve key. The seismic valve will be actuated using an electric actuator.

The smaller valves for the scour/drain, inlet/outlet bypass and air valve isolation will be resilient-seated sluice valves. Drains, instrumentation, and sample isolation will be provided by ball valves.

A DN400 pressure reducing valve (PRV) is to be installed on the bypass between the inlet and the outlet pipe. This valve is a redundancy measure where the Eastern Hills reservoir is out of service and full flow is unable to be supplied to the network from the other reservoirs. The bypass has been sized for a pressure drop of no greater than the operational range of the reservoir (6.48m) at a flowrate of 450 L/s (75% of 2050 predicted flow). This valve is to be in accordance with the RSWS requirements for a PRV. Refer to Section 10.3 for further information on the bypass.

Flexible bellows will be provided on the internal pipework to provide seismic resilience within the valvehouse. Externally, two double-knuckle seismic joints (e.g. Flex-tend) will provide seismic movement capacity for the inlet and delivery pipelines. The overflow pipeline is recommended to be constructed from PE, so will not require additional seismic movement mitigation; however if StCL is selected as the material, a seismic joint will be required.

Pipework will generally be supported on concrete saddles with galvanised steel or stainless steel restraining straps; some fabricated steel supports may be required depending on the final equipment selections.

8.6.8 Future Proofing

The design of pipework from Summit Rd to the reservoir and all pipework on the main reservoir construction platform should consider the future replacement of the Naenae reservoir. Where practical pipework should be aligned to maximise the available space for a new reservoir, locating the pipework as far from the existing reservoir as practical. The design of the pipework should account for heavy vehicles which would be used in the replacement of the Naenae reservoir, pipe protection measures such as buried HDPE plates should be considered.

8.7 Delivery and Scour Pipe

The delivery pipe and overflow / scour pipe will traverse a bush-covered hillside from the reservoir platform to the Waiwhetū Stream near the end of Balgownie Grove; refer Section 6 for information on the selection of this alignment.

Pipe gradient will range from 15 - 45%, with an average of approximately 25%. The delivery pipe is to be DN750 as discussed in Section 5.1. The nomograph in A3-2 of the RWSW, sized the overflow pipe at DN500 for a flow of 894 L/s as per section 5.1; this sizing assumes a 1:4 slope.

Water stops will be installed at intervals of every 5 meters for grades steeper than 20%. These shall be as per the typical detail shown on drawing 3-WW021.02_W008. A subsoil drain is also recommended in the trench that discharges to the overflow / scour outfall. In the steep sections of the trench, stabilized fill material may be necessary for backfilling and to serve as a continuous water stop. Due to the restricted construction access, it is recommended that the spacing of water stops be reviewed during detailed design and if possible increased.

Due to the restricted access along the ridgeline, consideration should be given to the use of pipe protection measures, such as HPDE plates. These would allow construction vehicles more freedom of mobility once the pipe is installed, as well as allowing the corridor width to potentially be reduced. Consideration also needs to be given to the future replacement of the Naenae reservoir.

Two manholes are proposed on the overflow line at the top of the hill. This allows for the connection of the Naenae overflow / scour line and for stormwater to be discharged down the hill to the Waiwhetū Stream. The manholes also allow easy access to assess the condition of the line and a point where operations can dose the scour water to remove chlorine. The common overflow / scour pipe is DN500 and will discharge into the Waiwhetū Stream at the bottom of the hill, refer to Section 8.10 for design of the discharge.

8.8 Waiwhetū Stream Outfall

The scour/overflow pipe has an outfall to Waiwhetū Stream, via a lined swale. The swale and associated rip rap have been designed to accommodate flows up to the maximum overflow rate of 894 L/s. Gabions shall be embedded in the stream bank at the discharge to Waiwhetū Stream to protect the stream bank from erosion. The swale shall output to the stream approximately 500mm above the dry weather stream flow level. Connect Water have assessed the likelihood of scour on the opposite bank of the stream and concluded that it shall not require any reinforcement against scouring from the flows out of the swale.

8.9 Waiwhetū Stream Crossing

The Waiwhetū Stream will need to be crossed at the end of Balgownie Gr. A submarine option has been selected as the preferred option, refer Section 6. Approximately 9m of DN750 StCL pipe shall be concrete encased, or sleeved, to protect it from scour under the Waiwhetū Stream. There shall be a 3m diameter valve chamber on each stream bank of the Waiwhetū Stream. These shall house a butterfly valve with dismantling joint, an inspection point and a scour valve; flexible joints should be considered at detailed design. The scour valve shall discharge to the same outfall as the overflow/scour pipe. The depth of cover under the stream is to be confirmed during detailed design. The current design assumes approximately 1m cover from the bottom of the stream.

The stream crossing is recommended to be installed by open trenching through the stream. The stream will need to be dammed and over pumped, this has been confirmed to have a lower ecological impact than a stream diversion. Refer to Section 9.4 for more detail on the construction methodology.

8.10 Scour & Overflow Discharge

Due to the steep grade of the overflow/scour pipeline down the hillside, there will be a significant flow velocity at the discharge point to the Waiwhetū Stream. An energy dissipation device is required, and a bubble-up chamber is proposed prior to discharge into the stream via a lined swale. The large bubble up chamber diameter (approximately 1,800mm) will reduce the overflow velocity and absorb the kinetic energy of the incoming water. The location of the bubble up chamber shall be optimised during detailed design.

A small diameter outlet is proposed in the bubble-up chamber to enable small flows (e.g. stormwater) to pass through the chamber without creating a sump which may otherwise accumulate silt and debris.

The swale from the bubble up to the stream shall be approximately 12m long, filled with rock rip rap and have a geotextile bidim lining for reinforcement to ensure long-term stability. The swale shall be a 700mm deep trapezoidal channel with side slopes of 1H:0.5V.

Gabions shall be embedded in the stream bank at the discharge to Waiwhetū Stream to protect the stream bank from erosion. The swale shall output to the stream approximately 500mm above the dry weather stream flow level. The opposite bank of the stream shall not require any reinforcement against scouring from the flows out of the swale.

8.11 Pipe Material Options

Wellington Water's Regional Standards for Water Services (Table 3.1 in Section 3.7.5.2) lists the following resilient pipe materials for bulk water supply pipelines with a nominal diameter larger than 300 mm:

- **Steel** with fully restraint joints, which includes butt weld joints, lap joints with internal and external welds, welding band joints with internal and external welds and flange joints.
- **Ductile iron** with seismically resilient joints, complying to the following:
    - ISO 16134 "Earthquake and subsidence resistant design of ductile iron pipelines" and the class of pull-out resistance, rotation and elongation identified.
    - In liquefiable ground, ductile iron pipe joints should be able to meet:
        i. The highest classification of ISO 16134 at Class S-1 for expansion/contraction performance;
        ii. Class A for pull out resistance;
        iii. A minimum joint deflection angle of 3 degrees.
- **Welded polyethylene**, with a maximum allowable nominal outside diameter.

The Regional Standards (Table 6.3 in Section 6.4.6.3) further lists the following requirements:

- Trunk mains (with no customer connections) with nominal internal diameter from 300 mm up to 750 mm is either StCL or DICL.
- The maximum permitted nominal outside diameter for PE pipelines is 750 mm.

- Trunk mains greater than 750 mm nominal diameter must be StCL or DICL.

The RSWS (Section 6.4.6.3) states that STCL and DICL are preferred by WWL for large diameter pipelines due to difficulty in ensuring high quality jointing on large diameter PE100 pipes. However, pipes may be PE100 if these materials are not suitable for specific technical reasons only.

8.11.1 Pipeline diameter

All pipe diameters presented within this design report and associated documents are based on the nominal diameter of a RSWS compliant StCL pipe. Where an alternate pipe material is selected (i.e. PE100 SDR11), the equivalent internal diameter is to be selected e.g. for a DN750 StCL pipe with an internal diameter of 762mm, a 900OD PE100 pipe with an internal diameter of 720mm may be used.

8.11.2 Proposed pipe materials

The follow pipe material requirements apply to the Eastern Hills reservoir project:

- Any above ground piping, including piping in the valvehouse, and the inlet pipe are constructed from StCL, excluding the in-reservoir pipework, which is stainless steel.
- The overflow / scour pipe is recommended to be constructed using PE100, however StCL may be installed.
- For the delivery pipelines PE100, SDR11 or StCL in accordance with the RSWS may be selected as the material; refer to Section 5.2.4 for departure allowing PE100 for the material. One of the major factors for selection is the capabilities of the successful D&C tenderer and therefore material will be finalised during detailed design.
- DICL is not recommended to be used due to the following:
    - Unable to use impressed current cathodic protection, leaving the pipeline more reliant on corrosion protection provided by linings. This is compounded by standard concrete lining thickness being lower in DICL than StCL
    - The ductility of PE and ability to fully restrain StCL through welding pipe joints, provides a high level of resilience to damage from thrust, seismic activity of lateral spread. A DICL system has lower inherent resilience and thrust blocks would need to be used.
    - In the event of damage to the pipe StCL is more easily repairable as it can be patch welded, while PE100 does not suffer from corrosion which is the most likely cause of damage.

The following systems are proposed for the materials options:

- **Concrete lined steel pipe (StCL)**

Concrete lined steel pipe with a polyethylene wrapped external coating. Pipe lengths will be joined by welds and fittings will be connected by means of flanges to pipe ends. All fittings will be manufactured from steel with factory applied epoxy coatings.

- **Polyethylene pipe (PE)**

Butt-welded polyethylene pipes, PE100, SDR11 (PN16). Fittings will be connected by means of stub flanges with backing rings to pipe ends. Fittings will be manufactured from PE100, SDR 11 polyethylene.

8.11.3 Jointing

Based on the RSWS the following jointing techniques are recommended for seismic resilient pipelines:

- Butt welded concrete lined steel pipe (Section 6.4.6 in RSpecWS)
- Butt welded polyethylene pipe (Section 6.4.3 in RspecWS)

These jointing techniques exclude joining of fittings and specials to the pipeline.

8.11.4 Maintenance requirements

The maintenance requirements of the pipe material selected will have a major impact on the life-cycle cost of the pipeline. It is therefore important to consider the maintenance requirements of the pipeline materials. The maintenance requirements include:

- Corrosion protection / cathodic protection
- Lining maintenance
- External coating protection
- Repairs to accidental damage

Maintenance requirements for the different pipe materials includes:

- **Concrete lined steel pipe (StCL)**

Concrete lined steel pipes must be inspected for corrosion, damage to the concrete lining, as well as damage to the external coating. The cathodic protection system must also be maintained during the life-cycle of the pipeline. It is possible that the internal lining will have to be replaced during the life-time of the pipeline. Repairing accidental damage to this pipeline will be complex due to the large diameter.

- **Polyethylene pipe (PE)**

Polyethylene pipelines will not require any maintenance during the life-cycle of the pipeline.

8.11.5 Cathodic Protection

A steel pipeline larger than DN600 and more than 1000m long is required to have an impressed-current cathodic protection system installed, Section 6.4.11 of the RSWS. The pipeline, including the urban alignment, which falls outside of this projects scope, exceeds this threshold. Therefore, it is proposed that cathodic protection be implemented in accordance with 6.4.11 of the RSWS.

The urban alignment of the new delivery pipeline has been confirmed to be constructed from StCL and will require a cathodic protection system. The design of the impressed current system will assume that the downhill section of the delivery pipe, within the scope of the reservoir project, will be constructed from StCL. If StCL is selected by the D&C contractor, they will be required to consult with Connect water on integrating the design of the cathodic protection system.

If the pipe material is changed to PE100, cathodic protection will not be required. Other sections of pipe do not require cathodic protection.

8.12 Vents, Hatches, Chambers and Access

The reservoir is to be supplied with stainless steel free vents near the top of the wall. Vents are to be sized for both design inlet and volumetric flowrates, ensuring that the reservoir is not damaged due to overpressure or vacuum. Each vent is to be provided with mesh at the opening to prevent animals from accessing the reservoir, and also be arranged with a downward bend to prevent rainwater or animal waste entering.

The reservoir is to be supplied with a minimum of two stainless steel access hatches in accordance with RSWS Section 6.13.4. Hatches are to be located on opposite sides of the reservoir, with at least one adjacent to the overflow pipe and the primary outlet. Hatch design is to follow standard WWL design for Hutt City Council hatches, hatch design HL3. Additional hatches which may be required for construction are subject to WWL approval.

At least one of the access hatches should be provided with an internal staircase, to be constructed of stainless steel.

All underground valve chambers shall be a minimum of 1.5m in diameter and be provided with a Sika lid.

8.13 Electrical, Instrumentation and Controls

The Wellington Water Activity Brief calls for the existing hut to be used, if practical, to house all electrical and controls for the new reservoir. Connect Water proposes that the Eastern Hills Reservoir valvehouse be sufficiently sized to house the new electrical and control equipment, with space for the equipment for a second reservoir when the existing Naenae reservoir is replaced. This is proposed due to the following:

- There will be an easier transition when the Naenae reservoir is replaced as the Eastern Hills Reservoir operation would not be affected.
- As a structure needs to be constructed to house the valves in any case, the control equipment can be housed within the superstructure sufficiently large enough to house the control equipment provides best value for money.
- The valvehouse will be designed and constructed to the most recent codes and standards, providing improved resiliency.

8.13.1 Existing Naenae Reservoir

Electrical and controls for the existing reservoir are housed within a control hut, constructed on top of the reservoir on its western edge. Aside from equipment and controls associated with the Naenae reservoir, it also houses a radio repeater for Hutt City Council in the form of a control panel and roof-mounted antennae.

The existing control hut includes water quality sampling equipment to measure the FAC, pH and turbidity of the water leaving the reservoir. This utilises a small pump to provide a sample flow as the instruments are mounted above the roof of the reservoir.

The Naenae reservoirs controls will remain as-is, i.e. separate from the Eastern Hills Reservoir controls. When the Naenae reservoir is replaced, the new reservoir's controls can be housed in the Eastern Hills Reservoir valvehouse.

8.13.2 Eastern Hills Reservoir Valvehouse

The controls for the proposed and existing reservoirs will be housed in the Eastern Hills Reservoir valvehouse. These will include a new mains switchboard and control panels to house electrical, control, and monitoring components. Control equipment will be accessed on a ground level platform.

8.13.3 Power Supply

It is proposed that a new single-phase power supply is installed to the new Eastern Hills Reservoir valvehouse. Provision will be provided in the Eastern Hills Reservoir switchboard for a replacement Naenae replacement reservoir.

The new power supply for the Eastern Hills Reservoir will be supplied to the reservoir from the end of Summit Rd where the is a pole-mounted transformer. This will require a new buried mains cable to be laid up the access road to the valvehouse.

No changes are proposed to the existing three-phase power supply that feeds the Naenae 1 reservoir.

8.13.4 Lighting and Utility Power

Lighting will be provided, both internally and also on the external entrance to the valvehouse. Single phase socket outlets will be provided in the control building, with residual current protection. External lighting will be manually activated only and typically off unless required by operations. Lighting tends to attract people and preference is to not have the reservoir area used as a gathering place for potentially anti-social behaviours.

8.13.5 Cabling and Cable Ducts

The power cable supplying the valvehouse will be via buried PVC cable duct which will be continuous between the supply point and the valvehouse. All power and control cables within the valve house will be run in galvanised steel cable trays or conduit. Conduits running up the side of the reservoir for the level switches and aerial cables will be specified as stainless steel to prevent vandalism.

All power and control cables will have an expansion loop before termination, providing seismic resiliency. Care must be taken where cables enter and exit the valvehouse structure, and allowance must be made to prevent the cable from shearing in the case of differential movement.

8.13.6 Earthing

Earthing will be specified to be in accordance with AS/NZS 3000.

8.13.7 Instrumentation

A pressure transducer, accurate to 0.5 kPa, shall be installed between the reservoir wall and the isolation valve on the scour pipe, this will measure the hydrostatic level in the reservoir. Local indication of the reservoir level will be provided on the door of the control cabinet.

Two new level probes will be specified for the new reservoir to provide alarming for both low level and reservoir overflow.

New bi-directional ABB magnetic flow meters are to be installed on the inlet and outlet pipework. Local indication is to be provided on the door of the control cabinet.

A 24V DC Rotork IQT actuated valve will be provided on the outlet of the reservoir. The valve is to be capable of local actuation from the control panel door, with a Manual/Off/Auto three-way switch and open/close push buttons. When the valve is in “Auto” it is able to be controlled remotely via telemetry. A seismically activated trigger system is to be installed, when activated the actuated valve will automatically close.

8.13.8 Control

Changes to the existing reservoir control systems will be made to include the new reservoir, a functional description will be prepared in subsequent design phases.

8.13.9 Security

Reed switches will be provided on all reservoir hatches, valve/flowmeter chambers and the control building door. All of the above will be wired into the control system.

8.14 Landscape Design

As part of the consent application a separate Landscape and Visual Assessment has been conducted to assess the impact of the works on the natural landscape, as well as planting plants and mitigations to minimise the impact of the works on the landscape both during and after construction.

Replanting plans are provided in Appendix A, and summarised below:

- Planting plans are indictive only. As vegetation clearance required for construction may change through detailed design and during construction, based on the site conditions encountered, planting plans should be revised to take into account the extent of the clearance.
- Final planting plans should be developed in consultation with ecologists to ensure that the appropriate species are present.
- Final earthworks should be contoured as best as possible to blend in with the natural environment.

- Hardstands around the new and existing reservoirs for maintenance and emergency vehicle access.
- Planting should occur in stages, with faster growing plants being introduced as early as practical for visual mitigation.
- Any planting on 1:1 slopes or greater shall consider retention cells to prevent erosion prior to establishment.
- Revegetation down the pipe alignment to Waiwhetū Stream is to be shallow rooting plants only, minimising the risk of damage to pipes.
- Low ground shrubs to be planted between the reservoirs. It is expected this area will require clearance for replacement of the Naenae reservoir, expected in the 2040's. The intent is to have an area which will establish quickly and is low maintenance.
- Taller broadleaved hardwoods to the west, northeast and east of the reservoir to mitigate long term visual effects of the reservoir.
- Riparian planting along the banks of the Waiwhetū Stream as a mitigation.

8.14.1 Topsoil

Newly planted areas would need to be prepared to achieve successful plant establishment. Where possible, existing soil could be re-used providing is appropriately tested and improved as needed to meet standards.

When existing soil is not sufficient, imported good quality first class topsoil should be used. This should be of good quality, free draining, free of perennial weeds, undecomposed or partly decomposed organic matter, any debris, and capable of sustaining the required plant growth.

The clay content shall not exceed 25% by dry weight and have an organic content by dry content of between 7% and 20%.

Topsoil shall be good quality medium loam, easily moulded when moist. It must be neither too sticky nor leave a smooth polished surface when smeared. It shall be free from all chemical or other pollution, without excessive proportions of clay, sand, chalk, or lime, nor may it include rubbish or other extraneous material, including perennial weeds whether roots or top-growth, or roots of trees or shrubs. Topsoil should have a pH value of 5.5 to 7.5, with a humus content greater than 50%. Stones, and debris greater than 30 mm diameter shall be removed from the topsoil prior to spreading.

Where possible, topsoil depths shall be 400 mm minimum deep on new planted areas. The Contractor to supply samples to the Engineer for approval. Compost not approved prior to delivery to site will not be accepted. Where topsoil is required on slopes, allowance should be made to prevent mobility of topsoil due to rain events.

All soil would need to be tested and meet NZS4403 and NZS4454.

8.14.2 Deep Cut Rock Faces

In deep cut rock faces, providing there is good truck access, hydroseeding or direct seed methods could be applied to aid establishing of natives. Methodology of direct seeding surface to be confirmed by the supplier in the concept design phase.

8.14.3 Soil Testing

Earthworks would require verification (testing and observation) by an accredited laboratory and appropriately qualified person for tests required in the earthworks specification. Testing shall include pH, phosphorus, extractable cations, cation exchange capacity, total base saturation plus any recommendations for bringing the topsoil up to the required standards.

8.14.4 Soil Conditioners, Compost and Mulch Mat

All soil conditioners shall be pasteurised composted soil conditioners complying with the requirements of NZS 4454 “Composts, soil conditioners and mulches”.

Biodegradable mulch mat and pins are to be used.

9 Construction Methodology

9.1 Overview

The following construction methodology has been developed as part of early contractor engagement. This is based on a combination of the proposed methodologies from HEB and Fulton Hogan.

A construction methodology, including staging drawings, is being prepared as part of the consent application; the key considerations are summarised below.

9.2 Proposed Construction Sequence

The general construction sequence is expected to be the following:

1. Set up of site, environmental controls and access road preparation.
2. Bulk earthworks and enabling works for the reservoir.
3. Subgrade works at the reservoir and valvehouse footprints.
4. Reservoir and valvehouse construction.
5. Earthworks and enabling works for the delivery/scour pipelines.
6. Install scour and delivery pipes.
7. Valvehouse fitout.
8. Reservoir testing and commissioning.
9. Landscaping and site finishing works

Both contractors have proposed that the delivery and scour pipes are installed in parallel with bulk earthworks. However, Connect Water note that there is restricted working space on the site and the feasibility of this proposal should be considered further in detailed design. For consenting purposes we have assumed the vegetation clearance and earthworks for the reservoir and pipelines occur over two different summer periods.

9.3 Reservoir Construction

9.3.1 Construction Access Restrictions and Considerations

Access to site is via Summit Road which is a moderately steep, winding and narrow residential street. There are no overhead lines up Summit Road, but some vegetation may need to be trimmed to allow the passage of high loads.

There is likely to be some damage to the road from the heavy vehicle movements and restrictions on timing of deliveries and noise. The noise and vibration assessment, completed as part of the NOR application, shows there is unlikely to be damage to properties from vibration.

A dilapidation survey is recommended for the properties along Summit Rd (particularly on the steeper sections where vehicles will be braking or climbing under load). There is also a large (DN750) bulk watermain in Summit Rd which could potentially be affected by the increased heavy vehicle movements.

Site offices will be placed on the roof of the existing Naenae reservoir roof.

Construction vehicles accessing the reservoir site will need to cross a bridge across the Waiwhetū Stream on Tilbury Street, at the base of Summit Road. The bridge has no visible maximum capacity indicators and a review conducted by WSP found that the bridge is not on the list of structures typically checked for overweight permits; this could mean that the load capacity of the bridge if adequate, or more likely that it is not on typical overweight vehicle routes. Recent works on the Naenae reservoir had fully laden trucks removing earthworks. There are alternate locations that overweight vehicles, such as crawler cranes, can cross the Waiwhetū Stream; this includes bridges at Rossiter Ave and Norton Park Ave. Further assessment has not been conducted at this stage to assess the capacity of the bridge or to apply for an overweight vehicle permit. The successful contractor will need to complete this based on their final design and construction methodology.

A crane shall be set up on the reservoir slab and will work its way north with the progress of works.

9.3.2 Earthworks

Vegetation clearance and bulk earthworks for the reservoir will be the first significant construction activity. A large volume (approximately 83,000 m^3) of excess spoil will need to be excavated and removed from the site to create the reservoir platform. Due to access constraints on Summit Rd this will create a large number of truck movements.

Rigid 6- and 8-wheel trucks will be used for the initial stages of excavation, handling approximately the first third of material removal. Once the site allows truck and trailer units to turn around within the boundary and working area, these will be used to transport spoil. We expect an average of 50 return truck trips per day during the reservoir earthworks phase.

9.3.3 Sediment and Dust Control

Erosion and sediment control is key part of the construction methodology, with a specific focus on protecting the Waiwhetū Stream and the nearby wetlands from construction run-off. A separate Erosion and Sediment Control Plan (ESCP) has been produced as part of the consent application and is to be read in conjunction with this report. The ESCP considered four main construction activities:

1. Earthworks for the reservoir
2. Reservoir construction, including associated construction on the main platform.
3. Construction of the scour and delivery pipes down the hill.
4. Work in and around the Waiwhetū Stream.

Key erosion and sediment controls mentioned below:

- Clean water diversion bunds around the permitter of the site, prevent clean runoff entering the site.
- Super silt fence located around the perimeter of the site, capturing sediment as in any water runoff.
- Grading of the main construction platform to capture and treat water in two sediment retention ponds (SRP). These ponds will discharge treated water to the top of the adjacent gullies, riprap will be used as scour protection.

- Filter socks along the contours of the hill between the construction site and the Waiwhetū Stream. These are secondary measures to restrict sediment mobility and protect the wetlands.
- A decanting earth bund (DEB) at the base of the scour and delivery pipe alignment, adjacent to the Waiwhetū Stream. This will treat runoff from the construction area around the Stream and from the alignment down the hill. An open channel along the edge of pipe corridor will direct runoff to the DEB.
- Dust suppression using water spray during construction. Where possible water in the SRPs will be used to conserve water.
- Use of a lamella sediment tank to treat water from trenches around and through the Waiwhetū Stream. Water will be discharged to the Waiwhetū Stream downstream of the construction area.
- Undertake major earthworks during summer to reduce the risk of rain during land disturbing activities.
- Stabilise exposed surfaces as soon as earthworks are complete. Where trafficked, use washed and compacted aggregate. Use a combination of matting and hydroseeding on temporary cut faces. Permanent stabilisation measures, such as revegetation, should be enacted as soon as possible.
- Have a wheel-wash at the entrance to the site.

9.3.4 Traffic Implications

There will be a large amount of construction traffic during off-site disposal of bulk earthworks and concrete pours. Traffic for transport of panels and beams may require access to site outside of the core working hours to comply with transportation permits i.e., be off the road before 7am. Concrete pours will involve night works starting from approximately 3am.

Temporary traffic management will be required for the large delivery of the precast beams, columns, slabs, transporters for plant and machinery, and construction materials on transports. TM will be required on Summit Rd to manage the Trucks (and Trucks with Trailer units) during the excavation phase of works. This will require removal of on-street car parking along a significant stretch of Summit Road. Coordination will be necessary at the intersections of Tilbury, Waiwhetū Rd, Riverside Dr, Summit Rd, Laura Fergusson Dr, and Farrelly Gr.

It is expected that Summit Rd will be damaged during construction through heavy vehicle use. The road condition is to be surveyed (including intrusive testing) prior to construction commencement and monitored throughout, with repairs made where required to ensure safe use of the road. At the end of the works the road may require resealing, which should be discussed during detailed design with HCC roading team and agreement reached regarding the extent of resurfacing and any sharing of costs.

There is a lesser likelihood that Balgownie Grove may require repairs following heavy vehicle movement, as the anticipated heavy vehicle movements are much less. However, the road condition will be surveyed prior to construction commencement to ensure that no damage has occurred. Any damage will be repaired to pre-existing condition with agreement with HCC.

9.3.5 Reservoir structure and craneage

Once the bulk excavation of the reservoir footprint reaches the target RL (reference level), a detailed trim will be conducted to achieve the underside of the base slab level. All pipework that passes through the base slab of the reservoir will be installed first, followed by backfilling and casting of thrust blocks where necessary. A minimum 70mm concrete blinding layer will be placed over the entire footprint of the reservoir.

Leak detection trenches will be set out and installed within the blinding layer with a minimum 1:100 fall towards the external monitoring/drainage collection point.

To facilitate movement during the stressing operation, HDPE sheeting will be placed on top of the blinding layer, which forms the underside of the reservoir base. The base slab will be constructed using reinforced and post-tensioned concrete. On top of the HDPE layer, reinforcing bars and ducting will be installed. Post-tension ducts will be laid out in a grid pattern, and post-tension strands will be threaded through the ducts. The base slab will extend beyond the walls' footprint, and the perimeter reinforcing and stressing heads will be strategically positioned to handle congestion and provide sufficient working space.

Water stops will be installed around each of the cast in pipes through the base slab. The slab surface will have a fall towards the drainage/scour drain.

During the concrete placement, a single pour will be executed using a 58m concrete pump and a 32m concrete pump positioned on either side of the north end of the reservoir footprint. The estimated concrete volume is approximately 300 m^3, which translates to around 50 concrete truck deliveries. After the slab concrete has gained sufficient strength, the tendons will undergo an initial partial stressing, also known as an anti-crack stressing, followed by a full stressing process. The stressing will be carried out in a prescribed sequence, aiming to achieve a target tendon stress. Hydraulic jacks will be employed at the stressing end for this purpose. Once the target stress is attained, the tendons will be locked off, and the ducts will be grouted to secure the tendons in place.

9.4 Reservoir Pipework Construction

9.4.1 Construction Access Restrictions and Considerations

The construction process for the reservoir will be carried out in two phases to ensure ample working space on-site. Phase 1 will focus on installing the below-ground pipework, the base slab, and the lower half section of the valvehouse walls below RL66m (a reference level). This phase will commence once sufficient excavation has been completed prior to the reservoir construction. Detailed excavation and trimming will be performed up to the invert level of the valve house and the pipework mains.

During Phase 1, the sections of the inlet, outlet, and scour pipes that lie beneath the reservoir footprint will be positioned and installed concurrently with the construction of the in-situ base slab of the valve house. The lower half of the valve house end wall will be cast, incorporating the pipes and adjacent thrust blocks. The pipe sections at each end of the valve house will be temporarily capped, and the half valvehouse will be temporarily backfilled with bedding material and a protective layer. This arrangement will allow for plant and materials to traverse over the footprint during the reservoir construction.

Phase 2 will take place when the reservoir construction is nearing completion. In this phase, the protection layer and fill material surrounding the valve house will be removed. The area will undergo thorough cleaning, and the top half of the valve house walls will be constructed. The roof of the valve house will be built using precast panels and a topping slab. There might be an opportunity to install and position some of the pipe and valve work into the valvehouse before the construction of the roof slab.

9.4.2 Existing Services

There are no known existing services within the footprint for the new reservoir and valve house. Services affected by this project are primarily confined to Summit Rd and Farrelly Grove area and include all three water services. The inlet pipe for the Eastern Hills reservoir shall tie into the existing DN750 bulk main at the top of Summit Road. As part of this connection, the existing DN150 main servicing pipes from 23-35 Summit Road may be affected. Connect Water recommend that service location is undertaken as part of detailed design to confirm this. The new delivery pipe shall connect to the existing DN450 main at the Farrelly Grove cul de sac, which goes west. The new DN450 main shall replace the existing DN150 pipe in Farrelly Grove.

9.4.3 Operational Continuity of Network

The Naenae 1 reservoir is supplied with water from the DN750 bulk watermain which comes up Summit Rd; and water flows from the reservoir into the network via a pipeline which runs towards the west.

The activities that will have an operational impact are the connection to the existing DN750 bulk watermain, which will require that this is shut down whilst a connection is made to the existing flanged end. It is expected that this could be completed within a few hours. The other activity is the connection of the new DN450 delivery pipe to the existing DN450 running to the west, at the Farrelly Grove cul de sac. Connect Water assume that this is programmed to be undertaken once the new DN750 delivery main connecting to the new delivery pipe at Balgownie Grove is installed and commissioned. If this pipe is in service, it will allow the majority of the wider network to be serviced while the cut-in is made at Farrelly Grove.

A value for money initiative as part of this project is to renew the existing DN150 watermain in Farrelly Grove with a new DN450 cross connection delivery pipe between Naenae and Eastern Hills Reservoirs. The existing watermain was installed in 1945 and would be due for renewal within the next 20 years. For this work to be done it is possible that some properties water supply may be affected as there is a chance that the pipeline will be renewed on the existing alignment. This is due to proximity to other services in Farrelly Grove and Summit Road. Confirmation of the alignment of the new cross connection main is to be confirmed in detailed design once service location has been undertaken. Properties potentially affected include: 1-10 Farrelly Grove, 23-35 Summit Road. Alternative water supply options such as water trucks may need to be utilised during the construction of the new main.

9.5 Scour/Overflow and Delivery Pipe Construction

The section of pipeline from the reservoir platform to the Waiwhetū Stream will traverse a bush-covered hillside. The chosen method of construction for the combined alignment of the scour and overflow pipes is buried pipe via open excavation. The route for the pipes will be within a consented footprint and will follow the ridge to the north of the valvehouse towards Waiwhetū Stream and Balgownie Grove.

The indicative trench width for the delivery and scour pipe will have a nominal width of 3 meters and a typical depth of 2 meters, as shown in Figure 5. Trench depth may increase in places if unsuitable ground material exists. In which case, unsuitable material would be undercut and replaced with an approximately 500mm combination of imported hard fill and geogrid. A 7m working area adjacent to the trench has been allowed for to accommodate construction vehicles and material stockpiling. An additional 1m at each side of the trench and working area has been allowed for, providing room for ESCP devices and a buffer to slop edge. An overall designated pipeline corridor width ranging from 30 – 40m has been allowed for in the construction of the delivery pipeline to allow for minor modifications to alignment and possible increase of the trench working area. This corridor width may be optimised to reduce disturbance during detailed design; methods such as trench shoring, or material stockpiling on the reservoir platform may be used.

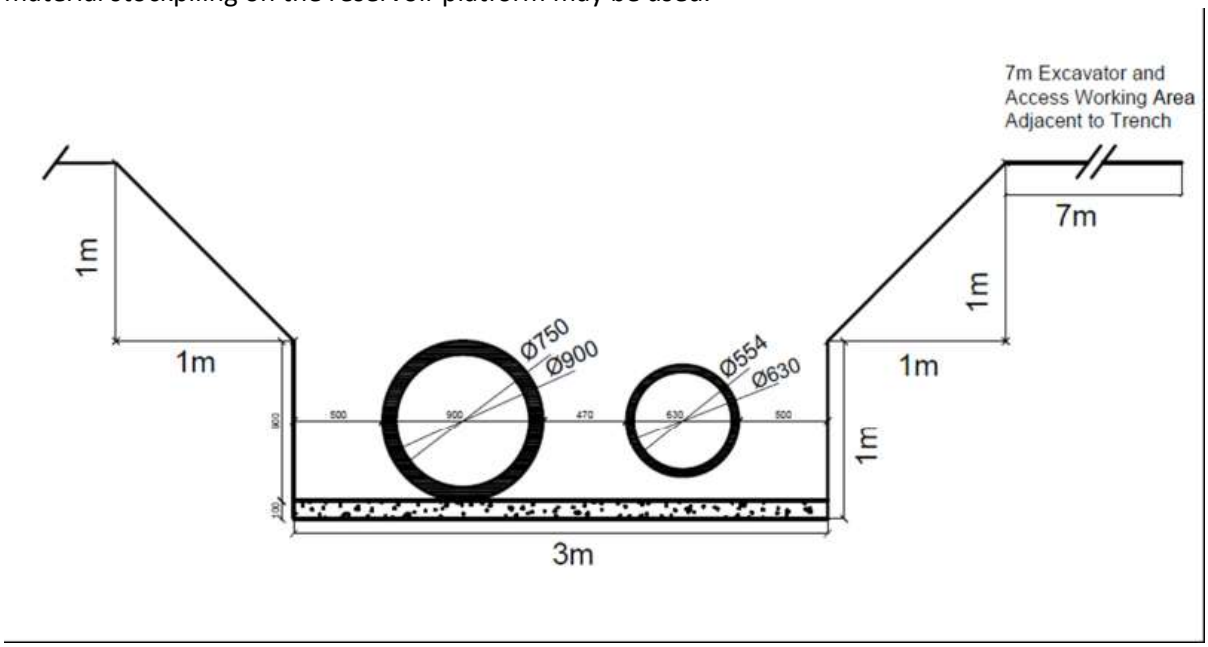


Figure 5. Indicative trench section for delivery and scour pipes

Prior to the construction of the pipelines, lizard relocation and vegetation clearance will be required. Once the vegetation is cleared and preliminary ESCP devices, such as the super silt fence, are established, the pipeline construction corridor will be excavated along the ridgeline. The bulk earthworks, approximately 7,000 m3, are to be undertaken outside of the winter season. Access to excavate the ridge will be from the reservoir construction platform and work will progress down the hill. Excavated material may be temporarily stockpiled on the reservoir platform and loaded onto larger truck and trailer vehicles for disposal. As excavation of the ridgeline progresses, the exposed working platform will be graded to the west and stabilised; compacted aggregate will be required for the trafficable areas. Due to the steepness of the ridge, tracked vehicles are recommended; in some sections a winch may be required to assist vehicles. Assessment of slope stability will be required throughout the works, as slope collapse is a significant risk, a minimum distance to slope edge should be assigned once further geotechnical studies are undertaken.

Access to the ridgeline for pipe installation, can be either from the reservoir platform or a temporary staging bridge across Waiwhetū Stream from the end of Balgownie Grove, refer to Section 9.5.4. Due to the confined nature of the ridgeline, vehicles movement may be in one direction with vehicles accessing from the reservoir platform and egress across the stream. The area at the end of Balgonie

Grove will be used as a staging area to crane lift equipment across the stream. The pipework will be installed in stages, backfilling and stabilising as the work progresses. While the corridor allows for vehicle access alongside the pipe, protective cover may be required over the pipes to prevent vehicle damage. Pipe work will be installed from the bottom up, this provides thrust load bearing for the installed pipes. Dust will be controlled by the use of water carts where required.

Bedding material will be placed, followed by the installation of the pipes. The trench will then be backfilled and compacted to match the grade. Benching will be required for the trenches, and shoring may be necessary depending on further geotechnical assessment. If the rock is deemed stable enough, shoring may not be required for the entire construction alignment, or benching may be utilized.

Water stops will be installed at intervals of every 5 meters for grades steeper than 20% and a subsoil drain is recommended along the length of the pipe. Increasing water stop spacing is recommended to be further investigated during detailed design. In the steep sections of the trench, stabilized fill material may be necessary for backfilling and to serve as a continuous water stop.

The successful contractor will nominate the preferred material for the pipelines, from either HDPE or concrete lined steel (StCL). The engineer shall also assess the suitability of the contractor's preferred material and Wellington Water must approve the material. Due to the slope of the site and available construction area, material selection should suit the expertise of the successful contractor.

During the construction process, water runoff will be managed by creating earth bunds and channels down the western edge of the corridor using surrounding material. This will divert dirty water from the work area to a decanting earth bund between the base of the hill and the Waiwhetū Stream. Super silt fences along the perimeter of the corridor and filter sock will provide additional barriers to sediment mobility. The vehicle track will require maintaining, with assessments completed after rain events to ensure scouring does not present additional hazards.

Permanent re-vegetation is to occur as soon as possible to stabilise the surface

9.5.1 Waiwhetū Stream Crossing and Outfall

The work adjacent to the Waiwhetū Stream will require dewatering. Sheet piling will be used to minimise the local groundwater draw-down effects. Silt fencing and a small lamella sediment tank will be utilised on the north side of Waiwhetū Stream.

The delivery pipe stream crossing will be below-ground; constructed by either trenchless methodology or open trench. For the purposes of consenting, we have assumed open trench as this has greater environmental impacts.

To construct the trench through the stream bed will require dewatering such as sheet piling and bypass pumping of Waiwhetū Stream. Fish barriers and other fish management measures will be required as outlined in the WSP ecology assessment.

There is a DN225 stormwater main in the grassed area at the end of the Balgownie Grove cul de sac which clashes with the new DN750 delivery pipe. We recommend relocating the stormwater pipe to allow for construction of the below-ground stream crossing.

We have confirmed the presence of wetlands on site and have established a 10 m buffer zone to ensure protection of the wetland.

9.5.2 Traffic Implications

The installation of pipelines will require trucks to transport materials to the site; however, these will be significantly reduced in number and weight to those required for the bulk earthworks and reservoir construction. It is expected that approximately 700 heavy trucks are expected to visit the site over a 7–9-month period. Given the lack of storage room at the site, it is likely that truck movements will be regular but less frequent as they will be matching construction progress. Temporary traffic management using parking restrictions on Summit Road is expected to be in place during this period.

A lay-down area and access from Balgownie Grove will be required, necessitating the removal of street parking between numbers 5 and 6 Balgownie Grove for most of the duration of the works adjacent to and through Waiwhetū Stream. It is expected that delivery vehicles, cranes, loaders, excavators and concrete pumps/trucks may access the site from Balgownie Grove.

9.5.3 Dewatering

Trenches for pipe construction around the Waiwhetū Stream are likely to require dewatering and trench support. There is a risk of ground subsidence in neighbouring areas as a result of dewatering. The appropriateness of different construction techniques, the need for dewatering and its effects have been assessed by a Hydrogeologist. The hydrogeologist report is being prepared as part of the consent application.

9.5.4 Temporary Staging Bridge

A temporary staging bridge across the Waiwhetū Stream is to be established to assist in the construction of the pipes down the hill and the works around the stream. The bridge will be a prefabricated deck installed on driven piles, with an approximate total span of 30m with two sets of bridge abutments, crossing above the majority of the flood plain on the south bank. Piles are to be located such that they are not driven through the stream bed. Due to the presence of private properties on the north bank of the stream and the wetlands on the south bank of the stream, the bridge can only be located along a similar alignment to the delivery pipe stream crossing. The temporary staging bridge will therefore need to be removed prior to construction of the stream crossing.

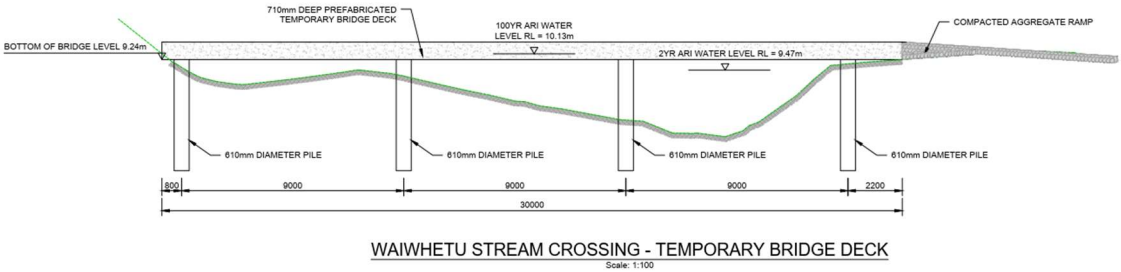


Figure 6. Temporary staging bridge section view

The staging bridge may be installed for up to 4 – 5 months primarily over the summer period. A separate assessment of the effect of the bridge on the stream, especially how it may impact flood flows, is currently being conducted as part of the consent application. This assessment will identify preferred timing for the bridge to be established, based on historic flow data of the Waiwhetū Stream. It will also clarify the level of the bridge deck and any flood mitigations required. The bridge will be designed such that in the event of heavy flooding, no part of the bridge is washed downstream.

10 Operations and Maintenance

10.1 Reservoir

The new reservoir is to be designed to the current Wellington Water standards and specifications to allow safe operation and maintenance. The following key design elements are proposed:

- External stairway to the roof from ground level, fitted with handrailing. These will be monitored for entry.
- Two access openings into the reservoir interior on opposite sides. These will be fitted with safety gratings and be large enough to enable all internal items to be removed.
- An internal staircase will allow entry to the floor of the reservoir from one of the access openings. The top section from the roof will comprise a short vertical ladder to a platform, with the stairs extending around the inside wall from there.
- The perimeter of the reservoir will be fully handrailed to provide fall protection.
- Within the reservoir, safety gratings will be installed over large pipework openings and the drainage sump to eliminate fall hazards.
- The floor of the reservoir will be sloped towards a sump to facilitate efficient cleaning.
- An asphalt vehicle access road will go round the entire perimeter of the reservoir, allowing access for maintenance. This vehicle road is to be graded away from the reservoir.
- Double isolation has been provided to reduce the risk of water entering the reservoir while activities in the confined space are carried out. The inlet has only single isolation when the bypass between the inlet pipe and outlet pipe is in operation; it is recommended that the flexible bellows be dropped from the inlet pipe upstream of the inlet valve, and a blank flange installed. Alternatively there is sufficient space for a spade which may be installed, this should be considered during detailed design.

10.2 Pipework

All reservoir valves and control equipment will be housed in an accessible valvehouse, stairways will be provided to allow safe access to all equipment below ground level. A platform will be provided for equipment stored at ground level.

Pipework and valves will have dismantling provision, either by dismantling joints, flexible bellows, unions, or removable sections such as flanged elbows. Drain and bleed provision will be provided for each section.

The valvehouse will be provided with monorails to enable components to be removed or maintained using a chain hoist and girder trolley. A safe lifting capacity of around 1,000 kg is expected to be sufficient, depending on final equipment selection. It is expected that at least two monorails will be required to adequately cover the area; some maintenance activities will also need to use temporary equipment to manoeuvre items into position for lifting and removal.

The platform near the western doors will be sufficiently rated to allow items to be placed where they can then be lifted outside by external equipment or via a trolley.

10.3 Scour / Overflow Pipe

During the planned scouring of the reservoir discharge water is required to be dosed to reduce free chlorine levels prior to being discharge to the receiving environment at the Waiwhetū Stream. To enable dosing, an access manhole has been provided adjacent to the access road on the reservoir platform. This manhole is required to sit proud of the ground level by 500 mm and can be used for drone or CCTV access to conduct pipe condition assessments.

As a permanent path is not being provided down the ridgeline, additional inspection points have not been allowed for. During detailed design it should be confirmed where or not access points at the top and bottom are sufficient, if not additional manholes should be provided. These should sit proud of the ground level by 500 mm to ensure they are visible. An easement will be obtained across the delivery pipe and scour pipeline corridor to ensure future access for maintenance.

Access to the scour discharge point at Waiwhetu Stream will be along the stream bank from Waddington Drive, or down the hill from the reservoir, as no footbridge or pedestrian access has been provided at the end of Balgownie Grove.

10.4 Inlet / Outlet Bypass

A bypass is provided between the inlet and outlet of the reservoir, allowing for redundancy should the reservoir be taken out of service. As requested by Wellington Water during the Safety in Design workshop, this bypass has been provided with a pressure reducing valve (PRV) to mitigate the risk of pipe over pressurisation.

A review of the operational modes for the reservoir undertaken by Connect Water highlights three potential scenarios where the valve will be used:

1. Eastern Hills reservoir out of service; water still able to be supplied from Naenae, Gracefield and Taita reservoirs.

2. Eastern Hills and Naenae reservoirs simultaneously out of service; water still able to be supplied from Gracefield and Taita reservoirs.

    a) Occurs due to an incident damaging both reservoirs.

    b) Occurs due to an incident to Eastern Hills reservoir, while the Naenae reservoir is replaced.

Scenario 1 is considered the highest likelihood, however addition of the PRV would complicate the operation of the system as supply would still need to be provided from the other reservoirs. In this scenario the bypass would not be used.

Scenario 2a is considered low likelihood and if an event was significant enough to damage both reservoirs, it is unlikely the bypass would be a primary option for water supply. Scenario 2b is the most likely scenario where the PRV will be used, and it is considered low likelihood.

Other cross-connections and reservoirs in the system act as further redundancy should a reservoir, or two go offline. Connect water recommend further review of the operational modes be conducted during HAZOP and whether the PRV is required, considering the increased maintenance requirements and potential failure of a PRV in an emergency.

11 Cost Estimate

A level 2 cost estimate was prepared during concept design and can be found in the Cost Estimate Report. The cost estimate was not updated during preliminary design at the request of Wellington Water.

The costs are not included in this report due to the sensitivity of including costs on Woogle for a D&C contract.

12 Carbon Assessment

A high-level assessment of embodied carbon was completed during the site selection process and used within the multi criteria analysis process to identify a preferred reservoir site. Alongside the cost estimate, the carbon estimate has been updated based on the refined quantities developed during the concept design. The Capital Carbon Assessment is summarised below.

12.1 Methodology

The capital carbon estimate developed during the site selection process used a 'bottom up' methodology, taking emission factors for the various construction elements from databases such as the Infrastructure Council of Australia (ISCA). In the intervening period, Wellington Water have secured a Moata Carbon Portal licence and have communicated a desire for all capital carbon estimates to be conducted using 'the portal'. The concept level capital carbon estimate was therefore conducted using the portal, aligning it with any future project estimates. Therefore the estimate presented in the concept design, cannot be directly compared to the estimate prepared as part of the site selection process, as the change in methodology results in:

- A widened scope of emission sources, with the key inclusions being: transport of materials to site, onsite emissions from labour and plant, offsite waste disposal other than disposal of excavated material
- Changes in emissions factors
- Differences in other assumptions inherent to the scope

12.2 Results

The results of the capital carbon estimate are presented in Table 6. These results differ significantly than what was produced during the site selection stage, however, as discussed in the previous section, this difference is primarily due to a change in methodology. The key findings of the capital carbon estimate are:

- Earthworks form the largest contributor to carbon emissions (42%). Reducing the volume of material disposed offsite presents one of the best options in the reduction of carbon emissions; it has been assumed all material is disposed of off-site.
- The second largest contributor to carbon emissions is the construction of the pipelines (34%). The selection of alternative materials and / or construction methodology may reduce carbon emissions; it has been assumed all pipes are installed via open trench methodology.

Table 6: Capital carbon estimate results

Component Categories	Carbon Emissions (tCO_2-e)
Earthworks	2,240
Concrete Works	1,020
Pipelines	1,840
Paving, surfacing and stormwater	260
Total	**5,360**
Total as a range (-30% to +50%)	**3,750 – 8,040**

13 Risks

13.1 Safety in Design

Connect Water developed the Safety in Design (SiD) register and updated the register at a workshop held with Wellington Water on 5 July 2023. A copy of this register can be found in Appendix B and is stored on Woogle. It is considered a live document and will be updated throughout the design process.

The most significant risk elements are as follows:

1. Traffic or pedestrian movement along Summit Road and connecting streets interacting with truck movements, at potentially high speeds around corners. This risk will be managed by the contractor during construction but has been reduced by installing the delivery pipeline down the hill to Balgownie Grove, rather than along Summit Road. Engagement with the public has commenced to understand how truck movements and parking removal will impact residents.
2. Risk to the existing Naenae reservoir being damaged during construction. This may result injury to individuals, and also significant service or water quality issues. Structural engineers have provided initial advice on allowable loads. This risk will need to be managed by the contractor during construction.
3. The construction site is constrained due to the steep slopes and limited work platform without undertaking significant earthworks to extend the site. The area between the new reservoir and the existing reservoir has been levelled to extend the working platform and a minimum of 5m buffer provided around the perimeter of the platform. Contractor involvement during consenting confirmed the level working area required.
4. Risk of installing the delivery main down the hill where the slope of the alignment is on average 1:4 H:V and there are steeper slopes heading to gullies on either side of the alignment. Geotech investigations have investigated slope stability of the slope.
5. Natural events causing failure of temporary works or other hazards. The valve chambers at the stream crossing away have been set back from the stream bank. Control measures such as weather/rainfall monitoring and emergency response plans shall be implemented in construction.

13.2 Project Risk Register

A project risk and opportunity workshop was held on Monday 12 December 2022 (during concept design). Another risk workshop was held on 21 July 2023, with WWL and Connect Water stakeholders, to reconsider project risks and update the risk register.

The top five project risks identified are presented in Table 7 and the top three opportunities are presented in Table 8. The project risk register is a live document. The version at the time of writing this report is provided in Appendix C.

Table 7: Top five project risks

Risk Title	Description	Mitigations
Lack of tender price competition	**Description**: There is a threat that the obtaining of priced tenders from only one supplier results in higher costs than estimated. **Cause**: The cause of the threat is the procurement approach is to directly award the reservoir contract to a single D&C supplier. **Consequence**: The consequence of the threat is Contractor free to price in additional risk and profit compared to a competitive tender. Tender prices could exceed estimates.	Make allowance in the risk components of cost estimate. WWL to develop strategy for comparing pricing and getting some price tension.
TTM - Increased requirements	**Description**: There is a threat that temporary traffic management requirements on roads for pipeline installation and reservoir access requires increased TTM than allowed for in the estimate. **Cause**: The cause of the threat is higher safety risks or need to reduce impacts on community. **Consequence**: The consequence of the threat is increased cost over that allowed in estimate. Reputational harm from public impacts.	Work with ECI/ D&C contractor to identify key mitigations
Construction vehicle access to site	**Description**: There is a threat that construction vehicle access will be limited causing reduced productivity and increasing costs over that allowed for in estimates. **Cause**: The cause of the threat is lack of access space on access roads requiring stop/ gos to be in place. Turnaround space on site is also very limited. **Consequence**: The consequence of the threat that smaller vehicles than assumed need to be used and longer journey times/ slower productivity due to access controls.	Work with ECI/ D&C contractor to identify key mitigations.
Contractor availability	**Description**: There is a threat that low availability of contractors/subcontractors results in higher tender pricing or lack of tenders resulting in delay. **Cause**: Tight labour / resources market. High workload in the market. Cyclone relief work impacts. **Consequence**: Programme delays, inflated prices through lack of competitiveness or need to accelerate. High number of tender tags protecting Contractor position resulting in greater cost risk for WWL during works or delayed award of contract.	Advance notice to market. Procurement strategy to assess options for D&C and packaging of project.

Risk Title	Description	Mitigations
Appeals to Consents and NOR	**Description**: There is a threat of submissions against the consent applications causing delays and additional cost resulting from a hearing. **Cause**: Public or stakeholder perceives the project to have an unacceptable negative impact and lodges a submission against the consent. **Consequence**: Consent gets appealed and has to go to Environmental Court.	Prepare robust consent and NOR notification that has been through advanced review with regulatory teams, legal review. Undertake early engagement with stakeholders to understand perceptions / issues so that stakeholder "challenges" can be clearly defined and strategies to bring stakeholders to a satisfied position can be identified accordingly.

Table 8: Top three project opportunities

Risk Title	Description	Action
Storage volume over-sized	**Description:** There is an opportunity to optimise the Eastern Hills water storage volume of 15ML. **Cause:** The cause of the opportunity is the condition of the Gracefield Reservoir and the potential replacement of the reservoir prior to 2060 (as assumed in the Storage Volume Assessment work that derived the volume). **Consequence:** The consequence of the opportunity is a change to the volume at Eastern Hills (either larger or smaller). This could reduce costs but would require a consent variation.	Memo to be prepared by Connect Water considering Gracefield, Naenae and Eastern Hills volumes. WWL to decide next steps for a potential master plan (ZMP) or 3WDMC paper.
Re-use cut material	**Description:** There is an opportunity to export cut material to another project **Cause:** The cause of the opportunity is effective construction planning (planning where material is coming from and going to) **Consequence:** The consequence of the opportunity is material efficiency, waste reduction and reducing cost for other project.	Discussed with contractors during ECI. Opportunity still there. Consider potential for fill on other HCC projects. WWL to raise with HCC. Propose opportunities in RFT.
Change site level	**Description:** There is an opportunity to raise the RL of the working platform and finished levels to reduce the amount of cut. **Cause:** The cause of the opportunity is construction could utilise a ramp down to the reservoir invert. **Consequence:** The consequence of the opportunity is improved balance between cut and fill and have partially buried reservoir.	The option of raising the RL of the working platform and finished levels to approximately 68 m R.L (rather than 66m) was raised during ECI. Will result in a partially buried reservoir. Consent RL of 66m, but leave as option for D&C team.

14 Consultation and Approvals

14.1 Consenting

A high-level planning assessment has been undertaken to determine what resource consents may be required to construct the reservoir and associated pipe work. The assessment has undergone a legal review by Dentons Kensington Swan; it has been provided on Woogle and in Appendix D.

This report considers the scope of work to be the works to construct the reservoir including bulk earthworks and vegetation clearance and the inlet, overflow and outlet pipes, including the delivery pipe crossing under the Waiwhetū Stream.

The installation of the remainder of the delivery pipe in Balgownie Grove, along Waddington Drive and Naenae Road to the connection with the Oxford Terrace watermain will be discussed in a separate report.

The rationale for the splitting the works is that the delivery pipeline works are more straightforward and do not require the same level of design or any planning approvals.

The works to construct the reservoir and associated pipe work on the hill, will require resource consent from Greater Wellington Regional Council including those for a submarine crossing of Waiwhetū Stream, works in the vicinity of wetlands, bulk earthworks and vegetation removal/disturbance exceeding 3,000 m^2. Resource consents from Hutt City Council are likely to be required for the construction of the reservoir and underground network utilities, exceedance of noise limits, and works in a Significant Natural Area. It is recommended that instead of applying for multiple resource consents, a Notice of Requirement be prepared and submitted to Hutt City Council to designate the site. This would enable the construction of the reservoirs and associated pipe work, as well as ongoing maintenance and operation works without needing to apply for additional resource consents. Note that the operation and maintenance of the existing Naenae reservoir will not be included in the designation.

An easement across the delivery and scour pipe corridor is recommended to allow for future maintenance.

14.2 Hutt City Council

A pre-application consent meeting was held with Nancy Gomez from Hutt City Council planning team on 12 June 2023 – refer to minutes in Appendix E.

Feedback was sought from the HCC Parks and Recreation team. Their feedback is included in Appendix F.

14.3 Greater Wellington Regional Council

A pre-application consent meeting was held with Heidi Andrewartha from Greater Wellington Regional Council planning team on 19 June 2023 – refer to post-meeting email in Appendix G.

14.4 FENZ

A meeting was held with Fire & Emergency New Zealand (FENZ) on 22 May 2023 regarding the maintenance of the existing firebreak during construction – refer to minutes in Appendix H. The outcomes of the consultation are listed below:

- The firebreak also acts as an emergency access road, although according to FENZ, they would not expect to get a fire engine up the road.
- FENZ do not maintain the firebreak themselves, it is either the responsibility of HCC or the Electricity Corporation New Zealand (ECNZ).
- It is not expected that the firebreak will be maintained during construction. It is an acceptable risk to assume that the firebreak will not be needed, and there are other access roads above the site that can be used by FENZ vehicles over that time.
- At project completion, the firebreak shall be reinstated. It is sufficient to use the road grade of other ECNZ roads when reinstating this one.
- FENZ want to know the viability of reinstating the road to a standard where fire engines can access the reservoir in the case of an emergency.
- FENZ did raise concerns around access to properties during an emergency and maintaining suitable water supply and pressure during any emergencies.

14.5 Wellington Water Stakeholders

WWL stakeholders including the Customer Operation Group (COG), Network Engineering Team, Chief Advisor Potable Water, and WWL Design Manager have been consulted with at the following meetings during preliminary design – refer to Table 9.

Table 9: WWL Meetings

Date	Meeting Topic & Woogle Link	WWL Attendees
13/04/23	Reservoir elevation and pipeline meeting	Gareth Penhale (WWL PD) Keith Wooley (Specialist) Paul Winstanley (COG)
02/05/23	Operator feedback on ECI inputs	Gareth Penhale (WWL PD) Paul Winstanley (COG) Ben Hemara (COG)
04/05/23	Gully fill consenting	Gareth Penhale (WWL PD) Zeke Hudspith (Dentons)
29/05/23	Preliminary design update	Gareth Penhale (WWL PD) Jane Nichols (NET) Ben Hemara (COG) Laurence Edwards (Chief Advisor)
05/07/23	Safety in Design meeting	Gareth Penhale (WWL PD) Jane Nichols (NET) Paul Winstanley (COG) Francis Leniston (WWL Design Manager)
21/07/23	Risk workshop minutes Risk register	Gareth Penhale (WWL PD) Kacey Paul (NET) Andre Bresler (GHD Independent Reviewer)

15 Customer and Community

15.1 Overview

The project community and engagement plan is a live document and will be updated throughout the lifecycle of the project. The most recent version of this plan is provided in Appendix I and on Woogle.

For the Eastern Hills Reservoir project, the key stakeholders were identified as: Hutt City Council, Greater Wellington Regional Council, Mana Whenua partners, Regional Public Health, and identified property owners who may be affected.

Engagement with Wellington Waters Mana Whenua partners has been led by Wellington Water and further detail is provided in Section 15.3.

Key messages have been created to inform the public about the potential construction of Eastern Hills Reservoir. These messages are being relayed through a multi-layered communications strategy, including: social media releases, website development, flyer and letter drop and community drop-in sessions.

The following key communications activities have been undertaken as at the time of writing this report:

- Developed collateral for informing the public, including posters, flyers and letters;
- Briefed HCC (refer section 15.3) and held a pre-application consent meeting;
- Completed a letter and flyer drop to properties considered to be highly impacted by the works;
- Livened the webpage and issued media release to inform the wider public;
- Held community drop-in sessions on 9th and 11th March 2023;
- Communicated with local community groups, Team Naenae Trust, Epuni Fairfield Community Group and Friends of Waiwhetū Stream;
- Completed an on-line survey (July 2023) garnering community and local resident views on the social, community, recreation and construction impacts.
- Held two street events on 11 and 12 July 2023 targeted at residents of Summit Road and Balgownie Grove.

15.2 Hutt City Council

In addition to communicating with public, local HCC councillor Andy Mitchel was briefed on 20 February 2023 and an information package was provided to all HCC councillors and the mayor. One outcome of this meeting was to rename the reservoir to the Eastern Hills reservoir. This name will be carried forward in all subsequent documents.

15.3 Mana Whenua

Connect Water met with Taranaki Whānui (Port Nicholson Block Settlement Trust) in May 2022 to discuss and develop the preferred location for the reservoir serving Hutt City central area. An initial desktop review of information contained within the proposed Natural Resources Plan, te Mahere Wai o Kahui Taiao and the Te Whanganui a Tara Whaitua Implementation plan was completed prior to this meeting to identify risks for discussion with Mana Whenua representatives, and included in material prepared for workshop session to bring together technical and cultural knowledge relating to the project. At this workshop, the sites that were technically feasible were discussed and there was good alignment between the site preferred technically and the site which would carry least risk of impact on Mana Whenua values. The three sites that were discussed at the workshop included;

1. "Cambridge Terrace" - an area above the Taita Cemetery near the Pick a Part industrial area heading between Naenae township and Taita College

2. "Naenae 2" - an area off Tilbury Street, Fairfield. Already has the existing Naenae reservoir.

3. "Gracefield 2" - an area above the Ngāti Ira Pā site on the Wainuiomata Hill. Already has an existing reservoir. Above the Callaghan Innovation site.

It was agreed at this workshop that a follow up Cultural Impact Assessment (CIA) would be completed to confirm details relating to the preferred site (Naenae) and further guide the project through its next design phases. The CIA was completed in February 2023 by Raukura Consultants, in consultation with Kura Moeahu and Port Nicholson Block Settlement Trust. The CIA included several recommendations to be carried into the next phase of the project, these being;

1. The Port Nicholson Block Settlement Trust, Wellington Tenths Trust and Te Runanganui o Te Atiawa do not consider an archaeological survey of the area is required prior to this development.

2. The construction method should avoid any potential discharges of contaminated water into the Waiwhetū Stream.

3. The Trusts consider there is a need for an accidental discovery protocol for this development in the unlikely situation that cultural material may be found when the site is cleared prior to development.

4. If the reservoir were to be named it is proposed that the old block name Waiwerowero be used.

5. That a blessing of the site prior to the commencement of work is done by the kaumatua of Te Atiawa/Taranaki Whānui.

An "Iwi Information Pack" and letter was prepared by Connect Water and sent to Taranaki Whānui and Ngāti Toa by Wellington Water directly.

16 Procurement and Programme

16.1 Procurement

WWL held a procurement workshop on 14 September 2022 to discuss procurement options for the proposed Eastern Hills Reservoir, as well as three further reservoirs (Aotea, Upper and Lower Bell Road and Te Aro). WWL proposed procurement methods for all four reservoirs to the WWL Procurement Board in early October. On 12 October 2022, WWL advised that they would split the Eastern Hills reservoir project into two packages:

1. **Package 1**

   The scope of Package 1 is to include the Reservoir site and all associated works, the inlet and overflow pipe and the delivery pipe down the hill and across the Waiwhetū Stream. This scope is based on the works which will require the majority of consent applications.

   This package would be a design and construct (D&C) procurement method, in conjunction with the Aotea Reservoir project. The successful Aotea D&C contractor will complete pricing for the Eastern Hills Reservoir to secure this additional works package.

   Connect Water will progress the consent application with sufficient flexibility to allow the successful contractor to modify design and construction methodology.

2. **Package 2**

   The scope of this package starts from the delivery pipe termination on the Balgownie Grove side of the Waiwhetū Stream and includes all aspects of the delivery pipe through the carriageway, to the connection to the Oxford Tce main.

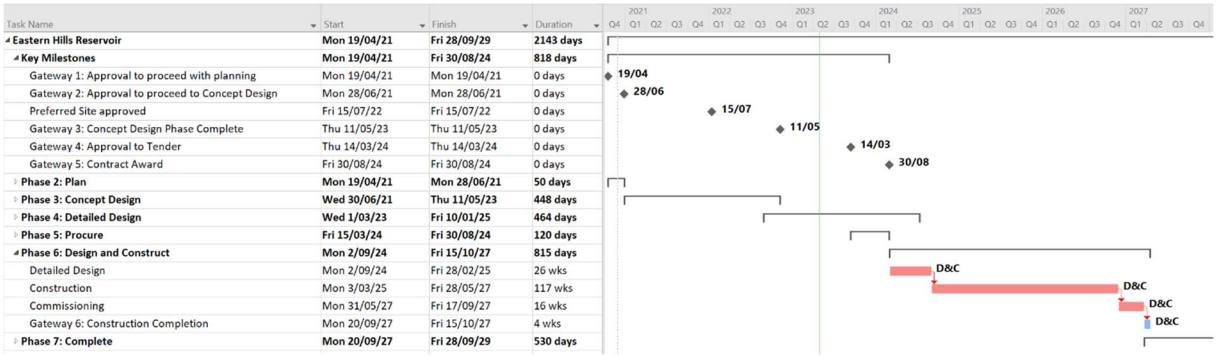
   This package will follow a traditional procurement method, where Connect Water will continue as the designer.

The two D&C teams tendering for Aotea Reservoir were engaged by WWL in March 2023 to provide constructability advice for Eastern Hills reservoir. The Aotea Tenderer's involvement in the Eastern Hills Reservoir project carries a 4% weighting on the Aotea reservoir tender. Specifically, the Tenderer's contributions to the Eastern Hills reservoir ECI have a 10% sub-attribute weighting under the Methodology attribute (40%).

Following award of the Aotea tender we recommend that WWL engages the preferred Aotea tenderer to prepare preliminary costings and advance the earthworks design.

16.2 Programme

The project programme presented in Figure 7 shows Package 1 construction commencing in mid-2025, with construction ending in early 2028.



Task Name	Start	Finish	Duration
Eastern Hills Reservoir	Mon 19/04/21	Fri 28/09/29	2143 days
Key Milestones	Mon 19/04/21	Fri 30/08/24	818 days
Gateway 1: Approval to proceed with planning	Mon 19/04/21	Mon 19/04/21	0 days
Gateway 2: Approval to proceed to Concept Design	Mon 28/06/21	Mon 28/06/21	0 days
Preferred Site approved	Fri 15/07/22	Fri 15/07/22	0 days
Gateway 3: Concept Design Phase Complete	Thu 11/05/23	Thu 11/05/23	0 days
Gateway 4: Approval to Tender	Thu 14/03/24	Thu 14/03/24	0 days
Gateway 5: Contract Award	Fri 30/08/24	Fri 30/08/24	0 days
Phase 2: Plan	Mon 19/04/21	Mon 28/06/21	50 days
Phase 3: Concept Design	Wed 30/06/21	Thu 11/05/23	448 days
Phase 4: Detailed Design	Wed 1/03/23	Fri 10/01/25	464 days
Phase 5: Procure	Fri 15/03/24	Fri 30/08/24	120 days
Phase 6: Design and Construct	Mon 2/09/24	Fri 15/10/27	815 days
Detailed Design	Mon 2/09/24	Fri 28/02/25	26 wks
Construction	Mon 3/03/25	Fri 28/05/27	117 wks
Commissioning	Mon 31/05/27	Fri 17/09/27	16 wks
Gateway 6: Construction Completion	Mon 20/09/27	Fri 15/10/27	4 wks
Phase 7: Complete	Mon 20/09/27	Fri 28/09/29	530 days

Figure 7: Indicative project programme

As noted in Section 16.1, the reservoir component of the works will be delivered as a D&C package in conjunction with the Aotea Reservoir project. The preferred contractor is unable to be signed up to complete the full Package 1 works until consent has been granted. There is an opportunity to engage the preferred contractor early to complete earthworks design, this would potentially enable the contractor to start works during the 2024/25 summer window.

Design and construction of the delivery pipeline (Package 2) can proceed in parallel with the D&C Package 1. There are expected to be no consent requirements for Package 2, however the procurement phase is dependent on the reservoir being granted consent. Tendering will be able to happen in parallel with the consent process for Package 1 and a contract signed upon gaining consent; this will optimise the programme.

There are significant risks within the programme, as both packages depend largely on the consenting process, which neither Connect Water or Wellington Water can control the duration of. Within the programme, allowance has been made for the consenting taking longer than indicated by both Hutt City and legal advice from Dentons Kensington Swan (Dentons). Additional advice has also been provided by Dentons on ways in which the risk of an extended consenting process can be mitigated. Connect Water recommend that a programme risk workshop is held between the preferred Aotea tenderer, Wellington Water and Connect Water to confirm programme risks and key mitigation measures.

17 Conclusions

Connect Water has developed a preliminary design for a new 15 ML reservoir in Naenae/Fairfield, providing operational resiliency for the Lower Hutt Central and Taita water storage areas, as well as providing additional seismic resiliency. The preliminary design of the reservoir ("Package 1") is intended to support the consent and Notice of Requirement submissions to HCC and GWRC. Note that the design and construction of the delivery pipeline ("Package 2") from Balgownie Grove along the road corridor, connecting to the existing bulk network, is being delivered under a separate project (OPC101676).

The new reservoir is to be a 55m diameter above ground circular reservoir, constructed at the top of Summit Road, adjacent to the existing Naenae Reservoir. Supply to the reservoir will be from the Waterloo WTP, utilising the existing DN750 bulk network pipe up Summit Rd; a connection point exists on this pipe at the intersection of Summit Rd and Farrelly Grove. The reservoir will supply the water network via a 1.1 km DN750 delivery pipe which will go north down the side of the hill, crossing the Waiwhetū Stream at the end of Balgownie Grove, connecting to the network at various points. A scour / overflow line will run along the same alignment as the delivery pipe down the side of the hill, before discharging into the Waiwhetū Stream; the existing Naenae reservoir overflow will be connected into this line. A DN500 cross-connection between the existing Naenae reservoir delivery line and the Eastern Hills Reservoir delivery pipe will be provided to allow for operational flexibility during any shutdowns or maintenance. Reservoir valves and control equipment will be housed in a new valvehouse connected to the reservoir.

Following three ECI (Early Contractor Involvement) workshops with two D&C contractor teams and network modelling by WWL, there have been some minor modifications to the concept design and site layout such as:

- Reservoir location shifted ~13 metres to the south-east to site the reservoir on more competent ground.
- Widening the site construction footprint to facilitate truck turning and erosion and sediment control measures.
- Network modelling confirmed the delivery pipe confirmed as DN750.
- Additional DN500 cross-connection between the existing Naenae reservoir and Eastern Hills delivery lines. This was confirmed by the WWL modelling team.

As part of the ECI and preliminary design process we investigated options for disposal of cleanfill on the adjacent gully and utilising directional drilling for the delivery pipe and/or stream crossing. The team concluded that these options do not provide additional cost, environmental or community benefits and introduce a number of other consenting and construction risks.

The D&C contract is currently programmed to begin construction in mid to late 2024, taking advantage of the summer construction window. The critical path task is the consent approval by HCC, with the currently programmed consenting process taking approximately 11 months.

A risk assessment for project identified a large number of both risks and opportunities. Key risks to the project include:

- Lack of tender price competition, potentially leading to increased costs.
- Increased traffic management requirements, potentially leading to increased cost and reputational harm from public impacts.
- Construction vehicle access to site is limited, potentially leading to increased programme and cost.
- Low availability of contractors, potentially leading to programme delays and increased cost.
- Appeals to the NOR and consents, potentially leading to significant programme delays and costs.

Key opportunities include:

- Disposal of cut in off-site location (alternate project site) to reduce cut material being disposed of to landfill.
- Change site level from 66m to 68m R.L. to reduce earthworks.

Note the opportunity to re-assess the balance of storage volume across Gracefield, Naenae and Eastern Hills reservoirs was undertaken as part of the volume sizing assessment and concluded that Eastern Hills reservoir is to remain at 15 ML.

18 Recommendations

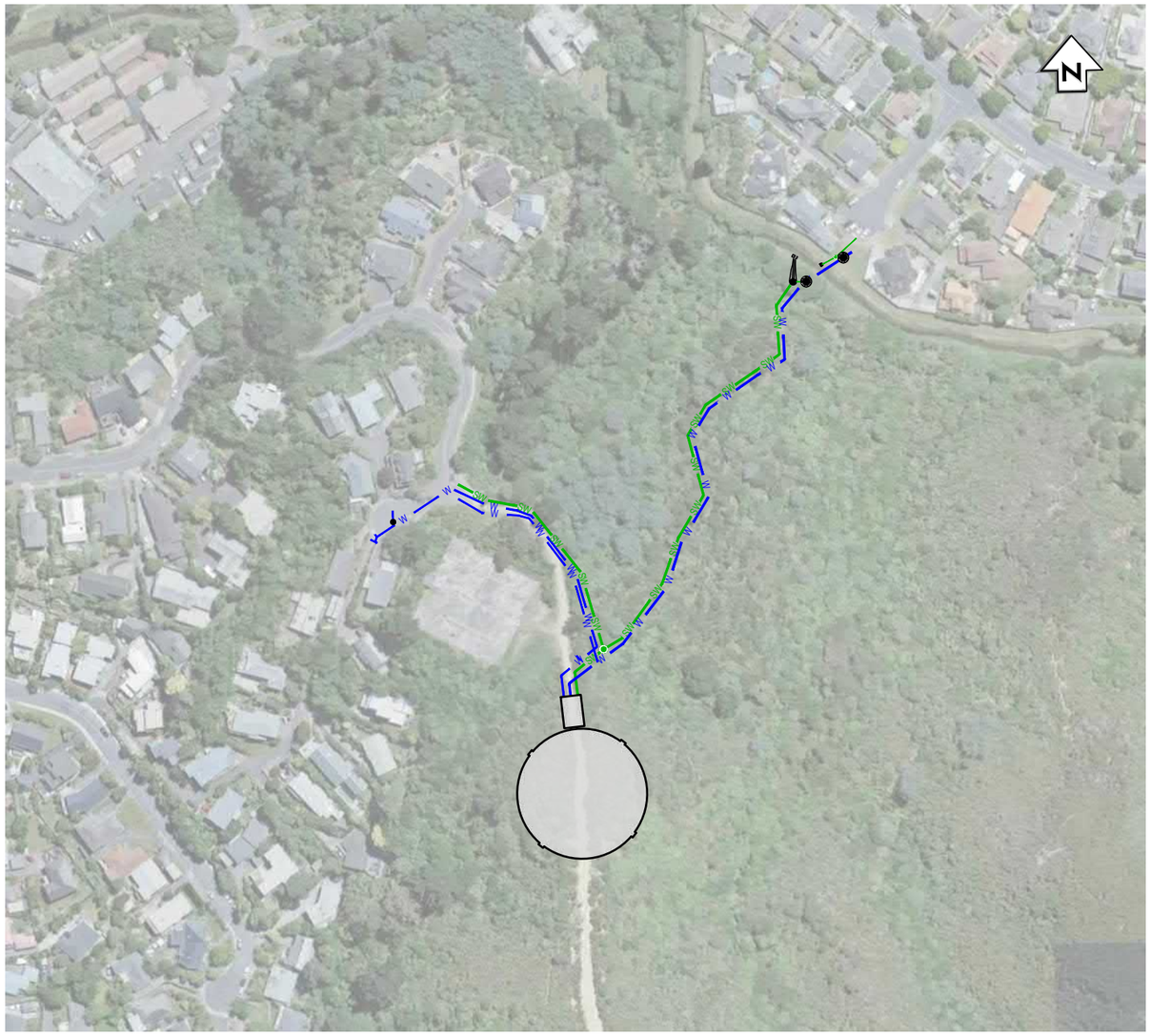
The following recommendations are made:

- Submit the GWRC resource consents and HCC Notice of Requirement for the reservoir and delivery pipeline down the hill, assuming all material is carted off-site to landfill.
- Complete soil testing of the site to confirm clean-fill requirements are met.
- Undertake further site-specific geotechnical investigations for the reservoir site and delivery pipeline down the hill and stream crossing to inform detailed design.
- Investigate potential disposal sites for cut material near the reservoir site or for another project.
- Continue community engagement.
- Engage the preferred Aotea tenderer to prepare preliminary costings and progress earthworks design and site investigations.
- Hold a programme risk workshop with the preferred Aotea tenderer, Wellington Water and Connect Water to confirm programme risks and key mitigation measures.

Appendices

Appendix A – Preliminary Design Drawings

WELLINGTON WATER
EASTERN HILLS RESERVOIR



LOCALITY PLAN

SCALE: 1:1250-A1 1:2500-A3

DISTRIBUTION			NUMBER OF COPIES				
CONNECT WATER			1	1	1		
WELLINGTON WATER			1	1	1		
		ISSUE STATUS	FOR INFORMATION ONLY	ISSUED WITH CONCEPT DESIGN - FINAL	FOR INFORMATION ONLY	ISSUED FOR REVIEW	UPDATED POST INDEPENDENT REVIEW
		DRAWING PRINT SIZE:	A3	A3	A3	A3	A3
		ISSUE FORMAT:	PDF	PDF	PDF	PDF	PDF
		DD	7	3	18	27	29
CAD FILE REFERENCE:	3-WW021.02	MM	12	3	8	9	9
DRAWING NUMBER	DRAWING TITLE	YY	22	23	23	23	23
3-WW021.02_C000	COVER SHEET, DRAWING REGISTER AND TRANSMITTAL, LOCATION PLAN		0	1	2		3
3-WW021.02_C001	GENERAL NOTES AND LEGENDS		0	1	2		
3-WW021.02_C002	SAFETY IN DESIGN RISK ASSESSMENT - SH1		0	1	2		
3-WW021.02_C003	SAFETY IN DESIGN RISK ASSESSMENT - SH2		0	1	2		
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3-WW021.02_C006	SAFETY IN DESIGN RISK ASSESSMENT - SH5				0		
3-WW021.02_C007	PROCESS & INSTRUMENTATION DIAGRAM				0		
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3-WW021.02_W003	RESERVOIR PIPEWORK - VALVEHOUSE		0	1	2		
3-WW021.02_W004	WAIWHETU STREAM - CROSSING AND DISCHARGE - 1		0	1	2		
3-WW021.02_W007	SITE PIPELINES - SUMMIT ROAD				0		1
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3-WW021.02_S003	RESERVOIR & VALVEHOUSE - TYPICAL DETAILS SHEET 1 OF 2		0	1	2		
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FOR INFORMATION
NOT FOR CONSTRUCTION

No.	Revision	By	Chk	Appd	Date
3	UPDATED POST INDEPENDENT REVIEW	G.H.	G.B.	J.L.	29/09/23
2	ISSUED FOR INFORMATION	G.H.	G.B.	J.L.	18/08/23
1	ISSUED WITH CONCEPT DESIGN - FINAL	G.H.	G.B.	J.L.	03/03/23
0	ISSUED FOR INFORMATION	C.Y.	G.B.	J.L.	07/12/23

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Original Scale (A1) 1:1250	Design	L.H.	29/09/23
	Drawn	G.H.	29/09/23
Reduced Scale (A3) 1:2500	Dsg Verifier	J.L.	29/09/23
	Dwg Check	L.H.	29/09/23

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

Client: Wellington Water

Project: WELLINGTON WATER
EASTERN HILLS RESERVOIR

Title: COVER SHEET, DRAWING REGISTER AND TRANSMIT AND LOCATION PLAN

Discipline: CIVIL

Drawing No.: 3-WW021.02_C000

Rev.: 3

A1 REPRODUCTION SCALE 0mm 20 40 60 80 100

A3 REPRODUCTION SCALE 0mm 10 20 30 40 50

DOCUMENT PATH: \\CORPNZ\PROJECTSNZ\3W3-WW021.02 NAENAE NO.2 RESERVOIR\HOME\700 DRAWINGS

DOCUMENT NO: 3-WW021.02_C000.DWG

PLOTTED BY: PIETERSEN, RIAAN

DO NOT SCALE - IF IN DOUBT ASK

DRAWING PLOTTED: 20-Jun-23

GENERAL NOTES

1. PIPES, CABLES AND OTHER UTILITIES, FOUNDATIONS, LEVELS, REFERENCE MARKS AND OTHER OBSTRUCTIONS INDICATED ON THIS DRAWING ARE BASED ONLY ON READILY AVAILABLE RECORD PLANS AND OTHER INFORMATION. THIS INFORMATION MAY NOT BE COMPLETE, ACCURATE OR UP TO DATE PRIOR TO CARRYING OUT ANY EXCAVATION OR OTHER PHYSICAL WORK, CONTRACTORS SHALL OBTAIN THE LATEST INFORMATION FROM UTILITY PROVIDERS AND CARRY OUT DETAILED EXPLORATORY WORK, TRACING, LOCATING, PROTECTION, ISOLATION AND ALTERATIONS AS REQUIRED UNDER NZS 3910 CLAUSE 5.13. CONTRACTOR MUST FOLLOW OSH GUIDELINES FOR SAFE LOCATION OF UNDERGROUND SERVICES.
2. RESIDENTS SHALL BE ADEQUATELY NOTIFIED PRIOR TO WORKS COMMENCING, AND 24 HOURS PRIOR TO DISRUPTION OF SERVICE.
3. ALL CARE MUST BE TAKEN BY THE CONTRACTOR NOT TO DAMAGE PRIVATE PROPERTY, OR ANY GARDENED AREA OTHER THAN THOSE NECESSARY AS PART OF THE WORKS.
4. ALL WORKS ARE TO BE CONSTRUCTED USING BEST TRADE PRACTICES.
5. APPROVAL MUST BE SOUGHT FROM THE ENGINEER PRIOR TO REMOVAL OF ANY FIXTURE (I.E. FENCE, TREE) IN PRIVATE PROPERTY.
6. ALL WORKS TO BE CONSTRUCTED IN ACCORDANCE WITH THE MOST RECENT VERSIONS OF: NATIONAL CODE OF PRACTICE FOR UTILITIES ACCESS TO TRANSPORT CORRIDORS HUTT VALLEY LOCAL CONDITIONS, NATIONAL CODE OF PRACTICE FOR UTILITIES ACCESS TO THE TRANSPORT CORRIDOR, REGIONAL SPECIFICATION FOR WATER SERVICES, REGIONAL STANDARD FOR WATER SERVICES, WELLINGTON WATER APPROVED PRODUCTS REGISTER, AND MANUFACTURER'S SPECIFICATIONS.

UNDERGROUND GAS PIPES

MACHINE DIGGING
STRATEGIC INTERMEDIATE PRESSURE (FEEDER MAIN OPERATING AT PRESSURES GREATER THAN 700 KPa (100 psi) AND MEDIUM PRESSURE GAS PIPES

(A) MACHINE DIGGING IS NOT PERMITTED CLOSER THAN 1.0m FROM ANY STRATEGIC INTERMEDIATE PRESSURE AND MEDIUM PRESSURE GAS MAINS OR SERVICES. ANY EXCAVATION WORK WITHIN THE DISTANCE MUST BE PERFORMED BY HAND DIGGING AND UNDER THE OBSERVATION OF A POWERCO APPROVED WORKS PROTECTION OBSERVER INCLUDING THE BACKFILLING OPERATION.

(B) PLEASE REFER TO THE POWERCO STANDARD "EXCAVATION WORKS IN THE VICINITY OF STRATEGIC CABLES AND PIPES" BEFORE COMMENCING EXCAVATION WORK IN THE VICINITY OF STRATEGIC GAS PIPES.

MEDIUM AND LOW PRESSURE GAS PIPES

(C) MACHINE DIGGING IS NOT PERMITTED CLOSER THAN 500mm FROM ANY MEDIUM OR LOW PRESSURE GAS MAIN OR SERVICE UNLESS THE POSITION OF THE PIPES HAS BEEN VERIFIED BY HAND DIGGING AND EXPOSING THEM FIRST.

NOTIFICATION OF WORK NEAR STRATEGIC INTERMEDIATE PRESSURE AND MEDIUM PRESSURE GAS PIPES.

(A) AT LEAST 2 WORKING DAYS NOTICE MUST BE GIVEN TO POWERCO PRIOR TO ANY EXCAVATION WORK TAKING PLACE.

(B) IT IS THE EXCAVATION CONTRACTOR'S RESPONSIBILITY TO CONTACT THE POWERCO HELP DESK ON 0800 769 372 FOR THE ABOVE NOTIFICATION.

(C) THE EXCAVATION CONTRACTOR WILL BE ISSUED WITH A WORKS AGREEMENT WHICH MUST BE COMPLETED AND SIGNED PRIOR TO ANY EXCAVATION WORK TAKING PLACE NEAR ANY STRATEGIC INTERMEDIATE PRESSURE OR MEDIUM PRESSURE GAS PIPES.

LOCATION OF OTHERS SERVICES

(A) INTERMEDIATE PRESSURE GAS PIPES
NO SERVICES SHALL BE LAID CLOSER THAN 300mm FROM ANY INTERMEDIATE PRESSURE GAS PIPE

(B) LOW OR MEDIUM PRESSURE GAS PIPES
NO SERVICES SHALL BE LAID CLOSER THAN 150mm FROM ANY LOW OR MEDIUM PRESSURE GAS PIPE

UNDERGROUND POWER

AT LEAST 2 WORKING DAYS NOTICE REQUIRED PRIOR TO EXCAVATION. HAND DIGGING IS REQUIRED WHEN EXCAVATING WITHIN 1m OF CABLE. REPLACEMENT TRENCH BACKFILL MATERIAL MUST BE THE SAME AS THAT REMOVED AND MUST BE REPLACED TO THE SAME LEVEL OF COMPACTION.

UNDERGROUND TELECOM

ONSITE CABLE LOCATE OR STANDOVER IS REQUIRED IF WORKING WITHIN 1m OF THESE CABLES. AT LEAST 2 WORKING DAYS NOTICE REQUIRED PRIOR TO EXCAVATION. FOR LOCATE AND STANDOVER CONTACT 0800 248 344.

WATER NOTES

1. THE CONTRACTOR TO CHECK INVERT LEVELS OF EXISTING AND PROPOSED SYSTEM AND ADVISE ENGINEER OF ANY ANOMALIES PRIOR TO COMMENCING PIPE LAYING.
2. WATER MAIN IS TO BE SCOURED TO REMOVE ALL DEBRIS BEFORE COMMISSIONING TESTING AND SERVICES ARE CONNECTED TO HOUSES.
3. MINIMUM COVER OF 750mm AT ALL PLACES MEASURED FROM THE GROUND SURFACE. MAXIMUM COVER TO BE 1350mm.
4. CONCRETE THRUST BLOCKS TO BE CONSTRUCTED ON ALL BENDS,TAPERS, TEES AND DEAD ENDS, CONCRETE TO BE 20 MPa, THRUST BLOCKS TO BE CONSTRUCTED TO MAINTAIN ACCESS TO THE BOLTS, ADJACENT JOINTS / FLANGES AND FITTINGS CONCRETE THRUST BLOCKS TO BE SIZED AS PER THE MOST RECENT VERSION OF THE REGIONAL STANDARD FOR WATER SERVICES .
5. BACKFILL MATERIAL SHALL BE AS PER THE REQUIREMENTS OF REGIONAL SPECIFICATION SECTION 4.7. ALL BACKFILL MATERIAL SHOULD BE PLACED AND COMPACTED IN LAYERS NOT EXCEEDING 200mm IN LOOSE DEPTH.
6. THE CONTRACTOR SHALL CARRY OUT SCALA PENETROMETER TESTING AT NOT MORE THAN 5m DISTANCES ALONG TRENCH, THE RESULTS MUST BE RECORDED AND MADE AVAILABLE TO THE ENGINEER A COMPACTION OF NOT LESS THAN 7 BLOWS / 50mm, 4 BLOWS / 50mm AND 2 BLOWS / 50mm IN CARRIAGEWAYS, FOOTPATHS AND BERMS RESPECTIVELY MUST BE ACHIEVED.
7. DETECTOR TAPE MUST BE LAID ABOVE ALL WATER PIPES IN ACCORDANCE WITH REGIONAL STANDARDS FOR WATER SERVICES.
8. CONTRACTOR TO REMOVE ABANDONED VALVES AND HYDRANTS. NOTE ALL REINSTATEMENT IS TO COMPLY WITH NATIONAL CODE OF PRACTICE FOR UTILITY OPERATOR'S ACCESS TO TRANSPORT CORRIDORS.
9. LOCATION AND REQUIREMENTS FOR BENDS SHOWN ARE INDICATIVE. CONTRACTOR TO CONFIRM SPECIFIC LOCATIONS AND REQUIREMENTS WITH ENGINEER ON SITE.
10. SERVICE CONNECTION LOCATIONS ARE INDICATIVE ONLY, SERVICE PIPES SHALL BE LAID PERPENDICULAR TO THE MAIN. ALL SERVICE PIPES SHALL BE EXTENDED TO THE NEW MAIN.
11. ALL SERVICE CONNECTIONS SHALL CONNECT TO NEW MAIN USING ELECTROFUSION TAPPING SADDLE AS PER REGIONAL SPECIFICATION DRAWING WS02.
12. ALL MATERIALS USED SHALL BE LISTED ON WELLINGTON WATER APPROVED PRODUCTS REGISTER.
13. PRESSURE TESTING OF ALL PIPELINES SHALL BE LIMITED TO MAXIMUM LENGTHS, TESTING PRESSURE AND DURATION AS PER REGIONAL SPECIFICATION.
14. ALL PIPELINES SHALL BE DISINFECTED AND BACTERIOLOGICALLY TESTED AS PER REQUIREMENTS OF REGIONAL SPECIFICATION.

SEWER / STORMWATER NOTES

1. THE CONTRACTOR IS TO ENSURE ALL WASTEWATER IS CONTAINED WITHIN THE SEWER SYSTEM. ANY OVERPUMPING IS TO BE ALLOWED FOR IN THE CONTRACT RATES. THERE ARE TO BE NO SEWAGE SPILLS IN PRIVATE PROPERTY.
2. THE CONTRACTOR IS TO ALLOW FOR ALL SHORING REQUIRED FOR TRENCHING IN ANY UNSTABLE GROUND WHICH MAY BE ENCOUNTERED.
3. THE LATERAL STUB POSITIONS TO BE CONFIRMED FROM CCTV BY THE CONTRACTOR. PRIOR TO RECONNECTION TO THE NEW PIPELINE, TESTS SHALL BE CARRIED OUT TO DETERMINE LIVE LATERALS. NO DEAD LATERALS SHALL BE CONNECTED.
4. EXISTING LAWN SHALL BE REMOVED AS TURF SLABS AND REINSTATED ON COMPLETION.
5. CONTRACTOR TO DEWATER AS NECESSARY TO COMPLETE THE WORKS.
6. CONTRACTOR TO REINSTATE ALL ROAD SURFACE MARKINGS AND RRPMs.
7. PROVIDE WATER STOPS ON STEEP SECTIONS IN ACCORDANCE WITH REGIONAL WATER SPECIFICATIONS, UNLESS OTHERWISE REQUIRED BY THE CONTRACT DOCUMENTS.
8. EXISTING SEWER PIPES TO BE ABANDONED SHALL BE CAPPED OFF AT BOTH ENDS WITH A CONCRETE PLUG.
9. WHERE EXISTING MANHOLES ARE BEING REPLACED WITH NEW, THE CONTRACTOR SHALL RECONNECT ALL EXISTING PIPELINES TO THE NEW MANHOLE.
10. THE PIPELINES ARE TO BE CONSTRUCTED AT THE INVERT LEVELS SHOWN ON THE LONG SECTIONS, WITH DEPTHS TO INVERT AND PIPE GRADES PROVIDED FOR GUIDANCE ONLY. DEPTHS TO INVERT AND PIPE GRADES SHALL BE ADJUSTED BY THE CONTRACTOR IF NECESSARY TO ACHIEVE THE SPECIFIED INVERT LEVELS.
11. THE CONTRACTOR SHALL CHECK AND CONFIRM ALL EXISTING SEWER LOCATIONS AND LEVELS ON SITE AS AN INITIAL ACTIVITY, ADVISE THE ENGINEER FOR FURTHER INSTRUCTION SHOULD THESE DIFFER FROM THE INFORMATION SHOWN ON THE DRAWINGS.
12. ALL MANHOLES AFFECTED BY THE WORKS SHALL HAVE THEIR CONDITION REVIEWED BY THE CONTRACTOR AS AN INITIAL ACTIVITY INCLUDING A RECOMMENDATION AS TO WHETHER UPGRADE OR REPLACEMENT IS REQUIRED. THE ENGINEER SHALL INSTRUCT ON THE REQUIRED APPROACH THEN.

IMPORTANT SERVICES NOTE

THE SERVICES SHOWN SHOULD BE CONSIDERED INDICATIVE ONLY AND ARE BASED ON RECORDS SUPPLIED BY THE UTILITY COMPANIES. PRIVATE SERVICES AND CONNECTIONS ARE NOT SHOWN.

THE CONTRACTOR IS RESPONSIBLE FOR ENSURING THAT ALL SERVICES ARE LOCATED/MARKED BY THE APPROPRIATE SERVICE AUTHORITY, OR THEIR OWN STAFF, PRIOR TO ANY SITE WORKS, AND FOR PROTECTING THESE SERVICES FOR THE DURATION OF THE SITE CONTRACT.

PIPE MATERIAL

CODE	DESCRIPTION	SUPERSEDED CODE
ABS	ACRYLONITRITE BUTADIENE STYRENE	
AC	ASBESTOS CEMENT	
AC-E	ASBESTOS CEMENT EVERITE	
AC-I	ASBESTOS CEMENT ITALITE	
AL	ALUMINIUM	
CI	CAST IRON	
CU	COPPER	
DI	DUCTILE IRON	
EW	EARTHEN WARE	
GI	GALVANISED IRON	
LBST	LOCKBAR STEEL	
PVC-M	MODIFIED POLYVINYL CHLORIDE	
PE100	POLYETHYLENE HDPE	
PE80	POLYETHYLENE MDPE	
PVC	POLYVINYL CHLORIDE	
RC	REINFORCED CONCRETE	CC
SS	STAINLESS STEEL	
ST	MILD STEEL	
UNK	UNKNOWN	
PVC-U	UNPLASTICISED POLYVINYL CHLORIDE	

PIPE LINING

CODE	DESCRIPTION	SUPERSEDED CODE
BL	BITUMEN	
CL	CONCRETE	
CML	CEMENT MORTAR	
CTL	COAL TAR ENAMEL	EL, CTE
EL	EPOXY	PL
NL	NO LINING	
TEL	COAL TAR EPOXY	CTE
UL	UNKNOWN LINING (use UL when not specified)	

PIPE COATING

CODE	DESCRIPTION	SUPERSEDED CODE
BC	BITUMEN	
CTE	COAL TAR ENAMEL, PITCH ENAMEL, ENAMEL	MC, EC
DC	DIMET (EPOXY)	
EC	EPOXY	
GC	GUNITE	
NC	NO COATING	
PC	POLYETHYLENE, POLYKEN TAPE	TC
PW	POLYETHYLENE WRAP (polyethylene sleeve on DI pipe)	
UC	UNKNOWN COATING (use UC when not specified)	KC

WW SERVICES LEGEND

NEW WATER MAIN — W
EXISTING WATER MAIN — W
NEW STORMWATER — SW
EXISTING STORMWATER — SW
NEW SEWER — SS
EXISTING SEWER — SS
ABANDONED SERVICE — X X X
PRIVATE WATER
PRIVATE SW
PRIVATE SEWER
KERBS
CONTOURS MAJOR
CONTOURS MINOR
PARCEL BOUNDARY
VALVE NEW OR EX / REDUNDANT — V V
BOUNDARY VALVE — V
HYDRANT NEW OR EX / REDUNDANT — FH FH
MANIFOLD NEW/EXISTING
EXISTING TOBY
PUMP
NEW SS/SW MANHOLE
EXISTING SS/SW MANHOLE
EXISTING SS/SW LHCE
EXISTING SW SUMP
PROPERTY NUMBER — 1

UTILITIES LEGEND

GAS - POWERCO — G
GAS - NOVA — NG
U/G POWER — UP
400V U/G POWER — 400V
11kV U/G POWER — 11kV
33kV U/G POWER — 33kV
O/H POWER / TROLLEY WIRE — OP
TELECOMMS / CHORUS — T
VODAFONE — V
FIBRE OPTIC — FO
CITYLINK BROADBAND — B
VECTOR COMMS — VC
OIL — OIL
LINZ SURVEY MARK — SM
POLE

FOR INFORMATION
NOT FOR CONSTRUCTION

No.	Revision	By	Chk	Appd	Date
2	ISSUED FOR INFORMATION	G.H.	G.B.	J.L.	30-06-23
1	ISSUED WITH CONCEPT DESIGN - FINAL	G.H.	G.B.	J.L.	03-03-23
0	ISSUED FOR INFORMATION	C.Y.	G.B.	J.L.	07-12-22

Drawing Originator: Connect Water
c/- WSP
PO Box 12-003 Thorndon
Wellington 6144
T 64 4 471 7000

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

Design	L.H.	03/03/23	Approved For Construction*
Drawn	G.H.	03/03/23	-
Dsg Verifier	J.L.	03/03/23	-
Dwg Check	L.H.	03/03/23	Date-

* Refer to Revision 1 for Original Signature

Client: Wellington Water

Project: WELLINGTON WATER
EASTERN HILLS RESERVOIR

Title: GENERAL NOTES, LEGEND AND ABBREVIATIONS SHEET

Discipline: CIVIL
Drawing No.: 3-WW021.02_C001
Rev.: 2

DOCUMENT PATH: \\CORPANZPROJECTSNZ\3W3-WW021.02 NAENAE NO.2 RESERV\OIR\HOME\700 DRAWINGS
DOCUMENT NO: 3-WW021.02_C001.DWG

A1 REPRODUCTION SCALE: 100 80 60 40 20 0mm
A3 REPRODUCTION SCALE: 50 40 30 20 10 0mm

PLOTTED BY: HAMBLYN, GARTH

DO NOT SCALE - IF IN DOUBT ASK

DRAWING PLOTTED: 29-Jun-23

Safety in Design H&S Risk Assessment

Administration

Project Name	Eastern Hills Reservoir (previoulsy Naenae No 2)
Project No. (if applicable)	OPC101031

Assessment Date	5/07/2023	**Asset Type**	Water - Reservoir	**Location / Site Name**	Summiit Road, Faifield, Lower H
Designer	Connect Water	**SID Process Step**	Review H&S Risk Assessment (Step IV)		

Safety in Design Process Decisions

Opex: Technical Input Required? (Step III)	Yes
Design Meeting Required? (Step V)	Yes
Record decision reasoning for Step V:	Require input from WWL stakeholders around operation of the reservoir. Held design meeting with WWL COG.
More Detailed Assessment (e.g. Hazop) Required? (Step VIII)	Yes
Record decision reasoning for Step VIII :	HAZOP to be held during detailed design.

Safety in Design Stakeholders

Name	Gareth Penhale (WWL)	**Role**	Project Manager
Name	Lewis Hensman (Connect Water)	**Role**	Designer
Name	Jane Nichols (WWL)	**Role**	Investigator
Name	Paul Winstanley (WWL)	**Role**	Operator
Name	Francis Leniston (WWL)	**Role**	WWL Design Manager
Name	Jo Lucas (Connect Water)	**Role**	Project Manager
Name		**Role**	
Name	Ray Bewley (WWL) - Apology	**Role**	
Name	Kacey Paul (WWL) - Apology	**Role**	
Name		**Role**	
Name		**Role**	
Name		**Role**	
Name		**Role**	

If additional stakeholders are required, select the row above and insert new row. Record Name and Role as per Safety in Design Process.

Raw risk						Risk management								
Specific Asset Reference (if applicable)	Risk Source (Hazard)	Risk Description	Raw Consequence	Raw Likelihood	Raw Risk Rating	Control Measure	Control Type	Control Description	Control Justification (if not eliminated)	Control Owner	Residual Consequence	Residual Likelihood	Residual Risk Rating	Risk Owner
1. Pre-Construction														
Summit Rd	Vehicles And Mobile Equipment	Pre-construction vehicles creating hazard on Summit Rd and connecting streets.	Moderate 40	Possible 4	Moderate 160	Minimise	2. Adminstration Control	Follow road rules and park sensibly on Farrelly Grove.	No other route available for construction vehicles.	Contractor	Minor 10	Unlikely 3	Low 30	Contractor
2. Construction														
Summit Rd	Traffic or Pedestrian Movement during construction	Construction vehicles creating hazard on Summit Rd and connecting streets.	Substantial 100	Possible 4	Extreme 400	Minimise	2. Adminstration Control	Manage using a TMP in accordance with CoPTTM. Potentially restrict access to Summit Rd for residents only. Early engagement with residents. Some construction traffic using Balgownie Grove.	No other route available for construction vehicles.	Contractor	Major 70	Unlikely 3	High 210	Contractor
Reservoir site	Traffic or Pedestrian Movement during construction	Construction vehicles creating hazard to persons using the firebreak and adjoining tracks for recreational use.	Substantial 100	Possible 4	Extreme 400	Minimise	1. Isolate	Close access to the tracks to the public for the duration of the construction period. Use physical barriers to isolate the area and provide signage. Engage early with users of the track using on-line survey and open evenings.	During preliminary design and ECI the team considered the practicalities and safety of maintaining access to the track. It was agreed that with a tight site it was safer to close the track.	Contractor	Moderate 40	Highly Unlikely 2	Moderate 80	Contractor
Outlet pipe	Traffic or Pedestrian Movement during construction	Construction vehicles creating hazard during construction of new outlet main. Vehicles on road posing risk to contractors.	Substantial 100	Possible 4	Extreme 400	Minimise	2. Adminstration Control	Manage using a TMP in accordance with CoPTTM. Potentially restrict access to Balgownie Grove for residents only.	Have changed the route of the outlet pipe to avoid going down Summit Rd. Selected pipe route down hill and connecting at Balgownie Gr. Has reduced impact on traffic movements.	Contractor	Major 70	Unlikely 3	High 210	Contractor
Whole site	Natural events	During construction there is a risk of high rainfall, high winds or earthquakes causing failure of temporary works or other hazards.	Substantial 100	Possible 4	Extreme 400	Minimise	1. Engineering Control	Design all temporary works to account for service limit state wind loads and earthquake loads. Engineer to provide guidance on the propping of permanent elements until construction complete. Work adjacent to slopes is of particular concern and should be avoided in high winds or heavy rain. After heavy rain slopes to be inspected before construction vehicles used on them.	Contractor will still be required to assess the conditions before undertaking works and have appropriate procedures in the event of an extreme natural event.	Designer	Substantial 100	Rare 1	Moderate 100	Contractor
Waiwhetu stream	Natural events	High rainfall causing stream level to rise. Potential significant risk to those working on or adjacent to stream. Can engulf trenches or wash away equipment and assets causing a hazard down stream.	Substantial 100	Possible 4	Extreme 400	Minimise	1. Engineering Control	Work adjacent to stream to have control measures such as weather warnings. Stage work for summer. Ensure that site is made safe if high rainfall is expected, removing equipment from site, or ensuring it is secured if it cannot be removed.	Contractor will still be required to assess the conditions before undertaking works and have appropriate procedures in the event of an extreme natural event.	Contractor	Substantial 100	Highly Unlikely 2	High 200	Contractor
Whole site	Mobile Plant	Due to small construction area required to minimise excavation work, restricted area for vehicle movements and risk of injury or fatality.	Substantial 100	Possible 4	Extreme 400	Minimise	1. Engineering Control	While there is a desire to minimise the excavation, need to design in an area for vehicle turnaround, laydown and lifting platform. Have levelled the area between the new reservoir and existing reservoir.	During consent/ECI phase the working area was confirmed with the contractors. Design can mitigate where practical, but cannot eliminate. Contractor will need to follow standard mobile plant safety protocols while on site.	Designer	Substantial 100	Highly Unlikely 2	High 200	Contractor
Reservoir site	Working at height, raised or falling objects	Lifting of reservoir panels, multiple risks of injury or fatality during crane lifting operations.	Substantial 100	Possible 4	Extreme 400	Minimise	1. Engineering Control	Design in dedicated lifting areas and minimise the size of the panels to be lifted in reducing risk. Review scheduling of the works to complete lift operations at time of the year when high winds are least likely.	On-site administrative controls required such as lift plans.	Designer	Major 70	Unlikely 3	High 210	Contractor

0 5 10 15 20 25
SCALE 1:500 AT ORIGINAL SIZE

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2	ISSUED FOR INFORMATION	G.H.	G.B.	J.L.	28-07-23
1	ISSUED WITH CONCEPT DESIGN - FINAL	G.H.	G.B.	J.L.	03-03-23
0	ISSUED FOR INFORMATION	C.Y.	G.B.	J.L.	07-12-22

Drawing Originator: Connect Water, c/- WSP, PO Box 12-003 Thorndon, Wellington 6144, T 64 4 471 7000

Original Scale (A1) AS SHOWN	Design	L.H.	28/07/23
	Drawn	G.H.	28/07/23
Reduced Scale (A3) 1/2 SHOWN	Dsg Verifier	J.L.	28/07/23
	Dwg Check	L.H.	28/07/23

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

Client: Wellington Water

Project: WELLINGTON WATER EASTERN HILLS RESERVOIR

Title: SAFETY IN DESIGN ASSESSMENT SHEET 1

Discipline: CIVIL

Drawing No.: 3-WW021.02_C002

Rev.: 2

DOCUMENT PATH: \\CORPANZPROJECTSNZ3W3-WW021.02 NAENAE NO.2 RESERVOIR\HOME\700 DRAWINGS

DOCUMENT NO: 3-WW021.02_C002-C006.DWG

A1 REPRODUCTION SCALE: 100 80 60 40 20 0mm

A3 REPRODUCTION SCALE: 50 40 30 20 10 0mm

DO NOT SCALE - IF IN DOUBT ASK

PLOTTED BY: HAMBLYN, GARTH

DRAWING PLOTTED: 21-Jun-23

Specific Asset Reference (if applicable)	Risk Source (Hazard)	Risk Description	Raw Consequence	Raw Likelihood	Raw Risk Rating	Control Measure	Control Type	Control Description	Control Justification (if not eliminated)	Control Owner	Residual Consequence	Residual Likelihood	Residual Risk Rating	Risk Owner
Reservoir site	Structural failure	Existing reservoir adjacent to the construction site: risk of exceeding structural loads on reservoir due to plant or equipment, falling objects. May cause injury if reservoir roof collapses. Damage to the reservoir poses risk to water supply.	Substantial 100	Possible 4	Extreme 400	Minimise	1. Engineering Control	Have assessed the potential loading the existing reservoir can withstand and planned site accordingly. Still requires temporary works design and confirmation during detailed design and construction.	Will need to be conservative in defining activities can occur on the reservoir roof, cannot risk disruption to water supply. Will need to take into account the existing reservoir in all lifting plans.	Designer	Substantial 100	Highly Unlikely 2	High 200	Contractor
Whole site	Confined Space	Some trenches around the site may be classified as a confined space, as will the reservoir and any manholes during points in construction. Standard confined space hazards.	Substantial 100	Possible 4	Extreme 400	Minimise	1. Engineering Control	Design trenches to be as shallow as practical to mitigate the risk.	Standard CSE to apply where a confined space is identified.	Designer	Substantial 100	Unlikely 3	High 300	Contractor
Reservoir site	Members of the public accessing site	Members of the public forcing entry to site and putting themselves at risk of harm or damaging assets	Major 70	Possible 4	High 280	Minimise	1. Isolate	Ensure that the perimeter of the site is fenced and that appropriate security measures are in place when on site. Secure all equipment and vehicles when site is unmanned	Cannot be avoided, need to manage through construction procedures	Contractor	Major 70	Highly Unlikely 2	Moderate 140	Contractor
Site access	Steep embankments adjacent to vehicle access way	Potential for vehicle to topple down the side of the access way, especially a concern for large vehicles due to the width of the access track.	Major 70	Possible 4	High 280	Minimise	1. Isolate	Widen, grade and resurface track as part of the site establishment. Consider the use of barriers, such as bollards or armco barriers to protect from the edge. These could also help provide safe pedestrian access up the access track. For oversize vehicles, consider the use of a pilot to guide the vehicle up the track. Where vehicles are required to arrive while dark, light the track to assist.	Due to the slope being very steep on one side and the existing reservoir on the other, it is difficult to widen the track to a point where this risk would be extremely unlikely. Need to manage through a mix of isolation, engineering and administrative controls.	Contractor	Major 70	Unlikely 3	High 210	Contractor
Reservoir site	Vehicles operating on a slope	Risk of vehicle run-away on site slopes, could cause significant damage to assets and pose a significant safety risk.	Major 70	Possible 4	High 280	Minimise	1. Engineering Control	Ensure the correct vehicle is selected for the task and operators are trained and competent. Emergency brakes to be engaged and chocks used to prevent runaway. Avoid leaving vehicles unattended on steep slopes, only park on steep slopes when required for work	Not possible to eliminate as work on a hill.	Contractor	Major 70	Unlikely 3	High 210	Contractor
Site access	Narrow width site access	Chance of vehicle collision on narrow access track, or toppling down slope to avoid collision.	Major 70	Possible 4	High 280	Minimise	2. Adminstration Control	Widen, grade and resurface track as part of the site establishment. Reduced speed zone through construction site. Will likely require traffic controllers on the access track, especially when large vehicles are using track.	Due to the slope being very steep on one side and the existing reservoir on the other, it is difficult to widen the track to a point where this risk would be extremely unlikely. Need to manage through a mix of isolation, engineering and administrative controls.	Contractor	Major 70	Highly Unlikely 2	Moderate 140	Contractor
Whole Site	Services – Working With or Near	Risk of striking underground or overhead services. This is a general risk, any risks associated with specific services or operations will be addressed separately.	Major 70	Possible 4	High 280	Minimise	1. Engineering Control	Use service drawings to inform pipe alignment and reservoir location. Design to avoid need to cross services.	Will reduce risk through design. Will still need appropriate administration controls through the construct period, such as following "Guidance to Utility Management in Design and Construction".	Designer	Major 70	Highly Unlikely 2	Moderate 140	Contractor
Outlet pipe	Services – Working With or Near	Services (large supply and delivery pipe) down Summit Road cross the street back and forth. Any pipe installed down this route would require multiple service crossings and deep trenches.	Major 70	Possible 4	High 280	Eliminate		Have eliminated this specific risk by rerouting the pipe down the hill to Balgownie Grove. Note this only refers to the delivery pipe and scour / overflow pipes. Does not eliminate the overall risk of striking services at the top of Summit Rd and Farrelly Grv, due to the installation of the new inlet, scour connection and delivery connection						
Outlet pipe	Excavation	Deep trench causing hazard of falling into trench or trench collapse causing injury.	Major 70	Possible 4	High 280	Minimise	1. Substitute	Designed delivery (outlet) pipe alignment down hill to minimise service crossings on Summit Rd and therefore the depth of trench required. Consider directional drilling for sections of the pipe.	Will reduce risk through design where practical. During construction will still require standard trench safety to be followed such as shoring and barriers. Don't anticipate deep trenches for delivery pipe.	Designer	Moderate 40	Unlikely 3	Moderate 120	Contractor
Reservoir site	Excavation	Risk of injury from being struck by excavator, collapse of any slopes, or toppling of excavator when operating on a slope.	Major 70	Possible 4	High 280	Minimise	1. Isolate	Review of the ground conditions on the construction site, will assist in determining where to locate machinery and the risk of slope failure.	Standard control of the site using barricading around operating excavators and training of contractors.	Designer	Major 70	Highly Unlikely 2	Moderate 140	Contractor

A1 REPRODUCTION SCALE 0mm 20 40 60 80 100

A3 REPRODUCTION SCALE 0mm 10 20 30 40 50

0 5 10 15 20 25
SCALE 1:500 AT ORIGINAL SIZE

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2	ISSUED FOR INFORMATION	G.H.	G.B.	J.L.	28-07-23
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c/- WSP
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T 64 4 471 7000

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	Drawn	G.H.	28/07/23
Reduced Scale (A3) 1/2 SHOWN	Dsg Verifier	J.L.	28/07/23
	Dwg Check	L.H.	28/07/23

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

Client: Wellington Water

Project: WELLINGTON WATER
EASTERN HILLS RESERVOIR

Title: SAFETY IN DESIGN ASSESSMENT
SHEET 2

Discipline: CIVIL

Drawing No.: 3-WW021.02_C003

Rev.: 2

DO NOT SCALE - IF IN DOUBT ASK

PLOTTED BY: HAMBLYN, GARTH

DRAWING PLOTTED: 21-Jun-23

DOCUMENT PATH: \\CORPANZ\PROJECTSNZ\3W3-WW021.02 NAENAE NO.2 RESERVOIR\HOME\700 DRAWINGS

DOCUMENT NO: 3-WW021.02_C002-C006.DWG

Specific Asset Reference (if applicable)	Risk Source (Hazard)	Risk Description	Raw Consequence	Raw Likelihood	Raw Risk Rating	Control Measure	Control Type	Control Description	Control Justification (if not eliminated)	Control Owner	Residual Consequence	Residual Likelihood	Residual Risk Rating	Risk Owner
Outlet / overflow pipe	Slope failure	During the construction of the pipe down the hill towards Balgownie Grove there is a risk of slope failure under heavy machinery causing toppling.	Major 70	Possible 4	High 280	Minimise	1. Engineering Control	During design undertake geotechnical assessment of route to assess the risk of failure. Provide advice to the contractor regarding construction methodology. Programme works for summer when fewer heavy rain events.	Design can mitigate risk, however contractor will need to ensure controls in place when using machinery. This may be by reducing the size of excavator etc used, and locating as far as practical from slope edges. Ensure suitably qualified team constructing pipeline. Installation method will depend on material selected, this is currently being left flexible for the D&C contractor	Designer	Moderate 40	Unlikely 3	Moderate 120	Contractor
Waiwhetu stream crossing	Slope failure	During the construction of the crossing of the Waiwhetu stream there is a risk of slope failure below heavy machinery.	Major 70	Possible 4	High 280	Minimise	2. Adminstration Control	Locate heavy machinery away from slope and schedule work for summer to avoid heavy rain events. Design has considered location of abutments to avoid slope failure.	Design can mitigate risk, however contractor will need to ensure controls in place when using machinery.	Contractor	Moderate 40	Unlikely 3	Moderate 120	Contractor
Reservoir site	Working at height, raised or falling objects	Working on the reservoir roof or above the valve pit, risk of falling off roof or objects being dropped on people.	Major 70	Possible 4	High 280	Minimise	1. Engineering Control	Multiple controls to be used during construction, from guardrails to fall restraint. Working at height procedures will need to be followed.	Standard procedures to be followed.	Contractor	Major 70	Unlikely 3	High 210	Contractor
Outlet pipe	Working at height, raised or falling objects	Crane lifting of the pipes into trenches in the carriageway. Potential for injury or fatality, including general public.	Major 70	Possible 4	High 280	Minimise	1. Isolate	Follow standard lifting procedures and putting in public exclusion zones.	Standard procedures to be followed.	Contractor	Major 70	Unlikely 3	High 210	Contractor
Water network cut-ins	Pressurised pipework and confined space	Risk of injury if cut into a pressurised line. Risk of engulfment in trenches due to cutting into live pipe.	Major 70	Possible 4	High 280	Minimise	1. Isolate	Ensure through the construction period that all isolations are in place and lines drained before cutting in. Follow standard WWL procedures.	Cannot eliminate this risk.	Contractor	Moderate 40	Rare 1	Low 40	Contractor
Valvehouse	Slope failure	The valvehouse will be constructed in a pit, risk of slope failure causing injury.	Major 70	Unlikely 3	High 210	Minimise	1. Engineering Control	Specify that the excavation should be benched or sloped at 1:1 to reduce risk. Further site investigations will inform risk.	Unable to avoid excavation, minimise risk. Excavation will likely be in rock and therefore the likelihood of collapse is minimised.	Designer	Moderate 40	Highly Unlikely 2	Moderate 80	Contractor
Whole site	Stormwater	Sedimentation and pollution to waterways, specifically the Waiwhetu Stream. Flooding of the site.	Major 70	Unlikely 3	High 210	Minimise	1. Engineering Control	Design the erosion and sediment control measures and stormwater management for storm events.	Cannot eliminate risk of rain.	Designer	Moderate 40	Unlikely 3	Moderate 120	Contractor
Waiwhetu stream crossing	Water - Being In, Near, Or On	Risk of falling into stream during construction.	Major 70	Unlikely 3	High 210	Minimise	2. Adminstration Control	Scheduling of work in summer to avoid high water levels.	Follow safety procedures for working around/over water.	Contractor	Moderate 40	Highly Unlikely 2	Moderate 80	Contractor
Reservoir	Scaffolding disassembly	Removal of scaffolding from the reservoir introduces multiple hazards including working from heights, suspended loads, manual handling and confined space,	Major 70	Unlikely 3	High 210	Minimise	1. Engineering Control	Ensure that during the detailed design of the reservoir, removal of scaffolding is taken into account when designing the size and location of any reservoir roof penetrations. Contractor should also consider during their construction sequencing.	Residual risk will still be present and need to be managed by contractor HSE procedures.	Designer	Major 70	Highly Unlikely 2	Moderate 140	Contractor
Whole site	House Keeping	An untidy site presents hazard for people and vehicles moving around site	Moderate 40	Possible 4	Moderate 160	Minimise	1. Isolate	Design a laydown area and construction offices area.	Will still require the administrative controls on site to keep a tidy site.	Designer	Minor 10	Unlikely 3	Low 30	Contractor
Whole site	Fires or explosions or hot work	Welding operations and storage of flammable/combustible materials on site. Risk of injury.	Moderate 40	Possible 4	Moderate 160	Minimise	2. Adminstration Control	Follow standard hot work procedures, correct storage and handling of hazardous materials.	Standard procedures to be followed.	Contractor	Moderate 40	Unlikely 3	Moderate 120	Contractor
Whole site	Manual handling	Risk of injury due to manual handling	Moderate 40	Possible 4	Moderate 160	Minimise	2. Adminstration Control	Ensure proper training and suitable lifting aids are provided where practical.	Standard procedures to be followed.	Contractor	Minor 10	Unlikely 3	Low 30	Contractor
Whole site	Tools and equipment	Risk of injury due to improper use of tools and equipment.	Moderate 40	Possible 4	Moderate 160	Minimise	2. Adminstration Control	Ensure all power tools are tested and tagged, operators to be trained	Standard procedures to be followed.	Contractor	Minor 10	Unlikely 3	Low 30	Contractor
Whole site	Hazardous substances	Injury due to improper storage or handling of hazardous materials.	Moderate 40	Possible 4	Moderate 160	Minimise	2. Adminstration Control	Ensure MSDS's are available and followed	Standard procedures to be followed.	Contractor	Minor 10	Unlikely 3	Low 30	Contractor
Reservoir site	Noise	Large amount of noise during rock breaking activities during construction. Risk of hearing damage.	Moderate 40	Possible 4	Moderate 160	Minimise	1. Engineering Control	Reduce earthworks required as far as possible, such as changing the outlet pipe alignment to reduce the rock breaking required. Noise assessment being undertaken and mitigation measures proposed.	Will need to manage construction hours and hearing protection for contractors on site.	Designer	Minor 10	Unlikely 3	Low 30	Contractor
Site access	Rutting of access way	Rutting / erosion of the track during wet weather events, creating driving hazards potentially resulting in loss of control of a vehicle.	Moderate 40	Possible 4	Moderate 160	Minimise	1. Engineering Control	Grade and surface the access track to manage stormwater, minimising the rutting of the track.	Contractor will need to monitor condition of access throughout project and maintain as required.	Designer	Minor 10	Highly Unlikely 2	Low 20	Contractor
Whole site	Noise	General risk of noise due to construction activities.	Minor 10	Possible 4	Low 40	Minimise	2. Adminstration Control	Will need to manage construction hours and hearing protection for contractors on site. Engage early with the public around noise and night works.	Standard procedures to be followed and working hours/days. For night works noise limited and monitored as much as possible.	Contractor	Minor 10	Unlikely 3	Low 30	Contractor
3. Commissioning														
Reservoir internal	Confined space	Use of hazardous substances in a confined space during disinfecting of reservoir. Health risks.	Major 70	Possible 4	High 280	Minimise	3. PPE	Comply with MSDS and standard CSE procedures	Cannot eliminate requirement to disinfect.	Contractor	Major 70	Highly Unlikely 2	Moderate 140	Contractor
Reservoir valvehouse	Confined space	General confined space risks.	Major 70	Possible 4	High 280	eliminate		Design the valvehouse for occupancy to eliminate confined space designation.		Designer				

A1 REPRODUCTION SCALE
100 80 60 40 20 0mm

A3 REPRODUCTION SCALE
50 40 30 20 10 0mm

0 5 10 15 20 25
SCALE 1:500 AT ORIGINAL SIZE

FOR INFORMATION
NOT FOR CONSTRUCTION

No.	Revision	By	Chk	Appd	Date
2	ISSUED FOR INFORMATION	G.H.	G.B.	J.L.	28-07-23
1	ISSUED WITH CONCEPT DESIGN - FINAL	G.H.	G.B.	J.L.	03-03-23
0	ISSUED FOR INFORMATION	C.Y.	G.B.	J.L.	07-12-22

Drawing Originator: Connect Water

Connect Water
c/- WSP
PO Box 12-003 Thorndon
Wellington 6144
T 64 4 471 7000

Original Scale (A1) AS SHOWN	Design	L.H.	28/07/23
	Drawn	G.H.	28/07/23
Reduced Scale (A3) 1/2 SHOWN	Dsg Verifier	J.L.	28/07/23
	Dwg Check	L.H.	28/07/23

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

Client: Wellington Water

Project: WELLINGTON WATER
EASTERN HILLS RESERVOIR

Title: SAFETY IN DESIGN ASSESSMENT
SHEET 3

Discipline: CIVIL

Drawing No.: 3-WW021.02_C004

Rev.: 2

DOCUMENT PATH: \\CORP\ANZPROJECTSNZ\3W3-WW021.02 NAENAE NO.2 RESERVOIR\HOME\700 DRAWINGS

DOCUMENT NO: 3-WW021.02_C002-C006.DWG

DO NOT SCALE - IF IN DOUBT ASK

PLOTTED BY: HAMBLYN, GARTH

DRAWING PLOTTED: 21-Jun-23

Specific Asset Reference (if applicable)	Risk Source (Hazard)	Risk Description	Raw Consequence	Raw Likelihood	Raw Risk Rating	Control Measure	Control Type	Control Description	Control Justification (if not eliminated)	Control Owner	Residual Consequence	Residual Likelihood	Residual Risk Rating	Risk Owner
Reservoir - Roof	Water - Being In, Near, Or On	Personnel on roof observing water levels during drop test of reservoir.	Major 70	Possible 4	High 280	Minimise	1. Substitute	Consider use of remotely operated devices to carry out task, such as pole extensions or CCTV. If not possible, ensure personnel are anchored with fall arrestors.	Testing required, but control measures or substitution can minimise risk.	Contractor	Major 70	Rare 1	Moderate 70	Contractor
Reservoir - Roof	Working at height	Accessing roof for commissioning, risk of injury due to falling off access way or the roof	Major 70	Possible 4	High 280	Minimise	1. Isolate	Reservoir to have a wrap around staircase and handrails. Anchor points/fall arrestors to be used when required.	Can minimise, not eliminate.	Designer	Major 70	Rare 1	Moderate 70	Contractor
Electrical and Controls	Electrocution	Potential for electrocution during the commissioning of the electrical and controls equipment.	Major 70	Possible 4	High 280	Minimise	1. Isolate	Ensure lock out / tag out procedures are followed and aligned with shutdown procedures.	To be included in contractor HSE plans.	Contractor	Major 70	Highly Unlikely 2	Moderate 140	Contractor
Reservoir	Hazardous substances	Introduction of Cl, for disinfection and commissioning presents a hazard of exposure	Major 70	Possible 4	High 280	Minimise	1. Engineering Control	Comply with MSDS. Include the commissioning in HAZOP and detail any design changes able to mitigate risk.	To be included in HAZOP	Designer	Moderate 40	Unlikely 3	Moderate 120	Contractor
4. Operations / Maintenance														
Reservoir Internal	Confined space	Reservoir is considered a confined space, general risks.	Substantial 100	Possible 4	Extreme 400	Minimise	1. Engineering Control	Design internal stair case for ease of access/egress. Ensure that double isolation is available to reduce risk of water being introduced during inspection.	Standard CSE procedures will need to be followed. Consider the use of drones to inspect where possible to eliminate the risk to operators.	Designer	Substantial 100	Highly Unlikely 2	High 200	Operator
Reservoir	Water quality	Tampering of the reservoir supply resulting in a public health risk.	Substantial 100	Possible 4	Extreme 400	Minimise	1. Engineering Control	Security as per WWL standards for Tier 1 security (access hatches, roof vents) .Adopt Tier 2 security at base of reservoir staircase. Control hut to be secured and alarmed. Have alarms on roof hatches. Identified security cameras don't work as they are frequently vandalised.	Minimise security risk as much as possible based on WWL experience at other sites.	Designer	Substantial 100	Rare 1	Moderate 100	Asset Manager
Valvehouse	Heavy lifting	Lifting of valves or equipment causes risk of injury.	Major 70	Possible 4	High 280	Minimise	1. Engineering Control	Design in lifting hoists in the valvehouse and make section of the platform removable.	Confirm in Principal's requirements and during D&C.	Designer	Minimal 1	Highly Unlikely 2	Low 2	Operator
Valvehouse	Vehicle movements	Risk of vehicle hitting and damaging valvehouse / control hut.	Major 70	Possible 4	High 280	Minimise	1. Isolate	Design in bollards.	Widely used for this purpose.	Designer	Major 70	Rare 1	Moderate 70	Operator
Valvehouse	Accessing pipework and equipment	Risk of injury going down in to valvehouse to access the pipework/equipment.	Major 70	Possible 4	High 280	Minimise	1. Engineering Control	Design so most frequent operations, such as sampling, can be completed at ground level. Valve wheels to be accessible from ground level platform. Use stairway with handrails to access valves/equipment below ground level. Design in an adequate means of drainage, including floor sump and pump.	Confirm in Principal's requirements and during D&C.	Designer	Moderate 40	Highly Unlikely 2	Moderate 80	Operator
Reservoir roof hatch	Water - Being In, Near, Or On	Risk of falling into reservoir when operator on roof with hatch open.	Major 70	Possible 4	High 280	Minimise	1. Engineering Control	Sampling to be completed in valvehouse to reduce activities which need to be conducted on roof. Standard HCC hatch design to be used (15kg limit).	WWL to advise on preference.	Designer	Moderate 40	Highly Unlikely 2	Moderate 80	Operator
Reservoir roof hatch	Manual handling	Risk of injury if operator required to shock dose the reservoir e.g. carrying 20kg drum of chlorine	Major 70	Possible 4	High 280	Minimise	1. Engineering Control	Consider alternative shock dosing methods, such as smaller drums or pumping from low level. Consider further during HAZOP.	Confirm during HAZOP.	Designer	Moderate 40	Unlikely 3	Moderate 120	Operator
Reservoir roof hatch	Manual handling	Reservoir roof hatch may be too heavy for single person lift.	Moderate 40	Likely 5	High 200	Minimise	1. Engineering Control	Consider weight of hatch during design and any lifting aids that can be installed.	WWL to advise on preference. Confirmed in Principal's requirements and during D&C.	Designer	Minor 10	Highly Unlikely 2	Low 20	Operator
Whole site	Public access	Site is in a public access area, risk of public injuring themselves.	Major 70	Possible 4	High 280	Minimise	1. Engineering Control	Security at the site as previously stated. Design to include any anti-climb barriers around conduits going up reservoir side or all conduits to be within the secured area. Include signage? Include handrails on valvehouse roof to prevent accidental falling.	Operations manual needs to include standard procedures for securing the site before leaving.	Designer	Major 70	Rare 1	Moderate 70	Asset Manager
Reservoir roof	Access to roof	Risk of falling off roof.	Major 70	Possible 4	High 280	Minimise	1. Engineering Control	Security at the site as previously stated. Design to include any anti-climb barriers around conduits going up reservoir side or all conduits to be within the secured area. Include signage? Include handrails on valvehouse roof to prevent accidental falling.	Confirm in Principal's requirements and during D&C.	Designer	Major 70	Rare 1	Moderate 70	Operator
Reservoir Walls	External wall inspections	Risk of falling during inspection of reservoir walls.	Major 70	Possible 4	High 280	Minimise	1. Engineering Control	Use standard EWP or scaffold practices. Design ground around the reservoir to be flat for an EWP to be stable.	Consider alternative means of inspection such as drones or cameras on extendable poles. This would eliminate the risk of working at height.	Designer	Major 70	Rare 1	Moderate 70	Operator

A1 REPRODUCTION SCALE 0 20 40 60 80 100 0mm

A3 REPRODUCTION SCALE 0 10 20 30 40 50 0mm

0 5 10 15 20 25

SCALE 1:500 AT ORIGINAL SIZE

FOR INFORMATION
NOT FOR CONSTRUCTION

No.	Revision	By	Chk	Appd	Date
0	ISSUED FOR INFORMATION	G.H.	G.B.	J.L.	28-07-23

Drawing Originator: Connect Water c/- WSP, PO Box 12-003 Thorndon, Wellington 6144, T 64 4 471 7000

Original Scale (A1) AS SHOWN	Design	L.H.	28/07/23	Approved For Construction* -
	Drawn	G.H.	28/07/23	
	Dsg Verifier	J.L.	28/07/23	
Reduced Scale (A3) 1/2 SHOWN	Dwg Check	L.H.	28/07/23	Date-
	* Refer to Revision 1 for Original Signature			

Client: Wellington Water

Project: WELLINGTON WATER
EASTERN HILLS RESERVOIR

Title: SAFETY IN DESIGN ASSESSMENT
SHEET 4

Discipline: CIVIL

Drawing No.: 3-WW021.02_C005

Rev.: 0

DOCUMENT PATH: \\CORP\ANZ\PROJECTS\NZ\3W3-WW021.02 NAENAE NO.2 RESERVOIR\HOME\700 DRAWINGS

DOCUMENT NO: 3-WW021.02_C002-C006.DWG

DO NOT SCALE - IF IN DOUBT ASK

PLOTTED BY: HAMBLYN, GARTH

DRAWING PLOTTED: 21-Jun-23

Specific Asset Reference (if applicable)	Risk Source (Hazard)	Risk Description	Raw Consequence	Raw Likelihood	Raw Risk Rating	Control Measure	Control Type	Control Description	Control Justification (if not eliminated)	Control Owner	Residual Consequence	Residual Likelihood	Residual Risk Rating	Risk Owner
Outlet pipework	Maintenance on pipework	Risk of injury if work needed on pipework running down hill due to the nature of terrain. Potential for vermin to enter pipe.	Major 70	Possible 4	High 280	Minimise	1. Engineering Control	Consider using a corrosion resistant material such as PE to reduce the likelihood that work required. Design trench as per WWL standards to prevent damage to pipe. Maintain a clear path over pipe for ease of access, identifying the closest (safest) access point to the bubble up camber. Investigate methods for vermin protection which do not impede flow.	Confirm in Principal's requirements and during D&C.	Designer	Moderate 40	Highly Unlikely 2	Moderate 80	Operator
Reservoir	Emergency water collection	Risk in the event that water needs to be taken directly from the reservoir (accessed from the roof) in the event of an emergency.	Major 70	Possible 4	High 280	Eliminate	1. Substitute	Design to provide emergency FH points within valvehouse.		Designer				
Stream Crossing	Height and water	Risk of falling into stream from people climbing across pipe stream crossing.	Major 70	Possible 4	High 280	Minimise	1. Isolate	Consider safety barriers or other methods to prevent climbing on the pipe stream crossing.	While aerial pipe stream crossing is being consented, a submarine crossing has not been fully ruled out and will be left open to the D&C contractor to investigate further.	Designer	Major 70	Unlikely 3	High 210	Asset Manager
Reservoir roof	Water contamination and additional maintenance	Water seals on the roof need replacing every 20 years - failure of these seals can lead to water quality issues. The need for replacement also introduces multiple risks from the works.	Major 70	Possible 4	High 280	Eliminate		Specify that the roof is to be a single pour.						
Site access	Steep slopes on side of access road	Risk of vehicle tipping down slope	Major 70	Possible 4	High 280	Minimise	1. Isolate	Widen and re-grade road, introduce permanent barriers to protect slope edge. Reinstate site gate to prevent public access.	Need to access site, so minimise risk SFARP	Designer	Major 70	Highly Unlikely 2	Moderate 140	Asset Manager
Reservoir site	Vehicle movements	Vehicles need to be able to drive up to reservoir and around reservoir. Risk of incident occurring.	Moderate 40	Possible 4	Moderate 160	Minimise	1. Engineering Control	Design clear vehicle access (3m min) around perimeter of reservoir and a compliant slope up to the site. Operator preference for asphalt to provide a hard and "level" surface around perimeter, with water drained away from reservoir	Vehicles require access but sufficient space reduces risk. Confirm with consenting specialists if asphalt is	Designer	Moderate 40	Highly Unlikely 2	Moderate 80	Operator
Valvehouse	Manual handling	Confined conditions of pipework and valves may present risk of injury	Moderate 40	Possible 4	Moderate 160	Minimise	1. Engineering Control	Use 3D modelling to provide an early 'feel' for the space. Can modify design based on operator input.	Confirm in Principal's requirements and during D&C.	Designer	Minor 10	Highly Unlikely 2	Low 20	Operator
Reservoir Internal	Internal inspection	Rushed inspection due to time pressure, may lead to unsafe work practices.	Moderate 40	Possible 4	Moderate 160	Minimise	1. Engineering Control	Design a full internal staircase with non-slip treads. Consider marking of the columns during construction to aid in inspections.	Consider the use of drones to inspect where possible to eliminate the risk to operators. Include in O&M manual?	Designer	Moderate 40	Highly Unlikely 2	Moderate 80	Operator
Reservoir Internal	Pipework replacement	Risk of injury during the replacement of internal/underfloor pipework.	Moderate 40	Possible 4	Moderate 160	Minimise	1. Engineering Control	Design pipework to minimise the need for replacement. Use stainless steel for all pipework.	Avoid risk as much as possible.	Designer	Moderate 40	Rare 1	Low 40	Operator
Overflow/Scour	Scour	Need to access manhole on scour line to dose during scouring. HSE risk.	Moderate 40	Possible 4	Moderate 160	Minimise	1. Engineering Control	Locate scour manhole in easy to reach location, ensuring clear drive up access.	Discuss potential dosing methods during HAZOP, which may eliminate the need to open a manhole.	Designer	Minor 10	Highly Unlikely 2	Low 20	Operator
Valve chambers	Confined Space	Risk of injury while accessing in-line valve chambers.	Moderate 40	Possible 4	Moderate 160	Minimise	1. Engineering Control	Design of chambers to be a minimum of 1.5m in diameter and have a Sike lid. Chambers to include drainage.	Need to mitigate as best as possible.	Designer	Moderate 40	Highly Unlikely 2	Moderate 80	Operator

SCALE 1:500 AT ORIGINAL SIZE

FOR INFORMATION
NOT FOR CONSTRUCTION

No.	Revision	By	Chk	Appd	Date
0	ISSUED FOR INFORMATION	G.H.	G.B.	J.L.	28-07-23

Drawing Originator: Connect Water
c/- WSP
PO Box 12-003 Thorndon
Wellington 6144
T 64 4 471 7000

Original Scale (A1) AS SHOWN	Design	L.H.	28/07/23	Approved For Construction*
	Drawn	G.H.	28/07/23	-
Reduced Scale (A3) 1/2 SHOWN	Dsg Verifier	J.L.	28/07/23	
	Dwg Check	L.H.	28/07/23	Date-
* Refer to Revision 1 for Original Signature				

Client: Wellington Water

Project: WELLINGTON WATER
EASTERN HILLS RESERVOIR

Title: SAFETY IN DESIGN ASSESSMENT
SHEET 5

Discipline: CIVIL

Drawing No.: 3-WW021.02_C006

Rev.: 0

DOCUMENT NO: 3-WW021.02_C002-C006.DWG

DOCUMENT PATH: \\CORP\ANZ\PROJECTS\NZ\3W3-WW021.02 NAENAE NO.2 RESERVOIR\HOME\700 DRAWINGS

DO NOT SCALE - IF IN DOUBT ASK

PLOTTED BY: HAMBLYN, GARTH

DRAWING PLOTTED: 21-Jun-23

A1 REPRODUCTION SCALE: 100 80 60 40 20 0mm

A3 REPRODUCTION SCALE: 50 40 30 20 10 0mm

A1 REPRODUCTION SCALE
100 80 60 40 20 0mm

A3 REPRODUCTION SCALE
50 40 30 20 10 0mm

NOTES:
1. INLET UPSTAND TO BE A TEE AT 60% TWL, BOTH OUTLETS TO BE ORIENTATED AT 60°
2. EXISTING ASSETS ASSOCIATED WITH NAENAE RESERVOIR ARE INDICATIVE ONLY, THIS P&ID SHOULD NOT BE CONSIDERED AN AS-BUILT
3. SMALL BORE LOW POINT DRAINS AND BLEEDS HAVE NOT BEEN SHOWN. THESE WILL NEED TO BE DETERMINED AS PART OF HAZOP
4. SECURITY INSTRUMENTATION HAS NOT BEEN PROVIDED FOR ON THE DRAWINGS
5. SWING CHECK VALVE WITH VERMIN PREVENTION

LEGEND
- EXISTING
- NEW
- GATE VALVE
- BUTTERFLY VALVE
- BALL VALVE
- NON-RETURN VALVE
- PRESSURE REDUCING VALVE
- FLEXIBLE BELLOWS
- FLEX-TEND
- VENT WITH MESH
- AIR VALVE
- H HYDRANT

NAENAE RESERVOIR (EXISTING)
11.3 ML
BWL: 66.05M
TWL: 72.53M

PROPOSED EASTERN HILLS RESERVOIR
15 ML
Ø 55M
BWL: 66.05M
TWL: 72.53M

FROM WATERLOO WTP
TO SUMMIT ROAD
TO WAIWHETU STREAM
TO BALGOWNIE GROVE
TO STORMWATER
TO FARRELLY GRV MAIN
TO FARRELLY GRV MAIN
TO SUMMIT RD MAIN
TO PRIVATE CONNECTION
SCOUR TO STORMWATER
SCOUR TO WAIWHETU STREAM
SCOUR TO WAIWHETU STREAM
ALLOWANCE FOR FUTURE NAENAE RESERVOIR REPLACEMENT
REMOVABLE SPOOL FOR FUTURE NAENAE RESERVOIR REPLACEMENT CONNECTION
VALVE HOUSE
VALVEHOUSE SUMP
ACCESS HATCH
ACCESS HATCH
INLET
OUTLET
OVERFLOW
SCOUR
SUMP
STREAM CROSSING
NOTE 1
NOTE 5
TIP 01
TIP 02
TIP 03
TIP 04
TIP 05
TIP 06
TIP 07
TIP 08

No.	Revision	By	Chk	Appd	Date
0	ISSUED FOR INFORMATION	K.R	G.B	J.L	28/07/23

Drawing Originator: Connect Water
c/- WSP
PO Box 12-003
Thorndon
Wellington 6144
T 64 4 471 7000

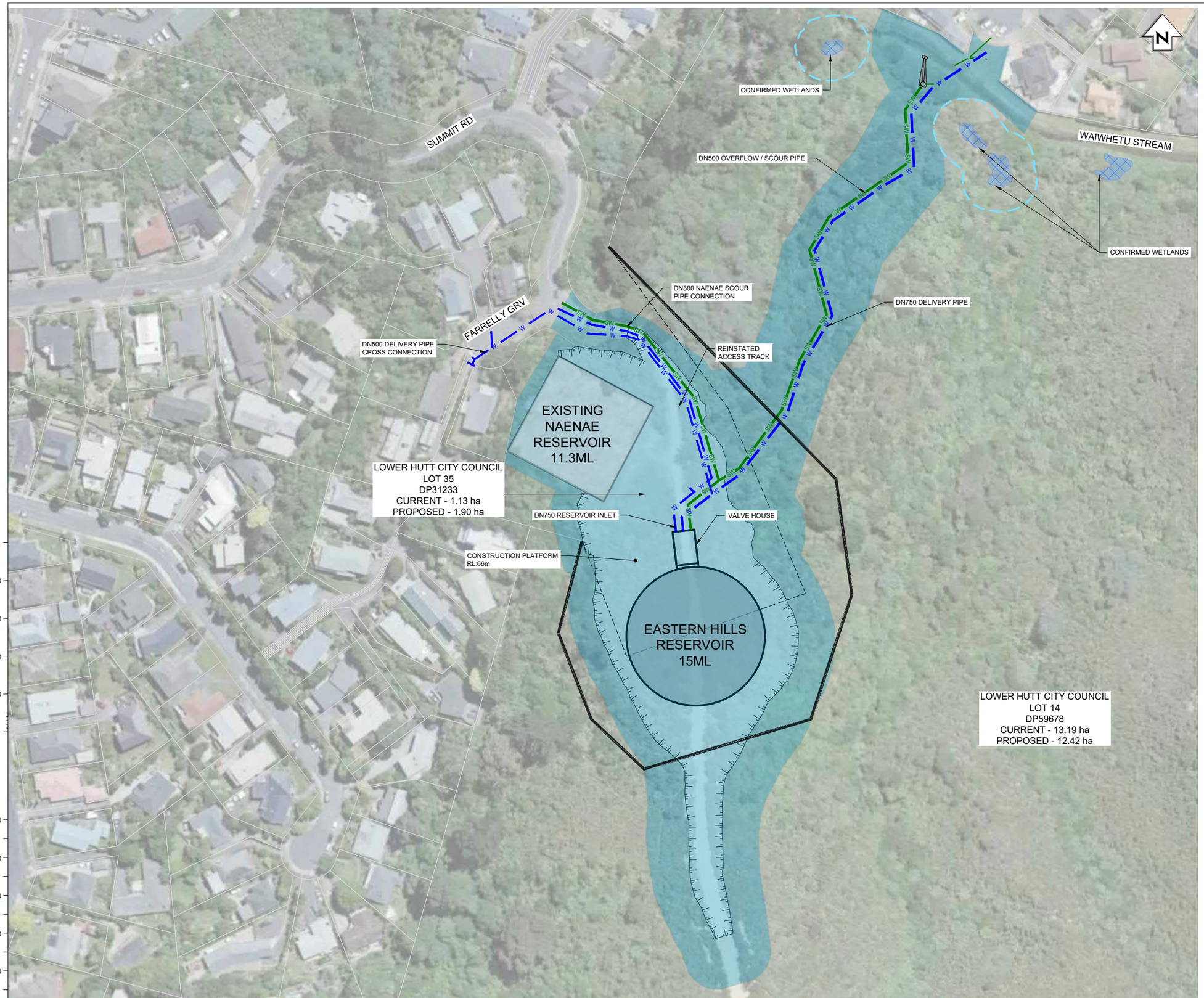
Original Scale (A1)
Reduced Scale (A3)

Design	L.H	28/07/23	Approved For Construction*
Drawn	K.R	28/07/23	
Dsg Verifier	G.B	28/07/23	
Dwg Check	G.B	28/07/23	Date

* Refer to Revision 1 for Original Signature

Client: Wellington Water
Project: WELLINGTON WATER EASTERN HILLS RESERVOIR
Title: EASTERN HILLS RESERVOIR - P&ID
Discipline: MECHANICAL
Drawing No.: 3-WW021.02_C007
Rev.: 0

DO NOT SCALE - IF IN DOUBT ASK



NOTES:

1. DO NOT SCALE OFF DRAWINGS.

LEGEND

- PROPERTY BOUNDARY
- PROPERTY BOUNDARY, TO BE ADJUSTED
- PROPOSED NEW PROPERTY BOUNDARY
- 10m WETLAND BUFFER
- DELIVERY / INLET PIPE (W)
- OVERFLOW / SCOUR DISCHARGE PIPE (SW)
- DESIGNATION BOUNDARY
- WETLAND (CONFIRMED)

A1 REPRODUCTION SCALE: 100, 80, 60, 40, 20, 0mm

A3 REPRODUCTION SCALE: 50, 40, 30, 20, 10, 0mm

0 5 10 15 20 25 30 35
SCALE 1:750 AT ORIGINAL SIZE

FOR INFORMATION
NOT FOR CONSTRUCTION

DOCUMENT PATH: \\CORP\ANZ\PROJECTS\NZ3\W3-WW021.02 NAENAE NO.2 RESERVOIR\HOME\700 DRAWINGS

DOCUMENT NO: 3-WW021.02_C008.DWG

No.	Revision	By	Chk	Appd	Date
1	UPDATED POST INDEPENDENT REVIEW	G.H.	L.H.	J.L.	29/09/23
0	ISSUED FOR INFORMATION	G.H.	L.H.	J.L.	18/08/23

Drawing Originator: Connect Water
c/- WSP
PO Box 12-003 Thorndon
Wellington 6144
T 64 4 471 7000

Original Scale (A1) 1:750
Reduced Scale (A3) 1:1500

Design	L.H.	29/09/23	Approved For Construction*
Drawn	G.H.	29/09/23	-
Dsg Verifier	J.L	29/09/23	
Dwg Check	J.L.	29/09/23	Date-

* Refer to Revision 1 for Original Signature

Client: Wellington Water

Project: WELLINGTON WATER
EASTERN HILLS RESERVOIR

Title: RESERVOIR AND PIPELINES
CONSENT DESIGNATION

Discipline: CIVIL

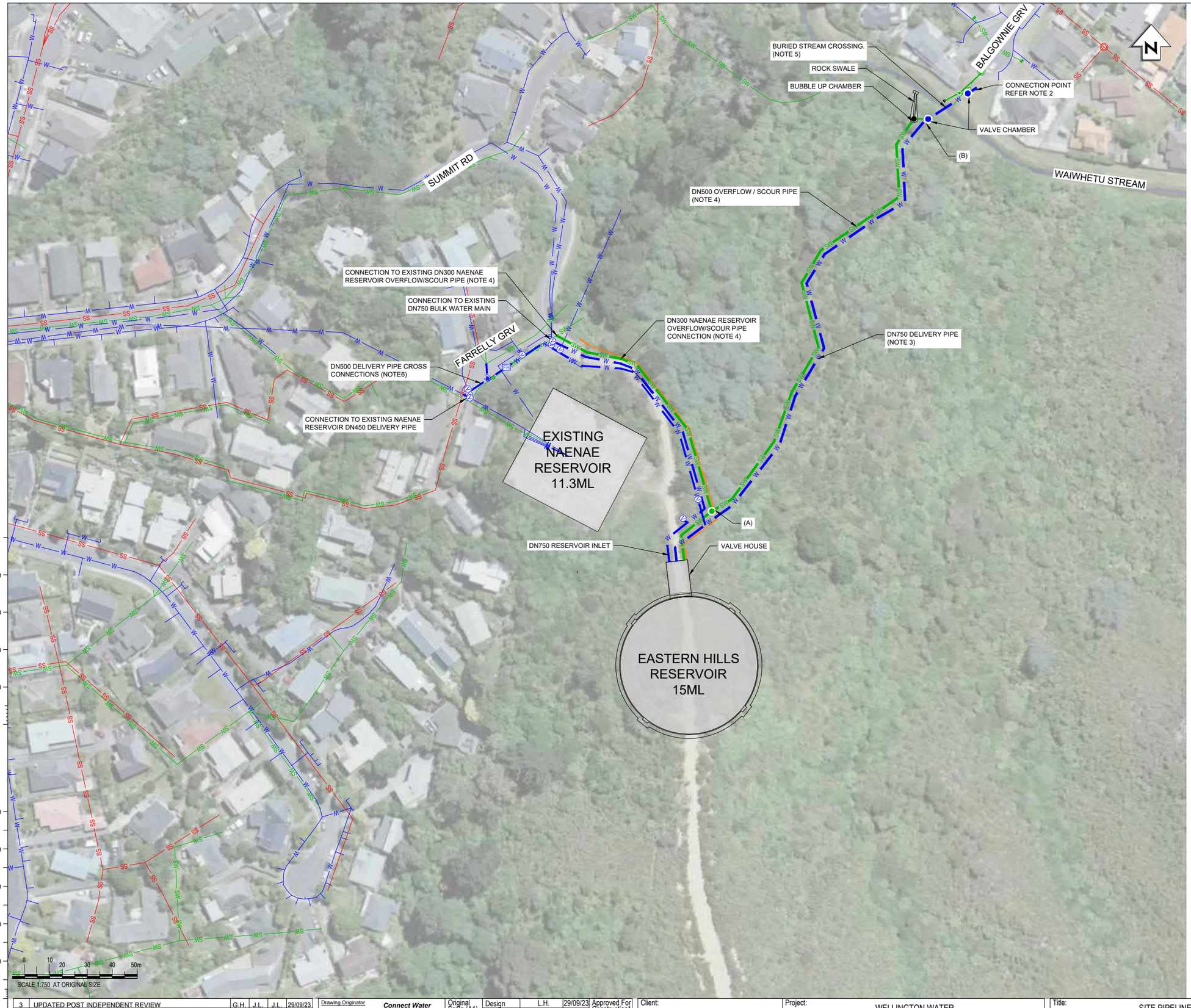
Drawing No.: 3-WW021.02_C008

Rev.: 1

DO NOT SCALE - IF IN DOUBT ASK

PLOTTED BY: PIETERSEN, RIAAN

DRAWING PLOTTED: 29-MAY-23



NOTES:

1. DO NOT SCALE OFF DRAWINGS.
2. CONNECTION POINT FOR URBAN DELIVERY ALIGNMENT
3. DELIVERY PIPE LONG SECTION SHOWN ON 3-WW021.02_W012
4. EXISTING DN300 EW FARRELLY GR, DN300 NAENAE SCOUR PIPE CONNECTION AND DN55 OVERFLOW/ SCOUR LONG SECTIONS SHOWN ON 3-WW021.02_W013
5. DELIVERY PIPE BURIED STREAM CROSSING SHOWN ON 3-WW021.02_W004 AND 3-WW021.02_W005
6. SITE PIPELINES FOR FARRELLY GRV AND SUMMIT ROAD SHOWN ON 3-WW021.02_W007
7. WATER STOPS WITH SUBSOIL DRAINS TO BE INSTALLED IN THE SHARED TRENCH FROM POINT (A) TO (B). REFER TO 3-WW021.02_W012 AND W013 FOR FURTHER DETAIL.

WW SERVICES LEGEND

NEW WATER MAIN	W
EXISTING WATER MAIN	W
NEW STORMWATER	SW
EXISTING STORMWATER	SW
NEW SEWER	SS
EXISTING SEWER	SS
NEW POWER LINE	400V
VALVE NEW OR EX / REDUNDANT	V V
HYDRANT NEW OR EX /REDUNDANT	FH FH
NEW SW MANHOLE	
EXISTING SW MANHOLE	

A1 REPRODUCTION SCALE 0mm 10 20 40 60 80 100

A3 REPRODUCTION SCALE 0mm 10 20 30 40 50

FOR INFORMATION
NOT FOR CONSTRUCTION

No.	Revision	By	Chk	Appd	Date
3	UPDATED POST INDEPENDENT REVIEW	G.H.	J.L.	J.L.	29/09/23
2	ISSUED FOR INFORMATION	G.H.	J.L.	J.L.	18/08/23
1	ISSUED WITH CONCEPT DESIGN - FINAL	G.H.	G.B.	J.L.	03/03/23
0	ISSUED FOR INFORMATION	C.Y.	G.B.	J.L.	07/12/22

Drawing Originator: Connect Water
Connect Water
a WSP
PO Box 12-003 Thorndon
Wellington 6144
T 64 4 471 7000

Original Scale (A1) 1:750	Design	L.H.	29/09/23
	Drawn	G.H.	08/09/23
Reduced Scale (A3) 1:1500	Dsg Verifier	J.L.	29/09/23
	Dwg Check	L.H	29/09/23

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

Client: Wellington Water

Project: WELLINGTON WATER
EASTERN HILLS RESERVOIR

Title: SITE PIPELINES
GENERAL LAYOUT

Discipline: CIVIL

Drawing No.: 3-WW021.02_W001

Rev.: 3

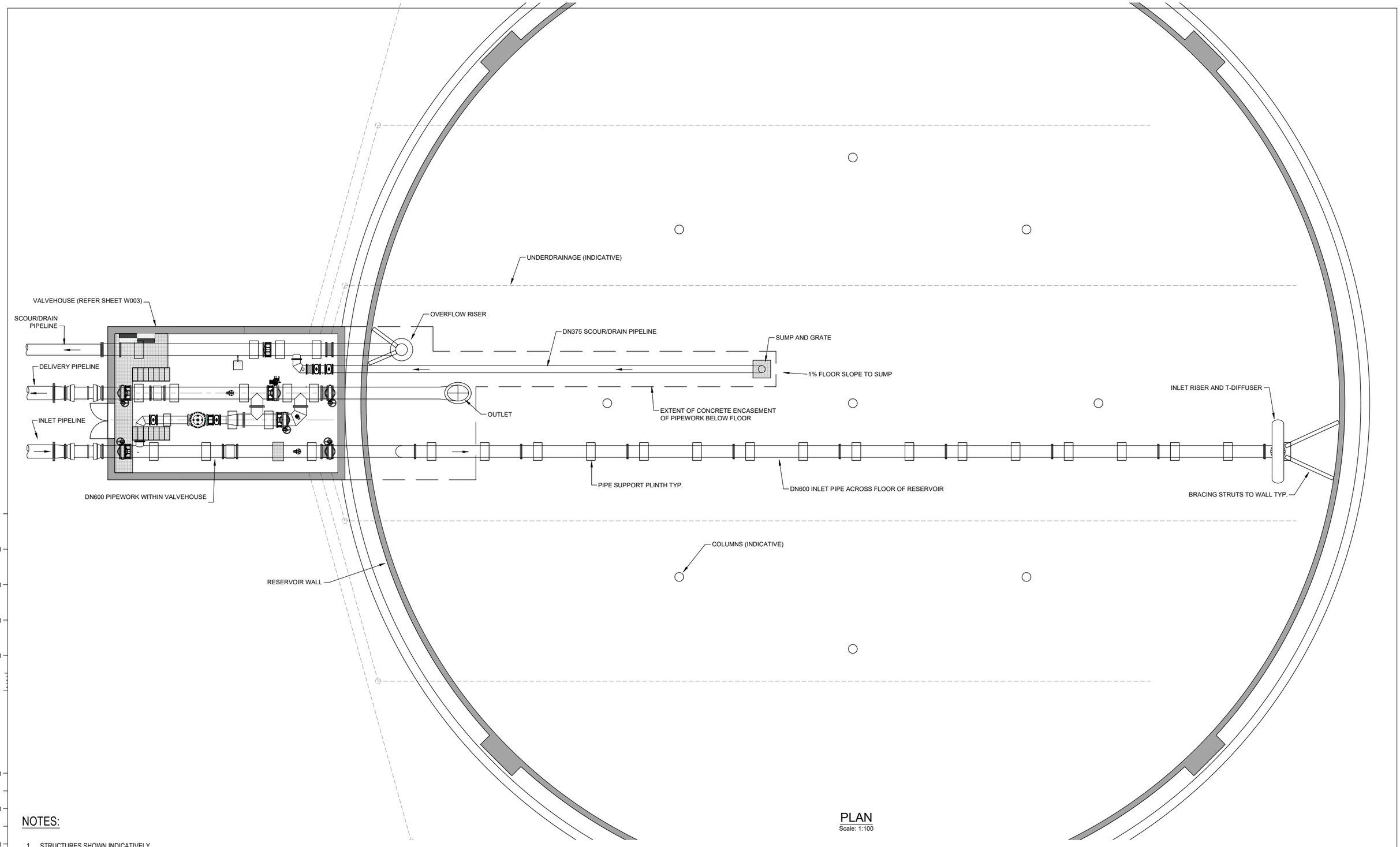
DOCUMENT NO: 3-WW021.02_W001.DWG

DOCUMENT PATH: \\CORP\ANZ\PROJECTS\NZ3W3-WW021.02 NAENAE NO.2 RESERVOIR\HOME\700 DRAWINGS

DO NOT SCALE - IF IN DOUBT ASK

PLOTTED BY: PIETERSEN, RIAAN

DRAWING PLOTTED: 18-Jul-23



PLAN
Scale: 1:100

NOTES:

1. STRUCTURES SHOWN INDICATIVELY

A1 REPRODUCTION SCALE
100 80 60 40 20 0mm

A3 REPRODUCTION SCALE
50 40 30 20 10 0mm

0 5 10 15 20 25
SCALE 1:500 AT ORIGINAL SIZE

FOR INFORMATION
NOT FOR CONSTRUCTION

No.	Revision	By	Chk	Appd	Date
2	ISSUED FOR INFORMATION	G.H.	L.H.	J.L.	28/07/23
1	ISSUED WITH CONCEPT DESIGN - FINAL	G.B	L.H.	J.L.	03/03/23
0	ISSUED FOR INFORMATION	G.B.	L.H.	J.L.	07/12/22

Drawing Originator: Connect Water
c/- WSP
PO Box 12-003 Thorndon
Wellington 6144
T 64 4 471 7000

Original Scale (A1) AS SHOWN	Design	G.B.	28/07/23
	Drawn	G.B.	28/07/23
Reduced Scale (A3) 1/2 SHOWN	Dsg Verifier	L.H.	28/07/23
	Dwg Check	L.H.	28/07/23

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

Client: Wellington Water

Project: WELLINGTON WATER
EASTERN HILLS RESERVOIR

Title: RESERVOIR PIPEWORK
GENERAL LAYOUT

Discipline: CIVIL

Drawing No.: 3-WW021.02_W002

Rev.: 2

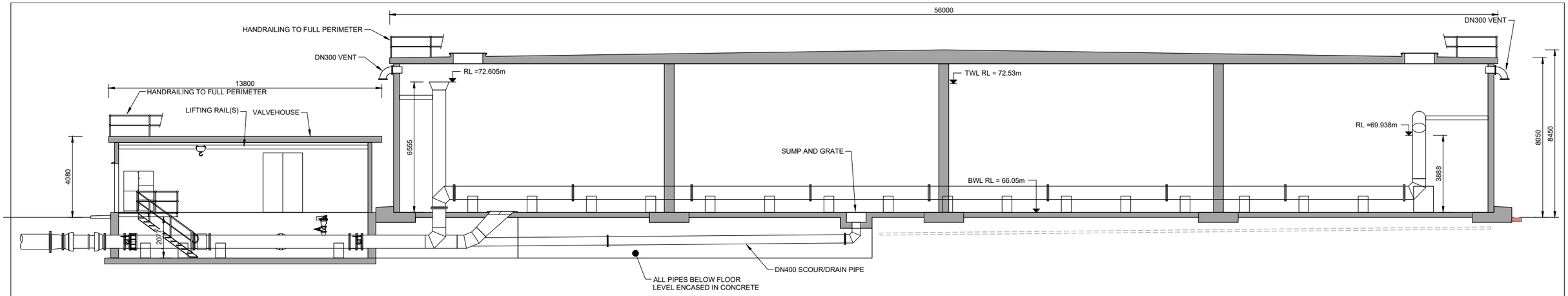
DOCUMENT PATH: \\CORP.PBWAN.NET\ANZ\PROJECTS\NZ3\W3-WW021.02 NAENAE NO.2 RESERVOIR\HOME\700 DRAWINGS

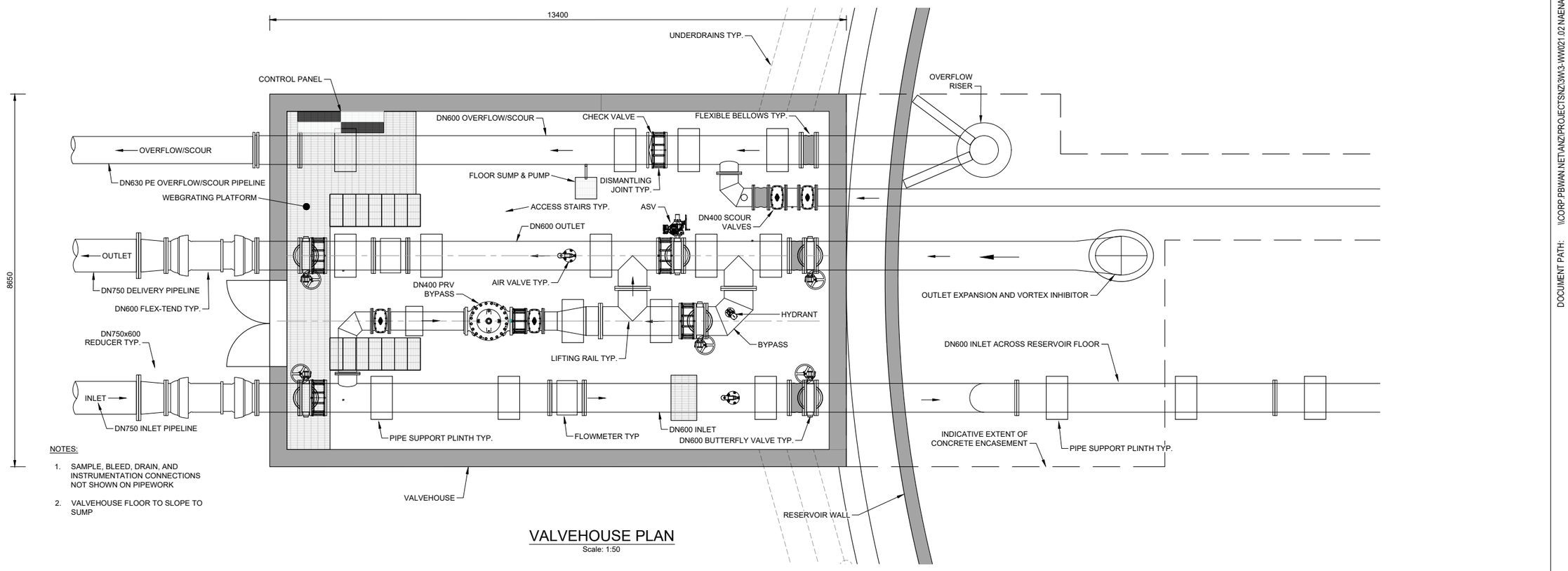
DOCUMENT NO: 3-WW021.02_W002.DWG

DO NOT SCALE - IF IN DOUBT ASK

PLOTTED BY: BIRDLING, GREG

DRAWING PLOTTED: 27-Jul-23





NOTES:

1. SAMPLE, BLEED, DRAIN, AND INSTRUMENTATION CONNECTIONS NOT SHOWN ON PIPEWORK
2. VALVEHOUSE FLOOR TO SLOPE TO SUMP

VALVEHOUSE PLAN

Scale: 1:50

A1 REPRODUCTION SCALE
100 80 60 40 20 0mm

A3 REPRODUCTION SCALE
50 40 30 20 10 0mm

0 5 10 15 20 25
SCALE 1:500 AT ORIGINAL SIZE

FOR INFORMATION
NOT FOR CONSTRUCTION

No.	Revision	By	Chk	Appd	Date
2	ISSUED FOR INFORMATION	G.B.	L.H.	J.L.	28/07/23
1	ISSUED WITH CONCEPT DESIGN - FINAL	G.B	L.H.	J.L.	03/03/23
0	ISSUED FOR INFORMATION	G.B.	L.H.	J.L.	07/12/22

Drawing Originator
Connect Water
c/- WSP
PO Box 12-003 Thorndon
Wellington 6144
T 64 4 471 7000

Original Scale (A1) AS SHOWN	Design	G.B.	28/07/23
	Drawn	G.B.	28/07/23
Reduced Scale (A3) 1/2 SHOWN	Dsg Verifier	L.H.	28/07/23
	Dwg Check	L.H.	28/07/23

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

Client: Wellington Water

Project: WELLINGTON WATER
EASTERN HILLS RESERVOIR

Title: RESERVOIR PIPEWORK
VALVEHOUSE LAYOUT

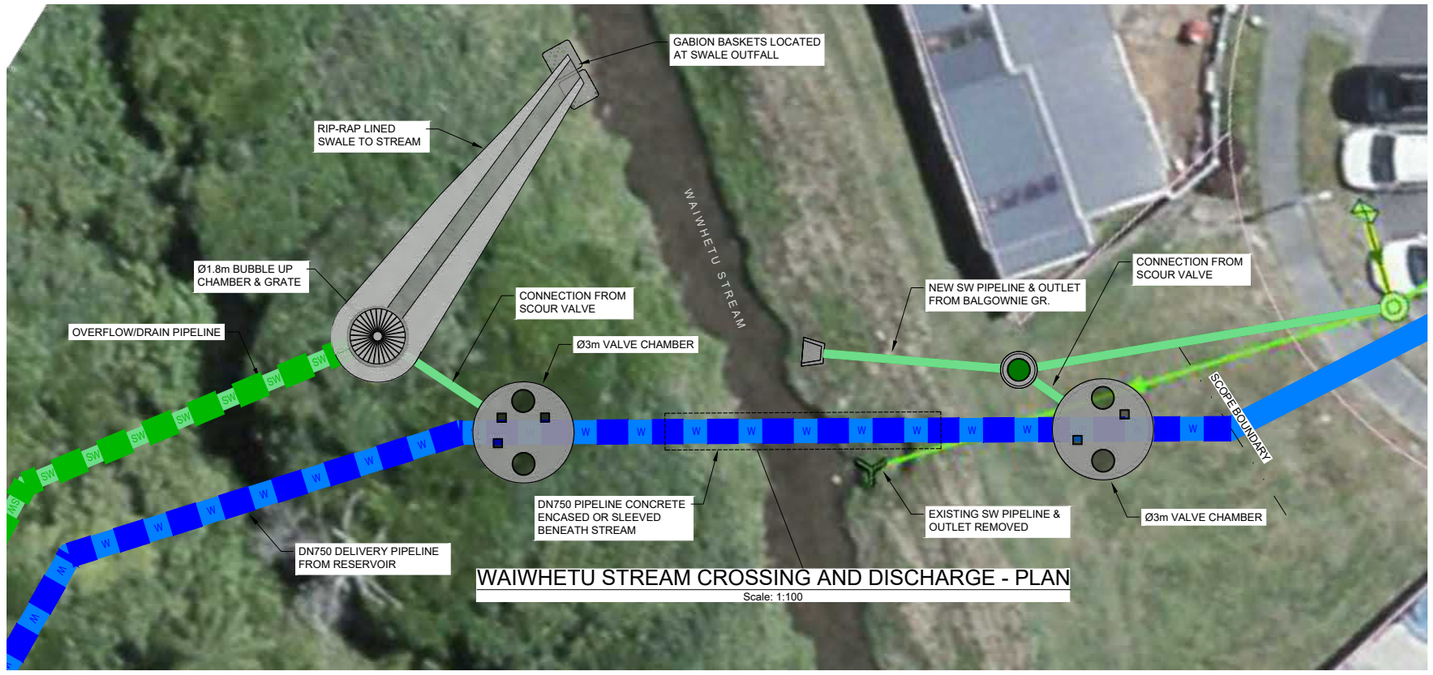
Discipline: CIVIL
Drawing No.: 3-WW021.02_W003
Rev.: 2

DOCUMENT PATH: \\CORP.PBWAN.NET\ANZ\PROJECTS\NZ\3W\3-WW\021.02 NAENAE NO.2 RESERV\OIR\HOME\700 DRAWINGS
DOCUMENT NO: 3-WW021.02_W003.DWG

PLOTTED BY: BIRDLING, GREG

DO NOT SCALE - IF IN DOUBT ASK

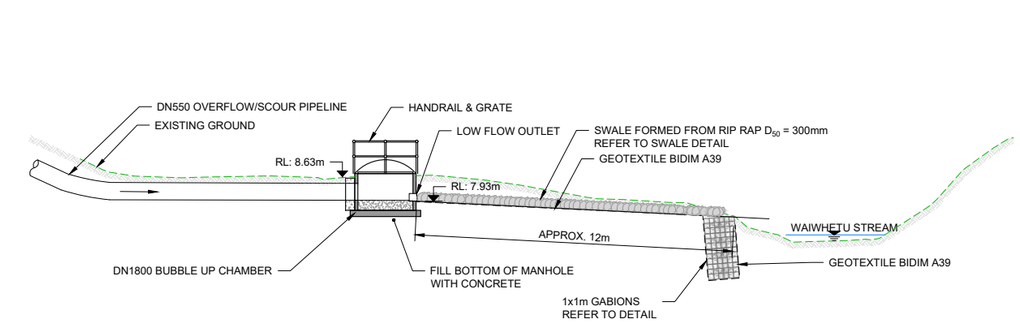
DRAWING PLOTTED: 21-Jun-23



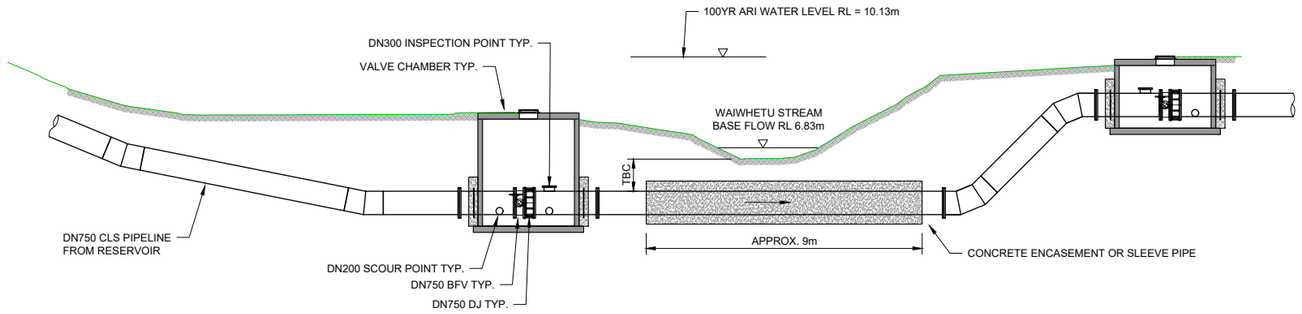
WAIWHETU STREAM CROSSING AND DISCHARGE - PLAN
Scale: 1:100

NOTES
1. DETAILED DESIGN TO CONSIDER THE SHAPE OF THE GROUND AROUND THE BUBBLE UP CHAMBER TO ENSURE DISPATCHED WATER IS CAPTURED AND REDIRECTED INTO THE SWALE.

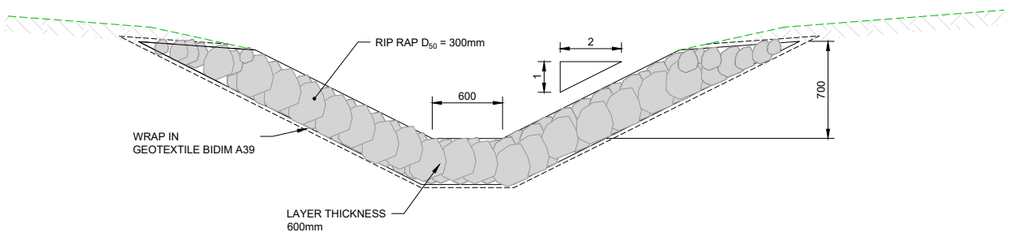
2. LOW FLOW OUTLET FROM BUBBLE UP CHAMBER TO BE SIZED IN DETAILED DESIGN.



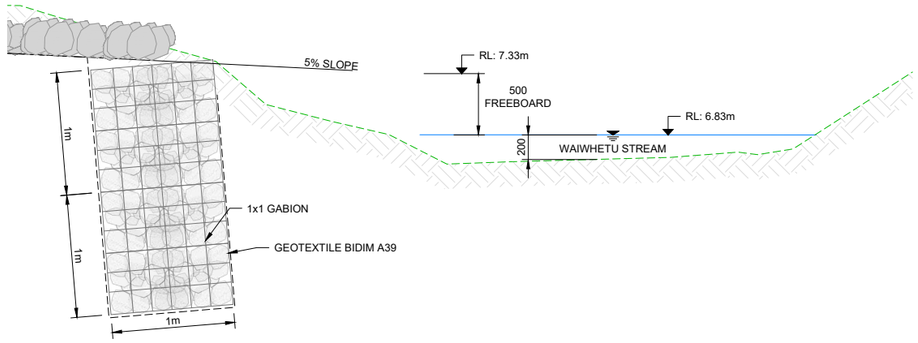
OVERFLOW/SCOUR DISCHARGE ELEVATION
Scale: 1:100



WAIWHETU STREAM CROSSING - BURIED OPTION
Scale: 1:100



SWALE DETAIL
Scale: 1:20



GABION DETAIL
Scale: 1:25

SCALE 1:20 AT ORIGINAL SIZE
SCALE 1:25 AT ORIGINAL SIZE
SCALE 1:100 AT ORIGINAL SIZE

FOR INFORMATION
NOT FOR CONSTRUCTION

No.	Revision	By	Chk	Appd	Date
2	ISSUED FOR INFORMATION	G.H.	L.H.	J.L.	28/07/23
1	ISSUED WITH CONCEPT DESIGN - FINAL	G.B	L.H.	J.L.	03/03/23
0	ISSUED FOR INFORMATION	G.B.	L.H.	J.L.	07/12/22

Drawing Originator: Connect Water — Connect Water d- WSP, PO Box 12-003 Thorndon, Wellington 6144, T 64 4 471 7000

Original Scale (A1) AS SHOWN	Design	T.G.	28/07/23
	Drawn	G.B.	28/07/23
Reduced Scale (A3) 1/2 SHOWN	Dsg Verifier	G.B.	28/07/23
	Dwg Check	L.H.	28/07/23

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

Client: Wellington Water

Project: WELLINGTON WATER
EASTERN HILLS RESERVOIR

Title: RESERVOIR PIPEWORK
WAIWHETU STREAM CROSSING
AND DISCHARGE

Discipline: CIVIL

Drawing No.: 3-WW021.02_W004

Rev.: 2

PLOTTED BY: PIETERSEN, RIAAN

DO NOT SCALE - IF IN DOUBT ASK

DRAWING PLOTTED: 21-Jun-23

DOCUMENT PATH: \\CORPPANZ\PROJECTS\NZ\3W\3-WW021.02 NAENAE NO.2 RESERV\OIR\HOME\700 DRAWINGS

DOCUMENT NO: 3-WW021.02_W004.DWG

A1 REPRODUCTION SCALE

A3 REPRODUCTION SCALE

On this drawing I would leave the boundary line type the same as the other boundaries i.e. white

VALVEHOUS

DN300 NAENAE RESERVOIR OVERFLOW/SCOUR PIPE CONNECTION REFER TO LONG SECTION ON 3-WW021.02_W013

SUMMIT RD

DN750 RESERVOIR INLET PIPE

CONNECTION TO EXISTING DN300 NAENAE RESERVOIR OVERFLOW/SCOUR PIPE

CONNECTION TO EXISTING DN750 BULK WATER MAIN REFER TO DETAIL A, DWG 3-WW021.02_W008

VALVE CHAMBER

CONNECTION TO DN150 SUMMIT RD MAIN

CONNECTION FOR FUTURE NAENAE RESERVOIR REPLACEMENT

VALVE HOUSE

EXISTING NAENAE RESERVOIR 11.3ML

CONNECTION TO DN40 FARRELLY GRV MAIN

REINSTATE OR REPLACE FIRE HYDRANT

FARRELLY GRV

REPLACE EXISTING DN150 MAIN ALONG FARRELLY GROVE

SCOUR TO SW

DN100 SCOUR VALVE

DN500 DELIVERY PIPE

CONNECTION TO DN40 FARRELLY GRV MAIN

CONNECTION TO EXISTING NAENAE RESERVOIR DN450 DELIVERY PIPE DETAIL B, DWG 3-WW021.02_W008

REMOVE EXISTING SW MANHOLE, REPLACE WITH DN300 PIPE

CONSTRUCTION PLATFORM RL:66m

Make the colour the same as the pipe line type on the drawing (legend is lighter orange)

WW SERVICES LEGEND

NEW WATER MAIN	W
EXISTING WATER MAIN	W
NEW STORMWATER	SW
EXISTING STORMWATER	SW
NEW SEWER	
EXISTING SEWER	SS
PARCEL BOUNDARY	
VALVE NEW OR EX / REDUNDANT	V V
HYDRANT NEW OR EX /REDUNDANT	FH FH
NEW SW MANHOLE	
EXISTING SW MANHOLE	
NEW 400V CABLE	400V
EXISTING 400V CABLE	400V

A1 REPRODUCTION SCALE
100 80 60 40 20 0mm

A3 REPRODUCTION SCALE
50 40 30 20 10 0mm

0 2.5 5 7.5 10 12.5
SCALE 1:250 AT ORIGINAL SIZE

FOR INFORMATION
NOT FOR CONSTRUCTION

No.	Revision	By	Chk	Appd	Date
1	UPDATED POST INDEPENDENT REVIEW	G.H.	G.B.	J.L.	29/09/23
0	ISSUED FOR INFORMATION	G.H.	G.B.	J.L.	18/08/23

Drawing Originator: Connect Water, c/- WSP, PO Box 12-003 Thorndon, Wellington 6144, T 64 4 471 7000

Original Scale (A1) 1:750	Design	L.H.	29/09/23
	Drawn	G.H.	29/09/23
	Dsg Verifier	G.B.	29/09/23
Reduced Scale (A3) 1:1500	Dwg Check	J.L.	29/09/23

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

Client: Wellington Water

Project: WELLINGTON WATER
EASTERN HILLS RESERVOIR

Title: SITE PIPELINES
SUMMIT ROAD

Discipline: CIVIL

Drawing No.: 3-WW021.02_W007

Rev.: 1

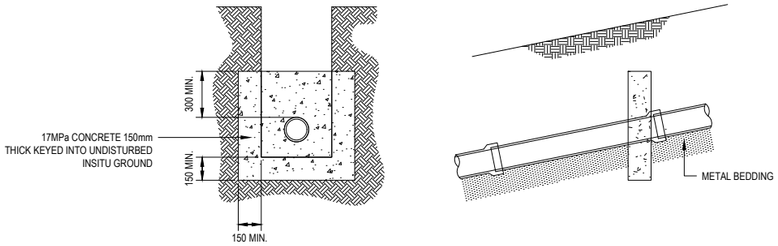
DOCUMENT PATH: \\CORP\ANZ\PROJECTS\NZ3W3-WW021.02 NAENAE NO.2 RESERVOIR\HOME\700 DRAWINGS

DOCUMENT NO.: 3-WW021.02_W007.DWG

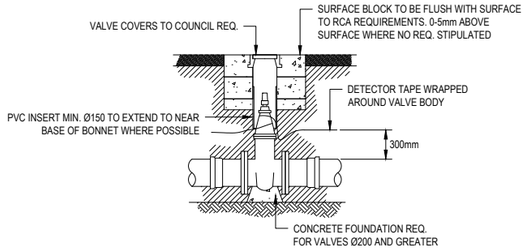
DO NOT SCALE - IF IN DOUBT ASK

PLOTTED BY: PIETERSEN, RIAAN

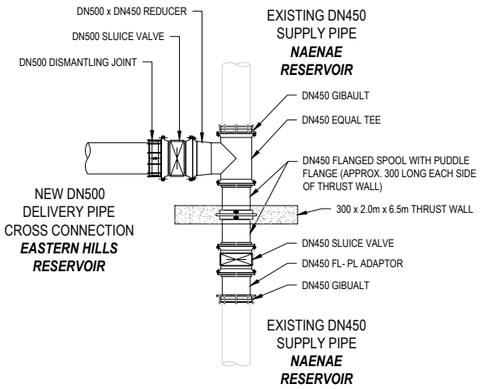
DRAWING PLOTTED: 27-Jul-23



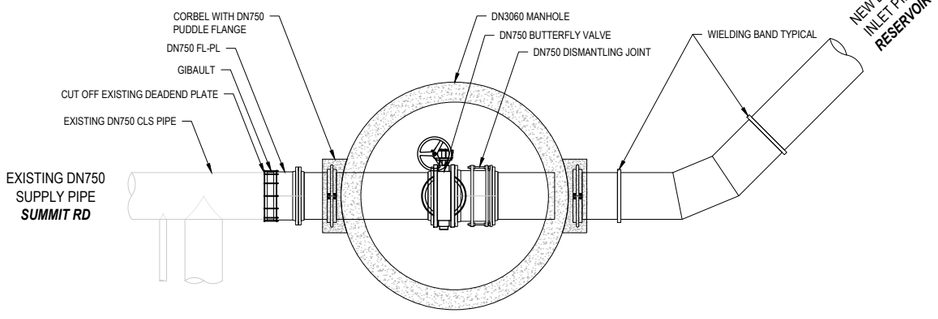
TYPICAL WATERSTOP DETAIL



GATE VALVES
Ø80 AND ABOVE



DETAIL B: CONNECTION TO NAENAE RESERVOIR
N.T.S.



DETAIL A: CONNECTION TO EXISTING INLET MAIN
N.T.S.

A1 REPRODUCTION SCALE
100 80 60 40 20 0mm

A3 REPRODUCTION SCALE
50 40 30 20 10 0mm

FOR INFORMATION
NOT FOR CONSTRUCTION

No.	Revision	By	Chk	Appd	Date
1	ISSUED FOR INFORMATION	G.H.	G.B.	G.B.	28-07-23

Drawing Originator: Connect Water
c/- WSP
PO Box 12-003 Thorndon
Wellington 6144
T 64 4 471 7000

Original Scale (A1)	N.T.S.		
Reduced Scale (A3)	N.T.S.		
Design	T.G.	28/07/23	Approved For Construction*
Drawn	G.H.	28/07/23	-
Dsg Verifier	GB.	28/07/23	
Dwg Check	L.H	28/07/23	Date-

* Refer to Revision 1 for Original Signature

Client: Wellington Water

Project: WELLINGTON WATER
EASTERN HILLS RESERVOIR

Title: RESERVOIR AND SITE PIPELINES
PIPELINE - TYPICAL DETAILS

Discipline: CIVIL

Drawing No.: 3-WW021.02_W008

Rev.: 1

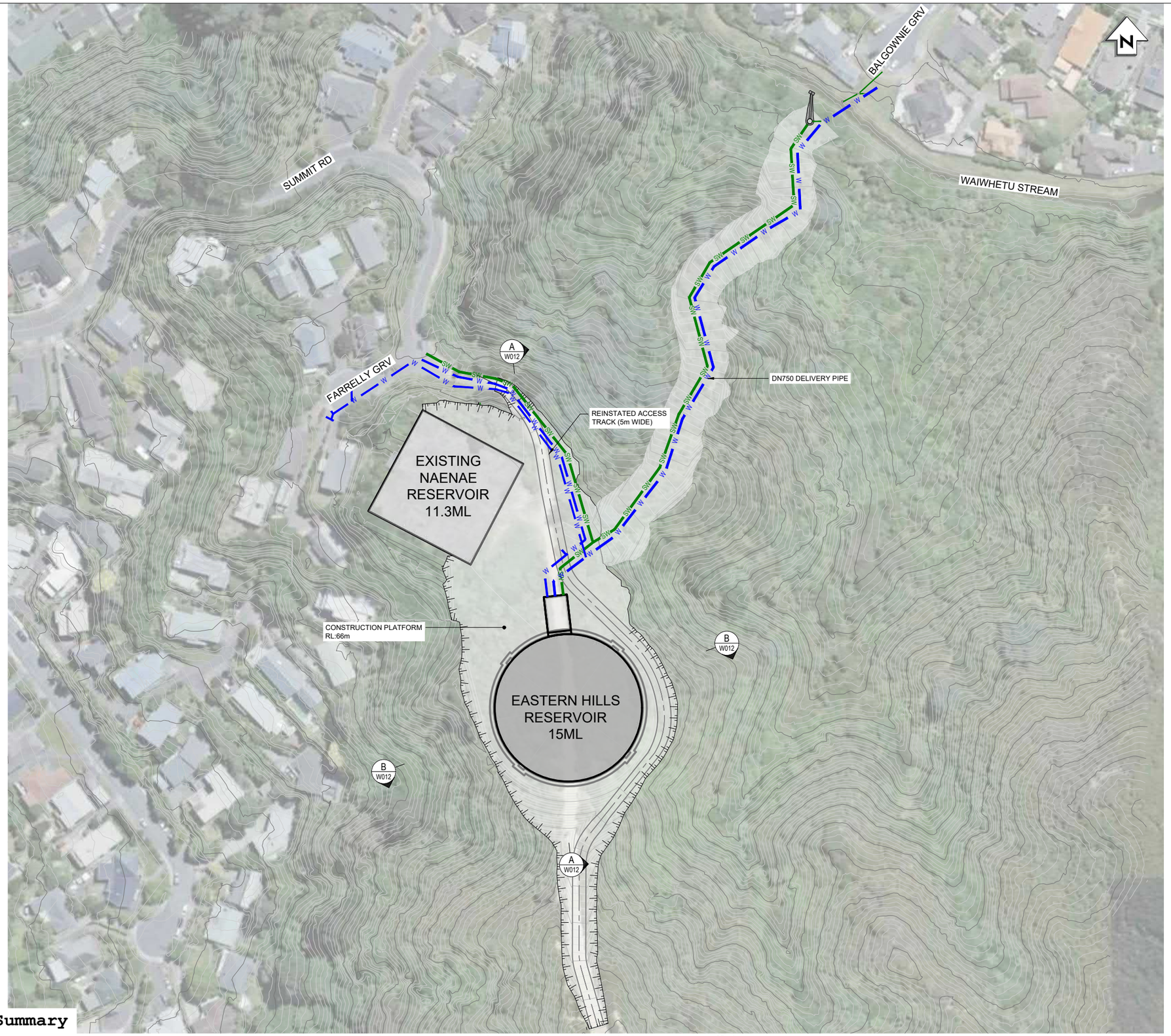
DOCUMENT PATH: \\CORP\ANZ\PROJECTS\NZ3\W3-WW021.02 NAENAE NO.2 RESERVOIR\HOME\700 DRAWINGS

DOCUMENT NO: 3-WW021.02_W008.DWG

DO NOT SCALE - IF IN DOUBT ASK

PLOTTED BY: HAMBLYN, GARTH

DRAWING PLOTTED: 22-Jun-23



NOTES:

1. DO NOT SCALE OFF DRAWINGS.
2. NEW SLOPE BATTERS 1H:1V
3. FOR EARTHWORKS SECTION REFER TO 3-WW021.02_W0W12

LEGEND

WATER SUPPLY (PROPOSED

DELIVERY / INLET PIPE — W W

OVERFLOW / SCOUR DISCHARGE PIPE — SW

0 5 10 15 20 25 30 35

SCALE 1:750 AT ORIGINAL SIZE

A1 REPRODUCTION SCALE

100 80 60 40 20 0mm

A3 REPRODUCTION SCALE

50 40 30 20 10 0mm

Cut/Fill Summary

Name	Cut Factor	Fill Factor	2d Area	Cut	Fill	Net
Totals			14417.91sq.m	90473.91 Cu. M.	398.00 Cu. M.	90075.90 Cu. M.<Cut>

FOR INFORMATION
NOT FOR CONSTRUCTION

No.	Revision	By	Chk	Appd	Date
1	UPDATED POST INDEPENDENT REVIEW	G.H.	J.L.	J.L.	29/09/23
0	ISSUED FOR INFORMATION	G.H.	J.L.	J.L.	18/08/23

Drawing Originator: Connect Water — c/- WSP, PO Box 12-003 Thorndon, Wellington 6144, T 64 4 471 7000

Original Scale (A1) 1:750
Reduced Scale (A3) 1:1500

Design	L.H.	29/09/23
Drawn	G.H.	29/09/23
Dsg Verifier	G.B.	29/09/23
Dwg Check	J.L.	29/09/23

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

Client: Wellington Water

Project: WELLINGTON WATER
EASTERN HILLS RESERVOIR

Title: RESERVOIR AND SITE PIPELINES
EARTHWORKS

Discipline: CIVIL

Drawing No.: 3-WW021.02_W010

Rev.: 1

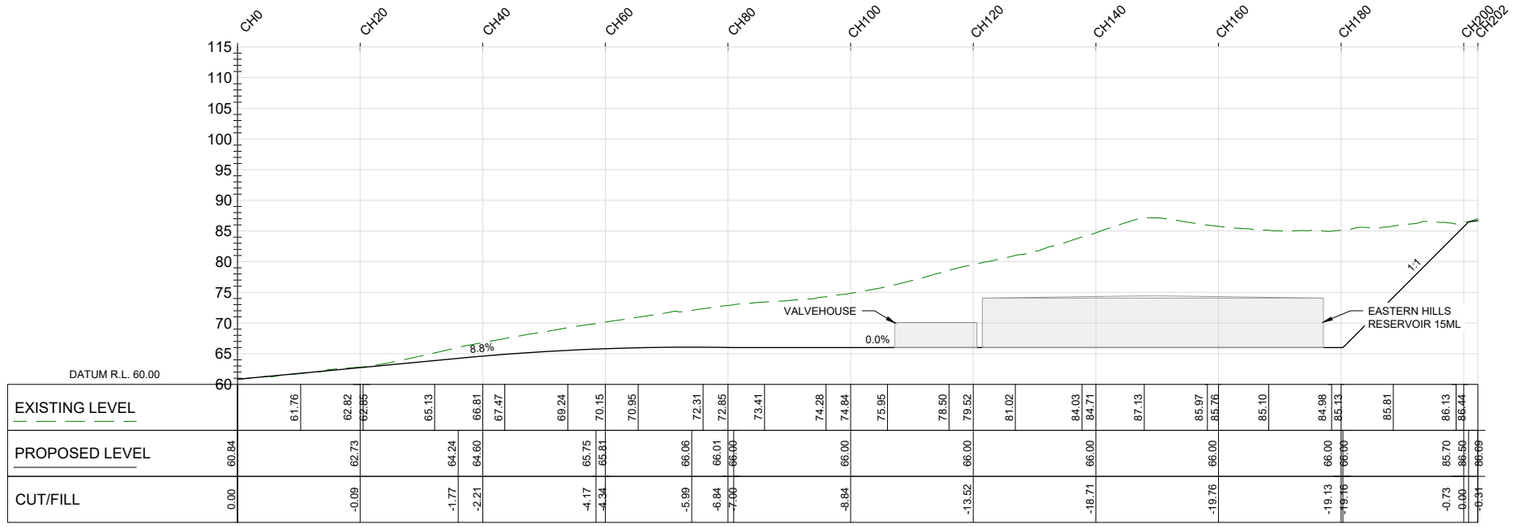
DOCUMENT PATH: \\CORP\ANZ\PROJECTS\NZ3\W3-WW021.02 NAENAE NO.2 RESERVOIR\HOME\700 DRAWINGS

DOCUMENT NO: 3-WW021.02_W010.DWG

PLOTTED BY: PIETERSEN, RIAAN

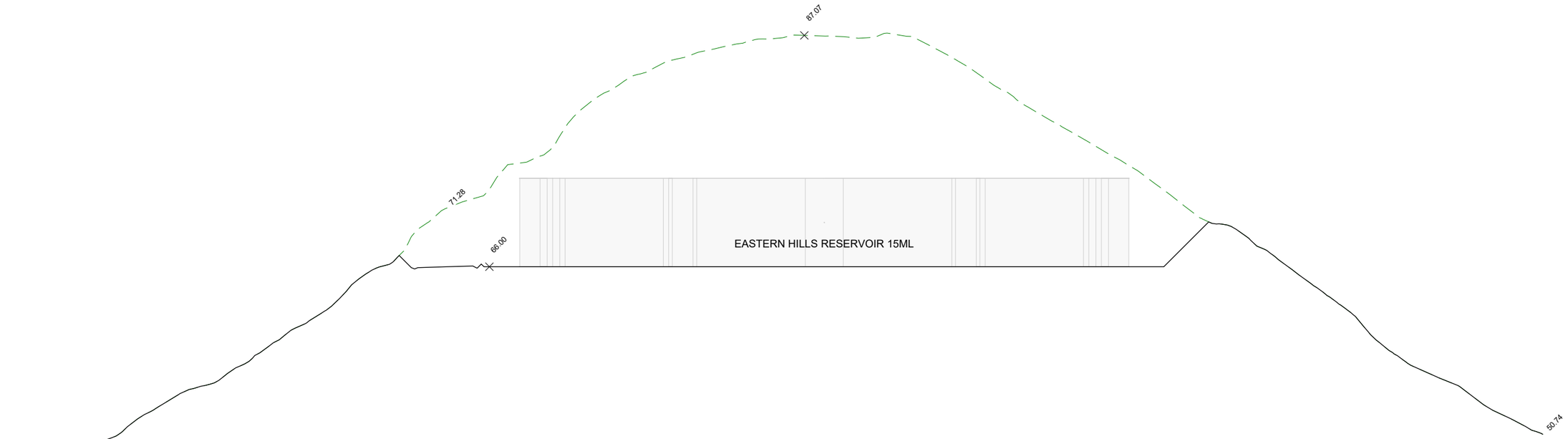
DO NOT SCALE - IF IN DOUBT ASK

DRAWING PLOTTED: 27-Jul-23



0 5 10 15 20 25
SCALE 1:500 AT ORIGINAL SIZE

EARTHWORKS SECTION A-A
1:500 A1
1:1000 A3



EARTHWORKS SECTION B-B
1:200 A1
1:400 A3

0 2 4 6 8 10
SCALE 1:200 AT ORIGINAL SIZE

A1 REPRODUCTION SCALE
A3 REPRODUCTION SCALE

FOR INFORMATION
NOT FOR CONSTRUCTION

No.	Revision	By	Chk	Appd	Date
0	ISSUED FOR INFORMATION	G.H.	J.L.	J.L.	28/07/23

Drawing Originator: Connect Water, c/- WSP, PO Box 12-003 Thorndon, Wellington 6144, T 64 4 471 7000

Original Scale (A1) AS SHOWN	Design	L.H.	28/07/23
	Drawn	G.H	28/07/23
	Dsg Verifier	G.B.	28/07/23
Reduced Scale (A3) AS SHOWN	Dwg Check	J.L.	28/07/23

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

Client: Wellington Water

Project: WELLINGTON WATER
EASTERN HILLS RESERVOIR

Title: GENERAL OVERVIEW
RESERVOIR LONGITUDINAL SECTIONS

Discipline: CIVIL

Drawing No.: 3-WW021.02_W011

Rev.: 0

DOCUMENT NO: 3-WW021.02_W011.DWG

DOCUMENT PATH: \\CORP\ANZ\PROJECTS\NZ3\W3-WW021.02 NAENAE NO.2 RESERVOIR\HOME\700 DRAWINGS

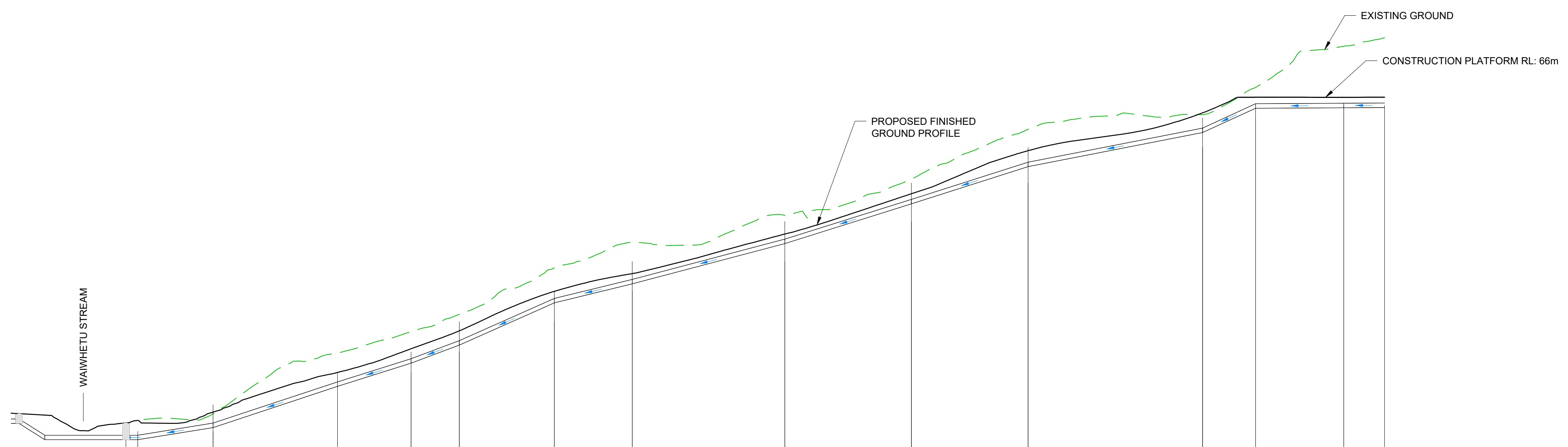
PLOTTED BY: HAMBLYN, GARTH

DO NOT SCALE - IF IN DOUBT ASK

DRAWING PLOTTED: 29-MAY-23

NOTES:

1. DO NOT SCALE OFF DRAWINGS.
2. REFER TO GENERAL AND STANDARD NOTES AND LEGENDS ON DRAWING: 3-WW021.02_C001
3. COORDINATES ARE IN TERMS OF WELLINGTON CIRCUIT 2000 (NZGD2K.WELLINGTON).
4. LEVELS ARE IN TERMS OF METRES ABOVE NZVD2016 DATUM.
5. WATER STOPS WITH SUBSOIL DRAINS TO BE INSTALLED IN THE SHARED TRENCH FORM THE DISTANCE 23.39 - 220.11. SPACING TO BE IN ACCORDANCE WITH TABLE 4-8 OF THE REGIONAL STANDARD. WATER STOP TO BE AS PER DR03.



GROUND LEVEL (m)	8.80	8.80	10.27	10.27	17.30	17.30	21.48	21.48	24.66	24.66	31.65	31.65	34.78	34.78	41.78	41.78	48.91	48.91	56.53	56.53	63.23	63.23	65.99	65.99	65.98	65.98	65.99
DEPTH TO INVERT (m)	3.97	3.40	2.72	2.72	2.46	2.46	2.54	2.54	2.52	2.52	2.04	2.04	1.80	1.80	1.68	1.68	1.78	1.78	2.82	2.82	3.48	3.48	1.94	1.94	1.84	1.84	1.81
PIPE INVERT LEVEL (m)	5.40	5.40	7.54	7.54	14.84	14.84	18.94	18.94	22.14	22.14	29.61	29.61	32.97	32.97	40.10	40.10	47.13	47.13	53.72	53.72	59.74	59.74	64.05	64.05	64.14	64.14	64.18
DISTANCE (m)	20.39	22.39	35.72	35.72	57.72	57.72	70.74	70.74	79.27	79.27	96.08	96.08	109.85	109.85	136.84	136.84	159.24	159.24	179.87	179.87	210.72	210.72	220.11	220.11	235.70	235.70	242.93

GRADIENT	0.00% (Horizontal)	16.12% (1:6)	33.15% (1:3)	31.48% (1:3)	37.52% (1:3)	44.45% (1:2)	24.42% (1:4)	26.39% (1:4)	31.38% (1:3)	31.94% (1:3)	19.53% (1:5)	45.90% (1:2)	0.55% (1:182)	0.55% (1:182)
PIPE SIZE	DN750	DN750	DN750	DN750	DN750	DN750	DN750	DN750	DN750	DN750	DN750	DN750	DN750	DN750

LONGITUDINAL PROFILE 0.0 m TO 242.9 m

HORIZONTAL SCALE 1:500 @ A1
VERTICAL SCALE 1:500 @ A1

DN750 DELIVERY PIPELINE LONGITUDINAL SECTION

A1 REPRODUCTION SCALE: 50, 40, 30, 20, 10, 0mm

A3 REPRODUCTION SCALE

0 5 10 15 20 25
SCALE 1:500 AT ORIGINAL SIZE

FOR INFORMATION
NOT FOR CONSTRUCTION

No.	Revision	By	Chk	Appd	Date
1	UPDATED POST INDEPENDENT REVIEW	G.H.	G.B.	J.L.	29/09/23
0	ISSUED FOR INFORMATION	G.H.	G.B.	J.L.	18/08/23

Drawing Originator: Connect Water, c/- WSP, PO Box 12-003, Thorndon, Wellington 6144, T 64 4 471 7000

Original Scale (A1) 1:750
Reduced Scale (A3) 1:1500

Design	L.H.	29/09/23
Drawn	G.H.	29/09/23
Dsg Verifier	J.L.	29/09/23
Dwg Check	L.H	29/09/23

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

Client: Wellington Water

Project: WELLINGTON WATER
EASTERN HILLS RESERVOIR

Title: LONG SECTION
DELIVERY PIPELINE

Discipline: CIVIL

Drawing No.: 3-WW021.02_W012 Rev.: 1

DOCUMENT PATH: \\CORP\ANZ\PROJECTSNZ\3\W3-WW021.02 NAENAE NO.2 RESERVOIR\HOME\700 DRAWINGS

DOCUMENT NO: 3-WW021.02_W012.DWG

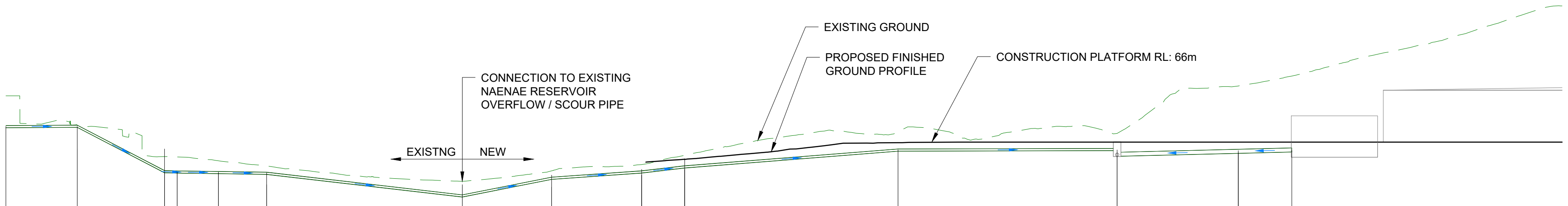
PLOTTED BY: PIETERSEN, RIAAN

DO NOT SCALE - IF IN DOUBT ASK

DRAWING PLOTTED: 30-Jun-23

NOTES:

1. DO NOT SCALE OFF DRAWINGS.
2. REFER TO GENERAL AND STANDARD NOTES AND LEGENDS ON DRAWING: 3-WW021.02_C001
3. COORDINATES ARE IN TERMS OF WELLINGTON CIRCUIT 2000 (NZGD2K.WELLINGTON).
4. LEVELS ARE IN TERMS OF METRES ABOVE NZVD2016 DATUM.
5. LONG SECTION OF EXISTING DN300 NAENAE RESERVOIR SCOUR/OVERFLOW PIPE IS ASSUMED INVERT LEVEL BASED ON HCC INFORMATION.
6. FROM DISTANCE 11.46 - 192.55 WATER STOPS WITH SUBSOIL DRAINS TO BE INSTALLED IN THE SHARED TRENCH. SPACING TO BE IN ACCORDANCE WITH TABLE 4-8 OF THE REGIONAL STANDARD. WATER STOP TO BE AS PER DR03.



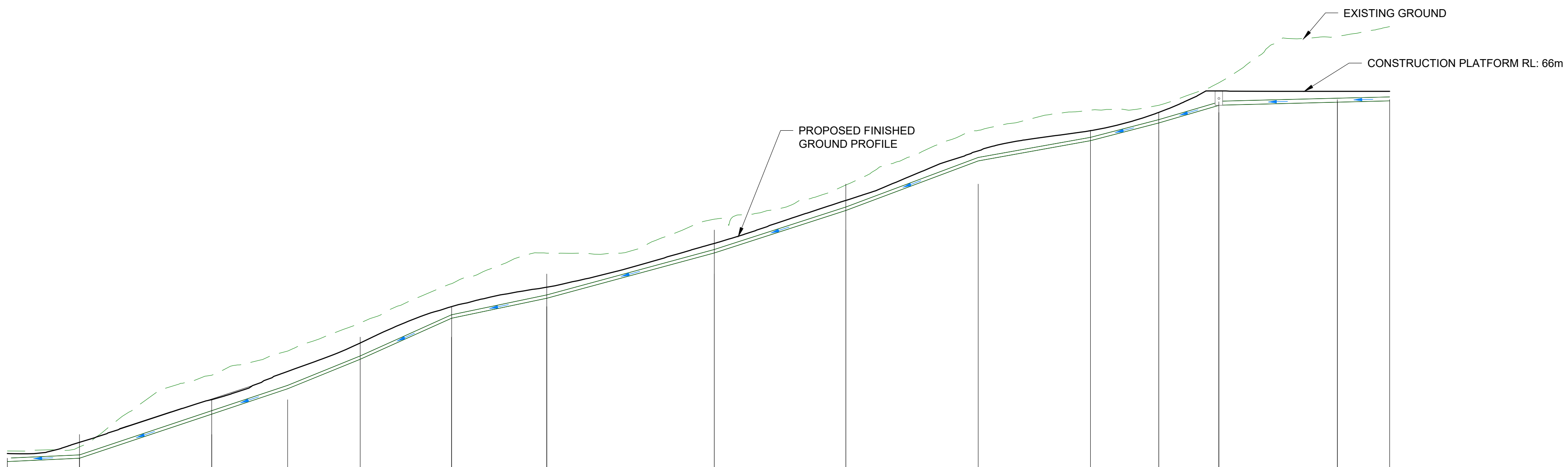
GROUND LEVEL (m)	DEPTH TO INVERT (m)	PIPE INVERT LEVEL (m)	DISTANCE (m)
73.18	4.93	68.24	0.00
68.59	0.28	68.30	11.10
68.59	0.28	68.30	11.10
63.75	2.51	61.25	24.67
63.69	2.50	61.29	26.63
63.69	2.50	61.19	26.63
63.09	1.97	61.11	33.04
63.09	1.97	61.11	33.04
62.30	1.31	60.99	40.52
59.89	2.42	57.47	197.38
62.30	1.30	60.99	211.39
59.89	2.42	57.47	70.95
61.53	1.30	60.22	84.84
61.53	1.30	60.22	84.84
62.51	1.30	61.20	98.81
62.51	1.30	61.20	98.81
63.29	1.30	61.99	105.51
63.29	1.30	61.99	105.51
65.92	1.32	64.60	138.68
65.92	1.32	64.60	138.68
66.03	1.35	64.68	172.73
66.03	2.25	63.79	192.55
65.98	1.73	64.26	211.39
65.98	1.73	64.26	211.39
65.99	1.52	64.47	219.71

GRADIENT	PIPE SIZE
-0.55% (-1:182)	DN300
52.00% (1:2)	DN300
2.84% (1:35)	DN3(
1.22% (1:82)	DN300
1.60% (1:62)	DN300
11.57% (1:9)	DN300
-19.80% (-1:5)	DN300
-7.01% (-1:14)	DN300
-11.77% (-1:8)	DN300
-7.87% (-1:13)	DN300
-0.24% (-1:411)	DN300
2.50% (1:40)	DN600
2.50% (1:40)	DN600

LONGITUDINAL PROFILE 0.0 m TO 241.9 m

HORIZONTAL SCALE 1:500 @ A1
VERTICAL SCALE 1:500 @ A1

DN300 NAENAE SCOUR PIPE LONGITUDINAL SECTION



GROUND LEVEL (m)	DEPTH TO INVERT (m)	PIPE INVERT LEVEL (m)	DISTANCE (m)
8.42	1.26	7.16	0.00
10.22	2.54	7.68	11.46
10.22	2.54	7.68	11.46
16.98	2.29	14.69	32.48
16.98	2.29	14.69	32.48
21.47	2.75	18.73	44.55
25.99	2.58	23.41	56.08
31.77	1.84	29.94	70.61
31.77	1.84	29.94	70.61
34.87	1.77	33.10	85.74
34.87	1.77	33.10	85.74
41.81	1.50	40.31	112.37
41.81	1.50	40.31	112.37
48.65	1.59	47.06	133.28
48.65	1.59	47.06	133.28
56.53	1.59	54.93	154.31
59.72	1.58	58.14	172.15
62.64	1.68	60.95	183.02
62.64	1.68	60.95	183.02
66.03	2.28	63.76	192.55
66.03	2.25	63.79	192.55
65.98	1.73	64.26	211.39
65.98	1.73	64.26	211.39
65.99	1.52	64.47	219.71

GRADIENT	PIPE SIZE
4.51% (1:22)	DN500
33.36% (1:3)	DN500
33.40% (1:3)	DN500
44.95% (1:2)	DN500
20.91% (1:5)	DN500
27.08% (1:4)	DN500
32.26% (1:3)	DN500
37.46% (1:3)	DN500
25.86% (1:4)	DN500
29.39% (1:3)	DN500
2.50% (1:40)	DN600
2.50% (1:40)	DN600

LONGITUDINAL PROFILE 0.0 m TO 219.7 m

HORIZONTAL SCALE 1:500 @ A1
VERTICAL SCALE 1:500 @ A1

EASTERN HILLS RESERVOIR OVERFLOW/SCOUR PIPE LONGITUDINAL SECTION

0 5 10 15 20 25
SCALE 1:500 AT ORIGINAL SIZE

A1 REPRODUCTION SCALE: 0mm 20 40 60 80 100
A3 REPRODUCTION SCALE: 0mm 10 20 30 40 50

FOR INFORMATION
NOT FOR CONSTRUCTION

No.	Revision	By	Chk	Appd	Date
1	UPDATED POST INDEPENDENT REVIEW	G.H.	L.H.	J.L.	29/09/23
0	ISSUED FOR INFORMATION	G.H.	L.H.	J.L.	18/08/23

Drawing Originator: Connect Water, c/- WSP, PO Box 12-003, Thorndon, Wellington 6144, T 64 4 471 7000

Original Scale (A1) 1:750
Reduced Scale (A3) 1:1500

Design	T.G.	29/09/23
Drawn	G.H.	29/09/23
Dsg Verifier	L.H.	29/09/23
Dwg Check	L.H	29/09/23

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

Client: Wellington Water

Project: WELLINGTON WATER EASTERN HILLS RESERVOIR

Title: LONG SECTION OVERFLOW / SCOUR CONNECTION EXISTING DN300 EW FARRELLY GRV

Discipline: CIVIL
Drawing No. 3-WW021.02_W013
Rev. 1

DOCUMENT PATH: \\CORP\ANZ\PROJECTS\NZ\3\W3-WW021.02 NAENAE NO.2 RESERVOIR\HOME\700 DRAWINGS
DOCUMENT NO: 3-WW021.02_W013.DWG

PLOTTED BY: PIETERSEN, RIAAN
DO NOT SCALE - IF IN DOUBT ASK
DRAWING PLOTTED: 25-Jul-23

NOTES:

1. DO NOT SCALE OFF DRAWINGS.

WW SERVICES LEGEND

- NEW STORMWATER — SW
- EXISTING STORMWATER — SW
- NEW STORMWATER V-CHANNEL
- STORMWATER FLOW ARROW
- STORMWATER MANHOLE

A1 REPRODUCTION SCALE
100 80 60 40 20 0mm

A3 REPRODUCTION SCALE
50 40 30 20 10 0mm

No.	Revision	By	Chk	Appd	Date
0	UPDATED POST INDEPENDENT REVIEW	G.H.	J.D.	J.L.	29/09/23

Drawing Originator: Connect Water
c/- WSP
PO Box 12-003 Thorndon
Wellington 6144
T 64 4 471 7000

Original Scale (A1) 1:750
Reduced Scale (A3) 1:1500

Design	T.G.	29/09/23	Approved For Construction*
Drawn	G.H.	29/09/23	"
Dsg Verifier	J.D.	29/09/23	
Dwg Check	J.D.	29/09/23	Date-

* Refer to Revision 1 for Original Signature

Client: Wellington Water

Project: WELLINGTON WATER
EASTERN HILLS RESERVOIR

Title: SITE STORMWATER PLAN
PRELIMINARY DESIGN

Discipline: CIVIL
Drawing No.: 3-WW021.02_W014
Rev.: 0

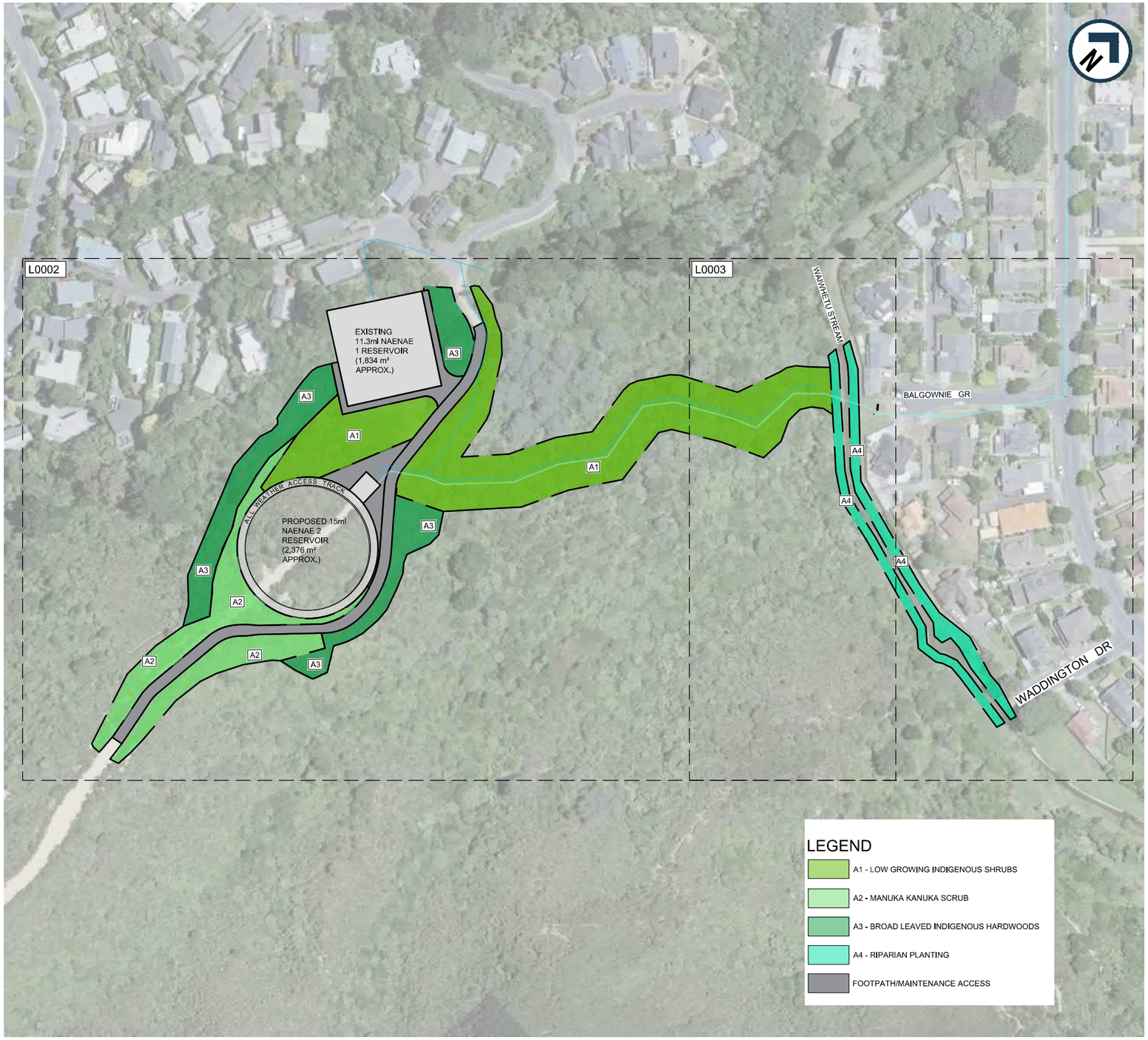
FOR INFORMATION
NOT FOR CONSTRUCTION

DOCUMENT NO: 3-WW021.02_W014.DWG
DOCUMENT PATH: \\CORP\ANZ\PROJECTS\NZ3W3-WW021.02 NAENAE NO.2 RESERVOIR\HOME\700 DRAWINGS

DO NOT SCALE - IF IN DOUBT ASK

PLOTTED BY: PIETERSEN, RIAAN

DRAWING PLOTTED: 18-Jul-23



CONCEPT LANDSCAPE PLAN

1:1000 @ A1, 1:2000 @ A3

A1 1:1000 / A3 1:2000 — 0 10 20 30 40 50m

NOTES:

Indicative Only - to be confirmed after vegetation losses have been assessed during the construction phase

No trees to be placed over the pipe alignment, only shrubs or grasses.

Where possible, all native species to be eco-sourced from the ecological areas.

All plants to be placed in a quincunx arrangement. Confirm set out with landscape architect or ecologist prior to undertaking any planting work.

All vegetation removal to be in accordance with the vegetation management plan.

PLANT SCHEDULE

Botanical Name	Common Name	Quantity	Size	Spacing
A1 - LOW GROWING INDIGENOUS SHRUBS		7178m2		
Asplenium bulbiferum gracillimum	Fern	373	1.5L	5% @ 1m oc
Astelia fragrans	Bush Astelia	746	2.5L	10% @ 1m oc
Coprosma autumnalis	Kanono	94	3L	5% @ 2m oc
Coprosma lucida	Karamu	94	2.5L	5% @ 2m oc
Coprosma robusta	Karamu	94	2.5L	5% @ 2m oc
Dianella nigra	Ink Berry	896	1.5L	12% @ 1m oc
Freycinetia banksii	KieKie	299	2.5L	4% @ 1m oc
Geniostoma ligustrifolium	Hangehange	75	1L	4% @ 2m oc
Leptospermum scoparium	Manuka	112	2.5L	6% @ 2m oc
Muehlenbeckia australis	Pohuehue	280	2.5L	15% @ 2m oc
Myrsine australis	Red matipo	19	2.5L	4% @ 4m oc
Phormium tenax	Harakeke	187	2.5L	10% @ 2m oc
Piper excelsum	Kawakawa	94	2.5L	5% @ 2m oc
Veronica salicifolia	Koromiko	332	2.5L	10% @ 1.5m oc
A2 - MANUKA/KANUKA SHRUB		3804.5m2		
Austroderia toetoe	New Zealand Toetoe	99	2.5L	10% @ 2m oc
Gahnia setifolia	Mapere	44	2.5L	10% @ 3m oc
Kunzea robusta	Kanuka	95	2.5L	60% @ 5m oc
Leptospermum scoparium	Manuka	16	5L	10% @ 5m oc
Pteridium esculentum	Bracken Fern	44	5L	10% @ 3m oc
A3 - INDIGENOUS HARDWOODS		3004.37m2		
Alectryon excelsus	Titoki	4	5L	3% @ 5m oc
Alsophila tricolor	Silver fern	28	5L	8% @ 3m oc
Aristotelia serrata	Makomako	63	2.5L	8% @ 2m oc
Beilschmiedia tawa	Tawa	4	5L	3% @ 5m oc
Brachyglottis repanda	Hedge Ragwort	14	1.5L	4% @ 3m oc
Cordyline australis	Cabbage Tree	24	2.5L	3% @ 2m oc
Corynocarpus laevigatus	Karaka	20	2.5L	10% @ 4m oc
Elaeocarpus dentatus	Hinau	14	2.5L	4% @ 3m oc
Fuchsia excorticata	Tree Fuchsia	42	2.5L	12% @ 3m oc
Fuscospora truncata	Whairaunui	6	2.5L	3% @ 4m oc
Griselinia littoralis	Broadleaf	32	2.5L	4% @ 2m oc
Knightia excelsa	Rewarewa	5	2.5L	4% @ 5m oc
Kunzea robusta	Kanuka	21	2.5L	6% @ 3m oc
Laurelia novae-zelandiae	Pukatea	6	2.5L	3% @ 4m oc
Melicytus ramiflorus	Whitey Wood	11	2.5L	3% @ 3m oc
Metrosideros robusta	Northern Rata	4	5L	3% @ 5m oc
Pittosporum eugenioides	Lemonwood	14	2.5L	4% @ 3m oc
Pseudopanax arboreus	Five Finger	28	2.5L	8% @ 3m oc
Pterophylla racemosa	Kamahi	14	2.5L	4% @ 3m oc
Sphaeropteris medullaris	Black Tree Fern	24	1.5L	3% @ 2m oc
A4 - RIPARIAN PLANTING		1658m2		
Aristotelia serrata	Makomako	77	2.5L	10% @ 1.5m oc
Carex secta	Sedge	345	2.5L	20% @ 1m oc
Cordyline australis	Cabbage Tree	22	2.5L	5% @ 2m oc
Juncus edgariae	Wiwi Rush	154	2.5L	20% @ 1.5m oc
Macropiper excelsum	Kawakawa	44	2.5L	10% @ 2m oc
Phormium tenax	New Zealand Flax	65	2.5L	15% @ 2m oc
Typha orientalis	Oriental Cattail	154	2.5L	20% @ 1.5m oc

A1 REPRODUCTION SCALE: 0mm 20 40 60 80 100

A3 REPRODUCTION SCALE: 0mm 10 20 30 40 50

No.	Revision	By	Chk	Appd	Date
2	ISSUED FOR REVIEW	M.P	A.K.	J.L.	27/09/23
1	ISSUED WITH CONCEPT DESIGN - FINAL	N.O.	A.K.	J.L.	06/03/23
0	ISSUED FOR INFORMATION	N.O.	A.K.	J.L.	07/12/22

Drawing Originator: Connect Water c/- WSP, PO Box 12-003 Thorndon, Wellington 6144, T 64 4 471 7000

Original Scale (A1) 1:1000 — Reduced Scale (A3) 1/2 SHOWN

Design	M.P	27.09.23	Approved For Construction*
Drawn	H.S.	27.09.23	
Dsg Verifier	A.K.	27.09.23	
Dwg Check	A.K.	27.09.23	Date

* Refer to Revision 1 for Original Signature

Client: Wellington Water

Project: WELLINGTON WATER EASTERN HILLS RESERVOIR

Title: LANDSCAPE CONCEPT PLAN SHEET 01 OF 03

Discipline: LANDSCAPE ARCHITECTURE

Drawing No.: 3-WW021.02_L0001

Rev.: 2

DO NOT SCALE - IF IN DOUBT ASK

A1 - LOW GROWING INDIGENOUS SHRUBS (1,466 m²)
(77) Asplenium bulbiferum gracillimum
(153) Astelia fragrans
(20) Coprosma autumnalis
(20) Coprosma lucida
(20) Coprosma robusta
(183) Dianella nigra
(61) Freycinetia banksii
(16) Geniostoma ligustrifolium
(23) Leptospermum scoparium
(58) Muehlenbeckia australis
(4) Myrsine australis
(39) Phormium tenax
(20) Piper excelsum
(68) Veronica salicifolia

A3 - INDIGENOUS HARDWOODS (494 m²)
(1) Alectryon excelsus
(5) Alsophila tricolor
(11) Aristotelia serrata
(1) Beilschmiedia tawa
(3) Brachyglottis repanda
(4) Cordyline australis
(4) Corynocarpus laevigatus
(3) Elaeocarpus dentatus
(7) Fuchsia excorticata
(1) Fuscospora truncata
(6) Griselinia littoralis
(1) Knightia excelsa
(4) Kunzea robusta
(1) Laurelia novae-zelandiae
(2) Melicytus ramiflorus
(1) Metrosideros robusta
(3) Pittosporum eugenioides
(5) Pseudopanax arboreus
(3) Pterophylla racemosa
(4) Sphaeropteris medullaris

EXISTING
11.3ml NAENAE
1 RESERVOIR
(1,834 m²
APPROX.)

WAIWHETU STREAM

A3 - INDIGENOUS HARDWOODS (1,380 m²)
(2) Alectryon excelsus
(13) Alsophila tricolor
(29) Aristotelia serrata
(2) Beilschmiedia tawa
(7) Brachyglottis repanda
(11) Cordyline australis
(9) Corynocarpus laevigatus
(7) Elaeocarpus dentatus
(20) Fuchsia excorticata
(3) Fuscospora truncata
(15) Griselinia littoralis
(3) Knightia excelsa
(10) Kunzea robusta
(3) Laurelia novae-zelandiae
(5) Melicytus ramiflorus
(2) Metrosideros robusta
(7) Pittosporum eugenioides
(13) Pseudopanax arboreus
(7) Pterophylla racemosa
(11) Sphaeropteris medullaris

BENCH SEAT

ALL WEATHER ACCESS TRACK

PROPOSED 15ml
NAENAE 2
RESERVOIR
(2,376 m²
APPROX.)

A1 - LOW GROWING INDIGENOUS SHRUBS (5,723 m²)
(296) Asplenium bulbiferum gracillimum
(593) Astelia fragrans
(74) Coprosma autumnalis
(74) Coprosma lucida
(74) Coprosma robusta
(713) Dianella nigra
(238) Freycinetia banksii
(59) Geniostoma ligustrifolium
(89) Leptospermum scoparium
(222) Muehlenbeckia australis
(15) Myrsine australis
(148) Phormium tenax
(74) Piper excelsum
(264) Veronica salicifolia

A2 - MANUKA/KANUKA SHRUB (1,659 m²)
(44) Austroderia toetoe
(20) Gahnia setifolia
(42) Kunzea robusta
(7) Leptospermum scoparium
(20) Pteridium esculentum

A3 - INDIGENOUS HARDWOODS (943 m²)
(2) Alectryon excelsus
(9) Alsophila tricolor
(20) Aristotelia serrata
(2) Beilschmiedia tawa
(5) Brachyglottis repanda
(8) Cordyline australis
(7) Corynocarpus laevigatus
(5) Elaeocarpus dentatus
(14) Fuchsia excorticata
(2) Fuscospora truncata
(10) Griselinia littoralis
(2) Knightia excelsa
(7) Kunzea robusta
(2) Laurelia novae-zelandiae
(4) Melicytus ramiflorus
(2) Metrosideros robusta
(5) Pittosporum eugenioides
(9) Pseudopanax arboreus
(5) Pterophylla racemosa
(8) Sphaeropteris medullaris

A2 - MANUKA/KANUKA SHRUB (1,020 m²)
(27) Austroderia toetoe
(12) Gahnia setifolia
(26) Kunzea robusta
(5) Leptospermum scoparium
(12) Pteridium esculentum

A1
A2
A3
A4

LEGEND
- A1 - LOW GROWING INDIGENOUS SHRUBS
- A2 - MANUKA KANUKA SCRUB
- A3 - BROAD LEAVED INDIGENOUS HARDWOODS
- A4 - RIPARIAN PLANTING
- FOOTPATH/MAINTENANCE ACCESS

A1 REPRODUCTION SCALE
100 80 60 40 20 0mm

A3 REPRODUCTION SCALE
50 40 30 20 10 0mm

CONCEPT LANDSCAPE PLAN

1:500 @ A1, 1:1000 @ A3

A1 1:500
A3 1:1000
0 20m

No.	Revision	By	Chk	Appd	Date
0	ISSUED FOR REVIEW	H.S	A.K.	J.L.	27/09/23

Drawing Originator: Connect Water
WSP
PO Box 12-003 Thorndon
Wellington 6144
T 64 4 471 7000

Original Scale (A1) 1:500
Reduced Scale (A3) 1/2 SHOWN

Design	M.P	27.09.23	Approved For Construction*
Drawn	H.S.	27.09.23	
Dsg Verifier	A.K.	27.09.23	
Dwg Check	A.K.	27.09.23	Date

* Refer to Revision 1 for Original Signature

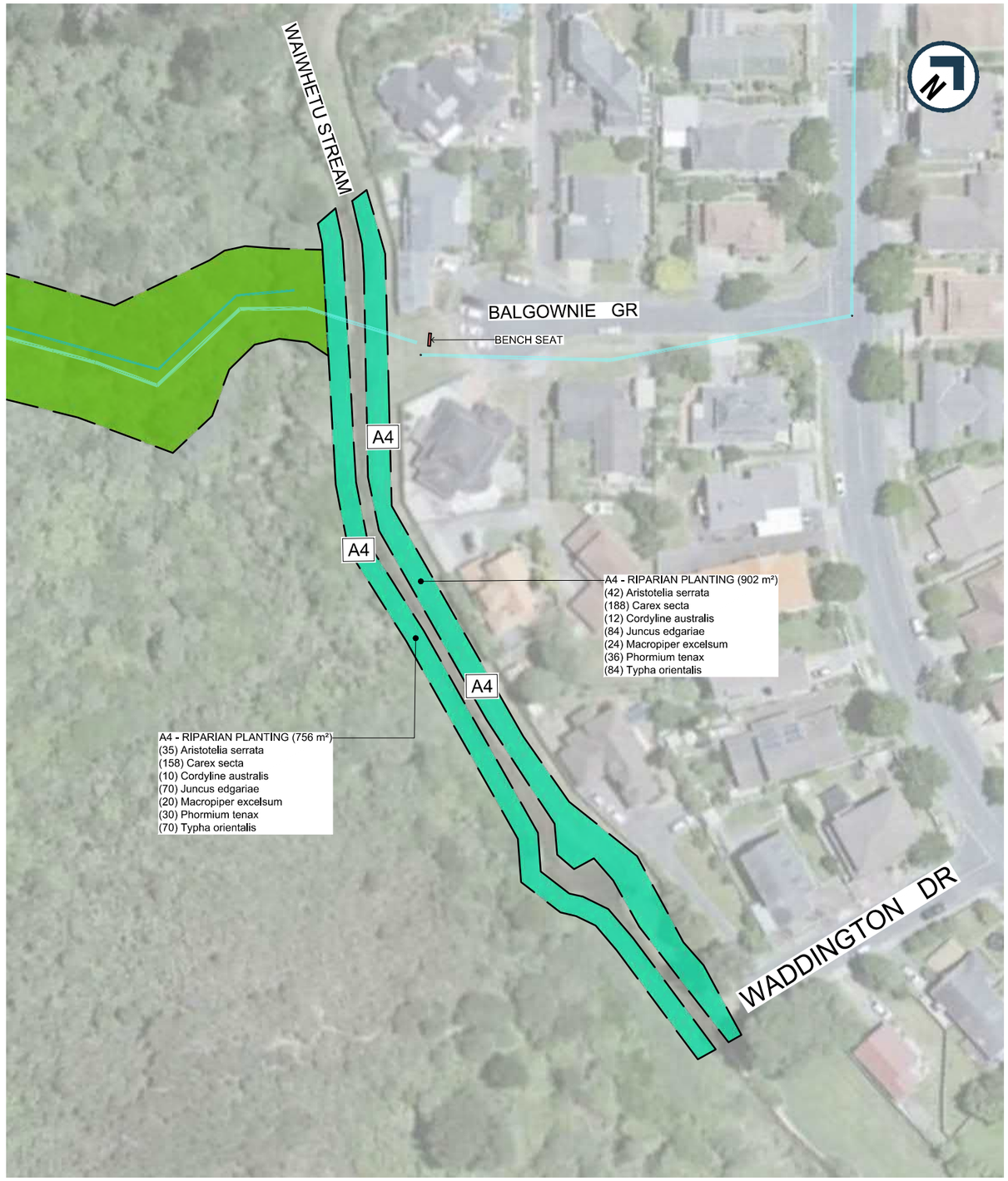
Client: Wellington Water

Project: WELLINGTON WATER
EASTERN HILLS RESERVOIR

Title: LANDSCAPE CONCEPT PLAN
SHEET 02 OF 03

Discipline: LANDSCAPE ARCHITECTURE
Drawing No.: 3-WW021.02_L0002
Rev.: 0

DO NOT SCALE - IF IN DOUBT ASK



LEGEND

- A1 - LOW GROWING INDIGENOUS SHRUBS
- A2 - MANUKA KANUKA SCRUB
- A3 - BROAD LEAVED INDIGENOUS HARDWOODS
- A4 - RIPARIAN PLANTING
- FOOTPATH/MAINTENANCE ACCESS

CONCEPT LANDSCAPE PLAN

1:500 @ A1, 1:1000 @ A3

A1 REPRODUCTION SCALE

100 80 60 40 20 0mm

A3 REPRODUCTION SCALE

50 40 30 20 10 0mm

A1 1:500 | **A3 1:1000** 0 20m

No.	Revision	By	Chk	Appd	Date
0	ISSUED FOR REVIEW	H.S	A.K.	J.L.	27/09/23

Drawing Originator: Connect Water c- WSP, PO Box 13-003 Thorndon, Wellington 6144, T 64 4 471 7000

Original Scale (A1) 1:500
Reduced Scale (A3) 1/2 SHOWN

Design	M.P	27.09.23	Approved For Construction*
Drawn	H.S.	27.09.23	
Dsg Verifier	A.K.	27.09.23	
Dwg Check	A.K.	27.09.23	Date

* Refer to Revision 1 for Original Signature

Client: Wellington Water

Project: WELLINGTON WATER
EASTERN HILLS RESERVOIR

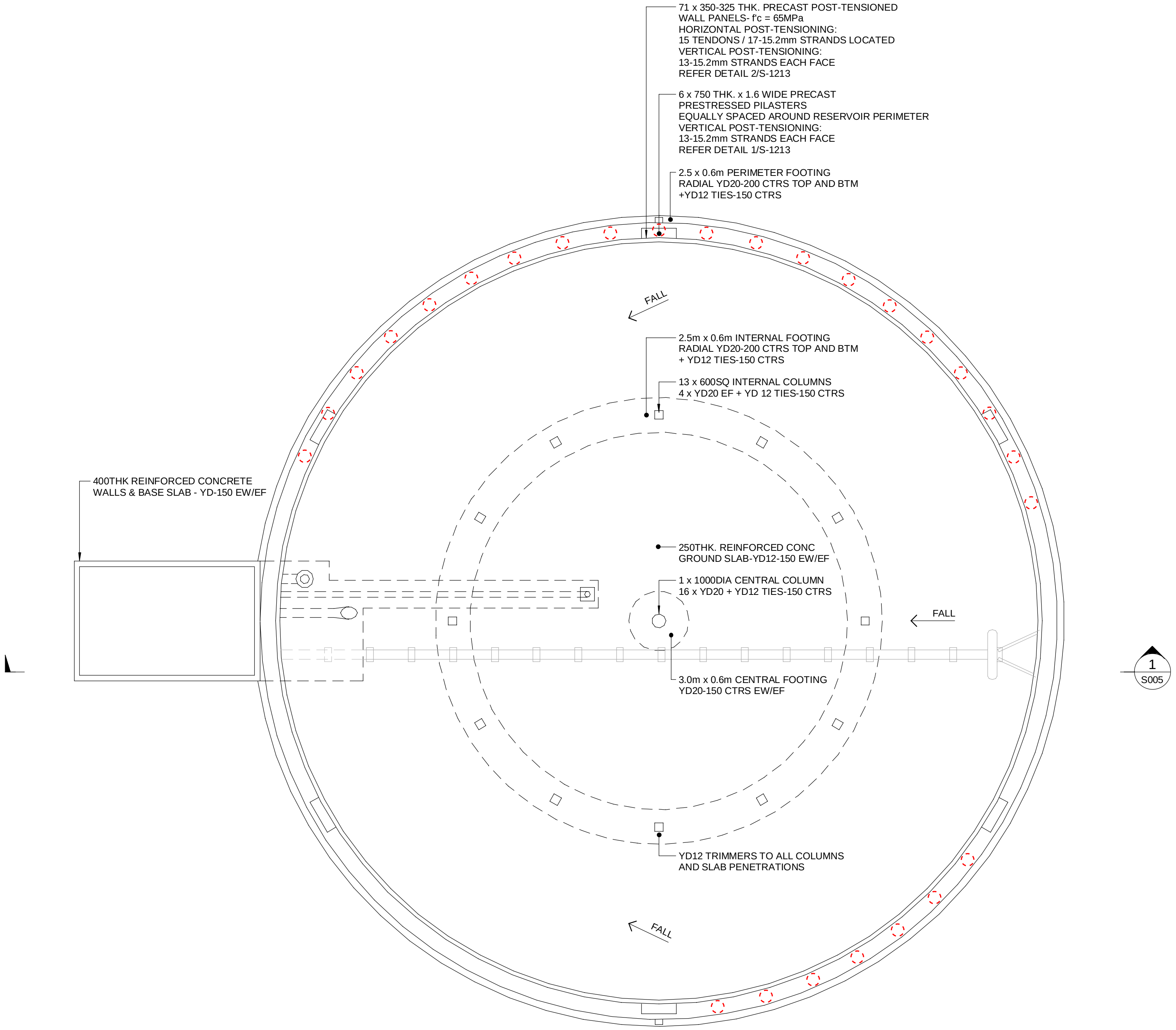
Title: LANDSCAPE CONCEPT PLAN
SHEET 03 OF 03

Discipline: LANDSCAPE ARCHITECTURE

Drawing No.: 3-WW021.02_L0003

Rev.: 0

DO NOT SCALE - IF IN DOUBT ASK



RESERVOIR GROUND FLOOR PLAN

SCALE 1 : 200

DESIGN INFORMATION

CONCRETE STRENGTH

- MINIMUM CONCRETE COMPRESSIVE STRENGTH AT 28 DAYS SHALL BE 65MPa FOR ALL PRECAST UNITS.
- INSITU JOINT BETWEEN PANELS SHALL BE 50MPa AT POST TENSIONING AND 65MPa AT 28 DAYS.

COVER TO REINFORCEMENT

- MINIMUM 50mm TO ALL FACES.

STRESSING AND REINFORCEMENT

- ALL GRADE 500E REINFORCEMENT SHALL BE MICRO ALLOY AND COMPLY WITH AS/NZS4671.

HORIZONTAL POST-TENSIONING :

- ALL STRESSING SHALL BE COMPLETED WITH THE BASE OF THE WALL FREE TO SLIDE.
- THE TENDON SHALL COMPRISE 17-15.2mm DIAMETER SUPERSTAND. SUPERSTRANDS SHALL HAVE A MINIMUM ULTIMATE TENSILE STRENGTH (UTS) OF 261kN/STRAND.

VERTICAL PRESTRESSING :

- THE VERTICAL PRESTRESSING STEEL SHALL BE 12.7mm DIAMETER SUPERSTRAND WITH A MINIMUM ULTIMATE TENSILE STRENGTH OF 184kN/STRAND.

NOTES

1. THIS DESIGN IS IN ACCORDANCE WITH NZS 3101 : PART 1 : 2006 CODE OF PRACTICE FOR THE DESIGN OF CONCRETE STRUCTURES.
2. EPOXY MORTAR TO BE SIKADUR UA OR SIMALAR APPROVED PRODUCT.

LEGEND

C11	600x600 CONC COL.
C21	1000Ø CONC CENTRAL COL.
B11	800x1000 CONC BEAM.
TB11	PRECAST TEE BEAM TYPE 1
TB13	PRECAST TEE BEAM TYPE 2

BORED CAST IN-SITU PILES - NUMBER AND SIZE OF PILES TO BE CONFIRMED.
LENGTH WILL VARY, PILES EMBEDDED 3m NOM. INTO COMPETENT ROCK.

PILECAP TO CONSIST OF NOM. 1.5m DEPTH CONTINUOUS BEAM - REINFORCEMENT TO BE CONFIRMED.

FOR INFORMATION
NOT FOR CONSTRUCTION

No.	Revision	Appd	Date
2	ISSUED FOR INFORMATION	B.L.C	28-07-23
0	ISSUED FOR INFORMATION	B.L.C	7-12-22
1	ISSUED WITH CONCEPT DESIGN - FINAL	B.L.C	3-03-23

Drawing Originator: **Connect Water**
c/- WSP
PO Box 12-003 Thorndon
Wellington 6144
T 64 4 471 7000

Original Scale (A1) AS SHOWN	Design	R.BARTOLOME	28-07-23
	Drawn	C.GONZALEZ	28-07-23
Reduced Scale (A3) 1/2 SHOWN	Dsg Verifier	B.CORNELL	28-07-23
	Dwg Check	K.HAMPSHIRE	28-07-23

*Refer to Revision 1 for Original Signature

Approved For Construction*
Date

Client: Wellington Water

Project: WELLINGTON WATER
EASTERN HILLS RESERVOIR

Title: RESERVOIR AND VALVEHOUSE GENERAL ARRANGEMENT - GROUND LEVEL

Discipline: STRUCTURAL

Drawing No: 3-WW021.02-S001

Rev.: 2

DOCUMENT NO: RESERVOIR.DWG

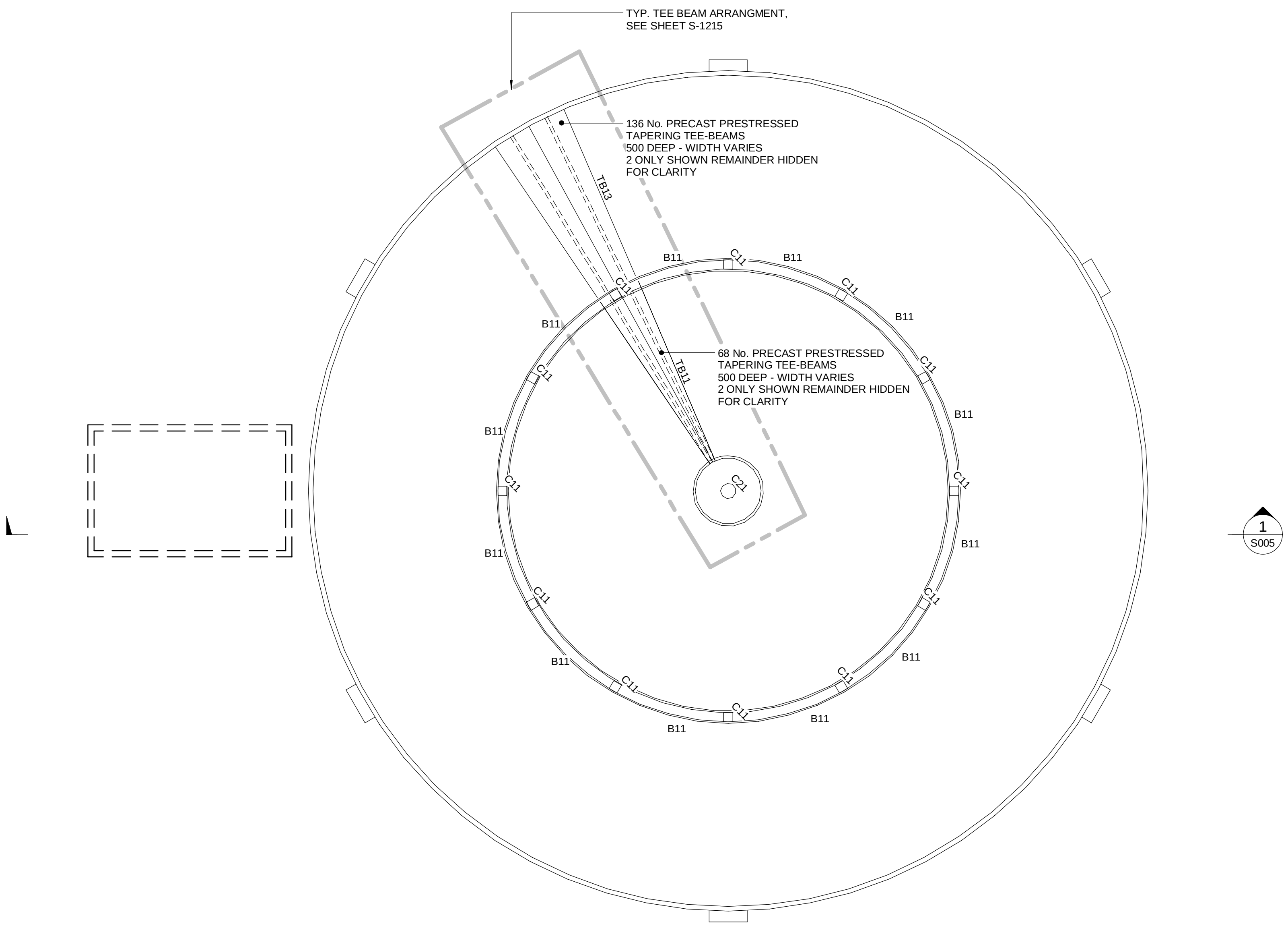
PLOTTED BY: GONZALEZ, CALEB

DO NOT SCALE - IF IN DOUBT ASK

DRAWING PLOTTED: 27/07/2023 3:23:56 pm

A1 REPRODUCTION SCALE: 0mm 20 40 60 80 100

A3 REPRODUCTION SCALE: 0mm 10 20 30 40 50



RESERVOIR ROOF PLAN

SCALE 1 : 200

DESIGN INFORMATION

CONCRETE STRENGTH

- MINIMUM CONCRETE COMPRESSIVE STRENGTH AT 28 DAYS SHALL BE 65MPa FOR ALL PRECAST UNITS.
- INSITU JOINT BETWEEN PANELS SHALL BE 50MPa AT POST TENSIONING AND 65MPa AT 28 DAYS.

COVER TO REINFORCEMENT

- MINIMUM 50mm TO ALL FACES.

STRESSING AND REINFORCEMENT

- ALL GRADE 500E REINFORCEMENT SHALL BE MICRO ALLOY AND COMPLY WITH AS/NZS4671.

HORIZONTAL POST-TENSIONING :

- ALL STRESSING SHALL BE COMPLETED WITH THE BASE OF THE WALL FREE TO SLIDE.
- THE TENDON SHALL COMPRISE 17-15.2mm DIAMETER SUPERSTAND. SUPERSTRANDS SHALL HAVE A MINIMUM ULTIMATE TENSILE STRENGTH (UTS) OF 261kN/STRAND.

VERTICAL PRESTRESSING :

- THE VERTICAL PRESTRESSING STEEL SHALL BE 12.7mm DIAMETER SUPERSTRAND WITH A MINIMUM ULTIMATE TENSILE STRENGTH OF 184kN/STRAND.

NOTES

1. THIS DESIGN IS IN ACCORDANCE WITH NZS 3101 : PART 1 : 2006 CODE OF PRACTICE FOR THE DESIGN OF CONCRETE STRUCTURES.
2. EPOXY MORTAR TO BE SIKADUR UA OR SIMALAR APPROVED PRODUCT.

LEGEND

C11	600x600 CONC COL.
C21	1000Ø CONC CENTRAL COL.
B11	800x1000 CONC BEAM.
TB11	PRECAST TEE BEAM TYPE 1
TB13	PRECAST TEE BEAM TYPE 2

FOR INFORMATION
NOT FOR CONSTRUCTION

No.	Revision	Appd	Date
2	ISSUED FOR INFORMATION	B.L.C	28-07-23
0	ISSUED FOR INFORMATION	B.L.C	7-12-22
1	ISSUED WITH CONCEPT DESIGN - FINAL	B.L.C	3-03-23

Drawing Originator
Connect Water
c/- WSP
PO Box 12-003 Thorndon
Wellington 6144
T 64 4 471 7000

Original Scale (A1) AS SHOWN	Design	R.BARTOLOME	28-07-23
	Drawn	C.GONZALEZ	28-07-23
Reduced Scale (A3)	Dsg Verifier	B.CORNELL	28-07-23
1/2 SHOWN	Dwg Check	K.HAMPSHIRE	28-07-23

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

Client: Wellington Water

Project: WELLINGTON WATER
EASTERN HILLS RESERVOIR

Title: RESERVOIR AND VALVE HOUSE GENERAL ARRANGEMENT - ROOF LEVEL

Discipline: STRUCTURAL

Drawing No: 3-WW021.02-S002

Rev. 2

DOCUMENT NO: RESERVOIR.DWG

DOCUMENT PATH: \\corp.pbwan.net\nz\Projects\NZ\3-WW021.02 ... EASTERN HILLS RESERVOIR

PLOTTED BY: GONZALEZ, CALEB

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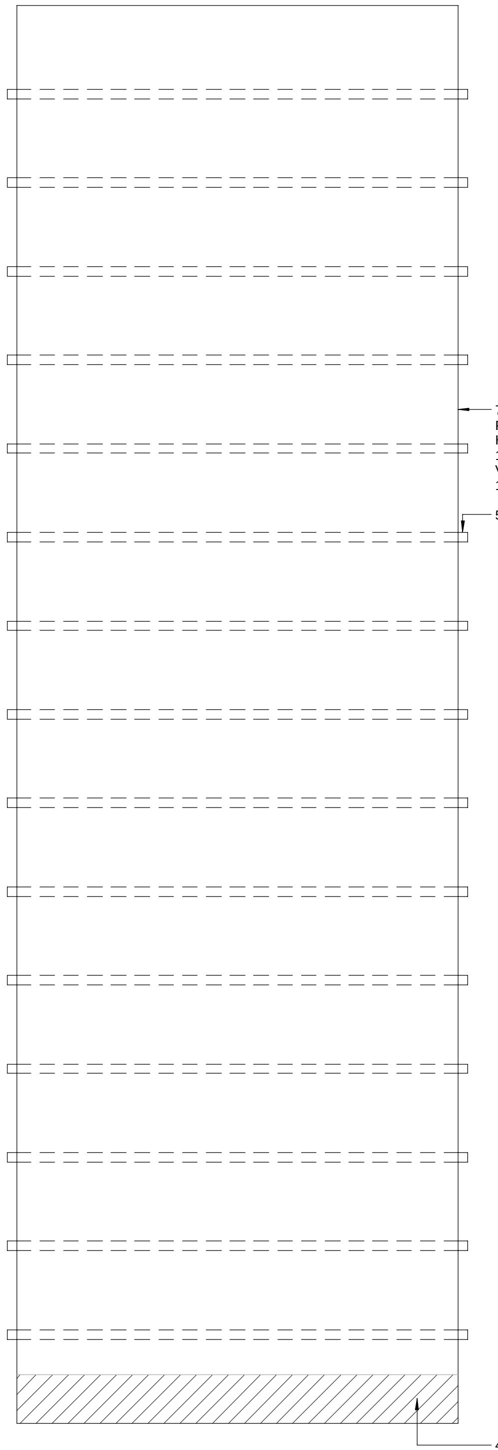
DRAWING PLOTTED: 27/07/2023 3:23:56 pm

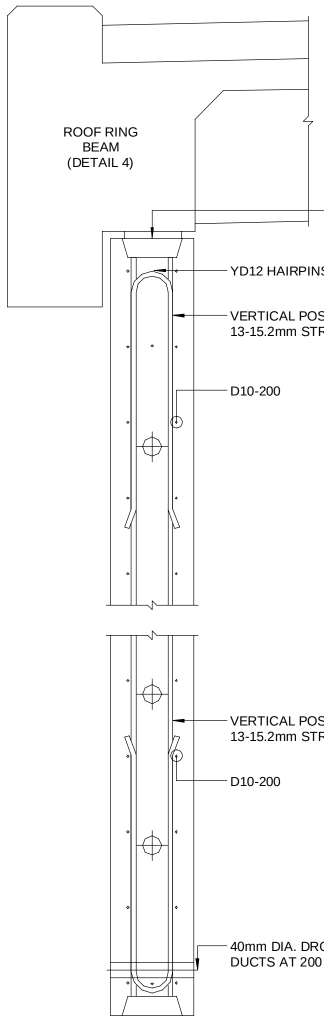
NOTE: THESE ARE REPRESENTATIVE DETAILS ONLY.
DESIGN OF THESE ELEMENTS HAS NOT BEEN CARRIED OUT

A1 REPRODUCTION SCALE 0mm 20 40 60 80 100

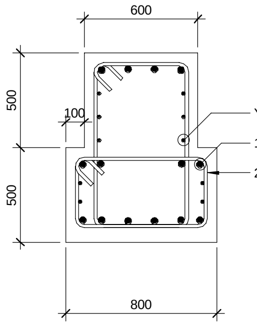
A3 REPRODUCTION SCALE 0mm 10 20 30 40 50



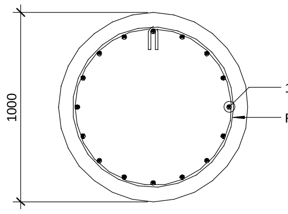
21 SECTION
SCALE 1 : 20
PRECAST PILASTER



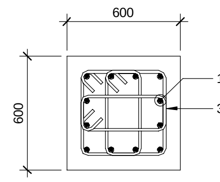
23 DETAIL
S005
SCALE 1 : 10
PRECAST WALL



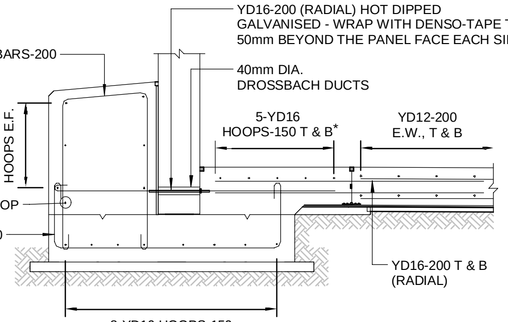
31 SECTION
SCALE 1 : 20
RC BEAM - B1



33 SECTION
SCALE 1 : 20
RC COLUMN - C1



37 SECTION
SCALE 1 : 20
RC COLUMN - C2



25 SECTION
SCALE 1 : 20
EXTERIOR WALL FOUNDATION

FOR INFORMATION
NOT FOR CONSTRUCTION

No.	Revision			Appd	Date
2	ISSUED FOR INFORMATION			B.L.C	28-07-23
0	ISSUED FOR INFORMATION			B.L.C	7-12-22
1	ISSUED WITH CONCEPT DESIGN - FINAL			B.L.C	3-03-23

Drawing Originator: Connect Water c/- WSP, PO Box 12-003 Thorndon, Wellington 6144, T 64 4 471 7000

Original Scale (A1) AS SHOWN	Design	R.BARTOLOME	28-07-23
	Drawn	C.GONZALEZ	28-07-23
Reduced Scale (A3)	Dsg Verifier	B.CORNELL	28-07-23
1/2 SHOWN	Dwg Check	K.HAMPSHIRE	28-07-23

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

Client: Wellington Water

Project: WELLINGTON WATER EASTERN HILLS RESERVOIR

Title: RESERVOIR AND VALVEHOUSE TYPICAL DETAILS SHEET 1 OF 2

Discipline: STRUCTURAL

Drawing No: 3-WW021.02-S003 Rev. 2

DOCUMENT NO: RESERVOIR.DWG

PLOTTED BY: GONZALEZ, CALEB

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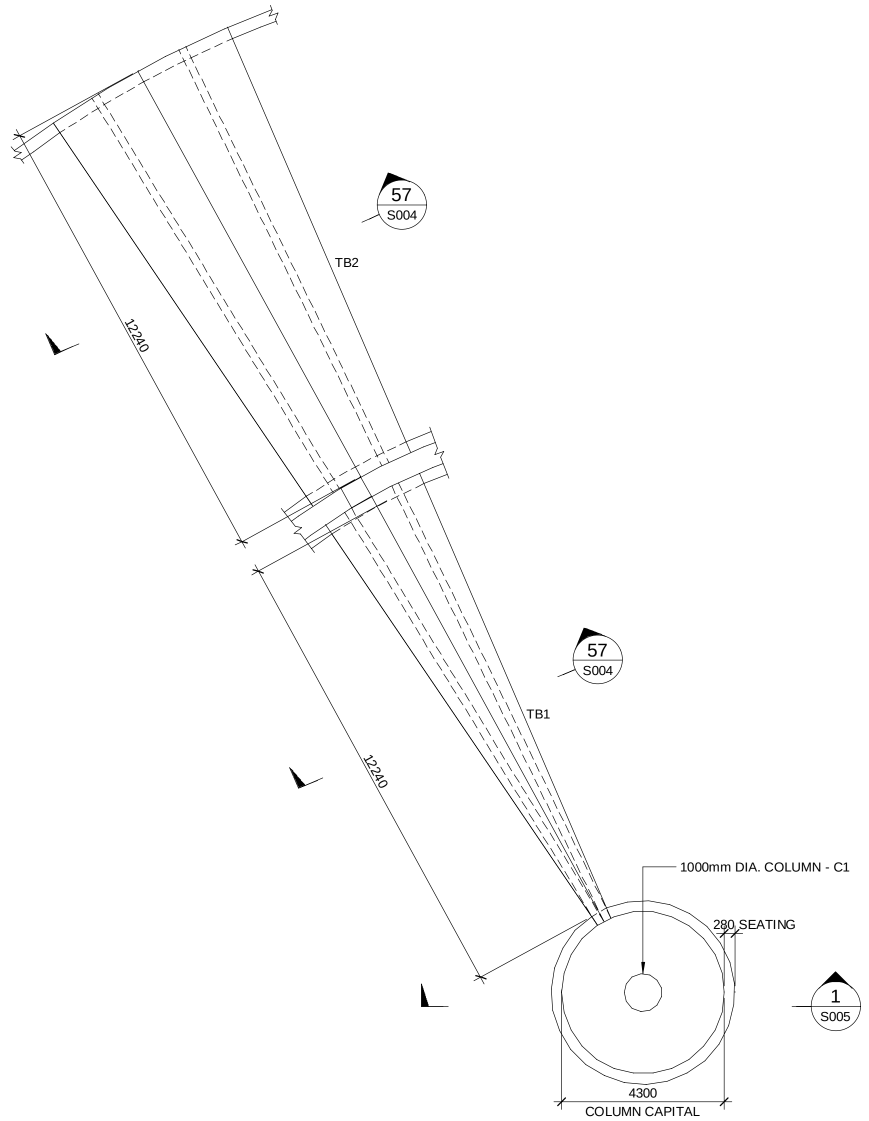
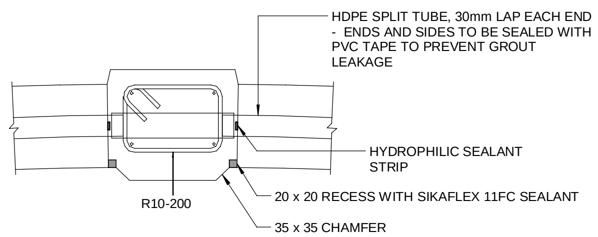
DRAWING PLOTTED: 27/07/2023 3:23:57 pm

NOTE: THESE ARE REPRESENTATIVE DETAILS ONLY.
DESIGN OF THESE ELEMENTS HAS NOT BEEN CARRIED OUT



TYPICAL T BEAM ARRANGEMENT

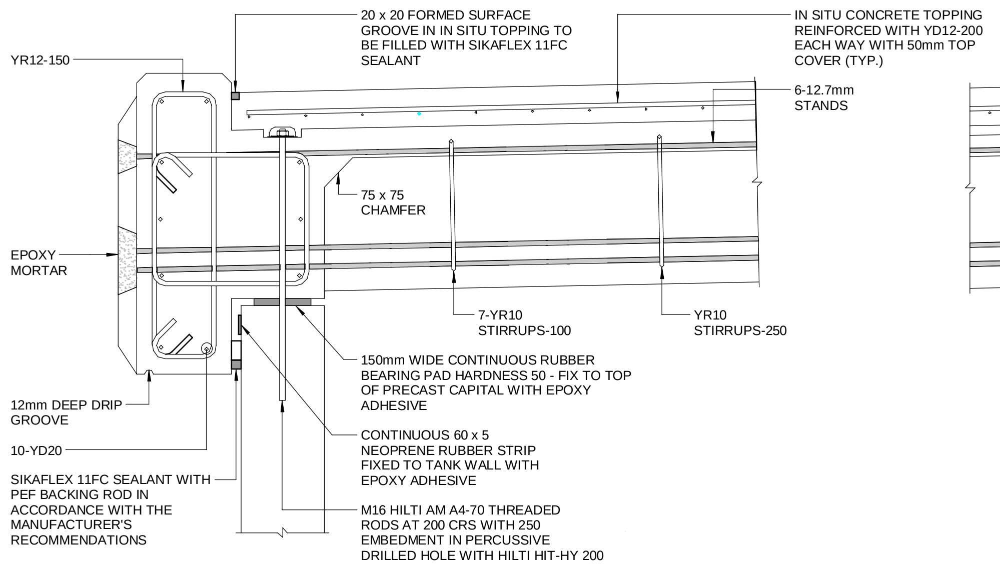
SCALE 1 : 100



55 SECTION

SCALE 1 : 10

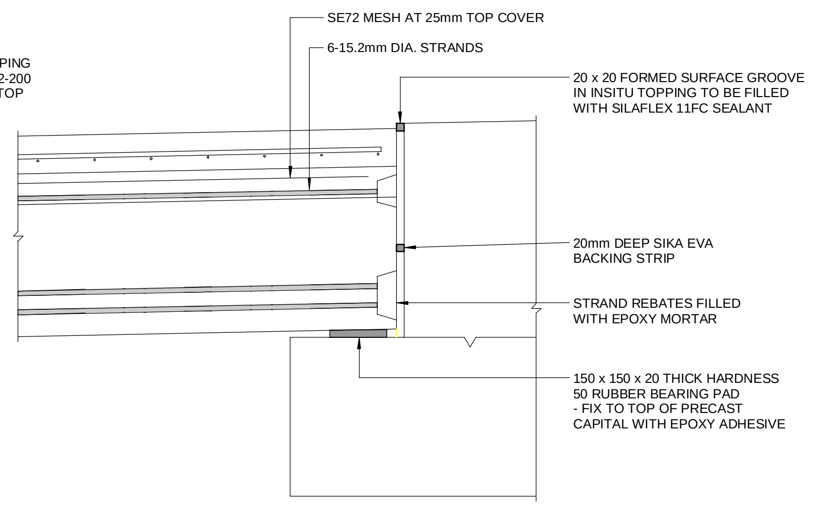
WALL PANEL JOINT



51 DETAIL

S005 SCALE 1 : 10

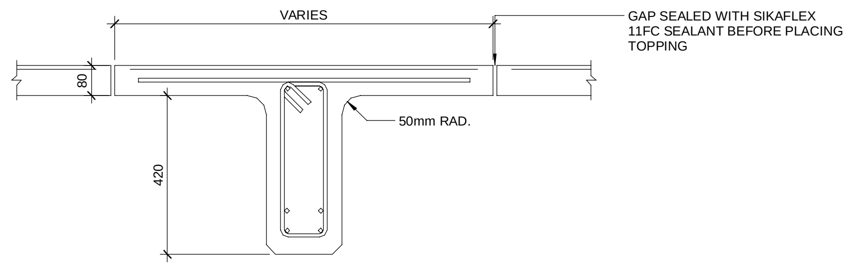
EXTERIOR RING BEAM



53 DETAIL

S005 SCALE 1 : 10

INTERIOR RING BEAM



57 SECTION

S004 SCALE 1 : 10

TB1 & TB2

FOR INFORMATION
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No.	Revision	Appd	Date
0	ISSUED FOR INFORMATION	B.L.C	28-07-23

Drawing Originator: Connect Water c/- WSP, PO Box 12-003 Thorndon, Wellington 6144, T 64 4 471 7000

Original Scale (A1)	AS SHOWN		
Design	R.BARTOLOME	28-07-23	Approved For Construction*
Drawn	C.GONZALEZ	28-07-23	
Dsg Verifier	B.CORNELL	28-07-23	
Dwg Check	K.HAMPSHIRE	28-07-23	Date
Reduced Scale (A3) 1/2 SHOWN	*Refer to Revision 1 for Original Signature		

Client: Wellington Water

Project: WELLINGTON WATER EASTERN HILLS RESERVOIR

Title: RESERVOIR AND VALVEHOUSE TYPICAL DETAILS SHEET 2 OF 2

Discipline: STRUCTURAL

Drawing No: 3-WW021.02-S004 Rev. 0

DOCUMENT NO: RESEVOIR.DWG

PLOTTED BY: GONZALEZ, CALEB

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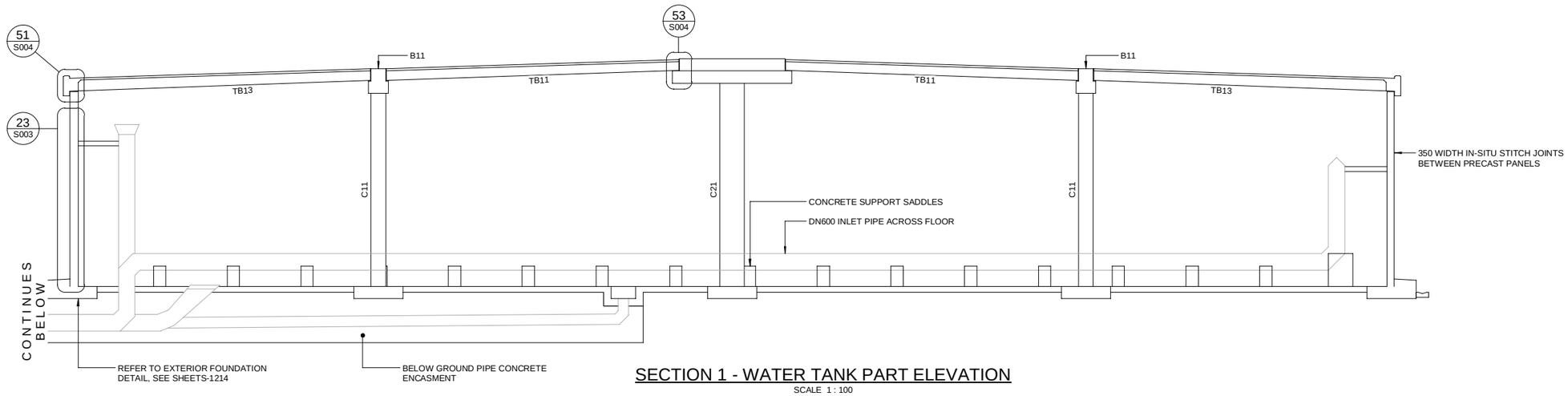
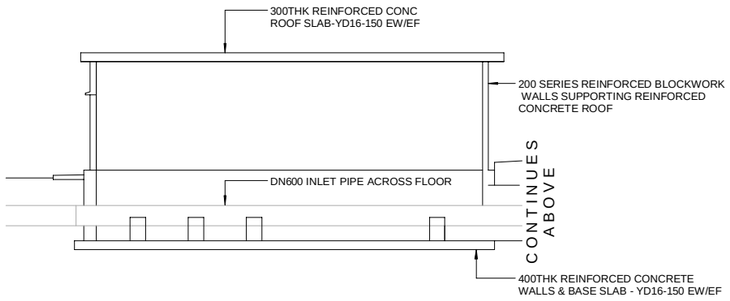
DRAWING PLOTTED: 27/07/2023 3:23:57 pm



SECTION 1 - WATER TANK PART ELEVATION

SCALE 1 : 100



SECTION 1 - CONTROL STATION PART ELEVATION

SCALE 1 : 100

DESIGN INFORMATION

CONCRETE STRENGTH

- MINIMUM CONCRETE COMPRESSIVE STRENGTH AT 28 DAYS SHALL BE 65MPa FOR ALL PRECAST UNITS.
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COVER TO REINFORCEMENT

- MINIMUM 50mm TO ALL FACES.

STRESSING AND REINFORCEMENT

- ALL GRADE 500E REINFORCEMENT SHALL BE MICRO ALLOY AND COMPLY WITH AS/NZS4671.

HORIZONTAL POST-TENSIONING :

- ALL STRESSING SHALL BE COMPLETED WITH THE BASE OF THE WALL FREE TO SLIDE.
- THE TENDON SHALL COMPRISE 17-15.2mm DIAMETER SUPERSTAND. SUPERSTRANDS SHALL HAVE A MINIMUM ULTIMATE TENSILE STRENGTH (UTS) OF 261kN/STRAND.

VERTICAL PRESTRESSING :

- THE VERTICAL PRESTRESSING STEEL SHALL BE 12.7mm DIAMETER SUPERSTRAND WITH A MINIMUM ULTIMATE TENSILE STRENGTH OF 184kN/STRAND.

NOTES

1. THIS DESIGN IS IN ACCORDANCE WITH NZS 3101 : PART 1 : 2006 CODE OF PRACTICE FOR THE DESIGN OF CONCRETE STRUCTURES.
2. EPOXY MORTAR TO BE SIKADUR UA OR SIMALAR APPROVED PRODUCT.

LEGEND

C11	600x600 CONC COL.
C21	1000Ø CONC CENTRAL COL.
B11	800x1000 CONC BEAM.
TB11	PRECAST TEE BEAM TYPE 1
TB13	PRECAST TEE BEAM TYPE 2

A1 REPRODUCTION SCALE: 100, 80, 60, 40, 20, 0mm

A3 REPRODUCTION SCALE: 50, 40, 30, 20, 10, 0mm

FOR INFORMATION
NOT FOR CONSTRUCTION

No.	Revision			Appd	Date
0	ISSUED FOR INFORMATION			B.L.C	28-07-23

Drawing Originator

Connect Water
c/- WSP
PO Box 12-003 Thorndon
Wellington 6144
T 64 4 471 7000

Original Scale (A1)	Design	R.BARTOLOME	28-07-23	Approved For Construction*
AS SHOWN	Drawn	C.GONZALEZ	28-07-23	
Reduced Scale (A3)	Dsg Verifier	B.CORNELL	28-07-23	
1/2 SHOWN	Dwg Check	K.HAMPSHIRE	28-07-23	Date
*Refer to Revision 1 for Original Signature				

Client: Wellington Water

Project: WELLINGTON WATER
EASTERN HILLS RESERVOIR

Title: RESERVOIR AND VALVEHOUSE ELEVATION

Discipline: STRUCTURAL

Drawing No: 3-WW021.02-S005

Rev.: 0

DOCUMENT NO: RESEVOIR.DWG

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PLOTTED BY: GONZALEZ, CALEB

DRAWING PLOTTED: 27/07/2023 3:23:57 pm

Appendix B – Safety in Design Register

Safety in Design H&S Risk Assessment

Administration

Project Name	Eastern Hills Reservoir (previoulsy Naenae No 2)
Project No. (if applicable)	OPC101031

Assessment Date	5/07/2023	**Asset Type**	Water - Reservoir	**Location / Site Name**	Summiit Road, Faifield, Lower H
Designer	Connect Water	**SID Process Step**	Review H&S Risk Assessment (Step IV)		

Safety in Design Process Decisions

Opex: Technical Input Required? (Step III)	Yes
Design Meeting Required? (Step V)	Yes
Record decision reasoning for Step V:	Require input from WWL stakeholders around operation of the reservoir. Held design meeting with WWL COG.
More Detailed Assessment (e.g. Hazop) Required? (Step VIII)	Yes
Record decision reasoning for Step VIII :	HAZOP to be held during detailed design.

Safety in Design Stakeholders

Name	Gareth Penhale (WWL)	**Role**	Project Manager
Name	Lewis Hensman (Connect Water)	**Role**	Designer
Name	Jane Nichols (WWL)	**Role**	Investigator
Name	Paul Winstanley (WWL)	**Role**	Operator
Name	Francis Leniston (WWL)	**Role**	WWL Design Manager
Name	Jo Lucas (Connect Water)	**Role**	Project Manager
Name		**Role**	
Name	Ray Bewley (WWL) - Apology	**Role**	
Name	Kacey Paul (WWL) - Apology	**Role**	
Name		**Role**	
Name		**Role**	
Name		**Role**	
Name		**Role**	

If additional stakeholders are required, select the row above and insert new row. Record Name and Role as per Safety in Design Process.

Raw risk						Risk management								
Specific Asset Reference (if applicable)	Risk Source (Hazard)	Risk Description	Raw Consequence	Raw Likelihood	Raw Risk Rating	Control Measure	Control Type	Control Description	Control Justification (if not eliminated)	Control Owner	Residual Consequence	Residual Likelihood	Residual Risk Rating	Risk Owner
1. Pre-Construction														
Summit Rd	Vehicles And Mobile Equipment	Pre-construction vehicles creating hazard on Summit Rd and connecting streets.	Moderate 40	Possible 4	Moderate 160	Minimise	2. Adminstration Control	Follow road rules and park sensibly on Farrelly Grove.	No other route available for construction vehicles.	Contractor	Minor 10	Unlikely 3	Low 30	Contractor
2. Construction														
Summit Rd	Traffic or Pedestrian Movement during construction	Construction vehicles creating hazard on Summit Rd and connecting streets.	Substantial 100	Possible 4	Extreme 400	Minimise	2. Adminstration Control	Manage using a TMP in accordance with CoPTTM. Potentially restrict access to Summit Rd for residents only. Early engagement with residents. Some construction traffic using Balgownie Grove.	No other route available for construction vehicles.	Contractor	Major 70	Unlikely 3	High 210	Contractor
Reservoir site	Traffic or Pedestrian Movement during construction	Construction vehicles creating hazard to persons using the firebreak and adjoining tracks for recreational use.	Substantial 100	Possible 4	Extreme 400	Minimise	1. Isolate	Close access to the tracks to the public for the duration of the construction period. Use physical barriers to isolate the area and provide signage. Engage early with users of the track using on-line survey and open evenings.	During preliminary design and ECI the team considered the practicalities and safety of maintaining access to the track. It was agreed that with a tight site it was safer to close the track.	Contractor	Moderate 40	Highly Unlikely 2	Moderate 80	Contractor
Outlet pipe	Traffic or Pedestrian Movement during construction	Construction vehicles creating hazard during construction of new outlet main. Vehicles on road posing risk to contractors.	Substantial 100	Possible 4	Extreme 400	Minimise	2. Adminstration Control	Manage using a TMP in accordance with CoPTTM. Potentially restrict access to Balgownie Grove for residents only.	Have changed the route of the outlet pipe to avoid going down Summit Rd. Selected pipe route down hill and connecting at Balgownie Gr. Has reduced impact on traffic movements.	Contractor	Major 70	Unlikely 3	High 210	Contractor
Whole site	Natural events	During construction there is a risk of high rainfall, high winds or earthquakes causing failure of temporary works or other hazards.	Substantial 100	Possible 4	Extreme 400	Minimise	1. Engineering Control	Design all temporary works to account for service limit state wind loads and earthquake loads. Engineer to provide guidance on the propping of permanent elements until construction complete. Work adjacent to slopes is of particular concern and should be avoided in high winds or heavy rain. After heavy rain slopes to be inspected before construction vehicles used on them.	Contractor will still be required to assess the conditions before undertaking works and have appropriate procedures in the event of an extreme natural event.	Designer	Substantial 100	Rare 1	Moderate 100	Contractor
Waiwhetu stream	Natural events	High rainfall causing stream level to rise. Potential significant risk to those working on or adjacent to stream. Can engulf trenches or wash away equipment and assets causing a hazard down stream.	Substantial 100	Possible 4	Extreme 400	Minimise	1. Engineering Control	Work adjacent to stream to have control measures such as weather warnings. Stage work for summer. Ensure that site is made safe if high rainfall is expected, removing equipment from site, or ensuring it is secured if it cannot be removed.	Contractor will still be required to assess the conditions before undertaking works and have appropriate procedures in the event of an extreme natural event.	Contractor	Substantial 100	Highly Unlikely 2	High 200	Contractor
Whole site	Mobile Plant	Due to small construction area required to minimise excavation work, restricted area for vehicle movements and risk of injury or fatality.	Substantial 100	Possible 4	Extreme 400	Minimise	1. Engineering Control	While there is a desire to minimise the excavation, need to design in an area for vehicle turnaround, laydown and lifting platform. Have levelled the area between the new reservoir and existing reservoir.	During consent/ECI phase the working area was confirmed with the contractors. Design can mitigate where practical, but cannot eliminate. Contractor will need to follow standard mobile plant safety protocols while on site.	Designer	Substantial 100	Highly Unlikely 2	High 200	Contractor
Reservoir site	Working at height, raised or falling objects	Lifting of reservoir panels, multiple risks of injury or fatality during crane lifting operations.	Substantial 100	Possible 4	Extreme 400	Minimise	1. Engineering Control	Design in dedicated lifting areas and minimise the size of the panels to be lifted in reducing risk. Review scheduling of the works to complete lift operations at time of the year when high winds are least likely.	On-site administrative controls required such as lift plans.	Designer	Major 70	Unlikely 3	High 210	Contractor

Specific Asset Reference (if applicable)	Risk Source (Hazard)	Risk Description	Raw Consequence	Raw Likelihood	Raw Risk Rating	Control Measure	Control Type	Control Description	Control Justification (if not eliminated)	Control Owner	Residual Consequence	Residual Likelihood	Residual Risk Rating	Risk Owner
Reservoir site	Structural failure	Existing reservoir adjacent to the construction site: risk of exceeding structural loads on reservoir due to plant or equipment, falling objects. May cause injury if reservoir roof collapses. Damage to the reservoir poses risk to water supply.	Substantial 100	Possible 4	Extreme 400	Minimise	1. Engineering Control	Have assessed the potential loading the existing reservoir can withstand and planned site accordingly. Still requires temporary works design and confirmation during detailed design and construction.	Will need to be conservative in defining activities can occur on the reservoir roof, cannot risk disruption to water supply. Will need to take into account the existing reservoir in all lifting plans.	Designer	Substantial 100	Highly Unlikely 2	High 200	Contractor
Whole site	Confined Space	Some trenches around the site may be classified as a confined space, as will the reservoir and any manholes during points in construction. Standard confined space hazards.	Substantial 100	Possible 4	Extreme 400	Minimise	1. Engineering Control	Design trenches to be as shallow as practical to mitigate the risk.	Standard CSE to apply where a confined space is identified.	Designer	Substantial 100	Unlikely 3	High 300	Contractor
Reservoir site	Members of the public accessing site	Members of the public forcing entry to site and putting themselves at risk of harm or damaging assets	Major 70	Possible 4	High 280	Minimise	1. Isolate	Ensure that the perimeter of the site is fenced and that appropriate security measures are in place when on site. Secure all equipment and vehicles when site is unmanned	Cannot be avoided, need to manage through construction procedures	Contractor	Major 70	Highly Unlikely 2	Moderate 140	Contractor
Site access	Steep embankments adjacent to vehicle access way	Potential for vehicle to topple down the side of the access way, especially a concern for large vehicles due to the width of the access track.	Major 70	Possible 4	High 280	Minimise	1. Isolate	Widen, grade and resurface track as part of the site establishment. Consider the use of barriers, such as bollards or armco barriers to protect from the edge. These could also help provide safe pedestrian access up the access track. For oversize vehicles, consider the use of a pilot to guide the vehicle up the track. Where vehicles are required to arrive while dark, light the track to assist.	Due to the slope being very steep on one side and the existing reservoir on the other, it is difficult to widen the track to a point where this risk would be extremely unlikely. Need to manage through a mix of isolation, engineering and administrative controls.	Contractor	Major 70	Unlikely 3	High 210	Contractor
Reservoir site	Vehicles operating on a slope	Risk of vehicle run-away on site slopes, could cause significant damage to assets and pose a significant safety risk.	Major 70	Possible 4	High 280	Minimise	1. Engineering Control	Ensure the correct vehicle is selected for the task and operators are trained and competent. Emergency brakes to be engaged and chocks used to prevent runaway. Avoid leaving vehicles unattended on steep slopes, only park on steep slopes when required for work	Not possible to eliminate as work on a hill.	Contractor	Major 70	Unlikely 3	High 210	Contractor
Site access	Narrow width site access	Chance of vehicle collision on narrow access track, or toppling down slope to avoid collision.	Major 70	Possible 4	High 280	Minimise	2. Adminstration Control	Widen, grade and resurface track as part of the site establishment. Reduced speed zone through construction site. Will likely require traffic controllers on the access track, especially when large vehicles are using track.	Due to the slope being very steep on one side and the existing reservoir on the other, it is difficult to widen the track to a point where this risk would be extremely unlikely. Need to manage through a mix of isolation, engineering and administrative controls.	Contractor	Major 70	Highly Unlikely 2	Moderate 140	Contractor
Whole Site	Services – Working With or Near	Risk of striking underground or overhead services. This is a general risk, any risks associated with specific services or operations will be addressed separately.	Major 70	Possible 4	High 280	Minimise	1. Engineering Control	Use service drawings to inform pipe alignment and reservoir location. Design to avoid need to cross services.	Will reduce risk through design. Will still need appropriate administration controls through the construct period, such as following "Guidance to Utility Management in Design and Construction".	Designer	Major 70	Highly Unlikely 2	Moderate 140	Contractor
Outlet pipe	Services – Working With or Near	Services (large supply and delivery pipe) down Summit Road cross the street back and forth. Any pipe installed down this route would require multiple service crossings and deep trenches.	Major 70	Possible 4	High 280	Eliminate		Have eliminated this specific risk by rerouting the pipe down the hill to Balgownie Grove. Note this only refers to the delivery pipe and scour / overflow pipes. Does not eliminate the overall risk of striking services at the top of Summit Rd and Farrelly Grv, due to the installation of the new inlet, scour connection and delivery connection						
Outlet pipe	Excavation	Deep trench causing hazard of falling into trench or trench collapse causing injury.	Major 70	Possible 4	High 280	Minimise	1. Substitute	Designed delivery (outlet) pipe alignment down hill to minimise service crossings on Summit Rd and therefore the depth of trench required. Consider directional drilling for sections of the pipe.	Will reduce risk through design where practical. During construction will still require standard trench safety to be followed such as shoring and barriers. Don't anticipate deep trenches for delivery pipe.	Designer	Moderate 40	Unlikely 3	Moderate 120	Contractor
Reservoir site	Excavation	Risk of injury from being struck by excavator, collapse of any slopes, or toppling of excavator when operating on a slope.	Major 70	Possible 4	High 280	Minimise	1. Isolate	Review of the ground conditions on the construction site, will assist in determining where to locate machinery and the risk of slope failure.	Standard control of the site using barricading around operating excavators and training of contractors.	Designer	Major 70	Highly Unlikely 2	Moderate 140	Contractor

Specific Asset Reference (if applicable)	Risk Source (Hazard)	Risk Description	Raw Consequence	Raw Likelihood	Raw Risk Rating	Control Measure	Control Type	Control Description	Control Justification (if not eliminated)	Control Owner	Residual Consequence	Residual Likelihood	Residual Risk Rating	Risk Owner
Outlet / overflow pipe	Slope failure	During the construction of the pipe down the hill towards Balgownie Grove there is a risk of slope failure under heavy machinery causing toppling.	Major 70	Possible 4	High 280	Minimise	1. Engineering Control	During design undertake geotechnical assessment of route to assess the risk of failure. Provide advice to the contractor regarding construction methodology. Programme works for summer when fewer heavy rain events.	Design can mitigate risk, however contractor will need to ensure controls in place when using machinery. This may be by reducing the size of excavator etc used, and locating as far as practical from slope edges. Ensure suitably qualified team constructing pipeline. Installation method will depend on material selected, this is currently being left flexible for the D&C contractor	Designer	Moderate 40	Unlikely 3	Moderate 120	Contractor
Waiwhetu stream crossing	Slope failure	During the construction of the crossing of the Waiwhetu stream there is a risk of slope failure below heavy machinery.	Major 70	Possible 4	High 280	Minimise	2. Adminstration Control	Locate heavy machinery away from slope and schedule work for summer to avoid heavy rain events. Design has considered location of abutments to avoid slope failure.	Design can mitigate risk, however contractor will need to ensure controls in place when using machinery.	Contractor	Moderate 40	Unlikely 3	Moderate 120	Contractor
Reservoir site	Working at height, raised or falling objects	Working on the reservoir roof or above the valve pit, risk of falling off roof or objects being dropped on people.	Major 70	Possible 4	High 280	Minimise	1. Engineering Control	Multiple controls to be used during construction, from guardrails to fall restraint. Working at height procedures will need to be followed.	Standard procedures to be followed.	Contractor	Major 70	Unlikely 3	High 210	Contractor
Outlet pipe	Working at height, raised or falling objects	Crane lifting of the pipes into trenches in the carriageway. Potential for injury or fatality, including general public.	Major 70	Possible 4	High 280	Minimise	1. Isolate	Follow standard lifting procedures and putting in public exclusion zones.	Standard procedures to be followed.	Contractor	Major 70	Unlikely 3	High 210	Contractor
Water network cut-ins	Pressurised pipework and confined space	Risk of injury if cut into a pressurised line. Risk of engulfment in trenches due to cutting into live pipe.	Major 70	Possible 4	High 280	Minimise	1. Isolate	Ensure through the construction period that all isolations are in place and lines drained before cutting in. Follow standard WWL procedures.	Cannot eliminate this risk.	Contractor	Moderate 40	Rare 1	Low 40	Contractor
Valvehouse	Slope failure	The valvehouse will be constructed in a pit, risk of slope failure causing injury.	Major 70	Unlikely 3	High 210	Minimise	1. Engineering Control	Specify that the excavation should be benched or sloped at 1:1 to reduce risk. Further site investigations will inform risk.	Unable to avoid excavation, minimise risk. Excavation will likely be in rock and therefore the likelihood of collapse is minimised.	Designer	Moderate 40	Highly Unlikely 2	Moderate 80	Contractor
Whole site	Stormwater	Sedimentation and pollution to waterways, specifically the Waiwhetu Stream. Flooding of the site.	Major 70	Unlikely 3	High 210	Minimise	1. Engineering Control	Design the erosion and sediment control measures and stormwater management for storm events.	Cannot eliminate risk of rain.	Designer	Moderate 40	Unlikely 3	Moderate 120	Contractor
Waiwhetu stream crossing	Water - Being In, Near, Or On	Risk of falling into stream during construction.	Major 70	Unlikely 3	High 210	Minimise	2. Adminstration Control	Scheduling of work in summer to avoid high water levels.	Follow safety procedures for working around/over water.	Contractor	Moderate 40	Highly Unlikely 2	Moderate 80	Contractor
Reservoir	Scaffolding disassembly	Removal of scaffolding from the reservoir introduces multiple hazards including working from heights, suspended loads, manual handling and confined space,	Major 70	Unlikely 3	High 210	Minimise	1. Engineering Control	Ensure that during the detailed design of the reservoir, removal of scaffolding is taken into account when designing the size and location of any reservoir roof penetrations. Contractor should also consider during their construction sequencing.	Residual risk will still be present and need to be managed by contractor HSE procedures.	Designer	Major 70	Highly Unlikely 2	Moderate 140	Contractor
Whole site	House Keeping	An untidy site presents hazard for people and vehicles moving around site	Moderate 40	Possible 4	Moderate 160	Minimise	1. Isolate	Design a laydown area and construction offices area.	Will still require the administrative controls on site to keep a tidy site.	Designer	Minor 10	Unlikely 3	Low 30	Contractor
Whole site	Fires or explosions or hot work	Welding operations and storage of flammable/combustible materials on site. Risk of injury.	Moderate 40	Possible 4	Moderate 160	Minimise	2. Adminstration Control	Follow standard hot work procedures, correct storage and handling of hazardous materials.	Standard procedures to be followed.	Contractor	Moderate 40	Unlikely 3	Moderate 120	Contractor
Whole site	Manual handling	Risk of injury due to manual handling	Moderate 40	Possible 4	Moderate 160	Minimise	2. Adminstration Control	Ensure proper training and suitable lifting aids are provided where practical.	Standard procedures to be followed.	Contractor	Minor 10	Unlikely 3	Low 30	Contractor
Whole site	Tools and equipment	Risk of injury due to improper use of tools and equipment.	Moderate 40	Possible 4	Moderate 160	Minimise	2. Adminstration Control	Ensure all power tools are tested and tagged, operators to be trained	Standard procedures to be followed.	Contractor	Minor 10	Unlikely 3	Low 30	Contractor
Whole site	Hazardous substances	Injury due to improper storage or handling of hazardous materials.	Moderate 40	Possible 4	Moderate 160	Minimise	2. Adminstration Control	Ensure MSDS's are available and followed	Standard procedures to be followed.	Contractor	Minor 10	Unlikely 3	Low 30	Contractor
Reservoir site	Noise	Large amount of noise during rock breaking activities during construction. Risk of hearing damage.	Moderate 40	Possible 4	Moderate 160	Minimise	1. Engineering Control	Reduce earthworks required as far as possible, such as changing the outlet pipe alignment to reduce the rock breaking required. Noise assessment being undertaken and mitigation measures proposed.	Will need to manage construction hours and hearing protection for contractors on site.	Designer	Minor 10	Unlikely 3	Low 30	Contractor
Site access	Rutting of access way	Rutting / erosion of the track during wet weather events, creating driving hazards potentially resulting in loss of control of a vehicle.	Moderate 40	Possible 4	Moderate 160	Minimise	1. Engineering Control	Grade and surface the access track to manage stormwater, minimising the rutting of the track.	Contractor will need to monitor condition of access throughout project and maintain as required.	Designer	Minor 10	Highly Unlikely 2	Low 20	Contractor
Whole site	Noise	General risk of noise due to construction activities.	Minor 10	Possible 4	Low 40	Minimise	2. Adminstration Control	Will need to manage construction hours and hearing protection for contractors on site. Engage early with the public around noise and night works.	Standard procedures to be followed and working hours/days. For night works noise limited and monitored as much as possible.	Contractor	Minor 10	Unlikely 3	Low 30	Contractor
3. Commissioning														
Reservoir internal	Confined space	Use of hazardous substances in a confined space during disinfecting of reservoir. Health risks.	Major 70	Possible 4	High 280	Minimise	3. PPE	Comply with MSDS and standard CSE procedures	Cannot eliminate requirement to disinfect.	Contractor	Major 70	Highly Unlikely 2	Moderate 140	Contractor
Reservoir valvehouse	Confined space	General confined space risks.	Major 70	Possible 4	High 280	eliminate		Design the valvehouse for occupancy to eliminate confined space designation.		Designer				

Specific Asset Reference (if applicable)	Risk Source (Hazard)	Risk Description	Raw Consequence	Raw Likelihood	Raw Risk Rating	Control Measure	Control Type	Control Description	Control Justification (if not eliminated)	Control Owner	Residual Consequence	Residual Likelihood	Residual Risk Rating	Risk Owner
Reservoir - Roof	Water - Being In, Near, Or On	Personnel on roof observing water levels during drop test of reservoir.	Major 70	Possible 4	High 280	Minimise	1. Substitute	Consider use of remotely operated devices to carry out task, such as pole extensions or CCTV. If not possible, ensure personnel are anchored with fall arrestors.	Testing required, but control measures or substitution can minimise risk.	Contractor	Major 70	Rare 1	Moderate 70	Contractor
Reservoir - Roof	Working at height	Accessing roof for commissioning, risk of injury due to falling off access way or the roof	Major 70	Possible 4	High 280	Minimise	1. Isolate	Reservoir to have a wrap around staircase and handrails. Anchor points/fall arrestors to be used when required.	Can minimise, not eliminate.	Designer	Major 70	Rare 1	Moderate 70	Contractor
Electrical and Controls	Electrocution	Potential for electrocution during the commissioning of the electrical and controls equipment.	Major 70	Possible 4	High 280	Minimise	1. Isolate	Ensure lock out / tag out procedures are followed and aligned with shutdown procedures.	To be included in contractor HSE plans.	Contractor	Major 70	Highly Unlikely 2	Moderate 140	Contractor
Reservoir	Hazardous substances	Introduction of Cl, for disinfection and commissioning presents a hazard of exposure	Major 70	Possible 4	High 280	Minimise	1. Engineering Control	Comply with MSDS. Include the commissioning in HAZOP and detail any design changes able to mitigate risk.	To be included in HAZOP	Designer	Moderate 40	Unlikely 3	Moderate 120	Contractor
4. Operations / Maintenance														
Reservoir Internal	Confined space	Reservoir is considered a confined space, general risks.	Substantial 100	Possible 4	Extreme 400	Minimise	1. Engineering Control	Design internal stair case for ease of access/egress. Ensure that double isolation is available to reduce risk of water being introduced during inspection.	Standard CSE procedures will need to be followed. Consider the use of drones to inspect where possible to eliminate the risk to operators.	Designer	Substantial 100	Highly Unlikely 2	High 200	Operator
Reservoir	Water quality	Tampering of the reservoir supply resulting in a public health risk.	Substantial 100	Possible 4	Extreme 400	Minimise	1. Engineering Control	Security as per WWL standards for Tier 1 security (access hatches, roof vents) .Adopt Tier 2 security at base of reservoir staircase. Control hut to be secured and alarmed. Have alarms on roof hatches. Identified security cameras don't work as they are frequently vandalised.	Minimise security risk as much as possible based on WWL experience at other sites.	Designer	Substantial 100	Rare 1	Moderate 100	Asset Manager
Valvehouse	Heavy lifting	Lifting of valves or equipment causes risk of injury.	Major 70	Possible 4	High 280	Minimise	1. Engineering Control	Design in lifting hoists in the valvehouse and make section of the platform removable.	Confirm in Principal's requirements and during D&C.	Designer	Minimal 1	Highly Unlikely 2	Low 2	Operator
Valvehouse	Vehicle movements	Risk of vehicle hitting and damaging valvehouse / control hut.	Major 70	Possible 4	High 280	Minimise	1. Isolate	Design in bollards.	Widely used for this purpose.	Designer	Major 70	Rare 1	Moderate 70	Operator
Valvehouse	Accessing pipework and equipment	Risk of injury going down in to valvehouse to access the pipework/equipment.	Major 70	Possible 4	High 280	Minimise	1. Engineering Control	Design so most frequent operations, such as sampling, can be completed at ground level. Valve wheels to be accessible from ground level platform. Use stairway with handrails to access valves/equipment below ground level. Design in an adequate means of drainage, including floor sump and pump.	Confirm in Principal's requirements and during D&C.	Designer	Moderate 40	Highly Unlikely 2	Moderate 80	Operator
Reservoir roof hatch	Water - Being In, Near, Or On	Risk of falling into reservoir when operator on roof with hatch open.	Major 70	Possible 4	High 280	Minimise	1. Engineering Control	Sampling to be completed in valvehouse to reduce activities which need to be conducted on roof. Standard HCC hatch design to be used (15kg limit).	WWL to advise on preference.	Designer	Moderate 40	Highly Unlikely 2	Moderate 80	Operator
Reservoir roof hatch	Manual handling	Risk of injury if operator required to shock dose the reservoir e.g. carrying 20kg drum of chlorine	Major 70	Possible 4	High 280	Minimise	1. Engineering Control	Consider alternative shock dosing methods, such as smaller drums or pumping from low level. Consider further during HAZOP.	Confirm during HAZOP.	Designer	Moderate 40	Unlikely 3	Moderate 120	Operator
Reservoir roof hatch	Manual handling	Reservoir roof hatch may be too heavy for single person lift.	Moderate 40	Likely 5	High 200	Minimise	1. Engineering Control	Consider weight of hatch during design and any lifting aids that can be installed.	WWL to advise on preference. Confirmed in Principal's requirements and during D&C.	Designer	Minor 10	Highly Unlikely 2	Low 20	Operator
Whole site	Public access	Site is in a public access area, risk of public injuring themselves.	Major 70	Possible 4	High 280	Minimise	1. Engineering Control	Security at the site as previously stated. Design to include any anti-climb barriers around conduits going up reservoir side or all conduits to be within the secured area. Include signage? Include handrails on valvehouse roof to prevent accidental falling.	Operations manual needs to include standard procedures for securing the site before leaving.	Designer	Major 70	Rare 1	Moderate 70	Asset Manager
Reservoir roof	Access to roof	Risk of falling off roof.	Major 70	Possible 4	High 280	Minimise	1. Engineering Control	Security at the site as previously stated. Design to include any anti-climb barriers around conduits going up reservoir side or all conduits to be within the secured area. Include signage? Include handrails on valvehouse roof to prevent accidental falling.	Confirm in Principal's requirements and during D&C.	Designer	Major 70	Rare 1	Moderate 70	Operator
Reservoir Walls	External wall inspections	Risk of falling during inspection of reservoir walls.	Major 70	Possible 4	High 280	Minimise	1. Engineering Control	Use standard EWP or scaffold practices. Design ground around the reservoir to be flat for an EWP to be stable.	Consider alternative means of inspection such as drones or cameras on extendable poles. This would eliminate the risk of working at height.	Designer	Major 70	Rare 1	Moderate 70	Operator

Specific Asset Reference (if applicable)	Risk Source (Hazard)	Risk Description	Raw Consequence	Raw Likelihood	Raw Risk Rating	Control Measure	Control Type	Control Description	Control Justification (if not eliminated)	Control Owner	Residual Consequence	Residual Likelihood	Residual Risk Rating	Risk Owner
Outlet pipework	Maintenance on pipework	Risk of injury if work needed on pipework running down hill due to the nature of terrain. Potential for vermin to enter pipe.	Major 70	Possible 4	High 280	Minimise	1. Engineering Control	Consider using a corrosion resistant material such as PE to reduce the likelihood that work required. Design trench as per WWL standards to prevent damage to pipe. Maintain a clear path over pipe for ease of access, identifying the closest (safest) access point to the bubble up camber. Investigate methods for vermin protection which do not impede flow.	Confirm in Principal's requirements and during D&C.	Designer	Moderate 40	Highly Unlikely 2	Moderate 80	Operator
Reservoir	Emergency water collection	Risk in the event that water needs to be taken directly from the reservoir (accessed from the roof) in the event of an emergency.	Major 70	Possible 4	High 280	Eliminate	1. Substitute	Design to provide emergency FH points within valvehouse.		Designer				
Stream Crossing	Height and water	Risk of falling into stream from people climbing across pipe stream crossing.	Major 70	Possible 4	High 280	Minimise	1. Isolate	Consider safety barriers or other methods to prevent climbing on the pipe stream crossing.	While aerial pipe stream crossing is being consented, a submarine crossing has not been fully ruled out and will be left open to the D&C contractor to investigate further.	Designer	Major 70	Unlikely 3	High 210	Asset Manager
Reservoir roof	Water contamination and additional maintenance	Water seals on the roof need replacing every 20 years - failure of these seals can lead to water quality issues. The need for replacement also introduces multiple risks from the works.	Major 70	Possible 4	High 280	Eliminate		Specify that the roof is to be a single pour.						
Site access	Steep slopes on side of access road	Risk of vehicle tipping down slope	Major 70	Possible 4	High 280	Minimise	1. Isolate	Widen and re-grade road, introduce permanent barriers to protect slope edge. Reinstate site gate to prevent public access.	Need to access site, so minimise risk SFARP	Designer	Major 70	Highly Unlikely 2	Moderate 140	Asset Manager
Reservoir site	Vehicle movements	Vehicles need to be able to drive up to reservoir and around reservoir. Risk of incident occurring.	Moderate 40	Possible 4	Moderate 160	Minimise	1. Engineering Control	Design clear vehicle access (3m min) around perimeter of reservoir and a compliant slope up to the site. Operator preference for asphalt to provide a hard and "level" surface around perimeter, with water drained away from reservoir	Vehicles require access but sufficient space reduces risk. Confirm with consenting specialists if asphalt is	Designer	Moderate 40	Highly Unlikely 2	Moderate 80	Operator
Valvehouse	Manual handling	Confined conditions of pipework and valves may present risk of injury	Moderate 40	Possible 4	Moderate 160	Minimise	1. Engineering Control	Use 3D modelling to provide an early 'feel' for the space. Can modify design based on operator input.	Confirm in Principal's requirements and during D&C.	Designer	Minor 10	Highly Unlikely 2	Low 20	Operator
Reservoir Internal	Internal inspection	Rushed inspection due to time pressure, may lead to unsafe work practices.	Moderate 40	Possible 4	Moderate 160	Minimise	1. Engineering Control	Design a full internal staircase with non-slip treads. Consider marking of the columns during construction to aid in inspections.	Consider the use of drones to inspect where possible to eliminate the risk to operators. Include in O&M manual?	Designer	Moderate 40	Highly Unlikely 2	Moderate 80	Operator
Reservoir Internal	Pipework replacement	Risk of injury during the replacement of internal/underfloor pipework.	Moderate 40	Possible 4	Moderate 160	Minimise	1. Engineering Control	Design pipework to minimise the need for replacement. Use stainless steel for all pipework.	Avoid risk as much as possible.	Designer	Moderate 40	Rare 1	Low 40	Operator
Overflow/Scour	Scour	Need to access manhole on scour line to dose during scouring. HSE risk.	Moderate 40	Possible 4	Moderate 160	Minimise	1. Engineering Control	Locate scour manhole in easy to reach location, ensuring clear drive up access.	Discuss potential dosing methods during HAZOP, which may eliminate the need to open a manhole.	Designer	Minor 10	Highly Unlikely 2	Low 20	Operator
Valve chambers	Confined Space	Risk of injury while accessing in-line valve chambers.	Moderate 40	Possible 4	Moderate 160	Minimise	1. Engineering Control	Design of chambers to be a minimum of 1.5m in diameter and have a Sike lid. Chambers to include drainage.	Need to mitigate as best as possible.	Designer	Moderate 40	Highly Unlikely 2	Moderate 80	Operator

Appendix C – Project Risk Register

Risk Register

Project/Contract:	Eastern Hills Reservoir	**Document Date:**	21 July 2023
Project/Contract ID:	3-WW021.02	**Supplier Lead:**	Jo Lucas
WWL Lead:	Gareth Penhale	**RM Specialist:**	Mark Stanko
		Risk Tolerance Threshold:	20

								Current Exposure					**Residual (Target) Exposure**			
								Semi-Quantitative			**Treatment Strategy**		**Semi-Quantitative**			
?	?		?	NOTE: EDIT BELOW DESCRIPTION TO SUIT FORMAT	?	?	?	?	?	?	?	?	?	?	?	?
Rank	**RID**	**Risk Category**	**Risk Title**	**Description/ Cause/ Consequence**	**Risk Owning Org**	**Risk Status**	**Phase**	**Consq.**	**Likelihood of occurrence in project lifecycle**	**Risk Score**	**Individual actions to be recorded in the Actions Register (Tab 4)**	**Consq.**	**Likelihood of occurrence in project lifecycle**	**Risk Score**	**Commentary & Closure Statement**
1	1	Procurement	Lack of tender price competition	**Description:** There is a threat that the obtaining of priced tenders from only one supplier results in higher costs than estimated. **Cause**: The cause of the threat is the procurement approach is to directly award the reservoir contract to a single D&C supplier. **Consequence**: The consequence of the threat is Contractor free to price in additional risk and profit compared to a competitive tender. Tender prices could exceed estimates.	Wellington Water	Live - Parked	Procurement	High	Very High	22	WWL to develop strategy for comparing pricing and getting some price tension. Potential to get two independent price reviews e.g. Bonds. Review Aotea prices and compare to EH cost estimate. Ask preferred tenderer to provide cost estimate, Can revise procurement approach and go to market. Made allowance in the risk components of cost estimate.	High	High	21	
2	106	Scope	Storage Volume - Over-sized	**Description:** There is an opportunity to optimise the Eastern Hills water storage volume of 15ML. **Cause**: The cause of the opportunity is the condition of the Gracefield Reservoir and the potential replacement of the reservoir prior to 2060 (as assumed in the Storage Volume Assessment work that derived the volume). **Consequence:** The consequence of the opportunity is a change to the volume at Eastern Hills (either larger or smaller). This could reduce costs but would require a consent variation.	Wellington Water	Live - Treat	Optioneering	Low	Low	6	Memo to be prepared by Connect Water considering Gracefield, Naenae and Eastern Hills volumes. WWL to decide next steps for a potential master plan (ZMP) or 3WDMC paper.	High	High	21	
3	2	Stakeholder	TTM - Increased requirements	**Description**: There is a threat that temporary traffic management requirements on roads for pipeline installation and reservoir access requires increased TTM than allowed for in the estimate. **Cause**: The cause of the threat is higher safety risks, or need to reduce impacts on community. **Consequence**: The consequence of the threat is increased cost over that allowed in estimate. Reputational harm from public impacts.	Connect Water	Live - Parked	Design Development	High	Very High	22	Included TTM requirements from EIC workshops as well as outcomes from traffic assessment in construction methodology. Cost estimate not being updated during prelim design so accept risk of cost increase.	High	Medium	19	
4	4	Construction	Construction vehicle access to site	**Description**: There is a threat that construction vehicle access will be limited causing reduced productivity and increasing costs over that allowed for in estimates. **Cause**: The cause of the threat is lack of access space on access roads requiring stop/ goes to be in place. Turnaround space on site is also very limited. **Consequence**: The consequence of the threat that smaller vehicles than assumed need to be used and longer journey times/ slower productivity due to access controls.	Connect Water	Live - Parked	Design Development	High	High	21	Have incorporated ECI feedback into site layout, programme and vehicle movements. To be assessed further by D&C team during detailed design.	High	Medium	19	
5	5	Procurement	Contractor availability	**Description**: There is a threat that low availability of contractors/subcontractors results in higher tender pricing or lack of tenders resulting in delay. **Cause**: Tight labour / resources market. High workload in the market. Cyclone relief work impacts. **Consequence**: Programme delays, inflated prices through lack of competitiveness or need to accelerate. High number of tender tags protecting Contractor position resulting in greater cost risk for WWL during works or delayed award of contract.	Wellington Water	Live - Parked	Procurement	High	High	21	Discuss programme and resourcing with preferred Aotea Tenderer. Procurement strategy to assess options for D&C and packaging of project (although packaging unlikely due to timing of various reservoir projects).	High	Medium	19	
6	6	Consents	Appeals to Consents and NOR	**Description**: There is a threat of submissions against the consent applications causing delays and additional cost resulting form a hearing. **Cause**: Public or stakeholder perceives the project to have an unacceptable negative impact and lodges a submission against the consent. **Consequence**: Consent gets appealed and has to go to Environmental Court.	Connect Water	Live - Treat	Design Development	High	High	21	Prepare robust consent and NOR notification that has been through advanced review with regulatory teams, legal review. Undertake early engagement with stakeholders to understand perceptions / issues so that stakeholder "challenges" can be clearly defined and strategies to bring stakeholders to a satisfied position can be identified accordingly. Decide whether we propose public notification for NOR.	High	Medium	19	
7	7	Financial	Cost Estimates - Inadequate	**Description:** There is a threat that the cost estimates are inaccurate and/or overspend occurs resulting in insufficient budget availability and reputational harm. **Cause**: The cause of the threat is that cost estimates do not account for full project scope and/or sufficient risk/ uncertainty. **Consequence:** The consequence of the threat is that WWL need to seek additional funding due to budgets being insufficient which will cause reputational harm and potentially delay project or make it unviable.	Connect Water	Live - Parked	Design Development	High	High	21	WWL are accepting this risk currently, as no revised cost estimate required for prelim design. Utilise Bond CM to provide parallel cost estimate once D&C contractor engaged for further "ECI".	High	Medium	19	

Risk Register

Project/Contract:	Eastern Hills Reservoir	**Document Date:**	21 July 2023
Project/Contract ID:	3-WW021.02	**Supplier Lead:**	Jo Lucas
WWL Lead:	Gareth Penhale	**RM Specialist:**	Mark Stanko
		Risk Tolerance Threshold:	20

								Current Exposure				**Residual (Target) Exposure**			
								Semi-Quantitative			**Treatment Strategy**	**Semi-Quantitative**			
7	7		7	NOTE: EDIT BELOW DESCRIPTION TO SUIT FORMAT	7	7	7	7	7	7	7	7	7	7	7
Rank	**RID**	**Risk Category**	**Risk Title**	**Description/ Cause/ Consequence**	**Risk Owning Org**	**Risk Status**	**Phase**	**Consq.**	**Likelihood of occurrence in project lifecycle**	**Risk Score**	**Individual actions to be recorded in the Actions Register (Tab 4)**	**Consq.**	**Likelihood of occurrence in project lifecycle**	**Risk Score**	**Commentary & Closure Statement**
8	8	Consents	Consent - Reservoir construction nuisance impacts on community	**Description:** There is a threat of perceived amenity impact on local residents from reservoir construction (noise, vibration, road closures etc) and community concerns about these may lead to objections from community **Cause**: The cause of the threat is the high heavy vehicle traffic required up residential streets, Earthworks activity, temporary traffic control and proximity of properties to the construction sites. Perception of impact may be greater than actual impact. **Consequence:** The consequence of the threat is objections to the consent and associated costs/ delays.	Connect Water	Live - Treat	Design Development	High	High	21	Noise, vibration, traffic and visual impact assessments are being prepared that identify mitigation. Early engagement with potentially impacted residents is being undertaken via on-line survey, letter drop and street events (11th/12th July '23). Investigate options to reduce heavy vehicle traffic, through disposal of cut material on or near site and allow use of truck and trailers. Consider the conveyor opportunity.	High	Medium	19	
9	9	Construction	Slope stabilisation	**Description:** There is a threat that a higher level of temporary and permanent slope stabilisation is required than allowed for in the cost estimate. **Cause:** The cause of the threat is slope stability is found to be worse than expected during investigation or construction. **Consequence**: The consequence of the threat is costs exceed budget allowance based on estimate.	Connect Water	Live - Parked	Design Development	High	High	21	Carried out geotechnical investigations (3 boreholes and window samples) during concept design. Dynamic analysis during prelim design confirmed slope stabilisation measures (~30 no soldier piles, 1.2m dia ~10m deep around 2/3 of perimeter). Risk allowance was made in the cost estimate for slope stabilisation which should be sufficient. WWL are accepting this risk currently, as no revised cost estimate required for prelim design.	High	Medium	19	
10	10	Reservoir site	Reservoir platform - Unexpected geological features	**Description**: There is a threat that once excavated the reservoir platform has less suitable rock or more defects than expected resulting in need for ground improvements. **Cause**: The cause of the threat is ground conditions being different to that indicated by investigations. **Consequence**: The consequence of the threat is additional cost and construction delay to improve the ground and address areas of weak ground.	Connect Water	Live - Treat	Investigations	High	High	21	Carried out geotechnical investigations (3 boreholes and window samples) during concept design. Shifted tank during prelim design ~13m to SE to more competent ground. Have consulted with D&C contractors to confirm additional geotech site investigations. Arranging site investigations for 2023 to inform detailed design - although high cost (>$300k).	High	Medium	19	
11	11	Reservoir site	Unfeasible cut slopes for excavation	**Description**: There is a threat that assumed cut slopes for excavation are infeasible due to soil parameters being different than assumed. **Cause:** The cause of the threat cut material being worse than expected. **Consequence:** The consequence of the threat is additional cut material to flatten sloped or retaining walls are required. Therefore, project cost increase.	Connect Water	Live - Treat	Investigations	High	Very High	22	Carried out geotechnical investigations (3 boreholes and window samples) during concept design. Arranging SI for 2023 to inform detailed design.	High	Medium	19	
12	12	Environmental	Loss of habitat	**Description:** There is a threat that there will be loss of natural habitat for animal life **Cause:** The cause of the threat is vegetation clearance to make space for construction of the reservoir and pipelines **Consequence:** The consequence of the threat is disrupting ecosystem, difficulty in consenting and negative public perception towards project.	Connect Water	Live - Parked	Design Development	High	High	21	Ecology site visits and assessment almost completed. The loss of habitat will be temporary and managed through avoiding wetlands, construction programming (nesting birds) and applying for a lizard permit to salvage and transfer lizards. Directional drilling of the hillside pipe considered during ECI. Not ruled out, but appears too high-risk.	High	Medium	19	
13	14	Reservoir Site	Move tank up ridgeline	**Description**: There is an opportunity to move the tank up the ridgeline to improve balance between cut and fill **Cause**: The cause of the opportunity is site space constraints **Consequence**: The consequence of the opportunity is improve balance between cut and fill / improve stability.	Connect Water	Live - Parked	Design Development	Medium	Very Low	4	WWL confirmed TWL to stay as per existing Naenae 1, therefore limited opportunity to move tank up ridgeline.	High	Medium	19	
14	21	Procurement	Re-use cut material	**Description:** There is an opportunity to export cut material to another project **Cause:** The cause of the opportunity is effective construction planning (planning where material is coming from and going to) **Consequence:** The consequence of the opportunity is material efficiency, waste reduction and reducing cost for other project	Connect Water	Live - Parked	Construction	Medium	Low	11	Discussed with contractors during ECI. Opportunity still there. Consider potential for fill on other HCC projects. WWL to raise with HCC. Propose opportunities in RFT.	High	Medium	19	

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15	105	Reservoir Site	Change site RL	**Description**: There is an opportunity to raise the RL of the working platform and finished levels to reduce the amount of cut. **Cause**: The cause of the opportunity is construction could utilise a ramp down to the reservoir invert. **Consequence**: The consequence of the opportunity is improve balance between cut and fill and have partially buried reservoir.	Connect Water	Live - Parked	Detailed Design	Medium	Very Low	4	The option of raising the RL of the working platform and finished levels to approximately 68 m R.L (rather than 66m) was raised during ECI. Will result in a partially buried reservoir. Consent RL of 66m, but leave as option for D&C team.	High	Medium	19	
16	17	Environmental	Reservoir - plantings	**Description**: There is an opportunity to carry out more extensive plantings of vegetation around reservoir site than required in consents **Cause**: The cause of the opportunity is to leverage the site location with community and ecology in mind and planning what to do after construction **Consequence**: The consequence of the opportunity is improved ecology, recreational and social services in area, improve public perception of build	Connect Water	Live - Parked	Design Development	Medium	Medium	15	Allow additional budget for over and above planting. Confirm requirements for tender. Currently (July '23) carrying out on-line survey to gauge public use and interest in the site.	Medium	Very High	18	
17	18	Financial	Escalation allowance	**Description:** There is a threat that escalation is not allowed for appropriately when setting project budgets resulting in tender costs exceeding the project budget. **Cause:** The cause of the threat is inflation and escalation are difficult to estimate accurately due to volatile global markets and local constraints. **Consequence**: The consequence of the threat is that the project cost could exceed budget.	Wellington Water	Live - Parked	Procurement	Very High	Very High	25	An assessment of escalation was made in the cost estimation report. HCC allow for escalation across their LTP.	Medium	High	17	
18	19	Environmental	Waiwhetu Stream Crossing site - plantings	**Description**: There is an opportunity to carry out more extensive plantings at Waiwhetu stream crossing site than required by consents. **Cause**: The cause of the opportunity is to leverage the site location with community and ecology in mind and planning what to do after construction **Consequence**: The consequence of the opportunity is improved ecology, recreational and social services in area, improve public perception of build	Connect Water	Live - Parked	Design Development	Low	Low	6	Allow additional budget for over and above planting. Currently (July '23) carrying out on-line survey to gauge public use and interest in the site. Includes engagement with the Friends of Waiwhetu Stream.	Medium	High	17	
19	16	Procurement	Dispose of cut material at nearby gully	**Description**: There is an opportunity to dispose of cut material within a gully near the site. **Cause:** The cause of the opportunity is pre planning, high volume of cut material, presence of gullies close to the site and potential high negative impacts and cost of disposal offsite. **Consequence:** The consequence of the opportunity is not needing to transport cut material further than needed.	Connect Water	Live - Parked	Construction	Medium	Low	11	Complete a stockpile assessment to understand options for stockpiling, risks, mitigation and costs. Further investigations completed as part of ECI. Parked for now whilst focusing on main consent.	High	Low	16	
20	15	Stakeholder	Mana whenua - delays in feedback	**Description:** There is a threat that there will be delays in or lack of mana whenua engagement causes delays to consenting and reputational harm **Cause:** The cause of the threat is mana whenua representatives are extremely busy and Connect Water/ WWL do not engage early enough for them to schedule resourcing efforts to be in project at steps they wish. **Consequence:** The consequence of the threat is delay in project and relationship harm between Mana Whenua and WWL	Connect Water	Live - Parked	Design Development	High	High	21	CIA completed and letter received from Taranaki Whanui. Currently checking next steps with Paul Clarke (mana whenua engagement form completed). Latest process is to issue an "Iwi Engagement Pack" to Mana Whenua prior to finalising AEE.	High	Low	16	
21	22	Construction	Slope failure during construction	**Description**: There is a threat that construction activities destabilise slopes causing a slip that could impact properties at the base of the hill. **Cause**: The cause of the threat is inadequate design and construction considerations. Significantly adverse weather. **Consequence**: The consequence of the threat is slope failure therefore potential catastrophic risk to human life and/or structure	Connect Water	Live - Parked	Construction	Very High	Medium	23	Further site investigations planned to inform detailed design. Contractor to develop methodology to be reviewed by Principal's advisors (Geotech). Close monitoring.	High	Low	16	
22	23	Reservoir Site	Future replacement of Naenae 1	**Description**: There is an opportunity to consider Naenae1 future replacement in this design. **Cause**: The cause of the opportunity is future resilience consideration **Consequence**: The consequence of the opportunity is increased cost, increased resilience in network for Naenae 1 replacement.	Connect Water	Live - Parked	Design Development	Medium	Very Low	4	Have discussed during ECI and considered minimum offsets in the Eastern Hills design. A 15-20m offset has been suggested but further space allowed for by shifting tank. Include in Principal's Requirements.	High	Low	16	

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23	24	Site	Contaminated Land	**Description:** There is a threat that contaminated land is found during construction causing delays and additional cost. **Cause:** The cause of the threat is unidentified contaminated land is discovered particularly on pipeline routes. **Consequence:** The consequence of the threat is delays and additional cost during the construction phase.	Connect Water	Live - Treat	Optioneering	High	Medium	19	Included contaminated land testing in additional SI to be undertaken after consent lodgement. Contingency allowance included for contaminated material in estimate.	High	Low	16	
24	25	Consents	Consent - Stakeholder and Public Engagement	**Description:** There is a threat that ineffective stakeholder management and public engagement causing project delays, additional cost or negative reputational impacts. **Cause:** Poor stakeholder identification; stakeholder management plan does not reflect needs of stakeholders, insufficient public engagement. **Consequence:** Inability or delay to consent project. Project delays and additional costs. Onerous consent requirements leading to additional costs.	Connect Water	Live - Treat	Design Development	High	High	21	Community and Stakeholder Engagement Plan prepared and implemented. Keep HCC informed of public events. Potential to invite HCC councillors to events.	High	Low	16	
25	26	Construction	Construction and Commissioning	**Description:** There is a threat of insufficient availability of the right construction monitoring and observation staff. **Cause**: Tight labour market, busy with other projects. **Consequence**: Poor quality management / assurance during construction.	Connect Water	Live - Parked	Construction	High	Medium	19	Programme in MSQA requirements as soon as construction programme confirmed. Ensure MSQA staff have knowledge of amendments to NZS 3910/3916.	High	Low	16	
26	27	Consents	Missed or change in consented Scope	**Description**: There is a threat that an element of physical work scope is missed during the concept/detailed design phases or the D&C contractor moves away from the consented scope of work. **Cause**: The cause of the threat is multiple people working in isolation and not checking back to scope and lack of reviews. Consents sought prior to D&C engagement. **Consequence**: The consequence of the threat is that the cost estimate misses an element of scope resulting in actual costs exceeding budget. Revised consents required later which may or may not be granted affecting programme.	Connect Water	Live - Parked	Optioneering	High	High	21	Held cost/risk workshop in January 2023 with Connect Water, WWL stakeholders and Bond CM. Engaged with two potential D&C contractors during consenting phase and incorporate feedback on design and consents. Ensure all reasonable ECI feedback is included in consent lodgement. Allow some flexibility in details of consent.	High	Medium	19	
27	28	Project Delivery	3 Waters Reform transition	**Description**: There is a threat that Entity G may delay project or not provide funding. **Cause**: The cause of the threat is if the contract is not awarded before January 2024. New entity may have change in priority and funding. DIA also have right to reviewed and approve contracts. **Consequence**: The consequence of the threat is delay in project due to re-prioritsation.	Connect Water	Live - Parked	Optioneering	High	High	21	Further uncertainty around Entity G and the up-coming elections. New entity in ~Dec 24. Will HCC have funding for three large major projects at the same time? Going through list of priority projects now. Enter D&C contract prior to June 2024 if possible.	High	Low	16	
28	29	Consents	Discharge	**Description**: There is a threat of discharge consents for the overflow and stormwater discharge to Waiwhetu stream not being approved. **Cause**: The cause of the threat is flow rates for overflow or emptying of the reservoir are not accepted due to stream or scour impacts. Chlorination and fluoride levels in the water. **Consequence**: The consequence of the threat is difficulty in consenting or requirement to implement additional measures with increased cost.	Connect Water	Live - Parked	Construction	Very High	Medium	23	Have designed adequate scour protection and environmental mitigation. Design allows for de-chlorination in valve chamber for planned maintenance. Emergency discharge would have elevated chlorine levels, but that is not consentable. Review fluoride levels against allowable discharge limit of 1.5 mg/L and what the risk is.	High	Low	16	
29	109	Environmental	Lizard Permit	**Description**: There is a threat that the DOC lizard salvage and transfer permit is not granted in time for construction. **Cause**: DOC have limited staff and are also changing the process for lizard permits. Permits can take months to receive. Earthworks cannot start until the lizards are shifted. **Consequence**: Programme delays and cost due to missing the summer earthworks period.	Connect Water	Live - Treat	Construction	High	Medium	19	Have applied early for the salvage and transfer lizard permit with DOC (submitted May '23). Prepare Lizard Mnanagement Plan for submittal to DOC. Keep following up.	High	Low	16	

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30	110	Construction	Summit Rd and bridge condition	**Description**: There is a threat that Summit Road or the bridge at Tilbury St will be damaged during construction and require partial or full reinstatement or repairs. **Cause**: Heavy vehicles and high traffic volumes cause damage to road surface. Bridge may not be designed for heavy vehicle loads. **Consequence**: Additional cost to re-surface the road or repair the bridge.	Connect Water	Live - Treat	Construction	Medium	High	17	Check Tilbury St bridge allowable load limits. Check HCC plans for road resurfacing for both Balgownie and Summit Road. Include provisional sum or HCC cost?	High	Low	16	
31	31	Procurement	Steel Pipe supply	**Description:** There is a threat that steel pipe cannot be sourced at the required standard or estimated cost resulting in changes to material standards, design and/or increases in budget. **Cause:** The cause of the threat is Steel Pipe NZ going out of business and offshore supply options may be more expensive or not meet NZ standards, **Consequence:** The consequence of the threat is need to change standards, switch to alternative pipe material or pay increased costs for supply with longer supply timeframes.	Connect Water	Live - Treat	Detailed Design	Very High	High	24	Discussed option of PE with WWL (May '23). Will document in Prelim Design Report. Identify alternative suppliers for steel pipe. Consider Seismic Resilient Ductile Iron Pipe.	Medium	Medium	15	
32	32	Consents	Downhill pipeline - technical	**Description**: There is a threat that downhill pipeline is found to have level of difficulty compared to assumed resulting in new technical features being required and higher costs. **Cause**: The cause of the threat is difficult construction on steep slopes. **Consequence**: The consequence of the threat is would need to revisit second large pipeline down Summit Road or utilise directional drilling.	Connect Water	Live - Parked	Design Development	High	High	21	Have investigated directional drilling as part of Eci process. High risk but not ruled out. D&C contractors provided commentary on risks and methodology of pipeline construction. GHD to provide Indpendent Review of prelim design.	Medium	Medium	15	
33	33	Procurement	Supply chain issues	**Description**: There is a threat of construction material delay for reservoir and pipeline components **Cause**: The cause of the threat is supply chain issues (i.e., pandemic related) **Consequence**: The consequence of the threat is delay in project or more funding required to source and design for other suitable materials.	Connect Water	Live - Parked	Procurement	High	Medium	19	Early engagement and procurement plans	Medium	Medium	15	
34	34	Financial	Cut to waste cost estimate	**Description**: There is a threat that cut to waste costs exceed estimated cost due to increased clean fill landfill fees or need to tip further than estimated. **Cause**: The cause of the threat is inadequate cost estimate using inaccurate/out of date Information. Changes in landfill options and costs between estimate and construction. **Consequence**: The consequence of the threat is that WWL need to seek additional funding due to budgets being insufficient which will cause reputational harm and potentially delay project or make it unviable.	Connect Water	Live - Parked	Procurement	High	High	21	Investigate options for disposal of cut material on site or on other projects to avoid landfill. Note that changes to the NPS on indigienous biodiversity mean on-site fill disposal is highly unlikely to be granted consent. Parked while the team focuses on main consent.	Medium	Medium	15	
35	35	Design	Design change post consent	**Description:** There is a threat that there is a design change post lodgement that would not be covered by consents. **Cause**: The cause of the threat is a change by D&C Contractor from the prelim design on which consents are based. D&C contractor may find a more economic solution. **Consequence:** The consequence of the threat is requirement for new consents, delay in project, cost impact and reputational damage from community.	Connect Water	Live - Parked	Design Development	High	Very High	22	Engaged with two potential D&C contractors during consenting phase and incorporated feedback on design and consents. Ensure all reasonable ECI feedback is included in consent lodgement.	Medium	Medium	15	
36	36	Environmental	Visual impact	**Description**: There is a threat that the visual, landscape and natural character impact is assessed to be too high or submissions received against it. **Cause**: The cause of the threat is the fully above ground reservoir on a ridgeline with limited space for planting around it. Need to clear vegetation for pipelines and the stream crossing bridge. **Consequence**: The consequence of the threat is difficulty obtaining consents. Potential requirement to use more expensive screening treatment and alter pipe routes and underground the stream crossing.	Connect Water	Live - Treat	Procurement	High	High	21	Conduct landscape, visual and natural character assessment identifying key viewpoints and mitigation. Underway as of July '23. Changed to a below-ground stream crossing due to this threat (and H&S and resiliance).	Medium	Medium	15	

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37	37	Construction	Lack of site space	**Description**: There is a threat that there will be lack of working room on site **Cause:** The cause of the threat is lack of site space and not effectively planning construction activities to optimise space **Consequence**: The consequence of the threat is increased physical works costs over that estimated and budgeted due to reduced productivity or need to increase earthworks and temporary works to extend construction platform.	Connect Water	Live - Treat	Design Development	High	Very High	22	ECI carried out during prelim design to ensure consents allow sufficient construction footprint. D&C to transfer this risk. Cost estimate has allowed a relatively low productivity in cost estimate.	Medium	Medium	15	
38	40	Stakeholder	Unrealistic mitigation expectations	**Description:** There is a threat that there will be unrealistic mitigation expectations from surrounding neighbours **Cause**: The cause of the threat is not communicating early with neighbours with what can and cannot do - meeting in the middle. **Consequence:** The consequence of the threat is resident opposition to consents and potential project delays due to resolution not met or additional cost if expectations granted.	Connect Water	Live - Parked	Design Development	Medium	High	17	Early engagement with public. Allowance for additional mitigations in cost estimate.	Medium	Medium	15	
39	41	Operations and Maintenance	Water availability	**Description**: There is a threat that there will be a lack of water availability for commissioning/water testing **Cause:** The cause of the threat is water supply is constrained, particularly at certain times of the year. A large volume of water is required for water tightness and commissioning tests. **Consequence:** The consequence of the threat is unable to complete commissioning/water testing required or increased cost and network constraints required to enable water supply	Connect Water	Live - Parked	Operation	Medium	High	17	Programme to consider water availability for commissioning. Allowed for in cost estimate.	Medium	Medium	15	
40	42	Reservoir Site	Bury reservoir	**Description**: There is an opportunity to bury the reservoir fully or partly (i.e., 50%) **Cause**: The cause of the opportunity is to avoid earthworks off site **Consequence:** The consequence of the opportunity is access maintenance issues.	Connect Water	Live - Parked	Design Development	Low	Very Low	2	Connect Water discussed partial backfill of walls with WWL. Not preferred, but can be done. (Regulator doesn't prefer). ECI teams considered, but little benefit as the excavated material would require stockpiling on or near site. D&C team can consider further.	Medium	Medium	15	
41	43	Environmental	Recreational opportunities	**Description**: There is an opportunity to provide better recreational opportunities once reservoir complete (including a site look-out) **Cause**: The cause of the opportunity is to leverage the site location with community in mind **Consequence**: The consequence of the opportunity is increased social and recreational services to community, security and safety considerations required to ensure public safety and minimise reservoir damage.	Connect Water	Live - Parked	Design Development	Low	Very Low	2	Allow additional budget for over and above planting and landscaping. Consider as part of mitigations associated with consent. Currently (July '23) carrying out on-line survey to gauge public use and interest in the site.	Medium	Medium	15	
42	44	Commercial	Eastern Hills provide additional storage for Naenae 1	**Description**: There is an opportunity to provide additional storage to facilitate replacement of Naenae 1 **Cause**: The cause of the opportunity is the need to be site efficient due to lack of storage space **Consequence:** The consequence of the opportunity is water efficiency, improve resilience of network	Connect Water	Live - Parked	Closure	Low	Very Low	2	Volume of 15ML agreed during concept design. Potential to re-visit storage as part of wider zone storage volume considering Gracefield Reservoir replacement timing. Connect Water to prepare memo.	Medium	Medium	15	
43	45	Stakeholder	Incorporating local iwi members - procurement	**Description:** There is an opportunity to explore cultural initiatives within the procurement process and provide technical experience and career opportunities to members of local iwi. **Cause:** The cause of the opportunity is recognition of our duty as partners with Māori in this build. **Consequence:** The consequence of the opportunity is improved relationship with mana whenua, creation of employment and experience opportunities, meaningful outcomes.	Connect Water	Live - Treat	Design Development	Low	Very Low	2	Ongoing engagement with mana whenua throughout project lifecycle. Mana Whenua engagement form to be completed.	Medium	Medium	15	
44	46	Construction	Adverse Weather	**Description**: There is a threat that bad weather will delay construction **Cause**: The cause of the threat is large project requires long construction duration in different weather seasons **Consequence**: The consequence of the threat is additional cost over budget allowance and delay in programme.	Connect Water	Live - Parked	Construction	High	Very High	22	Works to take place over multiple year, schedule works to consider the weather conditions for various construction activities. Budget to allow sufficient contingency.	Medium	Medium	15	

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45	49	Health and Safety	Health and Safety - Poor practices on site	**Description:** There is a threat that there is poor health and safety practices on site **Cause:** The cause of the threat is not assessing contractor H&S suitability during tender evaluation. **Consequence**: Risk of death or serious injury. Will also result in potential legal ramifications and additional cost and delays	Connect Water	Live - Parked	Construction	Very High	Low	20	Assess contractor H&S suitability during tender evaluation. Frequent auditing during the construction period.	Very High	Very Low	13	
46	50	Environmental	Fire	**Description:** There is a threat that fire could be started during construction activities or threatening the site **Cause:** The cause of the threat is nearby vegetation in site area **Consequence:** The consequence of the threat is environmental damage, injury, fatality and/or infrastructure damage.	Connect Water	Live - Parked	Construction	Very High	Low	20	Have consulted with FENZ. Require emergency procedures as part of tender and fire mitigation measures. Take learning from Omaroro and apply.	Very High	Very Low	13	
47	53	Cultural	Māori name for reservoir, incorporating cultural elements	**Description**: There is an opportunity to incorporate Te ao Māori into name and/or other cultural elements of reservoir and involve mana whenua in the process **Cause**: The cause of the opportunity is recognition of Māori in partnership **Consequence**: The consequence of the opportunity is improved recognition of iwi Māori through lasting cultural elements. But need to ask mana whenua representatives with other aspects of project and not only name and cultural elements at end of project.	Connect Water	Live - Parked	Design Development	Very Low	Very Low	1	Consultation with Mana Whenua and CIA undertaken during concept design. Name "Waiwerowero" proposed for reservoir. To be adopted after consenting. Continue to engage with Mana Whenua.	Low	High	12	
48	13	Environmental	Threatened species finding	**Description:** There is a threat that more detailed ecological investigation may find threatened species or areas of ecological significance/ sensitivity. **Cause**: The cause of the threat is not doing a detailed ecological investigation early/in the concept phase and the project involving work with areas of well established vegetation. **Consequence:** The consequence of the threat is increased mitigation requirements, difficulty obtaining consents requiring design changes or in a worst case a change in location.	Connect Water	Live - Parked	Design Development	High	Medium	19	Ecology site visits and assessment almost completed. The loss of habitat will be temporary and managed through avoiding wetlands, construction programming (nesting birds) and applying for a lizard permit to salvage and transfer lizards. Directional drilling of the hillside pipe considered during ECI. Not ruled out, but appears too high-risk.	Medium	Low	11	
49	56	Reservoir Site	Seismic	**Description**: There is a threat concept structural design is found to not meet the required seismic performance criteria at later stages of design. **Cause:** The cause of the threat is structural analysis is not undertaken at concept design stage and ground conditions are not fully understood. **Consequence:** The consequence of the threat is a change of design that means the L2 estimate is exceeded.	Connect Water	Live - Treat	Optioneering	High	High	21	Concept structural design updated based on PSSHA and latest geotech findings. No update to cost estimate during prelim design.	Medium	Low	11	
50	57	Project Delivery	Design halt at review stage	**Description**: There is a threat that reviewers, Principal and D&C contractor cannot agree on design **Cause**: The cause of the threat is D&C contractor will aim to develop a low cost design that may rely on interpretations of the PRs or requirements different to that of reviewers. **Consequence:** The consequence of the threat is delays and cost impacts from extended review times and claims.	Connect Water	Live - Treat	Design Development	Medium	High	17	Write Princpal's Requirements robustly. Apply learnings from Aotea. Procurement as part of multiple reservoirs so Contractor needs to meet KPIs.	Medium	Low	11	
51	58	Design	Design Disciplines	**Description**: There is a threat that design disciplines are not involved at the right time leading to changes in design later. **Cause**: Poor PM co-ordination; unavailability of resources. **Consequence:** Poor decision making without right technical inputs, leading to future re-visit of these decisions and potential re-work/delays.	Connect Water	Live - Treat	Detailed Design	Medium	Low	11	Project management team and large part of technical team coming from one organisation (Connect Water).	Medium	Low	11	
52	59	Design	Design Assumptions	**Description**: There is a threat that design assumptions made during the optioneering and prelim design stage are later found to be incorrect resulting in rework, delays, additional cost or failure to meet objectives. **Cause**: The cause of the threat is assumptions made during optioneering are incorrect. **Consequence**: The consequence of the threat is rework, delays, additional cost or failure to meet objectives.	Connect Water	Live - Treat	Design Development	Very High	Medium	23	Connect Water have held various design review meetings with WWL stakeholders and have arranged GHD to independent review the prelim design.	Medium	Low	11	

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53	60	Pandemic	Pandemic	**Description**: There is a threat that a pandemic causes delays to the project due to government response, procurement delays and or other restrictions **Cause**: The cause of the threat is restrictions implemented due to outbreak of a pandemic within New Zealand or globally. **Consequence**: The consequence of the threat is delays to the project from slow procurement of materials or government restrictions slowing design and construction.	Wellington Water	Live - Treat	Optioneering	Medium	Medium	15	Design teams to have procedures for remote working to maintain progress during design stage. WWL has developed procedures for managing construction sites during pandemic restrictions. Ensure procurement and construction timeframes allow for long lead items. What NZS 3910/3916 special conditions does WWL have?	Medium	Low	11	
54	61	Design	Inadequate design review	**Description**: There is a threat of inadequate design review and allowance for WWL process during detailed design. **Cause**: D&C teams not being aware of or following the WWL approval process.. **Consequence:** Detailed design not incoporating WWL requirements. Threat of re-design or modifications post-construction.	Connect Water	Live - Treat	Detailed Design	Medium	Medium	15	Princpal's Requirements to include detailed requirements for design review and approval process.	Medium	Low	11	
55	61	Operation handover	Operations	**Description**: There is a threat of inadequate operations handover and instruction. **Cause**: Lack of investment in training and handover process; programme pressures. Change in operator entity during construction. **Consequence:** Operational errors, increased maintenance, facility costs more to run than expected.	Connect Water	Live - Parked	Handover	Medium	Medium	15	Princpal's Requirements to include detailed requirements for handover and training with agreement from ops team.	Medium	Low	11	
56	62	Consents	Building Consent	**Description**: There is a threat that building consent application is rejected **Cause**: The cause of the threat could be D&C supplier aiming for a low-cost design, lack of agreement between peer reviewer and designer on design/ seismic criteria satisfaction or council perceiving issues with the design.. **Consequence**: The consequence of the threat is redesign required and project delays	Connect Water	Live - Parked	Design Development	Medium	Medium	15	Connect Water has assessed building consents - low risk of not being approved. GHD engaged as independent reviewers can also comment on risk.	Medium	Low	11	
57	64	Pipelines	Pipelines stream crossing - poor ground conditions	**Description:** There is a threat that pipe stream crossing has poor ground conditions **Cause:** The cause of the threat is inadequate ground investigations and not considering this in design. **Consequence**: The consequence of the threat is design impact and increased cost to upgrade foundation design or change from directional drilling if that option is selected.	Connect Water	Live - Treat	Investigations	Medium	Medium	15	Carried out geotechnical investigations (3 boreholes and window samples) during concept design. This has informed the prelim design of the stream crossing. Have consulted with D&C contractors to confirm additional geotech site investigations, including at stream. Arranging SI for 2023 to inform detailed design. Allowed for risk in cost estimate.	Medium	Low	11	
58	65	Cultural	Not well understood cultural impacts	**Description:** There is a threat that the site is later found to have higher cultural significant than thought resulting in a need to change design. **Cause:** The cause of the threat is not considering cultural impacts with mana whenua input at site selection stage. **Consequence:** The consequence of the threat is that Iwi oppose the project consents or changes are required to gain supporting resulting in additional cost and delays.	Connect Water	Live - Treat	Optioneering	High	Very High	22	Have completed a CIA which was in consultation with mana whenua. Maintain mana whenua engagement throughout project lifecycle.	Medium	Low	11	
59	66	Construction	Vibration impacts	**Description**: There is a threat that vibration from reservoir or pipe construction causes damages to property **Cause:** The cause of the threat is proximity of works to properties and selection of inappropriate techniques and equipment. **Consequence:** The consequence of the threat is reputational harm and additional costs to repair properties.	Connect Water	Live - Parked	Construction	Medium	High	17	Completed vibration assessments as part of consent application. Cosmetic damage is unlikely, but there may be some exceedance of human annoyance threshold. Allow for de-lap survey for critical properties along Summit Road.	Medium	Low	11	
60	67	Construction	Construction impacts more than expected	**Description:** There is a threat that construction impacts exceed those anticipated by specialists **Cause:** The cause of the threat is complicated build in difficult site conditions **Consequence:** The consequence of the threat is environmental damage, cost increase, project delay, negative project perception	Connect Water	Live - Parked	Construction	High	Medium	19	Have involved D&C contractors during consenting phase and requested feedback on design and constructabiity.	Medium	Low	11	

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61	69	Stakeholder	Incorporating local iwi members - construction	**Description:** There is an opportunity for mana whenua involvement in construction / monitoring of reservoirs **Cause**: The cause of the opportunity is recognition of our duty as partners with Māori in this project. **Consequence:** The consequence of the opportunity is improved relationship with mana whenua, creation of employment and experience opportunities, meaningful outcomes	Connect Water	Live - Parked	Design Development	Low	Very Low	2	Consultation with Mana Whenua. Consider in PMP for construction phase and work with ECI contractor to understand opportunity.	Medium	Low	11	
62	72	Construction	Subsidence	**Description**: There is a threat that subsidence will occur in ground **Cause**: The cause of the threat is dewatering during construction phase **Consequence**: The consequence of the threat is will require additional work to remediate site	Connect Water	Live - Treat	Construction	Medium	Medium	15	Connect Water undertaking dewatering-induced settlement assessment.	Medium	Low	11	
63	111	Design	Change to reservoir volume	**Description**: There is a threat that the Eastern Hills reservoir project will be delayed while WWL re-assess the balance of storage volume across Gracefield, Naenae and Eastern Hills reservoirs. **Cause**: Gracefield reservoir condition means it needs replacing sooner than 2060, which has changed the basis of the volume sizing report. **Consequence**: Project delays and re-work of design and consent to suit new Eastern Hills reservoir volume.	Wellington Water	Live - Treat	Optioneering	High	Medium	19	Connect Water to prepare a sizing memo for WWL review. Connect Water PM to discuss with Chief Advisor Potable Water. Delivery team to continue with 15ML volume.	Medium	Low	11	
64	106	Environmental	Wetlands	**Description:** There is a threat that construction will be within 10m of an identified wetland. **Cause:** The cause of the threat is not confirming the wetland locations sufficiently during the detailed ecological investigations. **Consequence:** The consequence of the threat is increased mitigation requirements, difficulty obtaining consents requiring design changes, delay to programme, and increased legal costs.	Connect Water	Live - Parked	Design Development	High	Medium	19	Ecology site visits to confirm wetland locations and assessment almost completed. The delivery pipe alignment has been selected to avoid the wetland buffer of 10m, but there is a risk that the wetlands weren't mapped correctly or construction needs to be shifted due to other design or construction constraints. D&C team to assess further and be aware of wetland dilenation and risk.	Medium	Low	11	
65	94	Design	Outlet main undersized	**Description**: There is a threat that the outlet main is undersized. **Cause**: The cause of the threat is inadequate/inaccurate design flows and/or projections used during design phase. **Consequence**: The consequence of the threat is service issues and lower delivery pressure, may result in premature replacement of main.	Connect Water	Live - Parked	Detailed Design	Medium	Low	11	A modelling report was prepared by Stantec (through the WWL modelling team) and recommended a DN750 outlet main. However, the future flowrates were based on population projections to 2050. WWL are accepting the risk.	Medium	Low	11	
66	74	Legal	Legal - Consent breach	**Description:** There is a threat that a local authority takes legal action or imposes fines due to a breach of consent or lack of suitable consent. **Cause**: The cause of the threat is not the contractor not meeting resource consent requirements or works being unconsented due to consents being inappropriate. **Consequence**: Financial cost and reputational harm to WWL and client council.	Connect Water	Live - Treat	Construction	Medium	High	17	Draft resource consent conditions to form part of tender docs. Monitor during construction.	Low	Medium	10	
67	75	Consents	Lack of staff/resources	**Description**: There is a threat that there is a lack of planning staff/resources to prepare/review applications and specialist assessments.. **Cause**: The cause of the threat is not preparing resource capability and/or not enough capability within the team. **Consequence**: The consequence of the threat is potential severe project delay if there is little to no staff available and potential outsourcing of capability which could require additional time and funding.	Connect Water	Live - Treat	Design Development	Medium	High	17	Appointed planning lead for project to be part of core project delivery team, placing works in high priority. Planning team heavily involved.	Low	Medium	10	
68	76	Consents	Processing delays - HCC and/or GWRC	**Description**: There is a threat that there are processing delays with Hutt City Council and/or Greater Wellington Regional Council. **Cause**: The cause of the threat is resourcing constraints at processing councils and their experts. **Consequence**: The consequence of the threat is potential delay in the project.	Connect Water	Live - Parked	Design Development	Medium	Medium	15	Allow for extended processing period in programme. Re-check timeframes with planning team.	Low	Medium	10	

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69	77	Stakeholder	Vegetation clearing for project	**Description**: There is a threat that vegetation clearing required for project is opposed by the community or councils. **Cause**: The cause of the threat is lack of community engagement and transparency as to why vegetation clearing is required or presence of more native and valuable vegetation species. **Consequence**: The consequence of the threat is disgruntled public and potential project delays due to resolution not met.	Connect Water	Live - Parked	Design Development	Medium	Very High	18	Ecology site visits and assessment almost completed. The loss of vegetation will be temporary and restorative planting included in landscape plan. Two open days held in March. Further early engagement with potentially impacted residents is being undertaken via on-line survey, letter drop and street events (11th/12th July '23). Continue to undertake stakeholder engagement and implement	Low	Medium	10	
70	78	Project Delivery	Sickness	**Description**: There is a threat that Covid-19 or sickness occurs within design team. **Cause**: The cause of the threat is Covid-19 pandemic and other sickness circulating when working together face to face. **Consequence**: The consequence of the threat is delay to design delivery	Connect Water	Live - Parked	Detailed Design	Medium	High	17	Connect Water has pandemic response plan and business continuity plan, including ability to work remotely.	Low	Medium	10	
71	80	Reservoir Site	Improve mountain bike/walking access	**Description**: There is an opportunity to improve the mountain bike track and walking access in the area **Cause**: The cause of the opportunity is to leverage the nearby areas **Consequence**: The consequence of the opportunity is improved community recreational services and community connection with project/environment	Connect Water	Live - Treat	Design Development	low	Very Low	2	Allow additional budget for over and above design & landscaping. Currently (July '23) carrying out on-line survey to gauge public use and interest in the site.	Low	Medium	10	
72	81	Stakeholder	Installing recreational activity as part of clearing	**Description**: There is an opportunity to fulfil requests by community of installation of recreational activities as part of the clearing (i.e., hiking path or trail) **Cause**: The cause of the opportunity is utilising space where possible **Consequence**: The consequence of the opportunity is improved relationship with community, improved social and recreational services.	Connect Water	Live - Parked	Design Development	Very Low	Very Low	1	Allow additional budget for over and above design & landscaping. Currently (July '23) carrying out on-line survey to gauge public use and interest in the site.	Low	Medium	10	
73	82	Social	Community involvement - landscape planting	**Description:** There is an opportunity to involve community in landscape planting. potential opportunity to partner with community group (i.e., Rotary), create working bee. **Cause:** The cause of the opportunity is planting is required at site **Consequence**: The consequence of the opportunity is improved community engagement, social cohesion and providing opportunity for community to be a hands on part of build.	Connect Water	Live - Parked	Construction	Low	Very Low	2	Review through consultation stages and prior to construction.	Low	Medium	10	
74	48	Consents	Site - geotechnical suitability fatal flaw	**Description**: There is a threat that the site is identified to have geotechnical issues resulting in the reservoir not being technically feasible or being cost prohibitive on this site. **Cause**: The cause of the threat is investigations during design or excavation during construction identifies ground conditions worse than anticipated. **Consequence**: The consequence of the threat is a need to relocate the reservoir to another site.	Connect Water	Live - Treat	Design Development	Very High	Low	20	Geotechnical investigations for reservoir footprint, stream crossing and pipeline sections updated during prelim design. Site is feasible and not cost-prohibitive. Do further site investigations to inform detailed design.	High	Very Low	8	
75	83	Consents	Resource Consent due to perceived impacts	**Description**: There is a threat that resource consent application is rejected due to the environmental impacts being perceived by processing councils as too significant. **Cause**: The cause of the threat a large construction impact that may have significant impacts on the environment. **Consequence**: The consequence of the threat is redesign required and project delays.	Connect Water	Live - Treat	Design Development	Very High	Low	20	Connect Water have held pre-application meetings with HCC and GWRC. Use experienced specialists to assess the effects. Legal reviews.	High	Very Low	8	
76	84	Objectives	Objectives	**Description**: There is a threat that the project brief and objectives are unclear or unachievable. **Cause**: Brief is poorly written or contains unrealistic objectives. **Consequence**: Project brief and objectives are not met.	Wellington Water	Live - Treat	Design Development	High	Medium	19	Brief reviewed by Connect Water prior to progressing project and any uncertainty clarified. Alignment with brief to be checked at each report stage.	High	Very Low	8	
77	85	Legal	Legal - Action from contractor	**Description**: There is a threat that the contractor takes legal action. **Cause**: A contractual dispute during construction. **Consequence:** The consequence of the threat is project delays and additional project costs.	Connect Water	Live - Treat	Construction	High	Medium	19	Learn lessons from Aotea Reservoir tender docs. Ensure suitable review and sufficient time for reviews (legal review to be carried out).	High	Very Low	8	

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78	87	Procurement	Liquidation - Contractor or Designer in D&C team	**Description:** There is a threat that the contractor or designer in D&C team goes into liquidation **Cause:** The cause of the threat is poor financial status of one or more companies, poor performance on this or other projects. International companies leaving NZ. **Consequence:** The consequence of the threat is WWL need to bring in another team that will require additional funding which will delay project or make it unviable.	Connect Water	Live - Parked	Procurement	Very High	Low	20	Ensure sufficient contract protection is in place before going to tender.	High	Very Low	8	
79	88	Project Delivery	Local government change	**Description**: There is a threat that the project is delayed by a change in local government and a need to re-justify project requirement. **Cause**: The cause of the threat is change of local government (therefore perspectives to project) **Consequence**: The consequence of the threat is project delay	Connect Water	Live - Parked	Design Development	High	Low	16	Next local election in 2025, project expected to be well within contruction phase and liklihood of project delay low	High	Very Low	8	
80	90	Consents	Assessment of alternatives	**Description**: There is a threat that the assessment of alternatives is not robust- leaping to a solution results project not being able to obtain consent. **Cause**: Programme or cost pressures to arrive at preferred solution. Lack of knowledge of alternatives. **Consequence**: Consenting difficulty. Need to revisit assessment of alternatives and potential for more suitable option to be identified later resulting in rework and lost investment.	Connect Water	Live - Parked	Design Development	Low	Medium	10	Denton's was invovled throughout the MCA and site selection stage and reviewed the Site Selection Report. Dentons will review the AEE prior to lodgement.	Low	Low	6	
81	92	Environmental	Runoff impacts water quality in stream	**Description:** There is a threat that sediment laden runoff impacts water quality to stream **Cause:** The cause of the threat is increased sediment from construction phase **Consequence**: The consequence of the threat is impacting water quality to stream, consenting difficulty and negative public perception towards project	Connect Water	Live - Parked	Construction	Medium	Medium	15	Sediment control to be detailed by contractor and continually monitored.	Low	Low	6	
82	109	Consents	New NPS	**Description**: There is threat from the new National Policy Statement (NPS) on Indigenous Biodiversity which limits development within a Significant Natural Area. This comes into effect on 4 August. **Cause**: New legislation is un-tested and has no case law. Uncertainty around the application by HCC of the new NPS. **Consequence**: Consenting difficulty and delays for approval. Additional work to assess effects.	Connect Water	Live - Treat	Design Development	Medium	Medium	15	Consider additional NPS requirements in ecology assessment. Dentons are reviewing the EclA. WSP technical director providing advice to sector.	Low	Low	6	
83	97	Maintenance	Pipe on hill access	**Description**: There is a threat that manholes installed on the steep hillside pipe are difficult and unsafe to access. **Cause**: The cause of the threat is inadequate measures consider to gain access if steep hill is selected for pipe location site. **Consequence**: The consequence of the threat is unsafe access practices or in cases to pipe	Connect Water	Live - Parked	Operation	High	Medium	19	Gain acceptance from WWL to use vents as opposed to manholes.	Medium	Very Low	4	
84	98	Stakeholder	Pipe and surcharge perceived risk	**Description:** There is a threat that there is negative perceived risk to the stream from pipeline and discharge entering stream. **Cause**: The cause of the threat is not being transparent with community and/or not ensuring that inputs cause no risk to stream health. **Consequence:** The consequence of the threat is negative public perception and potential project backlash resulting in delays.	Connect Water	Live - Parked	Design Development	Medium	Low	11	Public engagement to make discharge quality clear. Currently (July '23) carrying out on-line, letter drop and street events. Includes engagement with the Friends of Waiwhetu Stream.	Medium	Very Low	4	
85	99	Scope	Storage Volume - Undersized	**Description:** There is a threat that the water storage volume of 15ML is insufficient to meet levels of service. **Cause**: The cause of the threat is design errors or incorrect assumptions during the development of the Zone Management plan and Storage Volume Assessment work that derived the volume. Population growth could be different to predicted. **Consequence:** The consequence of the threat is an increased volume or additional assets are required to meet the Loss resulting in delays and additional cost.	Wellington Water	Live - Treat	Investigations	High	Very Low	8	The reservoir storage volume assessment report was peer reviewed by Stantec, but not formalised in a 3WDMC paper. Memo to be prepared by Connect Water considering Gracefield, Naenae and Eastern Hills volumes.	Medium	Very Low	4	

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86	100	Site Selection	Archaeological Risk	**Description**: There is a threat that there is an archaeological find at the selected site during investigations or construction. **Cause:** The cause of the threat is presence of archaeological material not identified due to it being unforeseen and the lack of a archaeological check on site selection **Consequence:** The consequence of the threat is delays to project or reputational damage if a site is disturbed	Connect Water	Live - Parked	Optioneering	Medium	Low	11	Desktop arch check carried out. Risk of finding artefact considered low. Accidental discovery protocal required to ensure a known response to any finds.	Medium	Very Low	4	
87	101	Site Selection	WWL operations do not agree on preferred design	**Description:** There is a threat that WWL ops team do not agree on preferred design. **Cause:** The cause of the threat is not including WWL Ops team in design decisions and providing them opportunity to provide feedback. Change in operational team over project life is also a cause. **Consequence:** The consequence of the threat are design delays, potential operational issues once constructed requiring additional cost to retrofit	Connect Water	Live - Treat	Detailed Design	Medium	Medium	15	Hold design workshops with WWL ops team at key points during design. Ensure ops team signoff on design reports at each gateway.	Medium	Very Low	4	
88	102	Cultural, social and stakeholders	Community Opposition	**Description:** There is a threat that there will be a lack of buy-in / understanding from community members who may seek to involve local Councillors and the media if they feel their concerns are not being addressed. **Cause:** The cause of the threat is lack of community engagement, communication and transparency of project **Consequence:** The consequence of the threat is delay in project, negative perception.	Connect Water	Live - Parked	Design Development	High	Medium	19	Two open days held in March '23. Further early engagement with potentially impacted residents is being undertaken via on-line survey, letter drop and street events (11th/12th July '23). Continue to undertake stakeholder engaement and incorporate into mitigation measures.	Medium	Very Low	4	
89	103	Design	Inlet main undersized	**Description**: There is a threat that the inlet main is undersized. **Cause**: The cause of the threat is inadequate/inaccurate design flows and/or projections used during design phase. **Consequence**: The consequence of the threat is future service issues, may require upsized pumps which could create further work issues.	Connect Water	Live - Parked	Detailed Design	Medium	Medium	15	The DN750inlet main connection (from the existing supply line) has been sized using 100-year population projections.	Very Low	Low	3	
90	108	Project Delivery	Easement / Property delays	**Description:** There is a threat that obtaining easesments delays the handover of the project. **Cause:** The cause of the threat is insufficient time and poor communication with the HCC property and parks teams. **Consequence**: The consequence of the threat is delays to the finalisation of the project or additional cost to obtain easesments.	Connect Water	Live - Treat	Handover	Low	Low	6	Connect Water have contacted the HCC parks team - no response yet (21/07/23). Connect Water to follow-up.	Low	Very Low	2	
91	3	Consents	Contractor involvement with consents	**Description**: There is an opportunity to for D&C contractor to bring smarts into design to assist consent process **Cause**: The cause of the opportunity is because there are complicated consent requirements anticipated, contractors will be able to assess feasibility of what is being proposed **Consequence:** The consequence of the opportunity is less likelihood of consent being declined.	Connect Water	Closed	Design Development	Low	Low	6	ECI workshops completed during consent phase and feedback on design and construction methodology incorporated.	High	High	21	There is still further opportunity for the D&C team to propose smarts during detailed design.
92	20	Pipelines	PE material for large pipelines	**Description:** There is an opportunity to rationalise pipework pressure ratings to allow use of PE for large pipelines **Cause:** The cause of the opportunity is concept design is based on steel pipes due to regional spec requirements. **Consequence:** The consequence of the opportunity is reduced pipe costs due to improved material availability and reduced need for bends etc.	Connect Water	Closed	Detailed Design	Medium	Very Low	4	Discussed option of PE with WWL (May '23). Will document in Prelim Design Report.	Medium	High	17	Connect Water including PE and CLS as options.
93	30	Reservoir Site	Raise elevation	**Description:** There is an opportunity to raise elevation of reservoir through increase to the bottom and top water level **Cause:** The cause of the opportunity is avoid extensive earthworks. **Consequence:** The consequence of the opportunity is reduced earthwork volumes, reduced construction cost but differencing operating and supply pressures to resolve.	Connect Water	Closed	Design Development	Medium	Very Low	4	WWL confirmed at meeting on 13/04/23 that BWL/TWL are to remain as per the existing Naenae 1 reservoir.	High	Low	16	Opportunity not to be pursued during prelim design. Poses a risk that D&C team will re-raise opportunity during detailed design.

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Rank	**RID**	**Risk Category**	**Risk Title**	**Description/ Cause/ Consequence**	**Risk Owning Org**	**Risk Status**	**Phase**	**Consq.**	**Likelihood of occurrence in project lifecycle**	**Risk Score**	**Individual actions to be recorded in the Actions Register (Tab 4)**	**Consq.**	**Likelihood of occurrence in project lifecycle**	**Risk Score**	**Commentary & Closure Statement**
94	38	Pipelines	Pipeline stream crossing - Flood impacts	**Description:** There is a threat that aerial pipeline crossing Waiwhetu Stream needs to be elevated for flood flows. **Cause**: The cause of the threat is lack of flood management around stream **Consequence**: The consequence of the threat is adverse visual impact and cost.	Connect Water	Closed	Design Development	Medium	High	17	Completed flood impact assessment and designed pipe RL to be above 100-year flood level. Residual risk of flood team objecting to team. Consulted with HCC planning team. Whilst flood team do not prefer it, pipe bridges are provided for in the NRP planning rules. Due to visual impact, flooding, H&S, resilience the pipe is going to be below-ground through the stream.	Medium	Medium	15	Pipeline stream crossing is now buried.
95	39	Stakeholder	Kiwi rail requirements	**Description**: There is a threat that Kiwirail impose greater restrictions on the pipe rail crossing than anticipated. **Cause**: The cause of the threat is pipe will need to cross rail in a constrained corridor of services. **Consequence**: The consequence of the threat is additional cost over that allowed in estimate to meet requirements.	Connect Water	Closed	Design Development	Medium	High	17	Early engagement with Kiwirail, utilise design peronnel with experience with Kiwirail. Allowance made in cost estimate.	Medium	Medium	15	Pipeline project being delivered separately. Risk considered by that project team.
96	47	Stakeholder	Firebreak - access during construction	**Description**: There is a threat that FENZ require 24/7 unrestricted access along the firebreak during construction **Cause**: The cause of the threat is that the site sits on a firebreak that is understood to be an access track. **Consequence**: The consequence of the threat is a need for contractor to maintain access which may impact the site footprint, productivity and safety fencing arrangements.	Connect Water	Closed	Construction	Medium	Very High	18	Have engaged with FENZ in consenting phase. They do not require the fire break to remain open during construction. FENZ were more concerned with maintaining access to residents' properties and un-interrupted water supply for fire fighting.	Low	Very High	14	FENZ do not require the fire break to remain open during construction.
97	51	Consents	Consent - Pipeline construction nuisance impacts on community	**Description**: There is a threat of perceived amenity impact on local residents from pipeline construction(noise, vibration, road closures etc) and community concerns about these may lead to objections from community. **Cause**: The cause of the threat is the construction of buried pipelines on residential streets, temporary traffic control and proximity of properties to the construction sites. Perception of impact may be greater than actual impact. **Consequence**: The consequence of the threat is negative reputational impacts and complaints.	Connect Water	Closed	Design Development	Medium	Very High	18	Noise, vibration, traffic and visual impact assessments are being prepared that identify mitigation. Early engagement with potentially impacted residents. Vibraion assessment shows that cosmetic damage is unlikely, but there may be some exceedance of human annoyance threshold. Directional drilling impacts not assessed.	Low	High	12	Pipeline project being delivered separately. Risk considered by that project team.
98	52	Pipelines	Optimisation of pipeline routes	**Description**: There is an opportunity to optimise pipe routes during prelim and detailed design **Cause:** The cause of the opportunity is pipe routing has only undergone initial concept design with little refinement. **Consequence:** The consequence of the opportunity is to reduce cost through reduced pipe lengths.	Connect Water	Closed	Design Development	Medium	Very Low	4	Allow budget and programme in next stage of design to review pipe route options.	Low	High	12	Pipeline project being delivered separately. Risk considered by that project team.
99	54	Stakeholder	Kiwirail approvals delay	**Description:** There is a threat that Kiwirail approvals are delayed. **Cause:** The cause of the threat is late preparation of applications or resource constraints at KiwiRail. **Consequence:** The consequence of the threat is delays to the project.	Connect Water	Closed	Design Development	High	High	21	Design early and give them advance notice. Understand requirements early.	Medium	Low	11	Pipeline project being delivered separately. Risk considered by that project team.
100	55	Operations and Maintenance	Confined spaces access using engineering technologies	**Description:** There is an opportunity to minimise need for manned entry to confined spaces through use of engineering technology in reservoir design **Cause:** The cause of the opportunity is confined space entry is required for construction, operations and maintenance and how that is carried out is caused from prior planning **Consequence:** The consequence of the opportunity is improved safety for workers	Connect Water	Closed	Operation	Medium	Very Low	4	Close this and include in SID	Medium	Low	11	Included in SiD.
101	63	Environmental	Infrastructure vulnerability	**Description:** There is a threat that delivery pipe stream crossing could present vulnerability in infrastructure. **Cause:** The cause of the threat is for an above ground crossing the pipe could be at risk from high stream flows and debris or seismic risk for above and below ground pipe crossing. **Consequence:** The consequence of the threat is infrastructure failure	Connect Water	Closed	Detailed Design	High	Medium	19	Connect Water has assessed the risk and vulnerability of stream crossing (as well as H&S and visual impacts) and decided to bury the pipe for the stream crossing.	Medium	Low	11	Pipeline stream crossing is now buried.

Risk Register

Project/Contract:	Eastern Hills Reservoir	**Document Date:**	21 July 2023
Project/Contract ID:	3-WW021.02	**Supplier Lead:**	Jo Lucas
WWL Lead:	Gareth Penhale	**RM Specialist:**	Mark Stanko
		Risk Tolerance Threshold:	20

								Current Exposure				**Residual (Target) Exposure**			
								Semi-Quantitative			**Treatment Strategy**	**Semi-Quantitative**			
?	?		?	NOTE: EDIT BELOW DESCRIPTION TO SUIT FORMAT	?	?	?	?	?	?	?	?	?	?	?
Rank	**RID**	**Risk Category**	**Risk Title**	**Description/ Cause/ Consequence**	**Risk Owning Org**	**Risk Status**	**Phase**	**Consq.**	**Likelihood of occurrence in project lifecycle**	**Risk Score**	**Individual actions to be recorded in the Actions Register (Tab 4)**	**Consq.**	**Likelihood of occurrence in project lifecycle**	**Risk Score**	**Commentary & Closure Statement**
102	68	Reservoir Site	Dispose of cut material to Balgownie Grove	**Description:** There is an opportunity to dispose of excavated material to be transferred down to Balgownie Grove for removal instead of via Summit Road **Cause:** The cause of the opportunity there is anticipated to be a lot of earthwork material to be excavated **Consequence:** The consequence of the opportunity is reduction of heavy traffic impacts on residents and improved productivity. Conveyor and chute may be required.	Connect Water	Closed	Construction	Medium	Very Low	4	Did not progress this during prelim design. Not really a viable opportunity for D&C team to test feasibility further.	Medium	Low	11	
103	70	Reservoir Site	Property purchase	**Description:** There is an opportunity to purchase properties to allow through access or to provide an alternate site to place reservoirs **Cause:** The cause of the opportunity is space/access constraints in selected site **Consequence:** The consequence of the opportunity is reduced construction costs but potential negative public response.	Connect Water	Closed	Design Development	High	Very Low	8	Discussed this with D&C contractors but no obvious cost-effective option.	Medium	Low	11	
104	71	Operations and Maintenance	Cross connections to Naenae 1	**Description**: There is an opportunity to have cross connections to Eastern Hills. **Cause:** The cause of the opportunity is close proximity with selected site of Eastern Hills. **Consequence**: The consequence of the opportunity is added redundancy and operational benefits.	Connect Water	Closed	Design Development	Low	Very Low	2	WWL team carried out zone modelling and recommend installing a DN525 cross-connection between Naenae 1 and Eastern Hills Reservoir.	Medium	Low	11	Cross-connection included.
105	73	Scope	Steel reservoir solution	**Description:** There is an opportunity to construct a steel reservoir. **Cause:** The cause of the opportunity is a challenging site for concrete construction. **Consequence:** The consequence of the opportunity is potential reduction in working area required, timeframe on site, and cost but also may be deemed not to be a durable or otherwise suitable solution.	Connect Water	Closed	Construction	Low	Very Low	2	ECI contractor investigated steel options. There were not substantial benefits over reinforced concrete. Also not acceptable or preferred by WWL.	Medium	Low	11	Steel tank not preferred.
106	79	Environmental	Recreational opportunities - site lookout	**Description**: There is an opportunity to create a lookout on the reservoir site for recreational use **Cause:** The cause of the opportunity is to leverage the site location with community in mind **Consequence:** The consequence of the opportunity is increased social and recreational services to community, security and safety considerations required to ensure public safety and minimise reservoir damage	Connect Water	Closed	Design Development	Low	Low	6	Consider as part of mitigations associated with consent. Currently (July '23) carrying out on-line survey to gauge public use and interest in the site.	Low	Medium	10	Covered under risk ID#43.
107	86	Construction	Damage to existing reservoir during construction	**Description:** There is a threat that there is a vehicle collision, lift incident or other occurs during construction of new reservoir asset **Cause:** The cause of the threat is not designing adequate buffer space to access and construct the new reservoir. **Consequence**: The consequence of the threat is significant damage to the reservoir may result in water not being able to be supplied until the damage is fixed. This would result in significant cost, service delivery issues and reputational damage	Connect Water	Closed	Construction	Very High	Low	20	Design in an adequate buffer between the existing and new reservoirs. Will need to ensure during construction that the risk of a vehicle collision or incident during a lift is managed. Included in SiD register.	High	Very Low	8	Included in SiD register.
108	91	Operations and Maintenance	Inadequate site access during operation	**Description**: There is a threat that there is inadequate access to site and into structures for maintenance. **Cause**: The cause of the threat is access not well considering this during design development. **Consequence**: The consequence of the threat is increased cost of future maintenance.	Connect Water	Closed	Design Development	Medium	Medium	15	Safety in Design to consider maintenance and operation	Low	Low	6	Included in SiD register.
109	89	Commercial	Designate existing reservoir	**Description:** There is an opportunity to designate existing reservoir at same time as proposed reservoir **Cause:** The cause of the opportunity is the existing reservoir is not designated. **Consequence**: The consequence of the opportunity is easier process to upgrade or replace the reservoir in future.	Connect Water	Closed	Design Development	Low	Low	6	Denton's advice was to do an alteration to the designation later - agreed by WWL in January 2023.	Low	Low	6	
110	93	Operations and Maintenance	Operating two reservoirs at once	**Description**: There is a threat that the combined operation of the two reservoirs adds increased operational complexity putting a strain on operational resource and increasing operational cost. **Cause:** The cause of the threat is uncertainty of operating two reservoirs at same time - WWL not needing to do this in this area before. **Consequence:** The consequence of the threat is more operational resources/effort	Connect Water	Closed	Operation	Medium	High	17	Current design is to operate the two reservoirs separately.	Low	Low	6	Design it to operate reservoirs separately.

Risk Register

Project/Contract:	Eastern Hills Reservoir	**Document Date:**	21 July 2023
Project/Contract ID:	3-WW021.02	**Supplier Lead:**	Jo Lucas
WWL Lead:	Gareth Penhale	**RM Specialist:**	Mark Stanko
		Risk Tolerance Threshold:	20

								Current Exposure				Residual (Target) Exposure			
								Semi-Quantitative			Treatment Strategy	Semi-Quantitative			
?	?		?	NOTE: EDIT BELOW DESCRIPTION TO SUIT FORMAT	?	?	?	?	?	?	?	?	?	?	?
Rank	**RID**	**Risk Category**	**Risk Title**	**Description/ Cause/ Consequence**	**Risk Owning Org**	**Risk Status**	**Phase**	**Consq.**	**Likelihood of occurrence in project lifecycle**	**Risk Score**	**Individual actions to be recorded in the Actions Register (Tab 4)**	**Consq.**	**Likelihood of occurrence in project lifecycle**	**Risk Score**	**Commentary & Closure Statement**
111	95	Reservoir Site	Top down construction	**Description:** There is an opportunity to construct the reservoir top down **Cause**: The cause of the opportunity is construction techniques could allow construction of secant pile or contiguous wall that would significantly reduce excavation requirements. **Consequence**: The consequence of the opportunity is reduction of earthworks through no need to lower entire work platform. Potential design outcome issues.	Connect Water	Closed	Construction	Very Low	Very Low	1	ECI contractors assessed "top-down" option. Not proceeding with that design option - too high risk.	Low	Low	6	Assessed and discounted.
112	96	Scope	Tendering prior to consenting	**Description:** There is an opportunity to increase benefit of D&C **Cause:** The cause of the opportunity is tendering prior to consenting **Consequence**: The consequence of the opportunity is reduced risk to consents not being appropriate for final design.	Connect Water	Closed	Design Development	Low	Very Low	2	The procurement strategy is to lodge consents prior to tendering the D&C contract.	Medium	Very Low	4	Consents lodged prior to D&C tender.
113	104	Operations and Maintenance	Reservoir security	**Description:** There is a threat reservoir is not adequately secure and public could access it. **Cause:** The cause of the threat is access not well considering reservoir security measures during concept and design phase. **Consequence**: The consequence of the threat to public safety and/or damage of reservoir.	Connect Water	Closed	Design Development	Medium	Medium	15	Security and public access considerd as part of Safety in Design	Low	Very Low	2	Included in SiD register.

Risk Status	
	113
Draft	0
Live - Treat	34
Live - Parked	56
Impacted	0
Closed	0
Rejected	0
Blank	0
TOTAL	**90**

Current Risk Score	
Extreme	28
High	39
Moderate	11
Low	12
Zero	0
TOTAL	**90**

Residual Risk Score	
Extreme	2
High	44
Moderate	36
Low	8
Zero	0
TOTAL	**90**

Appendix D – Consenting Strategy

Consenting Strategy

Project Name: **Eastern Hills (Naenae No 2) Reservoir**

Project No.: **OPC101031 / 3-WW021.02**

Date: **10 May 2023**

Our water, our future.

Document Control

Panel Member	Connect Water/WSP
Panel Project Manager	Jo Lucas
Client Council	Hutt City Council
REVISION SCHEDULE	
Current Status	Final

No	Date	Description	Prepared by	Checked by	Reviewed by	Approved by
A	06/12/22	Issued for legal review	Cathy Crooks	Lewis Hensman	Steph Brown	John Leatherbarrow
B	09/03/23	Issued with Concept Design	Cathy Crooks	Lewis Hensman	Max Pocock	John Leatherbarrow
C	10/05/23	Updated ecological information and rules assessments	Cathy Crooks	Jo Lucas	Max Pocock	John Leatherbarrow

Executive Summary

A new water reservoir is required in Lower Hutt as current reservoir storage for potable water does not meet target levels of service. Additional potable water storage is required to ensure that Wellington Water can provide reliable services to customers and to accommodate future population growth. Currently, the storage deficit leaves the area vulnerable to bulk water supply interruptions. Following a site selection process including a Multi Criteria Assessment, the preferred site is Eastern Hills (previously called "Naenae 2"), which is adjacent to the existing Naenae reservoir.

It is proposed to split the work into two packages:

1. The works to construct the reservoir including bulk earthworks and vegetation clearance, inlet pipe, erosion and sediment control measures, and the delivery pipe across Waiwhetū Stream; and

2. The pipeline works to construct the delivery pipe in Balgownie Grove, along Waddington Drive and Naenae Road to the connection with the Oxford Terrace watermain.

Package 1: Reservoir Works

With respect to authorising the works necessary to construct the reservoir under the Hutt City District Plan, the proposal could be authorised by either seeking resource consents or through designating the land required for the proposed new reservoir in the Hutt City District Plan. In this instance, a designation to authorise the work provides the following benefits over a resource consent, and it is recommended that this approach be pursued:

- A designation can more readily provide for on-going use of the site for tank purposes, and a broader scope of maintenance and operation activities than a resource consent without the need to seek additional approvals in future (provided they are in accordance with the purpose of the designation).
- A designation can provide greater flexibility for design changes than a resource consent. Given the likelihood that authorisation will be sought based on high-level concept design, this flexibility is considered desirable.
- The land is immediately protected (at the time of notification) from third party activity, for water supply purposes.
- The final decision on the confirmation of the requirement and the conditions on the designation is made by Wellington Water.

Regardless of the magnitude of environmental effects, Wellington Water or Hutt City Council (as the requiring authority) may elect to request public notification under section 168A(1A) of the RMA in order to remove any perception of a conflict of interest where it is both the requiring authority requesting the designation and the territorial authority approving the designation.

With respect to Greater Wellington Regional Council, resource consent will likely be required under Rule R107 for earthworks and the discharge of sediment and stormwater run-off as a Discretionary Activity, and under either Rule R117 or R118 for activities in a natural wetland. Depending on the construction activities required, this would be either a Discretionary or Non-Complying Activity. Additionally, approvals will be required under the NES-F, regulation 45 for constructing specified infrastructure as a Discretionary Activity for those activities required to occur within, or near to, an identified natural wetland. If the effects are determined to be minor or less than minor, then public notification would not be required.

The following technical inputs are likely to be required to confirm consent requirements and accompany planning applications:

- Landscape and visual assessment
- Ecological assessment (including a mitigation or offset planting plan and wetland delineation mapping in accordance with the wetland delineation protocols)
- Amenity and recreation assessment (addressing construction and operation impacts)
- Geotechnical assessment (addressing ground suitability and seismic hazard)
- Draft erosion and sediment control plan
- Noise and vibration assessment
- Traffic assessment
- Social impact assessment
- Community engagement outcomes,
- Cultural values assessment, and
- Carbon outputs and climate change.

Package 2: Pipeline Works

This portion of the works will occur after the delivery pipeline has crossed the stream and will involve trenching within the road.

Both the installation of new underground network utilities and the operation and maintenance of existing network utilities are a Permitted Activity in the Hutt City District Plan. It is expected that construction, maintenance, and operation of the pipeline will be permitted under the District Plan with no resource consents required.

It is not anticipated that any resource consents will be required from Greater Wellington Regional Council for this portion of the works based on the current scope.

This portion of the delivery pipe will pass under the KiwiRail corridor for the Wairarapa Railway Line which is designated in the Hutt City District Plan (Ref: NZR3). Under section 176(1)(b) of the RMA written approval is required from KiwiRail prior to this work taking place.

Table of Contents

1 Introduction

1.1 Purpose of this Document

This consenting strategy has been developed for Wellington Water Limited (WWL) to provide a framework for pursuing the approvals required under the Resource Management Act 1991 (RMA) for the construction, operation and maintenance of the proposed Eastern Hills (previously "Naenae 2") Reservoir (the Reservoir) and associated delivery pipelines.

The consenting strategy outlines the likely approvals required, the potential approvals process, risks and challenges, and an indicative timeframe and project programme for obtaining the required approvals for the proposed works. This assessment has been prepared at the Concept Design phase of the project. While the reservoir design is still being developed, it is only possible to undertake a preliminary assessment of the proposal against relevant rules and standards. Once the proposal is confirmed, the preliminary assessment will be finalised as part of any planning applications. It is also important to note that this assessment is based on the applicable RMA plans and instruments as they stand at December 2022, and does not take into account any future plan, policy or legislation changes.

1.2 Problem Identification and Background

Available reservoir storage for potable water within the Lower Hutt Central and Taita Water Storage Areas (WSA) does not meet target levels of service which is: providing a minimum of 2 days storage of normal demand, or 15 days storage in the event of a natural disaster.

The existing storage deficit leaves the area vulnerable to bulk water supply interruptions and there is a potential for unreliable water supply. This will be exacerbated by future development and population growth which will place additional demands on the water network.

Additional potable water storage is required to ensure that Wellington Water can provide:

1. Reliable services to customers in day-to-day operations;
2. A more resilient water supply to recover from a significant seismic or weather event
3. For future population growth.

A reservoir storage volume assessment was completed in December 2021. The report identified an additional 15ML storage will match or exceed target levels of service up to 2049. A new 15 million litre (ML) reservoir was recommended to be constructed over the 2024 – 2027 period.

1.3 Site Selection

A staged approach was taken to identify and assess potential reservoir sites in the lower portion of the Hutt Valley. This initially involved consideration of the existing water network, topography and hydraulic requirements to establish a target contour zone for the reservoir site, which in turn was considered relative to access constraints/opportunities to broadly identify potential sites within the target zone. This process identified a total of 28 initial sites.

On closer examination many of the sites were able to be discounted from further consideration, generally due to steep terrain that would make access or formation of a suitable reservoir platform not feasible. A 'long list' of fourteen sites was taken forward for further consideration.

Following the initial screening assessment, the fourteen potential site options were further developed to assess indicative earthworks volumes, cuts and fills to form a suitable reservoir platform and access road, and potential corridors for inlet and delivery pipelines. Each of the long list sites was assessed against a range of factors and qualitative scoring applied in order to guide the selection of several sites for more detailed consideration and costing analysis.

The shortlisting process was workshopped with stakeholders (Wellington Water and Hutt City Council) and three site options were shortlisted:

- Cambridge Terrace, above Cambridge Tce/Kowhai St
- Naenae 2 (now known as "Eastern Hills"), adjacent to existing Naenae reservoir on Summit Rd
- Gracefield 2, adjacent to existing Gracefield reservoir on Wainuiomata Rd

A multi criteria analysis (MCA) approach was used to evaluate and score each of the three shortlisted sites against a range of environmental, social, technical and financial criteria. The MCA process is further described in the Site Selection Report dated June 2022.

1.4 Preferred Option

The highest scoring (preferred) site option from the site section process detailed above was Naenae 2, which is adjacent to the existing Naenae reservoir (Figure 1). This site scored as most favourable in most criteria groupings and is also the lowest cost option by a significant margin. The Naenae 2 site still ranks highest if the financial criterion is excluded from the analysis. The Naenae 2 site scored poorly in the social criteria grouping, reflecting the potential impacts of heavy construction vehicle movements and pipeline construction works on the residential community adjacent to the site. This did not alter the outcome of the MCA but reinforces the importance of strong community engagement through the design and construction process. Taranaki Whānui has provided feedback confirming that the Naenae 2 site presents the lowest risk of significant impacts on mana whenua values out of the three shortlisted options.

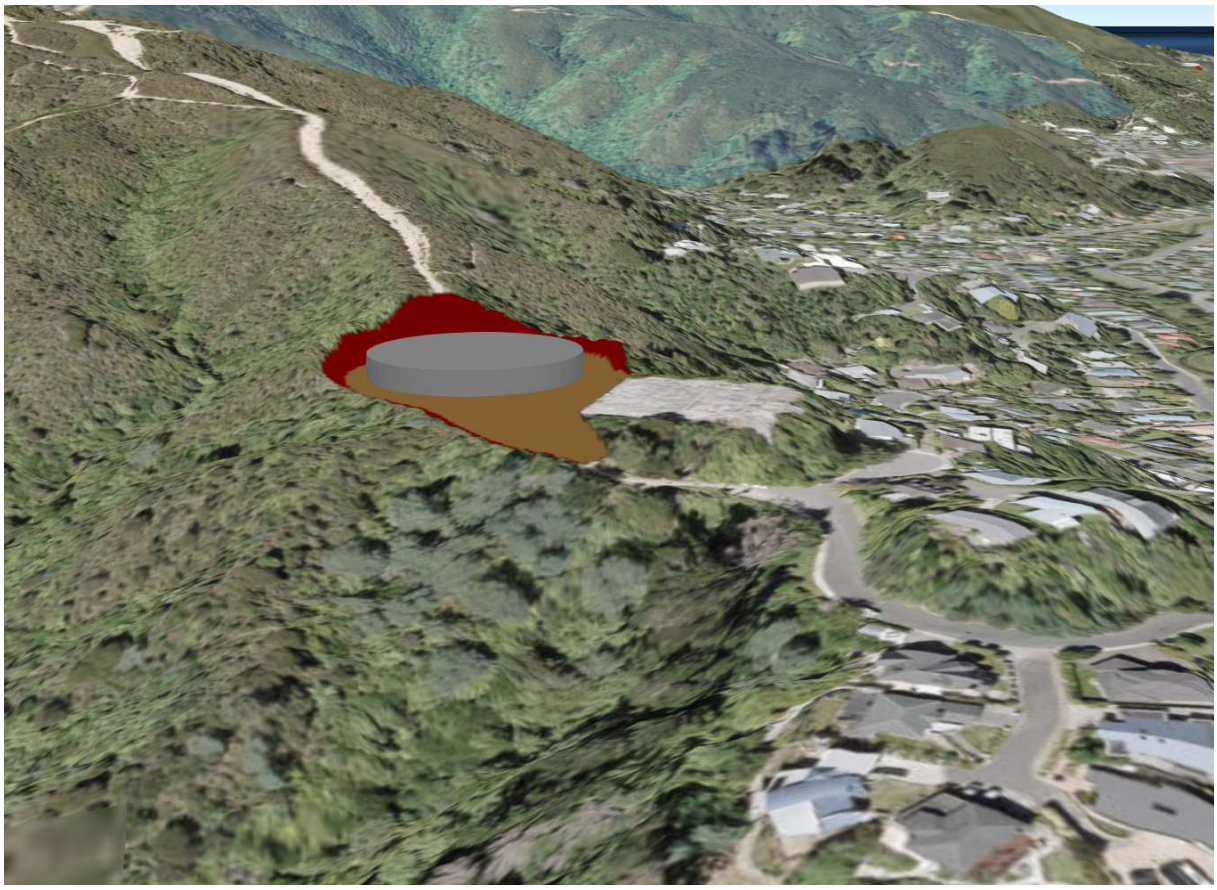


Figure 1: 3D Sketch of Preferred Site – Eastern Hills (or "Naenae 2")

2 Eastern Hills Reservoir

2.1 Project Objectives

The project objectives are to (adapted from activity brief November 2020):

1. Address the current water storage shortfall and ensure sufficient storage for future growth in the Lower Hutt Central and Taita water storage areas (WSA):

    a. To ensure disaster resilience of the Lower Hutt Central and Taita WSAs by providing a seismically resilient water supply capable of meeting Wellington Water's target level of service for the WSA of 7 days (day 8 to day 15) supply under a survival and stability state following a significant water supply disruption event.

    b. To ensure the Lower Hutt Central and Taita WSAs are operationally resilient by providing sufficient secure, safe, and reliable water storage to supply 48 hours of water to residents, businesses, and critical water users (including Fire and Emergency NZ) under normal operating conditions, based on projected demand with appropriate consideration of population growth.

2. To deliver a secure, safe, and reliable water storage solution that has a 100-year design life.

3. To integrate the chosen solution into the Lower Hutt Central WSA network in a cost-effective manner.

2.2 Proposed Works

The proposed Eastern Hills Reservoir includes four primary elements:

- 15ML reservoir
- Inlet pipe
- Delivery pipe; and
- Overflow/scour pipe.

The proposed reservoir will be a circular 15 ML above ground concrete reservoir, with a 55.2 m external diameter and a height of 8.35 m. It will be located adjacent to the existing Naenae Reservoir at the top of Summit Road, Naenae, Lower Hutt (Figure 2 and Appendix A). The planned location of the reservoir has a separation distance of 20 m from the existing reservoir, to provide for the construction and operational needs of the new reservoir. The location has also taken into consideration the preference to construct the reservoir entirely on excavated ground surface, i.e., not to be built on fill. A 5 m buffer around the reservoir has been allowed for, this is to provide a buffer for slope stability, as well as providing maintenance access around the outside of the reservoir during and post construction.

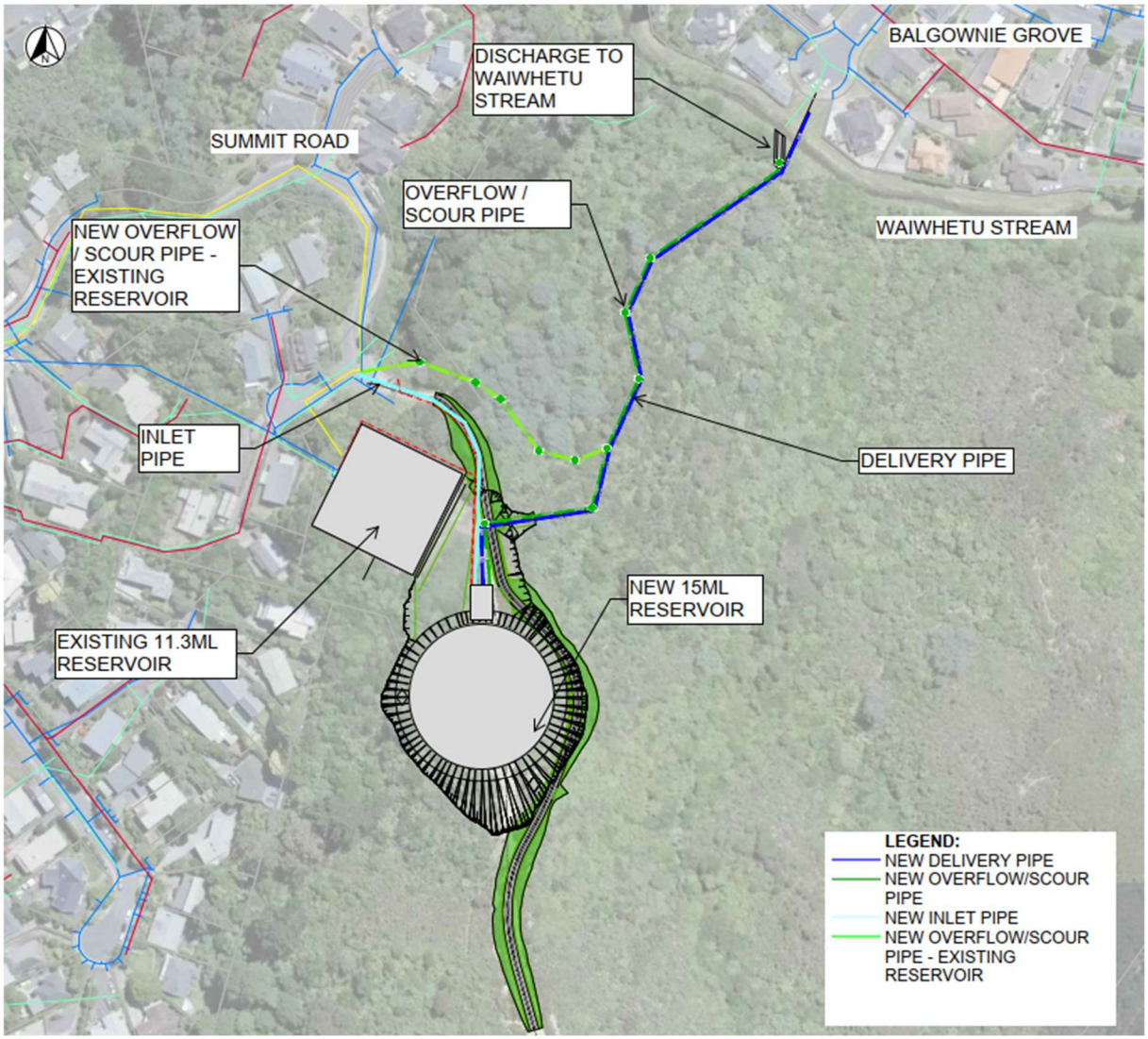


Figure 2: Reservoir Site

The Reservoir will be constructed at the same floor and top water level (TWL) elevation as the existing reservoir, and will require approximately 67,500 m^3 of earthworks, with a sediment pond required during construction.

The Reservoir will also have an adjacent associated valve/control house. This will be partially buried and a 5 m wide strip around the reservoir will be kept bare for access. The firebreak to the eastern side of the reservoir will be reinstated.

An **inlet pipe** supplying water to the Reservoir will be constructed in a trench from the existing Naenae reservoir inlet pipe, at the intersection of Summit Road and Farrelly Grove along the current vehicle access to the Reservoir. Both reservoirs will be supplied from the Waterloo water treatment plant (WTP) via the same bulk main.

A **delivery pipe** supplying water to the potable water network will run from the Reservoir down the hill to the north and across Waiwhetū Stream and into the potable water network along local roads (Figure 3).

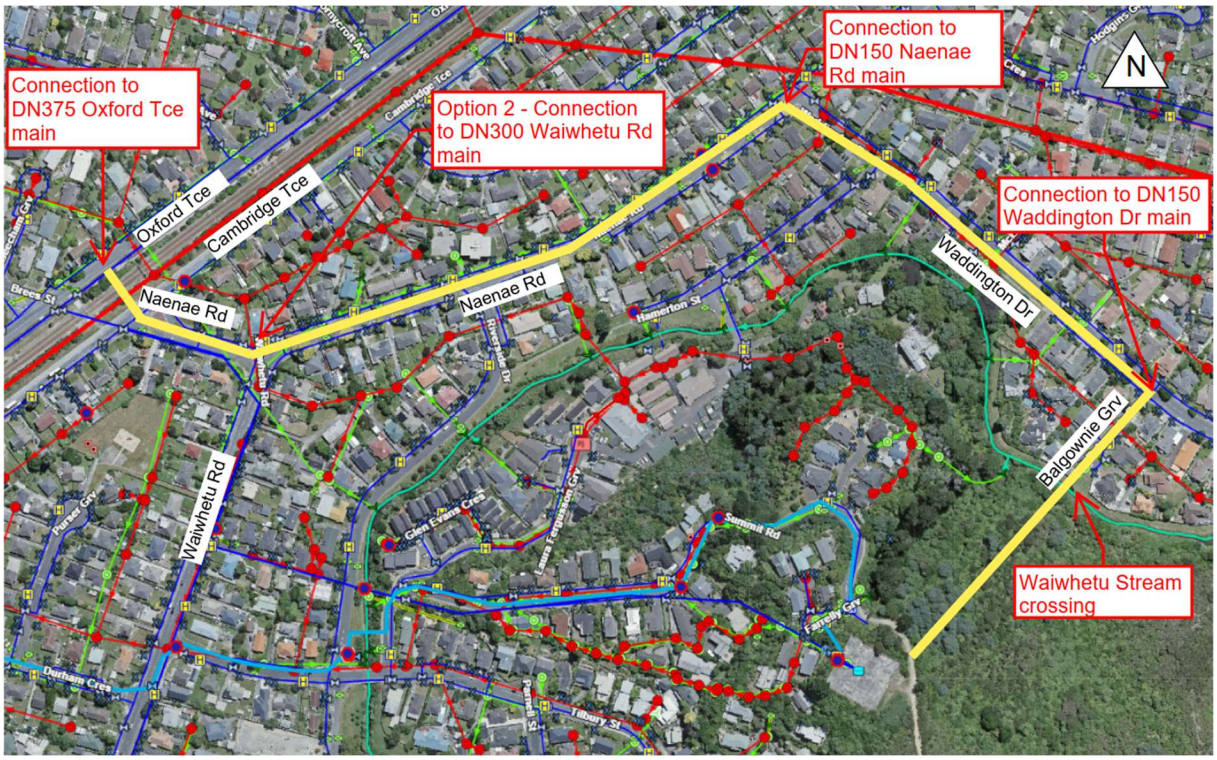


Figure 3: Delivery Pipe Route

The Waiwhetū Stream crossing will be either bridged or drilled under the stream. The pipe alignment down the hill from the proposed Reservoir to Balgownie Grove will be open trenched for 200 m, with a depth of approximately 2 m and width of approximately 1.5 m (600 m^3 & 300 m^2 of earthworks). A 4-5 m wide strip of vegetation will need to be cleared resulting in the removal of 800-1000 m^2 of vegetation.

The delivery pipe will then travel along Balgownie Grove, Waddington Drive and Naenae Road for approximately 1000 m until it connects into the potable water network bulk water main. It will be installed via open trenching in the carriageway with a 2 m deep trench that will be approximately 1.5 m wide (3,000 m^3 & 1,500 m^2 earthworks). At the intersection of Naenae Road and Cambridge Terrace the pipe will cross under the KiwiRail railway track via pipe jacking, or another trenchless method.

An **overflow/scour pipe** will be constructed following the same alignment as the delivery pipe down the hill before discharging into Waiwhetū Stream prior to Balgownie Grove. The pipe will be installed in a separate trench for 200 m, with a depth of approximately 2 m and width of approximately 1.5 m (600 m^3 & 300 m^2 of earthworks). The pipe will be designed to convey 900 L/s for emergency discharges or when the reservoir needs to be drained for maintenance or inspections. The pipe will discharge directly to Waiwhetū Stream in a managed approach and a method to dissipate the energy of the flow will be developed to minimise potential disturbance to the Stream. It is not practical to discharge the overflow into the existing stormwater network near the reservoir as the flow rates will exceed the network capacity in the area.

In addition, a **new overflow pipe** from the existing reservoir will be constructed to tie-in to the proposed overflow pipe with the new reservoir. Currently emergency and maintenance discharges from the existing Naenae Reservoir discharge overland to the north of the site into Waiwhetū Stream. As part of the proposed works, it is intended to construct a pipe to connect the overflow

from the existing reservoir into the proposed overflow pipe for the new reservoir. This is shown on the drawing in Appendix A and will require approximately 120 m of trenching and 600 m^3 of earthworks and 360 m^2 vegetation clearance.

2.3 Bundling of Works

For consenting purposes, it is recommended to split the work into two packages:

1. The Reservoir works shown in Figure 2 to construct the reservoir including bulk earthworks and vegetation clearance, inlet pipe, erosion and sediment control measures, and the delivery pipe across Waiwhetū Stream; and

2. The delivery pipeline works shown in Figure 6 to construct the delivery pipe in Balgownie Grove, along Waddington Drive and Naenae Road to the connection with the Oxford Terrace watermain.

The rationale for this split is that the delivery pipeline works are more straight forward and do not require the same level of design or any planning approvals. This work could potentially be progressed while the design for the reservoir is being developed and planning approvals sought.

These works and the approvals that are likely to be required to construct them are discussed in Sections 4 and 5.

3 Existing Environment

The site for the reservoir is adjacent to the existing Naenae 1 reservoir which is located at the top of Summit Road in Fairfield, Lower Hutt. The existing reservoir was built in 1946, is a partially buried square reservoir with a capacity of 11.3ML.

There are two land parcels which form the reservoir site, which are both owned by Hutt City Council:

- Lot 14 DP 59678 (13.206 ha), and
- Lot 35 DP 31233 (1.126 ha).

The neighbouring suburbs of Naenae and Fairfield include low density single family residential dwellings, with some small light industrial and commercial areas.

The geology of the site consists of a fractured greywacke spur with a clay weathering profile. Numerous ephemeral streams run down the spurs to the residential suburbs of Naenae and Fairfield where they are piped into the HCC stormwater network or join the Waiwhetū Stream, which ultimately discharges into Wellington Harbour at Seaview.

The site is predominantly covered in scrubby vegetation; a firebreak/track passes though it where the proposed reservoir would be sited. The site is sloped; the existing slopes are fairly steep in places.

Access to the site is via a track from Summit Rd; this has a lockable barrier to prevent unauthorised vehicle access, but pedestrian and cycling access is possible. The track is commonly used for recreation, such as walking and mountain biking. A HCC maintained firebreak suitable for 4wd vehicles extends from Summit Road up the ridgeline of the spur to the main ridgeline of the Eastern Hills where it joins a larger network of firebreaks.

3.1 Hutt City District Plan

Under the Hutt City District Plan (HCDP) part of the site is zoned as ‘Residential’ and part of it as ‘Passive Recreation’, with a Significant Natural Resource (SNR:12) overlay (Figure 4).

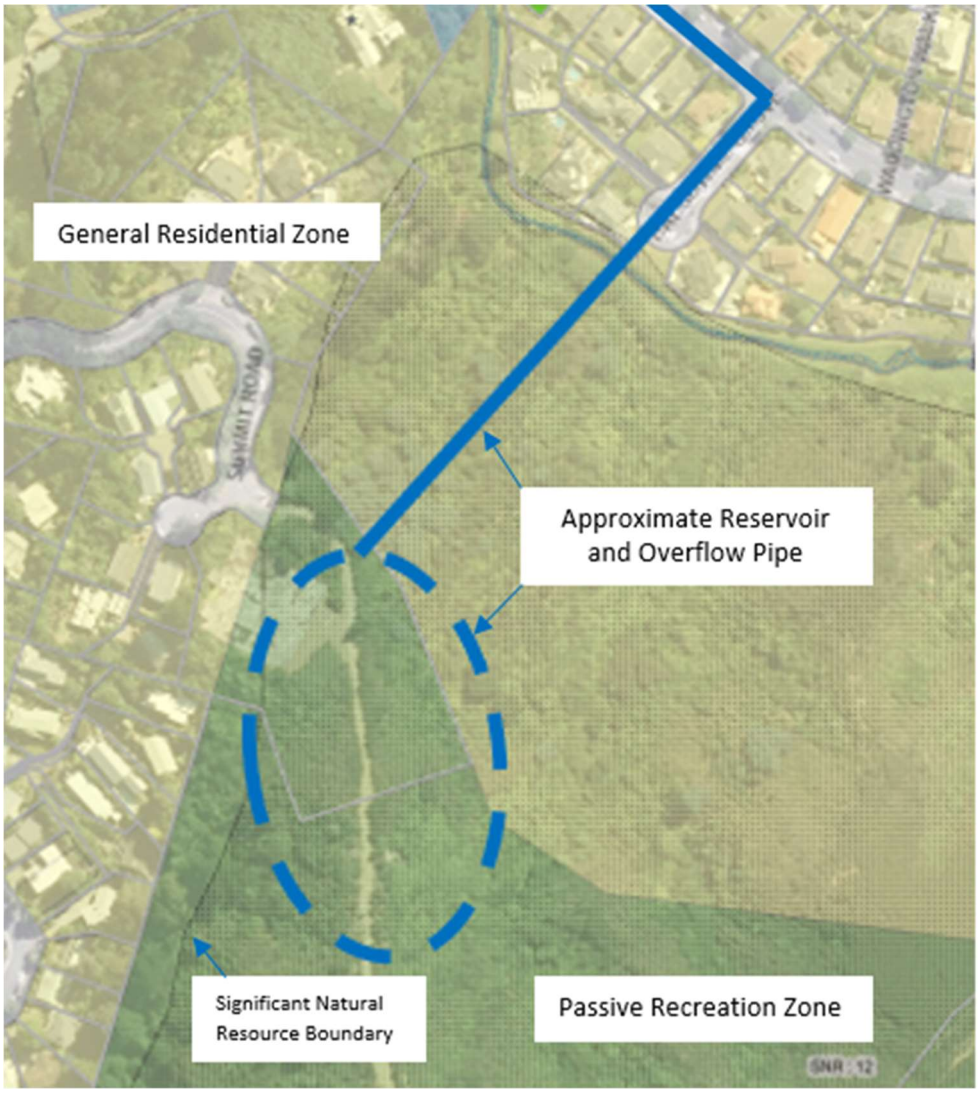


Figure 4: Hutt City District Plan Zoning

As shown in Figure 4 the site falls within a Significant Natural Resource (SNR) area. This area is described in the HCPD in Table 1, with the rules for works in this overlay discussed in Section 4.1

Table 1: Significant Natural Resource Area Description

SNR 12: Eastern Hills Bush	*Lowland forest on hill country. Contains a fire-induced regionally representative regenerating vegetation mosaic, including areas of pre-European Podocarps and Hard Beech.* *Nearly two-thirds of the forest is 90-110 years old. Plants - Arthropodium cirrhatum, Fuchsia excorticata and Podocarpus totara. Large species diversity due to different topography. Many bird species, including NZ pigeon.*

The existing Naenae reservoir is not designated, and there are no other notations on the site such as historic places, natural hazards, or protected trees.

3.2 Natural Resources Plan (Appeals Version – final 2022)

Under the Greater Wellington Natural Resources Plan (NRP) the site, including the area in the vicinity of the proposed crossing of Waiwhetū Stream (River Class 6), is not listed in any Schedules as having any values. However, following further ecological assessment in early 2023 it has been determined that there is a wetland present on site. It is important to note that due to their rarity, all natural wetlands in the Wellington Region are classed as ecosystems and habitats with significant indigenous biodiversity values.

3.3 Ecology

An ecological assessment of the site was carried out in March 2022 for the MCA, describing the vegetation, avifauna, and herpetofauna values which are summarised below.

3.3.1 Vegetation

The vegetation at the Naenae site is characterised by natural regeneration. There are two stages of this present within in the reservoir impact zone:

- Early successional: Predominantly kanuka with a mixture of gorse and broom, with native seedling and sapling species present in the understory; and
- Mid-successional: Predominantly mixed native species up to 3-4 m tall.

The ecological value of the site has been determined to be Low. The area rates Moderate in terms of ecological diversity due to the range of species present around the lower slopes. However, the site's rarity and context are rated as Low, and it is therefore of limited ecological value in the wider landscape.

3.3.2 Avifauna

The site may provide habitat for common introduced and native bird species. One nationally critical, and two at risk bird species have been recorded in the wider area. However, the probability of these species utilising this site on a regular basis is low. The ecological value of the site for birds has therefore been assessed as Low.

3.3.3 Herpetofauna

The DOC herpetofauna database was searched for observations in proximity to the sites. Several at risk lizards have been identified in the surrounding area within the last two years. Both the reservoir and stream crossing sites have suitable habitat to support these species. Therefore, it is possible that these species will be present at the sites. Due to the conservation status of these species the ecological value for herpetofauna has been assessed as High.

3.3.4 Watercourses

Waiwhetū Stream and an unnamed natural watercourse are present and will be impacted to varying degrees, by this project. The project design is required to be further confirmed to ensure that the watercourse features are adequately identified, and the magnitude of effects understood. Following this, it will be confirmed the level of mitigation proposed, as well as any offsetting should it be required.

It is noted that this portion of Waiwhetū Stream is not listed as having any values identified in the NRP. Currently no loss of habitat is proposed.

3.3.5 Wetlands

During the initial desktop assessments, a site to the south of the Waiwhetū Stream where the delivery pipeline will be constructed was identified as falling within a pre-human swamp wetland presence layer (Manaaki Whenua Landcare Research, 2023).

A scoping visit identified areas highly likely to qualify as natural wetland on-site, and within 100m of proposed pipework construction activities. Due to their rarity, GW consider all wetlands in the Wellington Region to have significant indigenous biodiversity values.

A wetland delineation survey is required to determine the presence, boundaries and values of those natural wetlands on-site. The wetland delineation survey should be performed out to 100m of the maximum extent of construction works, to guide consenting.

3.4 Contaminated Land

A desktop contaminated land study has determined that the proposed Reservoir site is not listed on Greater Wellington Regional Council's Selected Land Use Register (SLUR) as potentially contaminated.

3.5 Archaeology

A desktop archaeological assessment was carried out on the Reservoir site by way of desktop review of the NZ Archology Association's database, Archsite.

The nearest recorded archaeological site R27/739 is the site of the 1894 Flock Mill and is over 500 m from the proposed reservoir site. It will therefore be unaffected by the proposed project area and the archaeological risk is considered low.

4 Reservoir Works

These works include the construction of the reservoir including bulk earthworks and vegetation clearance, inlet pipe, overflow / scour pipe, erosion and sediment control measures, the overflow pipe and the delivery pipe across Waiwhetū Stream; and are shown in Figure 2.

4.1 Hutt City Council Approvals

4.1.1 Designation

As the Eastern Hills reservoir will be a key piece of strategic water network infrastructure, the works could be authorised by designating the land required for the works. HCC and WWL need confidence that they will be able to undertake routine operations and maintenance activities at the reservoir without additional consenting delays. They also need confidence that other activities that may affect the ability to operate the reservoir are not allowed to occur in the immediate vicinity of the reservoir.

In addition to securing the site for reservoir purposes, and providing certainty for routine maintenance and operation activities, use of a designation allows for approval for the works under the RMA based on a higher-level of design than might be required for a resource consent.

Under section 168A(3) of the RMA, the following matters will need to be covered in the Notice of Requirement and supporting Assessment of Environmental Effects (AEE): *

> *When considering a requirement and any submissions received, a territorial authority must, subject to Part 2, consider the effects on the environment of allowing the requirement, having particular regard to -*
>
> *(a) Any relevant provision of -*
> *(i) A national policy statement:*
> *(ii) A New Zealand coastal policy statement:*
> *(iii) A regional policy statement or proposed regional policy statement;*
> *(iv) A plan or proposed plan; and*
>
> *(b) Whether adequate consideration has been given to alternative sites, routes or methods of undertaking the work if –*
> *(i) The requiring authority does not have an interest in the land sufficient for undertaking the work; or*
> *(ii) It is likely that the work will have a significant adverse effects on the environment; and*
>
> *(c) Whether the work and designation are reasonably necessary for achieving the objectives of the requiring authority for which the designation is sought; and*
>
> *(d) Any other matter the territorial authority considers reasonably necessary in order to make a decision on the requirement.*

In this instance, s168A is the appropriate mechanism to use under the RMA as Wellington Water are not a requiring authority, and is instead carrying out the work on behalf of Hutt City Council whose name the reservoir designation will be under. Hutt City Council are a requiring authority.

WSP is currently finalising a concept design for the reservoir, which should include sufficient detail (subject to technical assessment and concept landscape design) for a Notice of Requirement (NOR) for a designation. Further work is required to complete a preliminary and detailed design prior to any construction activities, which will be commissioned once WWL has sufficient certainty that a designation will be approved and understanding of what conditions will be imposed.

With appropriate mitigation in place, it is considered that the works will generally be in accordance with the relevant provisions of the Regional Policy Statement for the Wellington Region, the Natural Resources Plan for the Wellington Region and the Hutt City District Plan.

As HCC owns the land and a robust MCA process has been carried out to demonstrate that consideration has been given to alternative sites, section 168A(3)(b) above will be able to be satisfied, although it cannot yet be determined whether the effects will be significant until specialist assessments have been completed.

Following detailed design, the Outline Plan process under s176A of the RMA would be used to confirm or refine the concept design.

The adjacent existing Naenae 1 reservoir is not currently designated. It is understood from discussions with Wellington Water's Planners that consideration is being given to designate this separately from this Project.

Therefore, from a strategic perspective, the most appropriate RMA authorisation is in the form of a designation that allows for the construction, operation and maintenance of the proposed reservoir. It is therefore considered that there are good grounds to meet the test of 'reasonable necessity' to meet the project objectives in s 168A(3)(c).

As WWL is not a requiring authority, any notice of requirement for a designation would need to be prepared on behalf of HCC (who own the land and reservoir and will fund the work) and processed accordingly under s168A of the RMA.

Notification and Hearing

Based on the site's prominent visual profile, the scale of works needed to undertake the development, the proximity of construction adjoining sensitive residential properties and recreational areas, the site's challenging topography, and general public interest, it is recommended that HCC and WWL request that the application be publicly notified under sections 168A(1A) and 149ZCB(2)(b) RMA.

In order to avoid (or at least reduce) the perception of a conflict of interest where HCC is both the applicant (requiring/territorial authority) and decision maker, it is recommended that the notice of requirement is considered, and a recommendation (including on conditions) made by an independent commissioner (or commissioners). However, it is recommended that the final decision on the proposed reservoir and any conditions to be imposed should be made by HCC (likely the Chief Planning Officer under delegation), rather than by the independent commissioner(s).

4.1.2 Resource Consents

If district resource consents are sought rather than a designation, then the following rules in the Hutt City District Plan in Table 2 would likely apply. If a designation is sought, the rules and assessment criteria should be considered in determining the NOR and addressed in the AEE.

While the Project is still being developed, it is only possible to undertake a preliminary assessment of the proposal against relevant rules and standards. Once the proposal is confirmed, the preliminary assessment will be finalised as part of any planning applications.

It should be noted that in the HCDC the earthworks rules in Chapter 14E do not apply to earthworks associated with the establishment of network utilities. Rules in Chapter 13 (Network Utilities) apply instead.

A high-level assessment of relevant policies can be found in Appendix B.

Table 2: Relevant District Plan Rules for the Construction and Operation of the Reservoir

Activity	Rule	Description	Comment	Status
NETWORK UTILITY RULES				
Construction of a new reservoir	13.3.1.33	Water Reservoirs in all areas are a Restricted Discretionary Activity	Discretion is restricted to the following matters which will need to be comprehensively assessed in any planning application: - The degree, extent and effects of the non-compliance with the Permitted Activity Conditions - Risks to public health and safety - Design and external appearance - Any effect on heritage and cultural values - Visual effects - Amenity effects, including noise, vibration, odour, dust, earthworks and lighting - Cumulative effects - Any potential interface with public use and enjoyment of the land and the operation of land uses in the vicinity - Measures to mitigate the bulk and scale of the utility, including screening, colour and finish treatment, earth mounding and / or planting, viewing distances, the location of support structures - The extent to which alternative locations, routes or other options have been appropriately considered. - Rehabilitation of the site following any construction or future maintenance period - The extent to which the affected persons / community has been consulted with - Earthworks and erosion and sediment control - Any adverse effects on an area of native vegetation - Any positive effects to be derived from the activity - Any constraints arising from technical and operational requirements of the network which may limit measures to avoid, remedy or mitigate environmental effects	Restricted Discretionary

Delivery pipe crossing of Waiwhetū Stream	13.3.1.14	Aerial crossings necessary for network utilities across watercourses are Permitted provided the following standards can be met: - Health and Safety: 13.3.2.1 - Earthworks: 13.3.2.5	An aerial pipe crossing Waiwhetū Stream would meet the Health and Safety permitted activity standard which relates to radio frequency emissions. However, it may not meet the earthworks requirements which limit the area of earthwork to 25 m^2 in riparian areas and 100 m^2 in residential and recreation areas, and to a depth of no greater than 1.5 m. If the crossing cannot meet the earthworks standards, then resource consent would be required under Rule 13.3.1.15 (discussed below).	Uncertain
The operation and maintenance of the reservoir / inlet, delivery, overflow pipelines	13.3.1.2	The operation and maintenance of network utilities is Permitted provided the following standards can be met: - Earthworks: 13.3.2.5.1 - Vegetation: 13.3.2.6 - Noise: 13.3.2.7	It is expected that maintenance and operation of the pipeline and reservoir, once constructed, will be permitted under this rule. Permitted activity standards associated with this rule are likely to be able to be complied with (the earthworks standard requires erosion and sediment control to be in place for any maintenance works, the vegetation clearance standard only applies to rural areas, and it is expected that maintenance and operation activities will comply with noise limits).	Permitted
Construction of the inlet, delivery and overflow Pipelines	13.3.1.15	All network utilities that are not otherwise listed as a permitted, controlled, restricted discretionary or non-complying activity.	Although the construction, installation and development, of new underground network utilities are Permitted under Rule 13.3.17, the proposed works will not meet the earthworks standards which only allow a maximum area of 100 m^2 of earthworks in the Residential and Recreational zones.	Discretionary
Noise Rules				
Earthworks and construction activities	14C 2.1.1 b	All non-residential activities must not exceed the conditions as specified, measured anywhere within a residential activity area other than the site on which the activity takes place. All properties within Residential Activity Areas are in Noise Area 3 <u>Noise area 3</u> - Max 50dBA 7am – 10pm - Max 40dBA 10pm – 7am	Further assessment will be required to determine whether the proposed works can meet these limits. If these limits cannot be met the resource consent would be required under Rule 14C 2.2 as a Discretionary Activity.	Uncertain

Significant Natural Areas				
Works within a Significant Natural Area Overlay	14E 2.2(b)	Any activity or site development works identified on or within the boundaries of a significant natural resources is a Restricted Discretionary Activity.	Assessment will be made of the following relevant factors: - The extent to which the resources is to be modified, damaged or destroyed - The extent to which the proposal may compromise natural character, visual amenities and landscape values - The impact on the coastal environment - The recognition and protection of cultural significance - Extent and effects of the works	Restricted Discretionary

Although the operation and maintenance of the reservoir (once constructed), and associated pipework would be a Permitted Activity, a number of other elements would require resource consents from Hutt City Council, with some uncertainty as to whether noise and waterway crossing standards can be met.

As the most restrictive activity status is applied to the whole proposal, the works would be considered as a Discretionary Activity. In considering an application for a discretionary activity, the Council's discretion is unrestricted, and they are able to consider any relevant matter with particular regard to the objectives and policies of the HCDP.

4.1.3 Recommendation

It is recommended that a designation is pursued to authorise the work as it provides the following benefits over using a resource consent:

- A designation can provide for on-going use of the site for water supply purposes and a broader scope of maintenance and operation activities than a resource consent without the need to seek additional approvals in the future, especially as the site is located within a Significant Natural Area meaning that maintenance works are not Permitted (provided they are for water supply purposes);
- A designation can provide greater flexibility for design changes than a resource consent. Given the likelihood that authorisation will be sought based on high-level concept design, this flexibility is considered debatable;
- The land is immediately protected for water supply purposes from third party activity; and
- The final decision on the confirmation of the requirement and the conditions on the designation is made by the Requiring Authority, which in this instance will be HCC.

4.2 Greater Wellington Regional Council Approvals

4.2.1 Natural Resources Plan (Appeals Version – Final 2022)

Resource consents that may be required under the Natural Resources Plan (NRP) have been assessed in Table 3. It should be noted that while the scheme is still being developed, and specialist survey work is being undertaken, it is only possible to undertake a preliminary assessment of the proposal against relevant rules. Once the proposal is confirmed, the preliminary assessment will be finalised as part of any planning applications.

While the discharge of potable water (once the reservoir is operational) and the crossing of Waiwhetū Stream are likely to be Permitted Activities, the construction of the Reservoir and associated pipelines will likely require resource consents for earthworks, the discharge of sediment and stormwater runoff, and for activities occurring within natural wetlands as indicated in Table 3 below. Overall, the proposed reservoir would fall for consideration as either a **Discretionary or Non-Complying Activity** depending on the scale and nature of works within, or adjacent to, the wetland.

If the effects associated with the regional consents are determined to be minor or less than minor, it is recommended that public notification is not requested, as public notification would serve no obvious benefit to WWL as the applicant and there is likely to be ample scope for public participation in the NOR process. Ultimately, the decision of whether to notify the application will be made by GWRC as the consent authority based on the statutory criteria in the RMA. Noting again that the

anticipated adverse effects may well be minor or less than minor meaning there is a good case for the regional consent to be processed on a limited or non-notified basis.

Table 3: Relevant Natural Resource Plan Rules for the Construction and Operation of the Reservoir

Activity	Rule	Rule Description	Comment	Activity Status
The discharge of potable water into water for the purpose of draining the reservoir for inspection, repair or maintenance.	R45	The discharge of potable water, including scouring water, into water, or onto land where it may enter water, for the purpose of draining pipelines or water reservoirs for inspection, repair, maintenance or upgrade	The discharge of potable water from the reservoir is likely to meet the permitted activity standards under Rule R45 (no backwash, concentrations of chlorine or fluoride are not exceeded, no changes in colour or clarity, no erosion). Care needs to be taken to ensure that the discharge does not cause any erosion of the channel or banks of Waiwhetū Stream at the point of discharge. A dosing point, to de-chlorinate the reservoir water, will be required prior to discharge to the stream to meet the chlorine limits.	Permitted under Rule R45
Earthworks and the discharge of sediment and stormwater run-off to water and to land where it may enter water from an area of earthworks exceeding 0.3 ha	R107	The use of land, and the associated discharge of sediment into water or onto or into land where it may enter water from earthworks, or vegetation clearance that is not permitted	The area of earthworks is likely to exceed the 0.3 ha limit imposed by permitted activity Rule R101 (although all other conditions can be met). The site is not identified on GWRC's GIS as being erosion prone so Rule R104 is not considered to apply. The earthworks fall under discretionary catch-all Rule R107.	Discretionary under Rule R107
Construction of a pipeline in a natural wetland	R117	The following activities in a natural wetland are discretionary activities a) The placement of new structures b) The discharge of water or contaminants c) The clearance of indigenous vegetation	Includes associated disturbance, deposition, damage, diversion, and discharge of sediment to water. The scale and nature of works within the natural wetland are still to be confirmed.	Discretionary under Rule R117
Construction of a pipeline in a natural wetland	R118	The following activities in a natural wetland are non-complying activities a) The taking, use, damming or diverting of	If any of these activities will take place in the wetland area, then resource consent would be required as a Non-Complying Activity. The scale and nature of works within the natural	Non-complying under Rule R118

Activity	Rule	Rule Description	Comment	Activity Status
		water in or within 50m of a wetland b) Land disturbance including excavation and deposition c) Reclamation of natural wetlands d) Disturbance of a river bed that forms part of a wetland e) Deposition on a river bed that forms part of a wetland f) … g) Diversion of water h) Discharge of sediment to water	wetland are still to be confirmed.	
Crossing Waiwhetū Stream	R128	The placement of a new structure, including pipes, that is fixed in, on, under, or over the bed of any river	Placement of a pipe in, on, under or over a stream bed is a Permitted Activity under Rule R128. If a pipe bridge is preferred, care will need to be taken to ensure that it is designed so that it does not reduce the ability of the river to convey flood flows. If this cannot be achieved, then the works would be Discretionary Activity under Rule R145 (all other activities).	Permitted under Rule R128

4.2.2 National Environmental Standard for Freshwater 2020

The National Environmental Standard for Freshwater (NES-F) came into force in September 2020. It sets out requirement for carrying out certain activities that pose risks to freshwater and freshwater ecosystems. As the proposed works involve activities in, on or near natural wetlands the NES-F will apply in this instance.

Any disturbance to the wetland will occur as the result of construction of a local authority water supply network, which is identified as Regionally Significant Infrastructure in the GWRC NRP. This means the works meet the definition for Specified Infrastructure within the NES-F and are then provided for under the Specified Infrastructure section of the NES-F as a Discretionary Activity, as discussed in Table 4. The exact approvals required will depend on the extent of the works in the wetland and construction related activities which is still to be determined.

A resource consent under this regulation will not be granted unless Greater Wellington is

a) Satisfied that the specified infrastructure will provide significant national or regional benefits; and

b) Satisfied that there is a functional need for the specified infrastructure in that location; and

c) Applied the effects management hierarchy (refer to Figure 5).

effects management hierarchy, in relation to natural inland wetlands and rivers, means an approach to managing the adverse effects of an activity on the extent or values of a wetland or river (including cumulative effects and loss of potential value) that requires that:

(a) adverse effects are avoided where practicable; then

(b) where adverse effects cannot be avoided, they are minimised where practicable; then

(c) where adverse effects cannot be minimised, they are remedied where practicable; then

(d) where more than minor residual adverse effects cannot be avoided, minimised, or remedied, aquatic offsetting is provided where possible; then

(e) if aquatic offsetting of more than minor residual adverse effects is not possible, aquatic compensation is provided; then

(f) if aquatic compensation is not appropriate, the activity itself is avoided

Figure 5: National Policy Statement for Freshwater Management Effects Management Hierarchy

Table 4: NES-F Regulations

Activity	Regulation	Rule Description	Comment	Activity Status
Vegetation clearance	45 (1)	Within, or within a 10 m setback from, a natural inland wetland	For the purposes of constructing specified infrastructure	Discretionary
Earthworks or land disturbance	45 (2)	Within, or within a 10 m setback from, a natural inland wetland	For the purposes of constructing specified infrastructure	Discretionary
	45 (3)	Outside a 10 m, but within a 100 m, setback from a natural inland wetland	For the purposes of constructing specified infrastructure and results, or is likely to result, in the complete or partial drainage of all or part of the wetland	Discretionary
Taking, use, damming or diversion of water	45 (4)	Within, or within a 100 m setback from, a natural inland wetland	For the purpose of constructing or upgrading specified infrastructure, there is a hydrological connection, and it is likely to change the water level range or hydrological function of the wetland.	Discretionary
Discharge of water	45 (5)	Within, or within a 100 m setback from, a natural inland wetland	For the purpose of constructing or upgrading specified infrastructure, there is a hydrological connection, the discharge will enter the wetland and it is likely to change the water level range or hydrological function of the wetland.	Discretionary

4.3 Summary

It is recommended that a designation is sought by Wellington Water on behalf of Hutt City Council to authorise the construction of the reservoir as it provides several benefits over using a resource consent such as greater flexibility for design changes. Based on factors such as the scale of works and the proximity of residential properties the application is likely to be publicly notified.

A resource consent from Greater Wellington Regional Council will likely be required under Rule R107 for earthworks and the discharge of sediment and stormwater run-off as a Discretionary Activity, and under either Rule R117 or R118 for activities in a natural wetland. Depending on the construction activities required, this would be either a Discretionary or Non-Complying Activity. Additionally, approvals will be required under the NES-F regulation 45 for constructing specified infrastructure as a Discretionary Activity. If the effects are determined to be minor or less than minor, then public notification would not be required.

5 Pipeline Works

The pipeline works follow on from the construction of the first part of the delivery pipeline as part of the main reservoir works and involve construction of an approximately 1000 m long delivery pipe in Balgownie Grove, along Waddington Drive and Naenae Road to the connection with the Oxford Terrace watermain as shown in Figure 6 below and described in Section 2.2 above.

Figure 6: Proposed Delivery Pipe Route (source: Hutt City Council maps)

5.1 Hutt City Council Approvals

Both the installation of new underground network utilities and the operation and maintenance of network utilities area Permitted Activity in the HCDP. Earthworks, vegetation and health and safety standards associated with these rules are likely to be able to be complied with. Accordingly, it is expected that construction, maintenance and operation of the pipeline will be permitted under the District Plan with no resource consents required. A certificate of compliance confirming this can be sought from Hutt City Council if required.

Further assessment can be found in Table 5.

Table 5: Relevant District Plan Rules for the Construction and Operation of the Delivery Pipeline

Activity	Rule	Description	Comment	Status
The construction of the delivery pipeline	13.3.1.17	The construction, installation and development, of new underground network utilities	It is expected that construction of the pipeline along Balgownie Grove, Waddington Drive and Naenae Road will be permitted under this rule. Permitted activity standards associated with this rule are not applicable in this instance (the earthworks standard does not apply to trenching in the road reserve, the vegetation clearance standard only applies to rural areas, and the health and safety standard relates to radiofrequency emissions).	Permitted
The operation and maintenance of the delivery pipeline	13.3.1.2	The operation and maintenance of network utilities	It is expected that maintenance and operation of the pipeline along Balgownie Grove, Waddington Drive and Naenae Road will be permitted under this rule. Permitted activity standards associated with this rule are likely to be able to be complied with (the earthworks standard requires erosion and sediment control to be in place for any maintenance works, the vegetation clearance standard only applies to rural areas, and it is expected that maintenance and operation activities will comply with noise limits).	Permitted

5.1.1 Designation

As no resource consents are required to construct, operate and maintain the pipeline in the road, a designation is not necessary or appropriate.

5.1.2 Recommendation

Subject to final design, it is anticipated that the works could proceed as a Permitted Activity under the HCDP. A Certificate of Compliance can be obtained from Hutt City Council confirming this prior to construction if necessary.

5.2 Greater Wellington Regional Council Approvals

The Natural Resources Plan for the Wellington Region (Appeals Version – Final 2022) states that "*Earthworks do not include… trenching … associated with … pipe laying*". The proposed trenching required to construct the pipeline therefore does not require earthworks consent under the NPR.

It is anticipated that a small portion of the works area on Naenae Road adjacent to Cambridge Terrace may need dewatering. At this stage is anticipated that the Wellington Water Global dewatering consent (WGN170366) can be used to carry out this work. Compliance with this will need to be assessed closer to construction once likely abstraction rates and construction timeframes are known.

At this stage, it is not anticipated that any resource consents are required from Greater Wellington Regional Council for this portion of the works.

5.3 KiwiRail Approvals

This portion of the delivery pipe will pass under the KiwiRail corridor for the Wairarapa Railway Line which is designated in the Hutt City District Plan (Ref: NZR3). Under Section 176(1)(b) of the RMA written approval is required from KiwiRail prior to this work taking place (if there is any prospect that the pipeline could 'prevent or hinder' the KiwiRail infrastructure).

5.4 Summary

No resource consents are required from either Hutt City Council or Greater Wellington Regional council for the construction, operation or maintenance of a delivery pipe along Balgownie Grove, Waddington Drive and Naenae Road. Written approval will be required from KiwiRail for the pipe to pass under their railway lines which are designated in the Hutt City District Plan.

6 Supporting Information Requirements

The following technical inputs are likely to be required to confirm consent requirements and accompany a NOR and resource consent applications:

- Landscape and visual assessment
- Ecological assessment (including a mitigation or offset planting plan and wetland delineation mapping in accordance with the wetland delineation protocols)
- Amenity and recreation assessment (addressing construction and operation impacts)
- Geotechnical assessment (addressing ground suitability and seismic hazard)
- Draft erosion and sediment control plan
- Noise and vibration assessment
- Traffic assessment
- Social impact assessment
- Community engagement outcomes
- Cultural values assessment
- Carbon outputs and climate change

Other technical assessments may be required, subject to further detailed design information and following discussions with the Councils regarding the applications.

7 Partner, Stakeholder and Community Engagement

7.1 Mana Whenua

Taranaki Whānui has previously provided feedback confirming that the Eastern Hills site presents the lowest risk of significant impacts on mana whenua values out of the three shortlisted options. Ongoing engagement with Taranaki Whānui will need to take place throughout the design, consenting and construction phases of the project to ensure they have opportunities for meaningful feedback and involvement.

During the concept design phase, a cultural impact assessment was produced by Raukura Consultants, in consultation with mana whenua. The assessment found that the proposed site in general is not considered a site of cultural significance, however:

- The Waiwhetū stream which runs through the site is significant and discharges of contaminated water into the stream should be avoided
- An accidental discovery protocol should be developed in the unlikely event cultural material is found
- A blessing of the site by Kaumatua of Te Atiawa/Taranaki Whānui should be performed prior to works commencing

7.2 Hutt City Council

Regardless of whether a designation or resource consents is sought, engagement with the HCC resource consents team is recommended once timeframes for applications and design details are known to determine the best course forward and to determine specialist inputs required. If a NOR is proposed then engagement with HCC will be required in relation to matters such as the project objectives, proposed conditions, decision making process and delegations (to independent commissioner(s) and possibly also to the Chief Infrastructure Officer or similar to make the final decision).

Input should also be sought from the HCC department who manages or informally manage the trails area adjacent to the site with regard to the impact of construction works and proposed planning and landscaping on completion of the works.

7.3 KiwiRail

Approval will be required from KiwiRail for works to construct the pipeline that crosses under their railway lines. As the railway lines are designated in the HCDP, approval will be required from KiwiRail under s176(1)(b) even though the works do not require resource consent. This could be sought conjointly with the necessary technical approvals for the pipe to occupy KiwiRail land once detailed design has been confirmed and closer to the time of construction.

7.4 GWRC Flood Protection (Waiwhetū Stream)

Once a preferred option for crossing Waiwhetū Stream is confirmed, it is recommended that the GWRC Flood Protection team is consulted to determine the impact (if any) on any flood protection works they may manage along this waterway.

7.5 Neighbours

Extensive and ongoing engagement will be required with nearby residential properties through the design, consenting and construction phases of the reservoir. The benefits of the project will need to be clearly communicated and any concerns, queries or questions they have will need to be taken into account. It is recommended that a Social Impact Assessment detailing potential impacts and concerns as well as potential mitigation opportunities be prepared as part of the planning approvals.

8 Procurement

WWL held a procurement workshop on 14 September 2022 with the intention of discussing procurement options for the proposed Eastern Hills reservoir, as well as three further reservoirs (Aotea, Upper and Lower Bell Road and Te Aro). WWL proposed procurement methods for all four reservoirs to the WWL Procurement Board in early October. On 12 October 2022, WWL advised that they would split the works into two packages:

1. **Package 1**

   This package would be a Design and Construct (D&C) procurement method, where Connect Water will progress the notice of requirement and planning applications with sufficient flexibility to allow the successful contractor to modify design and construction methodology. Shortlisted contractors will be engaged by WWL to provide input to the planning applications during this phase.

   The scope of Package 1 is to include the Reservoir site and all associated works, the inlet and overflow pipe and the delivery pipe down the hill and across the Waiwhetū stream. This scope is based on the works which will require the majority of consent applications

2. **Package 2**

   This package will follow a traditional procurement method, where Connect Water will continue as the designer.

   The scope of this package starts from the delivery pipe termination on the Balgownie Tce side of the Waiwhetū stream and includes all aspects of the delivery pipe through the carriageway, to the connection to the Oxford Tce main.

Two D&C teams have been selected to provide constructability advice for the Eastern Hills reservoir which will inform the consent and specialist studies moving forward.

9 Programme

The following timeline is proposed (subject to council processing timeframes and the consultation outcomes).

Indicative dates only:

Additional investigations	February/March 2023
Prepare RMA NOR/RC applications	May/June 2023
Finalise technical inputs to RMA NOR/RC applications	June 2023
Lodge RMA NOR/RC applications	August/September 2023
RMA NOR/RC applications processing	TBC
RMA NOR/RC applications decisions	TBC

10 Key Risks

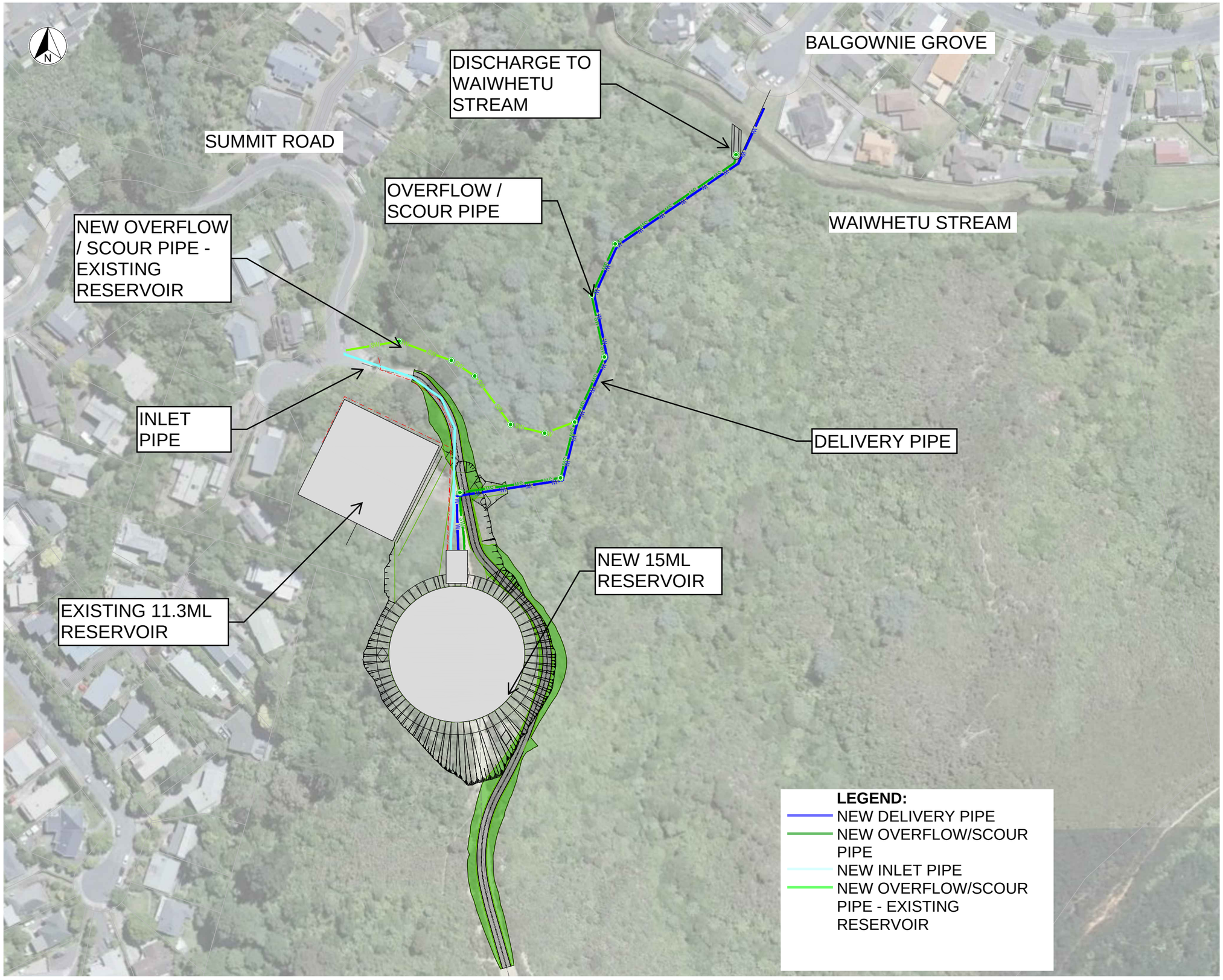
There are a number of key risks related to the planning approvals. These will be detailed in full in the Project Risk Register but are included here to highlight those understood at this early stage of the process:

Risk	Explanation	Recommendation
Stakeholder and iwi opposition or delay	Key challenge likely to be iwi resourcing and availability for meetings. Potential risk that HCC seek further information re iwi engagement, and it cannot be readily obtained	• Continue engagement with iwi, including discussions around their role and level of involvement • Seek a position statement or letter in support from iwi • Engage with HCC before lodgement regarding iwi information they require
	Nearby residents on Summit Road and/or Tilbury Street could raise concerns of opposition to the project, and in the worst-case appeal to the Environment Court. Key concerns may relate to the landscape/visual effects, construction noise and traffic.	• Engage early engagement with residential and potential submitters to understand their concerns • Consideration of mitigation measures through conditions that can be offered to resolve concerns • Additional expert assessment work to provide reassurance and or specialists available to meet with submitters • Explore whether a position statement or letter in support can be obtained from any residents • Consider direct referral if there is a high risk of Environment Court appeal
Lack of buy-in from local Councillors	Lack of buy-in from local Councillors who do not understand of support the project	• Wellington Water to liaise with Hutt CC staff to ensure Councillors have a good understanding of the project and support its outcomes
Specialist assessment and investigations	More detailed specialist investigations may take longer than anticipated or uncover risks that require further investigation or extensive mitigation, delaying the consenting programme or incurring additional costs	• Early involvement of specialist to allow scope for investigation and potential delays • Communicate programme and deadlines to specialists • Regular catch ups between specialist, planners and project managers to ensure no surprises environment
Potential legislative change	Potential for changes in legislation such as District Plan alterations, Natural and Built Environment Act and National Policy Statement on Indigenous Biodiversity could change information requirements or the levels of assessment or information required to be provided.	• Robust specialist assessment • Keep informed on proposed legislation changes and implementation dates
Lack of design detail or certainty	Because design and consenting will overlap, there is a risk that sufficient design detail won't be available in time to support specialist assessment works needed for the applications. Lack of detail or certainty in assessment likely to trigger a request for further information so effects have to be assessed on "worst	• Be clear on level of design detail required and when • Programme for inputs for lodgement • Regular team meetings with planners, designers and specialists • Clear lines of coordination and communication within team

Risk	Explanation	Recommendation
	case scenario". Or changes in design could mean work needs to be re-done resulting in delays.	• Ability to escalate information or design issues • Timely confirmation of upper limits of design parameters (e.g., maximum building height or platform)
Section 92 further information requests delays	HCC – Regulatory could request further information or commission a report on any matter relating to the Project (either before or other notification, although it is more common before notifying). This "stops the clock" on processing timeframes. This can significantly delay hearing processes because Councils generally prefer to wait for the further information before writing their reports and confirming hearings details.	• Sufficient clarity around design, methodology and operations to enable detailed assessments • Engage early with Council to address any questions as far as possible before lodgement • Lodge applications and reports in draft for review if possible • HCC to ensure processing team have capacity and resourcing • HCC commit to prioritising any further information requests so they can respond as quickly as possible • Lodge any additional information as drafts (assuming feedback can be provided quickly), and arrange experts to conference on these where necessary • If any further information is necessary, engage with HCC to explore ether they can be accommodated without impacting the hearing timeframe
Processing delays	Processing delays at HCC or GWRC delays the programme	• Pre-application engagement to inform the Councils about the project, timeframes and application so they can allocate resources in advance • HCC as requiring authority may be able to prioritise resources
Public notification delay (processing and decision making, prior to notification)	The default time period between lodgement and notification is 20 working days. That should be unnecessary where notification is requested but can still occur.	• Request public notification of the NOR • Engage with HCC – Regulatory and prepare notification materials in advance of lodgement so that it occurs smoothly (could save up to 15 working days)
Hearing resourcing and commissioner availability	The details timeframe for a hearing is 40 working days from close of submissions. This is a tight timeframe for HCC to schedule a hearing and could be extended if a Commissioner(s) is not available or HCC has insufficient processing resources.	• Engage early with HCC to confirm hearing and commissioners • Given HCC advance notice of when lodgement is likely to occur to ensure sufficient processing resources
Overly onerous conditions	Overly onerous conditions are imposed by HCC and/or GWRC especially if detailed design details are not yet finished	• Proffer draft conditions in initial applications • Request draft conditions for review before final decisions approved • Seek to delate final decision at HCC to Chief Infrastructure Officer

Risk	Explanation	Recommendation
		(or similar) to allow greater scope to stress test the workability of proposed conditions before decision if finalised
Conflicting or contradictory conditions	Conflicting or contradictory conditions on planning approvals from HCC and GWRC	• Try and obtain approvals from GWRC consents first if possible • Avoid overlaps in terms of who certifies which management plans • Proffer draft conditions in initial applications • Request draft conditions for review before final decisions approved
Delay in confirming the designation	Once a recommendation on the application is made by a Commissioner, there are further steps for HCC to take to confirm the designation.	• HCC commits to making and notifying a decision as soon as possible after positive recommendation is received • Consenting team assists by reviewing recommendation and advising any minor changes to conditions • If possible, have final decision-making function delegated to HCC employee rather the Councillors so decision doesn't have to go to full Council meeting. • HCC decision on the NOR is made and notified at the same time • Requirements and any further process agreed in advance so designation can be included in the plan as soon as possible
Design changes	If the design changes after planning approvals are obtained, then alterations to the consents/designation will need to be sought which could delay the programme.	• Ensure planning applications are as flexible as possible and allow for a conservative design assuming a 'worst case scenario' in terms of effects • Draft consent conditions that allow for further design details to be finalised via management plans

Appendix A: Drawings



A1 REPRODUCTION SCALE
100 80 60 40 20 0mm

A3 REPRODUCTION SCALE
50 40 30 20 10 0mm

0 10 20 30 40 50m
SCALE 1:750 AT ORIGINAL SIZE

No.	Revision	By	Chk	Appd	Date
0	ISSUED FOR INFORMATION	C.Y	L.H	J.L.	07/12/22

Drawing Originator
Connect Water
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PO box 12 003 Thorndon
Wellington 6144
T 64 4 471 7000

Original Scale (A1) 1:750
Reduced Scale (A3) 1:1500

Design	C.Y		Approved For Construction*
Drawn	C.Y		
Dsg Verifier			
Dwg Check	L.H		Date

* Refer to Revision 1 for Original Signature

Client: Wellington Water

Project: WELLINGTON WATER NAENAE NO.2 RESERVOIR

Title: GENERAL OVERVIEW RESERVOIR AND SITE PIPELINES

Discipline: CIVIL

Drawing No.: 3-WW021.02_W001

Rev.: 0

Plotted By: Birdling, Greg

DO NOT SCALE - IF IN DOUBT ASK

Drawing Plotted: 03 Feb 2023 1:12 PM

Document Path: \\CORP-PBWAN.NETPANZ\PROJECTSNZ\3W\3-WW021.02 NAENAE NO.2 RESERVOIR\HOME\700 DRAWINGS

Document No.: NN2 W2000 LAYOUT PLAN GB DRAFT.DWG

Appendix B: Policy Assessment

RESERVOIR WORKS

Hutt City District Plan Objectives and Policies

Objective/Policy	Compliance
General Residential	
Objective 4A 2.3 Built development is consistent with the planned low to medium density built environment and is compatible with the amenity levels associated with low to medium density residential development.	Likely to comply – reservoir is low density, won't generate impacts once construction complete
Objective 4A 2.4 Built development provides high quality on-site amenity for residents as well as high quality residential amenity for adjoining properties and the street.	Likely to comply – landscaping proposed for onsite amenity
Objective 4A 2.5 Built development is adequately serviced by network infrastructure or addresses any network infrastructure constraints on the site.	Likely to comply – reservoir will provide infrastructure
Policy 4A 3.2 Provide for residential activities and those non-residential activities that support the community's social, economic and cultural well-being and manage any adverse effects on residential amenity.	Likely to comply – will support community well being
Passive Recreation Activity Area	
Objective 7D 1.2.1 To ensure buildings and structures have adverse effects which are no more than minor on conservation and amenity values	Likely to comply – don't anticipate that it will have long-term adverse effects beyond construction
Policy 7D1.2.1 (a) To restrict the number of buildings and structures (b) To control the size, scale, location and external appearance of buildings and structures	Likely to comply – number of buildings on site limited, design of reservoir will control size/scale etc, will mitigate with planting
Network Utilities	
Objective 13.1.1 Regionally significant network utilities To recognise and protect the benefits of regionally significant network utilities	Likely to comply – reservoir is regionally significant network utility
Policy 13.1.1 (a) To identify regionally significant network utilities within the City on Council planning maps, as practicable. (b) To recognize the national, regional and local benefits of regionally significant network utilities.	Likely to comply – designation will be on planning maps, will have local benefits
Objective 13.1.2 Managing adverse effects, including reverse sensitivity effects, on regionally significant network utilities To ensure the operation, maintenance, upgrading and development of regionally significant network utilities is not compromised by other activities.	Likely to comply – reservoir is regionally significant network utility
Policy 13.1.2 (a) To avoid, or as appropriate, remedy or mitigate, the potential for any adverse effects, including reverse sensitivity effects on regionally significant network utilities from incompatible new subdivision, use and development occurring under, over or adjacent to regionally significant network utilities.	Likely to comply – designation will protect site from new development occurring under, over or adjacent to reservoir
Objective 13.1.3 Recognizing and providing for network utilities To recognise and provide for the sustainable, secure and efficient use, operation and development of network utilities within the city.	Likely to comply – reservoir is regionally significant network utility

Objective/Policy	Compliance
Policy 13.1.3 (a) To recognize and provide for the: (i) Need for new and the maintenance and upgrading of existing network utilities (ii) Technical and operational requirements and constraints of network utilities in assessing their location, design, development, construction and appearance and (iii) Benefits that network utilities provide to the economic, social and cultural functioning of the city. (b) To enable the efficient construction, installation, operation, upgrading and maintenance of network utilities. (c) To ensure that the provision and operation of utilities that cross jurisdictional boundaries is managed in an integrated manner. (d) To encourage the appropriate use of designations for new network utilities and extensions to existing network utilities that are not designated.	Likely to comply –reservoir is a new network utility
Objective 13.1.4 Managing environmental effects To manage any adverse effects on the environment resulting from the design, location, operation, upgrading and maintenance of network utilities	Likely to comply – adverse effects during construction will be managed
Policy 13.1.4 (a) To ensure that network utilities are designed, located, developed, constructed, upgraded, operated and maintained to avoid, remedy or mitigate any actual or potential adverse effects on the environment. (b) To manage effects on health and safety by ensuring network utilities are designed, located, upgraded, operated and maintained to comply with relevant national environmental standards and to meet other nationally recognized standards and guidelines. (c) To enable the co-location or multiple use of network utilities where this efficient, technically feasible and practicable and assists with avoiding, remedying or mitigating adverse effects on the environment (d) To require the underground placement of new network utilities unless (i) There are natural or physical features or structures, or technological and operational constraints that makes underground placement impractical or unreasonable (ii) They are of a temporary nature and required for emergency purposes or critical events; and (iii) They are of a nature that they can only operate above ground (e) To encourage the use of roads as network utility corridors in accordance with national code of practice for utility operators' access to transport corridors (f) To encourage network utility providers to consult with local communities, landowners and the Regional Council (where relevant) on the appropriate placement, location and design of new network utilities.	Likely to comply – will be co-located with existing reservoir, unable to be located underground due to operational requirements, cannot be located within the road, local community will be consulted
Noise	
Objective 14C1.1 Maintaining or enhancing health and amenity values To maintain or enhance the amenity value of all activity areas by ensuring that the adverse effects of excessive noise on the environment are avoided or mitigated	Likely to comply – noise will be mitigated

Objective/Policy	Compliance
Policy 14C1.1 (a) To recognize that background noise levels are markedly different throughout the city (b) To recognize that acceptable noise levels will vary according to the nature of the principal activities occurring within activity areas (c) To ensure that residential activity areas are protected by establishing appropriate noise levels at the interface between residential activity areas and non-residential activity areas. (d) That maximum noise levels are established within each activity area to ensure that amenity values are protected. (e) To make provision for those situations where there has already been considerable history to the establishment of specified noise conditions. (f) To recognise that noise levels may be different through a construction phase. (g) To recognise that Noise Management Plans may be appropriate to manage matters beyond those addressed in this District Plan	Likely to comply – noise assessment and noise management plan will be developed
Significant natural, cultural and archaeological resources	
Objective 14E1.1 Protection of significant natural, cultural and archaeological resources To identify and protect significant natural, cultural and archaeological resources in the City from inappropriate subdivision, use and development.	May not comply – construction of reservoir will not necessarily protect significant natural area
Policy 14E1.1 (b) That a schedule of significant natural, cultural and archaeological resources within the City be compiled. (c) That it be recognised that new significant natural, cultural and archaeological resources may be discovered, and added to the schedule of significant resources. (d) That any activity or site development shall not modify, damage or destroy a significant natural, cultural or archaeological resource. (e) That any activity or site development shall not compromise the natural character or visual amenity values of a significant natural, cultural or archaeological resource. (f) All buildings, structures and activities shall preserve the natural character, visual amenity values and landscape values of the significant natural, cultural or archaeological resources including the identified coastal environment. (g) The scale, height, location and design of all buildings and structures shall protect the amenity values, especially landscape values, of the identified coastal environment. (h) That any activity or site development will take into account new findings of significant natural, cultural and archaeological resources. (i) That the cultural significance of these natural resources be recognised and protected. (j) That any activity or site development shall not modify, damage or destroy the intrinsic values of the ecosystems of a significant natural, cultural or archaeological resource.	May not comply - will need robust mitigation in place to protect ecological values, planting around reservoir structure. Existing reservoir forms permitted baseline
Earthworks	
Objective 14I 1.1 To ensure that earthworks are designed to maintain the natural features that contribute to the City's landscape.	May not comply – need more details on proposed earthworks, designed to accommodate reservoir

Objective/Policy	Compliance
Policy 14I 1.1 (a) To ensure that earthworks are designed to be sympathetic to the natural topography (b) To protect significant escarpments, steep hillside areas, and the coastal area by ensuring that earthworks are designed to retain the existing topography, protect natural features and prevent erosion and slips.	May not comply – need more details on proposed earthworks, designed to accommodate reservoir not existing topography
Objective 14I 1.3 To ensure that provision is made for earthworks to be carried out for services which are essential to the health and safety of the community.	Likely to comply – reservoir is essential to health of community

Greater Wellington Natural Resources Plan

Objective/Policy	Compliance
Ki uta ki tai: Mountains to the sea	
Objective O2 The importance and contribution of air, land, water and ecosystems to the social, economic and cultural well-being and health of people and community are recognized in the management of those resources	Likely to comply – the reservoir will ensure well-being of the community
Beneficial use and development	
Objective O5 Sufficient fresh water of a suitable quality is available, for: (a) The health needs of people	Likely to comply – the reservoir will ensure a safe water supply
Objective O6 The social, economic, cultural and environmental benefits of taking and using water are recognised	Likely to comply – reservoir has social and economic benefits of using water
Objective O9 The social, economic, cultural and environmental benefits of Regionally Significant Infrastructure, renewable energy generation activities and the utilization of mineral resources are recognised	Likely to comply – reservoir is regionally significant network utility
Objective O10 Regionally Significant Infrastructure and renewable energy generation activities that meets the needs of present and future generations are enabled in appropriate places and ways.	Likely to comply – reservoir is regionally significant network utility needed to meet needs for future generations
Policy P6: Use of land and water The cultural, social and economic benefits of using land and water for: (b) Industrial process and commercial uses associated with the potable water supply network, and (c) Community and domestic water supply, and (j) Enabling urban development where it maintains the quality of the natural environment	Likely to comply – reservoir is part of the potable water supply network
Policy P11: Benefits of regionally significant infrastructure and renewable electricity generation facilities When considering proposals that relate to the provision of regionally significant infrastructure or renewable energy generation activities particular regard will be given to the benefits of those activities	Likely to comply – reservoir is regionally significant network utility

Objective/Policy	Compliance
Policy 13: Providing for regionally significant infrastructure and renewable electricity generation activities The use, development, operation, maintenance, and upgrade of regionally significant infrastructure and renewable energy generation activities are provided for, in appropriate places and ways. This includes by having particular regard to: (a) The strategic integration of infrastructure and land use and (d) The functional need and operational requirements associated with developing, operating, maintaining and upgrading Regionally significant infrastructure and renewable energy generation activities	Likely to comply – reservoir is regionally significant network utility
Māori Relationships	
Objective O13 Kaitiakitanga is recognised and mana whenua actively participate in planning and decision-making in relation to the use, development and protection of natural and physical resources.	Likely to comply – mana whenua will be invited to contribute to the project
Policy P20: Māori Values The cultural relationship of Māori with air, land and water shall be recognized and the adverse effects on this relationship and their values shall be minimized	Likely to comply – mana whenua will be invited to contribute to the project
Natural Character, Form and Function	
Objective O14 The natural character of the coastal marine area, natural wetlands, and rivers, lakes and their margins is preserved and protected from inappropriate use and development	Likely to comply – will depend on extent of works in wetland
Policy P24 Preserving and protecting natural character from inappropriate use and development To preserve natural character and protect is from inappropriate use and development by c) outside the coastal environment, avoiding and where avoidance is not practicable, remedying or mitigating significant adverse effects of activities on the natural character of wetlands, rivers, lakes and their margins that have high natural character, provided that the high natural character of the area taken as a whole is retained	Likely to comply – will depend on extent of works in wetland and mitigation offered
Natural Hazards	
Objective O15 The hazard risk and residual hazard risk, from natural hazards and adverse effects of climate change, on people, the community, the environment and infrastructure are acceptable	Likely to comply – reservoir will assist in ensuring continuity of supply due to natural hazards and climate change

Objective/Policy	Compliance
Policy P25: High hazard areas Use and development, including hazard mitigation methods, in on or over high hazard areas shall be managed to ensure that: (a) They have a functional need or operational requirement or there is no practicable alternative to be so located, and (b) An overall increase in risk of social, environmental and economic harm is avoided and (c) The hazard risk and/or residual hazard risk to the development, assessed using a risk-based approach, is acceptable or as low as reasonably practicable, recognizing that in some instances an increase in risk to the development may be appropriate and (d) The development does not cause or exacerbate hazard risk in other areas, and unless effects are avoided, remedied or mitigated in accordance with a hazard risk management strategy and (e) Adverse effects on natural processes (coastal, riverine and lake processes) are avoided, remedied or mitigated and (f) Natural cycles of erosion and accretion and the potential for natural features to fluctuate in position over time, including movements due to climate change and sea level rise over at least the next 100 years, are taken into account.	Likely to comply – not in a high hazard area
Biodiversity, aquatic ecosystem health and mahinga kai	
Objective 19 Biodiversity, aquatic ecosystem health and mahinga kai in freshwater bodies and the coastal marine area are safeguarded such that: a) Water quality, flows, water levels and aquatic and coastal habitats are managed to maintain biodiversity, aquatic ecosystem health and mahinga kai b) …freshwater water body or coastal marine area is meaningfully improved c) Restoration of aquatic ecosystem health and mahinga kai is encouraged	Likely to comply – will depend on extent of works in wetland and mitigation offered
Policy 30: Biodiversity, aquatic ecosystem health and mahinga kai Manage the adverse effects of use and development on biodiversity, aquatic ecosystem health and mahinga kai to:… c) maintain or where practicable restore aquatic habitat diversity and quality, including ii) the natural form of rivers, lakes, natural wetlands and the coastal marine area g) maintain or where practicable restore riparian habitats	Likely to comply – will depend on extent of works in wetland and mitigation offered
Policy 31: Adverse effects on biodiversity, aquatic ecosystem health and mahinga kai Adverse effects on biodiversity, aquatic ecosystem health and mahinga kai shall be managed by: … b) avoiding adverse effects where practicable; c) were adverse effects cannot be avoided, minimising them where practicable; d) where adverse effects cannot be minimised, they are remeidiend e) where more than minor residual adverse effects cannot be avoided, minimised, or remedied, biodiversity offsetting is provided where possible f) if biodiversity offsetting of more than minor resideual adverse effects is not possible, biodiversity compensation if provided g) the avitivty itself is avoided if biodiversity compensation cannot be undertaken in a way that is appropriate	Likely to comply – will depend on extent of works in wetland and mitigation offered

Objective/Policy	Compliance
Policy 34: Values of wetlands Activities in and adjacent to natural wetlands shall be managed to maintain and, where appropriate, restore their condition and their values including: a) As habitat for indeigenous flora and fauna b) For their significance to mana whenua c) For their role in the hydrological cycle including flood protection d) For nutrient attenuation and sediment trapping e) As a fisheries resource f) For recreation g) For education and scientific research	Likely to comply – will depend on extent of works in wetland and the values identified
Sites with significant indigenous biodiversity value	
Objective O26 Outstanding natural features and landscapes and their values are protected from inappropriate use and development	Likely to comply – will depend on extent of works in wetland and the values identified
Policy 42: Ecosystems and habitats with significant indegeouns biodiversity values Protect in accordance with Policy 31…and where approrpaiote, restore the following ecosystems and habitats with significant indigenous biodiversity values … c) natural wetlands, including natural wetlands identified in Schedule F3 Note: All natural wetlands in the Wellington Region are considered to be ecosystems and habitats with significant indigenous biodiversity values	Likely to comply – will depend on extent of works in wetland, the values identified and mitigation proposed
Natural features and landscapes	
Policy 52: Protecting natural features and landscapes from inappropriate use and development To protect natural features and landscapes of the coastal environmental, rivers, lakes and their margins and natural wetlands and their values, from inappropriate use and development by: … c) outside the coastal environment, avoiding and, where avoidance is not practicable, remedying or mitigating adverse effects of activities on the natural attributes and characteristics of outstanding natural features and landscapes, provided that the values of the natural features or landscapes that contribute to its outstanding status are retained.	Likely to comply – will depend on extent of works in wetland, the values identified and mitigation proposed
Land use	
Objective O34 The adverse effects on soil and water from use land activities are **minimized** including to assist with achieving the outcomes and indicators of desired environmental states for water in Tables 3.1 to 3.8.	Likely to comply – earthworks will have sediment control so waterways not likely be impacted
Discharges to land and water	
Objective O36 The runoff or leaching of contaminants to water from discharges to land is minimized, including to assist with achieving the outcomes and indicators of desired environmental states for water in Tables 3.1 and 3.8.	Likely to comply – earthworks will have sediment control so waterways not likely be impacted
Objective O37 The amount of sediment-laden runoff entering water is minimized, including to assist with achieving the outcomes and indicators of desired environmental states for water in Table 3.1 and 3.8.	Likely to comply – earthworks will have sediment control so waterways not likely be impacted

Objective/Policy	Compliance
Policy P66: Minimizing discharges to water or land Discharges of contaminants to water or land will be minimized through the following hierarchy: (a) Avoiding the production of the contaminants (b) Reducing the amount of contaminants, including by reusing, recovering or recycling contaminants (c) Minimizing the volume or amount of the discharge (d) Discharging to land is promoted over discharging direct to water, including using land-based treatment, constructed wetlands or other systems to treat contaminants prior to discharge.	Likely to comply – earthworks will have sediment control so waterways not likely be impacted
Policy P67: Human Drinking Water Supplies The adverse effects from discharges to land and water on the quality of community drinking water supplies and group drinking water supplies shall be avoided to the extent necessary to implement regulations for human drinking water. The drinking water supply operator will be consulted with as appropriate, taking into consideration emerging contaminants and industry best practice.	Likely to comply – Wellington Water is the drinking water supplier, water is in reservoir & pipes
Policy P68: Discharges to land The discharge of contaminants to land shall be managed to: (a) Minimize adverse effects on the life-supporting capacity of soil, (b) Avoid creating contaminated land (c) Not exceed the capacity of the soil to treat, use or remove the contaminant (d) Not exceed the available capacity of the soil to absorb the discharge (e) Avoid significant adverse effects on public health and amenity (f) Not result in a discharge to water that causes more than a minor adverse effects and (g) Avoid, remedy or mitigate adverse effects on mana whenua values when considering applications for discharges to land which may adversely affect statutory acknowledgement areas, sites of significance or Heritage New Zealand Pouhere Taonga sites, identified in this plan, any relevant district plan or in a planning document recognized by an iwi authority and lodge with a local authority	Likely to comply – earthworks will have sediment control so waterways not likely be impacted, won't create contaminated land, no known cultural or archaeological values on site
Activities in beds of lakes and rivers	
Policy P110: Loss of extent and values of the beds of lakes and rivers, and natural wetlands The loss of extent and values of the beds of lakes and rivers and natural wetlands, including as a result of reclamation and drainage is avoided except where a) In a natural inland wetland ii) for specified infrastructure 1. The activity, including any reclamation and drainage, is necessary for the construction or upgrade of specified infrastructure 2. The specified infrastructure will provide significant natural or regional benefits 3. There is a functional need for the specified infrastructure at that location	Likely to comply – the NRP defines the local authority water supply network as regionally significant infrastructure, which is included in the definition of specified infrastructure

PIPELINE WORKS

Hutt City District Plan Objectives and Policies

Objective/Policy	Compliance
Objective 13.1.1 Regionally significant network utilities To recognise and protect the benefits of regionally significant network utilities	Likely to comply – delivery pipeline is regionally significant network utility
Policy 13.1.1 (a) To identify regionally significant network utilities within the City on Council planning maps, as practicable. (b) To recognize the national, regional and local benefits of regionally significant network utilities.	Likely to comply – delivery pipeline is regionally significant network utility
Objective 13.1.2 Managing adverse effects, including reverse sensitivity effects, on regionally significant network utilities To ensure the operation, maintenance, upgrading and development of regionally significant network utilities is not compromised by other activities.	Likely to comply – delivery pipeline is regionally significant network utility
Policy 13.1.2 (a) To avoid, or as appropriate, remedy or mitigate, the potential for any adverse effects, including reverse sensitivity effects on regionally significant network utilities from incompatible new subdivision, use and development occurring under, over or adjacent to regionally significant network utilities.	Likely to comply – delivery pipe is underground so reverse sensitivity unlikely. Will seek written approval from KiwiRail for works under their infrastructure/railway line
Objective 13.1.3 Recognizing and providing for network utilities To recognise and provide for the sustainable, secure and efficient use, operation and development of network utilities within the city.	Likely to comply – delivery pipeline is part of sustainable development of network utility
Policy 13.1.3 (a) To recognize and provide for the: (iv) Need for new and the maintenance and upgrading of existing network utilities (v) Technical and operational requirements and constraints of network utilities in assessing their location, design, development, construction and appearance and (vi) Benefits that network utilities provide to the economic, social and cultural functioning of the city. (b) To enable the efficient construction, installation, operation, upgrading and maintenance of network utilities. (c) To ensure that the provision and operation of utilities that cross jurisdictional boundaries is managed in an integrated manner. (d) To encourage the appropriate use of designations for new network utilities and extensions to existing network utilities that are not designated.	Likely to comply – delivery pipeline is new infrastructure, provides for functioning city
Objective 13.1.4 Managing environmental effects To manage any adverse effects on the environment resulting from the design, location, operation, upgrading and maintenance of network utilities	Likely to comply – delivery pipeline unlikely to have adverse environmental effects

Objective/Policy	Compliance
Policy 13.1.4 (a) To ensure that network utilities are designed, located, developed, constructed, upgraded, operated and maintained to avoid, remedy or mitigate any actual or potential adverse effects on the environment. (b) To manage effects on health and safety by ensuring network utilities are designed, located, upgraded, operated and maintained to comply with relevant national environmental standards and to meet other nationally recognized standards and guidelines. (c) To enable the co-location or multiple use of network utilities where this efficient, technically feasible and practicable and assists with avoiding, remedying or mitigating adverse effects on the environment (d) To require the underground placement of new network utilities unless (iv) There are natural or physical features or structures, or technological and operational constraints that makes underground placement impractical or unreasonable (v) They are of a temporary nature and required for emergency purposes or critical events; and (vi) They are of a nature that they can only operate above ground (e) To encourage the use of roads as network utility corridors in accordance with national code of practice for utility operators; access to transport corridors (f) To encourage network utility providers to consult with local communities, landowners and the Regional Council (where relevant) on the appropriate placement, location and design of new network utilities.	Likely to comply – delivery pipeline will be underground in the road corridor

Greater Wellington Natural Resources Plan

Objective/Policy	Compliance
Ki uta ki tai: Mountains to the sea	
Objective O2 The importance and contribution of air, land, water and ecosystems to the social, economic and cultural well-being and health of people and community are recognized in the management of those resources	Likely to comply – the pipeline will ensure well-being of the community
Beneficial use and Development	
Objective O9 The social, economic, cultural and environmental benefits of Regionally Significant Infrastructure, renewable energy generation activities and the utilization of mineral resources are recognised	Likely to comply – pipeline is regionally significant network utility
Objective O10 Regionally Significant Infrastructure and renewable energy generation activities that meets the needs of present and future generations are enabled in appropriate places and ways.	Likely to comply – pipeline is regionally significant network utility
Policy P6: Use of land and water The cultural, social and economic benefits of using land and water for: (d) Industrial process and commercial uses associated with the potable water supply network, and (e) Community and domestic water supply, and (j) Enabling urban development where it maintains the quality of the natural environment	Likely to comply – pipeline is part of community water supply

Objective/Policy	Compliance
Policy P11: Benefits of regionally significant infrastructure and renewable electricity generation facilities When considering proposals that relate to the provision of regionally significant infrastructure or renewable energy generation activities particular regard will be given to the benefits of those activities	Likely to comply – pipeline is regionally significant network utility
Policy 13: Providing for regionally significant infrastructure and renewable electricity generation activities The use, development, operation, maintenance, and upgrade of regionally significant infrastructure and renewable energy generation activities are provided for, in appropriate places and ways. This includes by having particular regard to: (a) The strategic integration of infrastructure and land use and (d) The functional need and operational requirements associated with developing, operating, maintaining and upgrading Regionally significant infrastructure and renewable energy generation activities	Likely to comply – pipeline is regionally significant network utility
Māori Relationships	
Objective O13 Kaitiakitanga is recognised and mana whenua actively participate in planning and decision-making in relation to the use, development and protection of natural and physical resources.	Likely to comply – mana whenua will be invited to contribute to the project
Policy P20: Māori Values The cultural relationship of Māori with air, land and water shall be recognized and the adverse effects on this relationship and their values shall be minimized	Likely to comply – mana whenua will be invited to contribute to the project
Land use	
Objective O34 The adverse effects on soil and water from use land activities are minimized including to assist with achieving the outcomes and indicators of desired environmental states for water in Tables 3.1 to 3.8.	Likely to comply – earthworks will have sediment control so waterways not likely be impacted

Appendix E – HCC Pre-Application Meeting Notes

From: Pocock, Max Max.Pocock@wsp.com
Sent: Tuesday, July 18, 2023 12:54 PM
To: Nancy Gomez Nancy.Gomez@huttcity.govt.nz
Cc: Nicole Peurifoy <Nicole.Peurifoy@huttcity.govt.nz>
Subject: [EXTERNAL] RE: PREAPP230047 - Resource Consent Pre-Application Meeting - Naenae Reservoir 2 - 37 Summit Road, Fairfield

Thanks Nancy.

Just one amendment from me. Highlighted in yellow for ease.

Ngā mihi nui | Thank you

Max Pocock
Work Group Manager - Engagement, Planning and Sustainability

W: +64 4 471 4227
M: +64 21 597 363
Max.Pocock@wsp.com

wsp.com/nz

From: Nancy Gomez <Nancy.Gomez@huttcity.govt.nz>
Sent: Monday, July 17, 2023 12:10 PM
To: Pocock, Max <Max.Pocock@wsp.com>
Cc: Nicole Peurifoy <Nicole.Peurifoy@huttcity.govt.nz>
Subject: Re: PREAPP230047 - Resource Consent Pre-Application Meeting - Naenae Reservoir 2 - 37 Summit Road, Fairfield

Hi Max,

Following the pre-application meeting, I have included some notes of our discussion below.

In attendance: Cathy & Max (WSP Planners), Jo (Project Manager) & Nancy (HCC Planner).

It is our understanding that Wellington Water (WWL) is proposing the construction of a second Naenae reservoir behind the existing reservoir, a pipe bridge (that could also be modified to serve as a pedestrian bridge) and water pipeline from the second reservoir towards Balgownie Grove.
The second reservoir would be at the same level of the existing reservoir. Excavation (cut) is required for the building area of the second reservoir and to form the access track to the second reservoir.
It is anticipated that there would be high truck movements, approximately 50trips per day for 230 days, and some night work required for at least 4 nights
It is also our understanding that WSP is to apply for a new designation and hoping to apply by the end of August.

Brief recap HCC Resource Consent comments:

- The location of the second reservoir is within Passive Recreation area and within Significant Natural Resources SNR12, so at least Chapters 7D, 14E & 14I applies.
- The Parks & Reserves team must be informed about the proposed second reservoirs, since they are the assets owner and written approval will be required for the proposal. WSP is to contact the HCC Reserves Planner for this.
- The second reservoir will straddle two properties: 37 Summit Road (WN8B/1388) & 2 Balgownie Grove (WN28C/614). However, confining the second reservoir to the boundaries of one property is not possible. The applicant is to confirm how they intent to address this straddling issue - whether amalgamation of the titles or subdivision.
- The amount of vegetation clearance and cut to the hill is a huge concern. Landscaping plans and effective mitigation of the visual impact must be included in the resource consents application.
- Also of big concern is construction effects including vehicle movements (traffic effects), noise, vibration and night works on the surrounding residential area.
- The applicant is to give some thought about notification of the proposal or to leave it to HCC processing planner to make a decision on notification.
- I had a brief conversation with the HCC Reserves Planner Nicole about the location of the reservoir, amount of excavation and possible obstruction of existing tracks during construction, and she is still looking into these before commenting.

Regards,

Nancy Gomez
Senior Resource Consents Planner

Hutt City Council, 30 Laings Road, Hutt Central, Lower Hutt, Lower Hutt 5010
P: **M:** 027 208 1190 **W:** www.huttcity.govt.nz

From: Jotform <noreply@jotform.com>
Sent: Monday, May 29, 2023 9:15 AM
To: RC_Preapps <RC_Preapps@huttcity.govt.nz>
Subject: [EXTERNAL] Re: Resource Consent Pre-Application Meeting Request Form

Resource Consent Pre-Application Meeting Request Form

Name of Agent:	Maxwell Pocock
Who is the applicant for the property?	Wellington Water
Who should we contact for the pre-application stage?	Maxwell Pocock
Contact email:	max.pocock@wsp.coim
Contact mobile:	(642) 159-7363
Site address(es):	Lot 35 DP 31233
Known title restrictions:	N/A
Name	Jo Lucas
Email	jo.lucas@wsp.com
Phone Number	(642) 159-7363
Billing Address:	Level 9/100 Willis Street, Wellington, 6011
Proposal summary:	The proposal is a NoR for a new reservoir adjoining the existing Naenae reservoir at the top of Summit Road. The new reservoir will be a circular 15ML, above ground reservoir with a 55.2m external diameter and a height of 8.35m. A new inlet pipe supplying water to the Reservoir will be constructed in a trench from a connection with the existing Naenae reservoir inlet pipe. This new connection is located at the intersection of Summit Road and Farrelly Grove with the proposed alignment then running along the current vehicle access to the Reservoir. Both reservoirs will be supplied via the same exisitng bulk main from the Waterloo water treatment plant. A new 750 diameter delivery pipe supplying water to the potable water network will run from the Reservoir down the hill to the

	north and across Waiwhetu Stream and into the potable water network along local roads. The new Waiwhetu Stream pipe crossing will be bridged. Separate resource consents will be required to be obtained from Greater Wellington Regional Council. Material is still draft and subject to change.
Have you had professional advice obtained to date?	No
Preferred type of meeting:	In-person meeting
Names of expected attendees:	Max Pocock & Cathy Crooks
	Appendix A - Naenae reservoir concept drawings.pdf

You can edit this submission and view all your submissions easily.

-LAEmHhHzdJzBlTWfa4Hgs7pbKl

Appendix F – HCC Parks & Recreation Team Feedback

From: Nicole Peurifoy <Nicole.Peurifoy@huttcity.govt.nz>
Sent: Friday, July 21, 2023 2:58 PM
To: Pocock, Max <Max.Pocock@wsp.com>; Nancy Gomez <Nancy.Gomez@huttcity.govt.nz>
Cc: Corryn Elliott <Corryn.Elliott@huttcity.govt.nz>
Subject: RE: [EXTERNAL] RE: PREAPP230047 - Resource Consent Pre-Application Meeting - Naenae Reservoir 2 - 37 Summit Road, Fairfield

Kia ora,

My notes in green.

It is our understanding that Wellington Water (WWL) is proposing the construction of a second Naenae reservoir behind the existing reservoir, a pipe bridge (that could also be modified to serve as a pedestrian bridge) and water pipeline from the second reservoir towards Balgownie Grove.
The second reservoir would be at the same level of the existing reservoir. Excavation (cut) is required for the building area of the second reservoir and to form the access track to the second reservoir.
It is anticipated that there would be high truck movements, approximately 50trips per day for 230 days, and some night work required for at least 4 nights
It is also our understanding that WSP is to apply for a new designation and hoping to apply by the end of August. Is Wellington Water aware that they would be removing vegetation on assessed Significant Natural Areas (SNA) land? Below is a layer that shows SNA designated spots, and this includes the proposed reservoir area. Being an SNA, there are legal implications

and I am wondering how aware Wellington Water is about this. The NPS for Indigenous Biodiversity was adopted a few weeks ago and takes effect 7 August 2023. In the statement Section 3.10.3 and 3.10.4 state that any development causing adverse effects in SNAs must have a management hierarchy (offsetting or compensation). With the resource consent, it should be noted that SNA may be cleared per exception rules in the NPS (possibly 3.11.1 and 3.11.2b)With the pending DP review, we wont have updated policies by the time the RC is most likely granted however. Even with existing policy, we will need Wellington Water to do some offsetting and give us a plan for effect mitigation- we will need an Environmental Impact Assessment or similar assessment, including a management plan.

Brief recap HCC Resource Consent comments:

- The location of the second reservoir is within Passive Recreation area and within Significant Natural Resources SNR12, so at least Chapters 7D, 14E & 14I applies.
- The Parks & Reserves team must be informed about the proposed second reservoirs, since they are the assets owner and written approval will be required for the proposal. WSP is to contact the HCC Reserves Planner for this. A boundary adjustment will be required as the proposed reservoir is straddling 2 titles. This can take up to 8 weeks. All costs will need to be on Wellington Water.
- The second reservoir will straddle two properties: 37 Summit Road (WN8B/1388) & 2 Balgownie Grove (WN28C/614). However, confining the second reservoir to the boundaries of one property is not possible.

The applicant is to confirm how they intent to address this straddling issue - whether amalgamation of the titles or subdivision.

- The amount of vegetation clearance and cut to the hill is a huge concern. Landscaping plans and effective mitigation of the visual impact must be included in the resource consents application. See my SNA comment above, and looking from the plans (the Appendix A items) the 'potential spoil dump area' is a no go, apologies this will need to be contained and moved off-site. Also, there is a very high public perception risk and clash, especially with private landowners, as SNA are extremely controversial. WW clearing SNA land, even for a very important water requirement to serve thousands of people, needs to be informed to our Communications Team. Has someone from HCC Communications been linked in yet? I am assuming they have, as we require public notification signage in the area. I have copied in Corryn Elliot, Reserves Asset Manager. She has had previous discussion with Bruce H. but was mostly on given awareness to the track closure, not the significant adverse effects. I see that Appendix A also has a planting palette- however has this been viewed by a suitable ecologist? Vegetation will need to be nearly like for like of existing vegetation.
- Also of big concern is construction effects including vehicle movements (traffic effects), noise, vibration and night works on the surrounding residential area. Have residents been notified yet?
- The applicant is to give some thought about notification of the proposal or to leave it to HCC processing planner to make a decision on notification. We need notification asap as soon as we have confirmation of timeline and exactly what earthworks will be done.
- I had a brief conversation with the HCC Reserves Planner Nicole about the location of the reservoir, amount of excavation and possible obstruction of existing tracks during construction, and she is still looking into these before commenting. From the Appendix A, it looks like it is nearly encroaching onto the existing track, we will need some widening or protective barrier for the public.

Your previous email regarding comments:

- During our pre-application meeting with Nancy she mentioned it could be cleaner to do a minor boundary adjustment so that the proposed reservoir was located with one allotment (I understood it that this is predominantly driven from a building consent perspective). Currently the reservoir straddles two allotments as shown in the attached standalone plan. We would be interested in understanding the preference of the Parks team with respect to whether the reservoir should be contained wholly within one allotment, or if a minor boundary adjustment was preferred so that the reservoir was contained wholly within one allotment. Yes most likely a minor boundary adjustment as the reservoir cannot physically or technically sit in one allotment. A minor boundary adjustment would require a separate subdivision consent to be submitted as a Discretionary Activity.
- The reservoir design has been largely dictated by engineering requirements (ground stability etc). This means that access to the fire break will be cut off during construction as having public access maintained during construction poses a large health and safety risk. Does HCC require us to obtain any approvals for this temporary closure? Yes, from out Asset Manager with public notification and a risk mitigation plan. We have already met with FENZ who indicated that will not require access up firebreak through the construction period

- Following completion of construction, the area around the reservoir will be comprehensively landscaped, and a new path will be constructed around the reservoir re-connecting pedestrian access to the fire break. Would HCC like the opportunity to comment on draft landscape plans? Are there any design requirements you would like consideration to be given to given the lands underlying zoning? We need to see a proper landscape plan of what the space would look like after development is completed. Consideration to SNA vegetation, public track and surrounding neighbourhood.
- As part of the construction of the new water connection pipe, a pipe bridge needs to be constructed over Whaiwhetu Stream where the pipe will then connect into Balgownie Grove (see attached plans). As part of the Project there is the potential for this pipe bridge to feature a pedestrian crossing, which could then be connected to a track adjoining the pipe running up to the ridgeline. Would Hutt City Council be interested in pursuing this option further? So would this be a permanent fixture? If we don't take ownership who would? Potentially, we need to see better realistic concept plans and costing estimates. We are not in a position to continue taking on assets as we have growing Opex pressures. It would be more suitable for WW to acquire the asset as it is associated with development of resevoir I need to note that Wellington Water would then expect Hutt City Council to then take on the ownership and maintenance responsibilities for the bridge.

Happy to schedule a teams meeting about this next week.

Kindly,

Nicole Peurifoy, MconBio (She/her)
Parks Planner, Parks and Reserves
Hutt City Council, 30 Laings Road, Lower Hutt 5040
M: 027 337 8156 **W:** www.huttcity.govt.nz

Nicole Peurifoy
Parks Planner

Hutt City Council, 93 Hutt Park Road, Moera, Lower Hutt, Lower Hutt 5010
P: **M:** 027 337 8156 **W:** www.huttcity.govt.nz

Appendix G – GWRC Pre-Application Meeting Notes

Lucas, Jo

From: Heidi Andrewartha <Heidi.Andrewartha@gw.govt.nz>
Sent: Tuesday, 20 June 2023 9:08 am
To: Pocock, Max; Crooks, Cathy
Cc: Lucas, Jo
Subject: Nae Nae water reservoir
Attachments: Winter Works Application Guide 2023.pdf

Hi all,

I have gone through our plan to determine what consents you will need to apply for, for the above proposal.

- Land use consent for bulk earthworks over 3,000m2 (unlikely to meet permitted activity rule R101 so will fall as a discretionary activity under Rule R107)
- Land use consent for vegetation clearance on erosion prone land – Rule R104 outlines the permitted activity requirements – you will need to make a comment on this, and if you do not meet the conditions in this rule, it will again fall as a discretionary activity under Rule R107 (as above). Erosion prone land is if the pre-existing slope of the land exceeds 20 degrees.
- Land use consent for a new structure in and over bed of river (Rule R128 gives the permitted activity rule for both the proposed pipe across the stream, and the proposed structures in the stream – swales, erosion protection structures etc). I am assuming the structures will be over 10m2? I do note that pipes over a stream where no bed occupancy limits apply are permitted to occupy more than 10m2 under this rule – I assume the supporting structures for the pipe bridge are outside the bed of the stream? So the pipe bridge itself may fall as a permitted activity as long as it meets all general conditions in Section 5.4.4 – you will need to make an assessment on this. However the bank protection structures would prob not meet permitted activity standards due to size, and would therefore fall as a discretionary activity under Rule R145.

With regards to the wetlands on site, depending on where these are delineated and what works are being undertaken in and near the wetlands, you may require land use consents under the PNRP. From the plan I saw, it appears as though there will be no works within 10m of the wetlands themselves. As such, consent would not be required under Rules R115, R117, R118 in the Proposed Plan, as these rules all pertain to works actually in the wetland.

However the NES for Freshwater requires consent for certain activities. I note that the works probably fall under the definition of specified infrastructures as it is water storage infrastructure.

Reg 45 pertains to vegetation clearance, earthworks, land disturbance etc near wetlands if it is for the purpose of constructing specified infrastructure. It appeared from your plan that no earthworks, vegetation clearance etc would occur within 10m setback of the wetland. However earthworks/land disturbance outside a 10m, but within a 100m setback, would be a discretionary activity under Reg 45(3). Furthermore, the Reg 45(4)(5) & (6) may also be triggered.

- Discharge consent: Discharge of sediment laden stormwater into water (Waiwhetu Stream) from bulk earthworks
- Discharge consent – discharge of potable water into Waiwhetu Stream (from emergency overflows and maintenance works reservoir) – although this may in fact be permitted under Rule R45 depending on the exact nature of the discharges (see below)
- Rule R45 – you will need to make comments/assessment on Rule R45 which is the permitted activity rule for the discharge of potable water. I assume you will meet all these conditions in this rule?? If so, I do not think you will require a discharge consent for the discharge of potable water – that is when you fill/refill and empty the reservoir?

- Discharge of operational stormwater (stormwater generated once works are completed, for example, runoff from hardstanding areas etc. I am not sure what is proposed for this and even if there will be a specific discharge you require consent for. But potentially you may require consent for this. (Look at rules R48-R51)

I have also attached our guide for winter works. I would advise to keep any areas to be worked over winter fairly small with very tight sediment and control measures and hopefully that will be accepted when you apply for it. Hopefully this information helps!

Regards

Heidi

Heidi Andrewartha
Kaitohutohu Matua/ Resource Management Consultant to Environmental Regulation
Greater Wellington Te Pane Matua Taiao
Level 4, Departmental Building, 35-37 Chapel Street, Masterton
PO Box 41, Masterton 5840
Follow us online: Facebook | Twitter | gw.govt.nz

Hours: I am generally in the office from 9am until 1pm, Monday – Thursday depending on work loads.

Appendix H – FENZ Meeting Minutes

Minutes of Meeting

Project	Eastern Hills Reservoir
Recorded by	James Reilly
Date	22/05/2023
Time	11am – 12pm
Venue	Avalon Fire Station, 955 High Street, Avalon, Lower Hutt, 5011
Subject	FENZ Firebreak

	Persons Present	Organisation
1.	James Martin-Bond (JM)	FENZ
2.	Gareth Hughes (GH)	FENZ
3.	Lewis Hensman (LH)	Connect Water
4.	James Reilly (JR)	Connect Water
	Persons Absent	**Organisation**
1.	Jo Lucas	Connect Water

Notes:

	Discussion and Action	By Whom	By When
1.	GH and JM noted that for anything FENZ related (this project and others) in the Wellington Region, it is possible to email them directly for stakeholder related queries.		
2.	GH – Is the new reservoir going to put the pressure up in standpipes on Summit Rd and around Naenae? It's already at 500 kPa and there is concern of having high pressure in a poor reticulation network, specifically in respect to water hammer. LH - It shouldn't be significantly elevated above current peak pressures, due to the new reservoir being at a relatively similar height to the first one. Can be put within design documentation to ensure it is accounted for during the detail design phase.	LH	
3.	GH and JM wouldn't assume they would get a fire truck up the emergency road – it is a FWD access. More often, those roads are seen more as firebreaks. It's also not FENZ's job to maintain road. Need to confirm whose responsibility the maintenance of the road is (Council or Electricity Corporation NZ (ECNZ)).	JR	
4.	GM – full access up the firebreak does not need to be maintained during construction. There are other access roads		

	above the site that can be used. When reinstating the road, the other ECNZ road grades is a good policy to follow.	
5.	JM mentions the new firebreak policy that has been released. JM to forward those to GH and JR.	JM
6.	Parking construction vehicles on public roads may impact FENZ, as the fire engines may be unable to safely access the top of Summit Rd. LH - The intent is for construction vehicles to be parked on site, or at off site locations. This will need to be monitored throughout the construction period to ensure vehiceles do not restrict emergency vehicles from accessing the top of Summitt Rd. There will likely be restricted public parking on parts of Summit Rd for the construction period.	LH, JR
7.	GH – Another concern is the disruption to water supply from construction. LH - We anticipate there will be water disruption when the old reservoir is connected to the new on Farrelly Grove and the connection of the delivery pipe through the alignment on the flat. These are expected to be operationally managed, with no significant impact on water available for firefighting. Communication with FENZ throughout the design and construction will help mitigate the impact of planned, or unplanned disruption	
8.	GH - Is it possible to reinstate the access road to the level where fire trucks can access the water supply reservoir once the project is complete? LH – May be possible as access track will need to be improved to provide construction access, consideration to be put into specification for detailed design.	LH
9.	The site will likely be occupied Monday-Friday, and potentially Saturday, pending consents. Because of the size of the project the site will have access controls and people present should FENZ need access. There is unlikely to be lone workers.	
10.	FENZ does not mind us adding access routes to divert the public off the access road and work site. GH mentions a mountain bike track near the proposed supply pipe called Waddington Winder. This will be good to keep in mind and public notification carefully considered.	
11.	FENZ has a drone team. GH and JM offers the drone, which could be used for 3D mapping, etc. We have already done a drone survey, but it's a good thing to keep in mind, and a kind gesture.	
12.	LH or JR to send concept drawings of reservoir to GH. It is worth noting that the design could change, in which case FENZ will be updated. Keep GH and FENZ engaged throughout the process.	LH
13.	GH and JM noted that FENZ are generally in support of projects which increase water storage. It increases redundancy in the network and helps ensure that there is sufficient water available for firefighting needs.	

Appendix I – Communications & Stakeholder Engagement Plan

Eastern Hills Reservoir Communications Plan

[Last updated: June 2022 pre lodgment]

Background

Hutt City Council needs an additional water reservoir to increase available drinking water supplies and provide increased water security for Lower Hutt. Investigations for a suitable site were undertaken in 2021 – with 28 sites around the Hutt Valley area considered, this was reduced to seven options and then three shortlist options.

The Fairfield/Naenae site identified as the preferred location is immediately adjacent to the existing Naenae Reservoir – a 11.3 million litre square reservoir. The original reservoir will be retained and remain operational throughout the construction period.

The new reservoir will be an above ground cylindrical reservoir, with a nominal storage volume of 15 million litres of water. It will be 55 metres in diameter and 8 metres high.

Access to the new reservoir will be from the existing access point at the top of Summit Road. The existing access track will be extended up to the new reservoir and the existing DN750 bulk water supply pipeline up Summit Road will be extended up to the new valve house.

A new delivery pipeline (to the distribution network) to support the new reservoir is also required. It is proposed that this be routed down the hillside to the north-east, towards Balgownie Grove. The delivery pipeline would cross the Waiwhetu Stream at the foot of the hill and continue down Balgownie Grove.

A new overflow / scour pipeline for the reservoir will be routed down the same alignment as the delivery pipeline, this will discharge (very infrequently) into the Waiwhetu stream. The existing Naenae Reservoir will have its overflow / scour line connected into this new pipe.

The new reservoir will be at the same elevation as the existing reservoir requiring approximately 83,000 m^3 of earthworks to cut down the ridge to create a platform where the reservoir will be constructed. Approximately 7,000 m^3 of earthworks is required to construct the pipeline. Vegetation clearance would be required for the platform and pipe corridor down the hill. New planting is proposed surrounding the work site and where vegetation is removed to run the delivery and overflow / scour pipes. Taller planting around the reservoir will help to screen this visual impact. An access road will be retained running through the site and clear access will be provided around the reservoir to the existing fire break.

A new DN750 delivery pipeline constructed down Balgownie Grove, Waddington Drive and Naenae Road, connecting the new reservoir into the wider distribution network. This new pipeline will be constructed in the carriageway and will be approximately 1 km long.

Pending approval to proceed, construction is likely to begin in September 2024 and would take 2-3 years to build.

The project has been split into two work programmes :

1. The reservoir itself, including the pipe downhill as per Figure 1.
2. The pipeline along Waddington Road and Naenae Drive as per Figure 2.

Current status

Following community consultation during March 2023, reports and submissions have been prepared. As part of finalising resource consents, including the Assessment of Environmental Effects, further engagement with some community groups and a survey will be carried out.

Wellington Water expects to lodge a notice of requirement (NOR), on behalf of HCC for a new designation to HCC and a resource consent application to GWRC under the Resource Management Act 1991 for the construction of the reservoir by the end of August 2023.

Once the NOR has been lodged, the process will be run and controlled by HCC. Wellington Water will be requesting notification to enable the public and all interested stakeholders to have their say. The submission process will be run by HCC.

Depending on the nature of submissions received, HCC may choose to hold a hearing where submitters can speak to their submissions. If no major issues are raised by submitters, there may not be a need to hold a hearing. If the effects are minor or less than minor, the resource consent application to GWRC may not be publicly notified.

This communications plan covers the current period up to an including public notification and consultation period.

Work Area

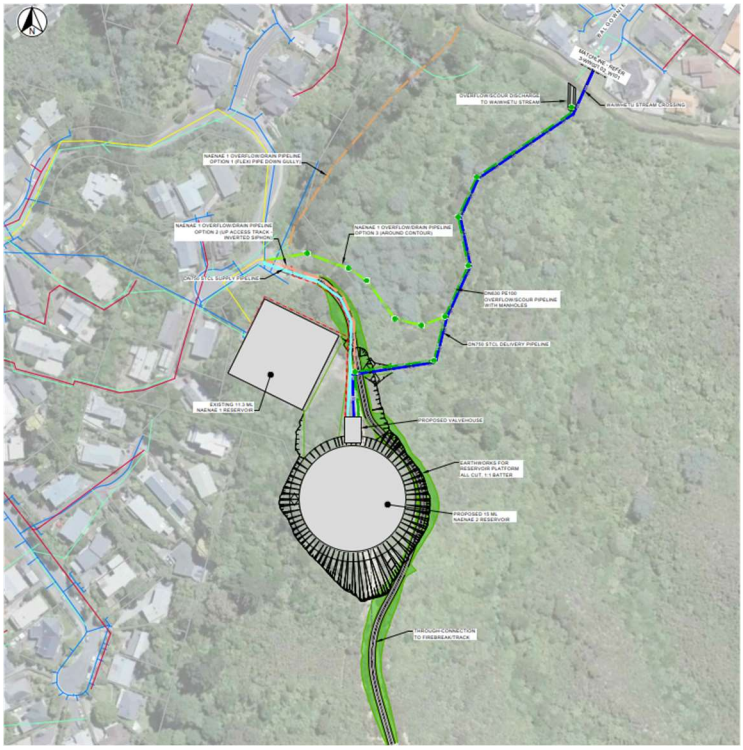

Figure 1: Reservoir site, including pipe corridor down hill

Figure 2: Delivery pipe alignment

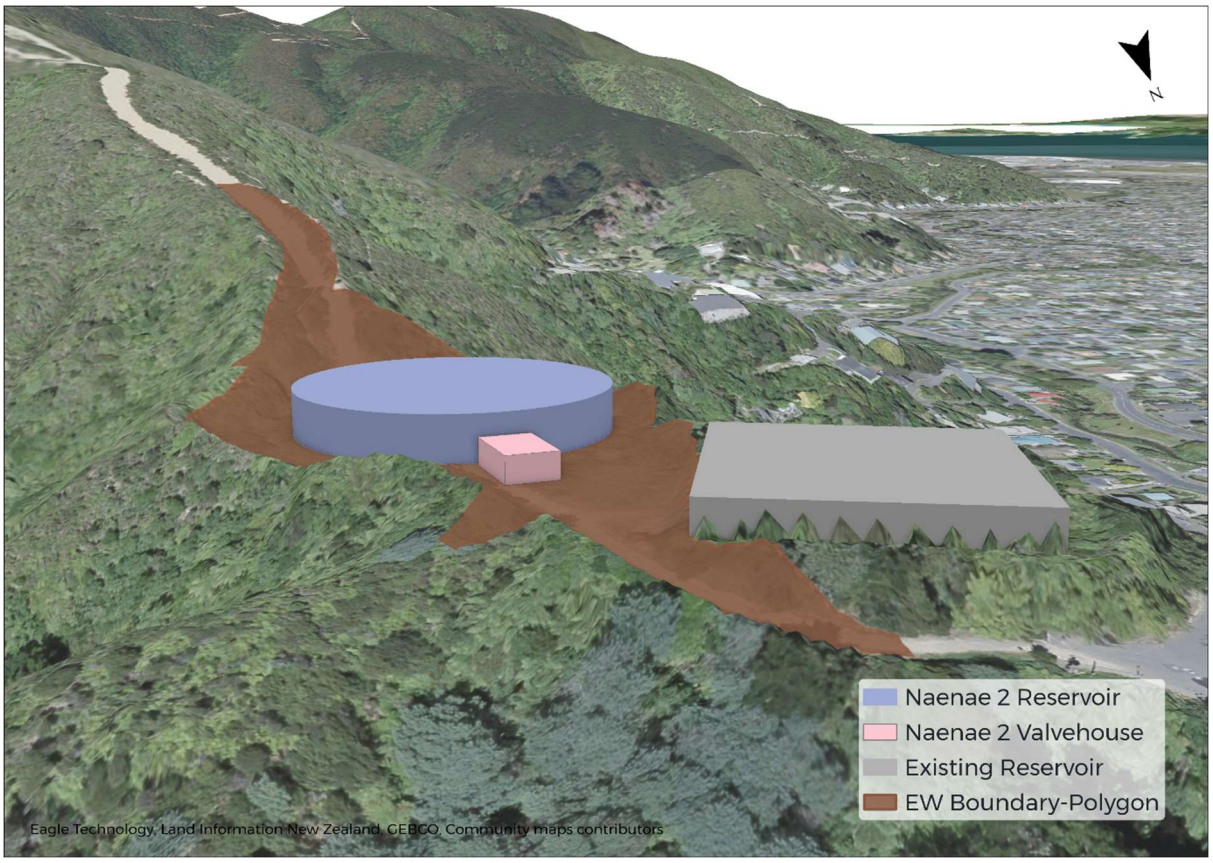

Figure 3: Visual representation of the reservoir (looking south)

Objectives

Objectives	Measures
Raise awareness and understanding of the project, why it is needed and where things are at in terms of the consenting engagement process. This ensure key stakeholders, affected residents, the wider community/community groups and local businesses are up to date, feel informed and understand how they can have their say.	No justified complaints about lack of information/opportunities to have say.
Residents and community are taken on the journey and feel included in the project process.	Participation in community engagement and positive responses to engagement approach.
Wellington Water and HCC reputations are maintained or enhanced.	Media coverage and positive stakeholder and community feedback.

Audiences

List both internal and external audiences here, what we need them to know or do as a result of the communications and how will we reach them. Example below of what this looks like.

Audience	What do we want them to know / do / understand	Channels to reach them
Internal		
WWL comms team WWL customer hub	• Be aware of project, purpose and benefits and comms activities • Timely sign-off of comms collateral • Share information and provide comms support	• Email
External		
Mana Whenua	• Support project objectives. • Provide cultural impact assessment	• Project team meetings.

Audience	What do we want them to know / do / understand	Channels to reach them
HCC staff including Head of HCC Libraries	• Be aware of the project and reasons for it. • Know where to direct queries and concerns. • Work collaboratively with project team to support engagement and communication objectives.	• Meeting as required, regular project updates and shared comms resources as required.
HCC Mayor and Councillors	• Be aware of the project and reasons for it. • Understand current status with consenting process • Who to contact to get information. • Know what engagement we are doing in the community and support the process around this.	• Ongoing briefings as required. • Brief Mayors office on project status ahead once NROR is lodged?. • Share engagement collateral with HCC councillors and staff.
Properties adjacent to areas of work	• Be aware of the project and reasons for it • Understand where the consenting process is at and how and where they can find out more and can have their say . • Know where to direct queries and concerns. • .	• Letter drop • Flyer drop • Visits as required. • Community drop in session. • Flyers, project display boards, website, social media, project contact person.

Audience	What do we want them to know / do / understand	Channels to reach them
Fairfield/Naenae Community	• Be aware of the project and reasons for it. • Understand consenting process and where and how to have their say • Know where to direct queries and concerns. • .	• Community drop in sessions. • Flyers, project display boards, website, social media, project contact person
Friends of Waiwhetu Stream	• Be aware of the project and reasons for it. • Understand consenting process and where and how they can have their say • Know where to direct queries and concerns. •	• Direct engagement and project briefing • Community drop-in session • Flyers, posters, social media, website
Wider Hutt Valley Residents	• Be aware of the project and reasons for it. • Know where to direct queries and concerns.	• Media, WWL website and social media channels.
Naenae Residents Association https://www.facebook.com/naenaeresidents/	• Be aware of the project and reasons for it. • Know where to direct queries and concerns. • Know how and when they can have their say. • Understand the engagement and consent process we need to go through.	• Engagement briefing • Community drop in sessions. • Flyers, project display boards, website, social media, project contact person

Audience	What do we want them to know / do / understand	Channels to reach them
Users of firebreaks in the area	• Be aware of the project and reasons for it. • Know where to direct queries and concerns. • Know how and when they can have their say. • Understand the engagement and consent process we need to go through. • Be aware of impacts on access to firebreaks and use	• Signage • Flyers, project display boards, website, social media, project contact person.
Pipeline residents – wider community (Fairfield, Naenae)	• Be aware of the project, the site investigations and the construction.	• Notification letters.
Pipeline residents – local communities (only affected residents)	• Be aware of any site activities	• Notification letters, flyers.

Key messages

Primary Key Messages

(For use once the NOR has been publicly notified)

- The Hutt community is being invited to have their say on resource consents for the proposed new Eastern Hills water reservoir to increase the capacity and resilience of the city's water supply.
- Following community engagement on the proposed new reservoir in Fairfield, Naenae during March 2023, Wellington Water has lodged a notice of requirement (NOR), on behalf of Hutt City Council (HCC) for a new designation to HCC and a resource consent application to Greater Wellington Regional Council under the Resource Management Act 1991 for the construction of the reservoir.
- Wellington Water is working on behalf of Hutt City Council to:
    - Ensure that Lower Hutt's water needs can be adequately met in the case of a significant earthquake or weather event
    - Reduce disruption on a day-to-day basis for network maintenance, repairs and upgrades
    - Cater for Lower Hutt's future growth needs.
- Investigations for a suitable site were undertaken in 2021 – with 28 sites around the Hutt Valley area considered, 14 sites long listed and 3 sites short listed.

- A site next to the existing Naenae Reservoir on Summit Road, Fairfield, has been identified as the preferred location based on a review of the three shortlisted sites taking into account environmental, social, technical, and financial impacts with the Naenae location the highest scoring option overall.
- Engagement with mana whenua provided feedback that the Naenae site presents a lowest risk of impact on mana whenua values.
- The evaluation process has identified that for the Fairfield/Naenae site, particular consideration needs to be given to potential noise, vibration, dust, traffic, and access impacts, along with mitigation of visual impacts and maintaining recreational opportunities.
- We want to hear from the community about what you think of this proposal and get your feedback before we apply for consent under the Resource Management Act.
- Pending approval construction could begin in September 2024 and take 2-3 years to build. Our timeline is:
    - **March 2023** – Community Engagement
    - **April-May 2023** – Prepare reports and submissions
    - **August - September 2023** – Lodge a notice of requirement, on behalf of HCC for a new designation to HCC and a resource consent application to GWRC under the Resource Management Act 1991 for the construction of the reservoir
        - Once the NOR has been lodged, the process will be run and controlled by HCC. Wellington Water will be requesting notification to enable the public and all interested stakeholders to have their say. The submission process will be run by HCC.
        - Depending on the nature of submissions received, HCC may choose to hold a hearing where submitters can speak to their submissions. If no major issues are raised by submitters, there may not be a need to hold a hearing.
        - If the effects are minor or less than minor, the resource consent application to GWRC may not be publicly notified
    - Subject to receiving approval, the provisional construction start date is 2024
- Pipeline construction would only start once the Resource Consent has been granted. Construction is expected to start in May 2025.
- Pipeline site investigations and design are progressing in parallel with the Reservoir Resource Consent works.

Secondary Key Messages

- The new reservoir would be able to store 15 million litres of water, equivalent to six Olympic sized swimming pools. Providing drinking water to more than 50,000 residents and improving access to safe drinking water following a major earthquake.
- The preferred location is immediately adjacent to the existing Naenae Reservoir – a 11.3 million litre square reservoir, that will be retained in service.
- Building a new reservoir will require earthworks and vegetation clearance, all areas will be replanted with the exception of the access road through the site and around the perimeter of the reservoir. Taller planting around the reservoir to help to screen the visual impact.

Strategic approach

The project strategic approach is to build on and utilise channels and relationships established during the March engagement:

1. Directly engage with the most affected residents early to ensure they are aware of the resource consent and NOR consultation period and how to provide feedback. This will be through letter drops and flyers and through community groups.
2. Support project team in engagement with most affected residents for Social Impact and Recreational Impact reports for Assessment of Environmental Effects and online survey of Fairfield/Naenae community
3. Continue to directly engage with Mana Whenua
4. Engage with key HCC council and councillor stakeholders through the project team working closely with council officers.
5. Engage with the wider Naenae and Hutt City community through a wider communications campaign to make sure people are aware of and understand the project and where and how to have their say on the NOR and resource consents and . This will be through proactive media engagement, flyers, proactive engagement with key community groups, a public drop in session, website and proactive social media.

Face-to-Face

- Regular meetings and communications to most affected parties – residents potentially affected by construction impacts in particular and briefings to key groups as required.
- Drop-in session

Social media

- Updates for project information, community days, opportunities to give feedback – WWL and HCC Facebook pages.
- Naenae Community Facebook Page

Media

- Proactive media release to announce consultation around the NOR and resource consent and ongoing engagement with media throughout project.

Digital

- WWL web site
- Online survey of Fairfield and Naenae community

Marketing / advertising

- Project boards in proposed construction area
- Letter drops
- Project flyer
- Targeted F2F as required

Spokespeople

- Laurence Edwards. Media queries will be managed by WWL comms with information/support provided by the project team.

Communication risks and mitigation

Risks	Mitigation
Community opposition to reservoir - don't need a new one, don't want one here.	Tell the water supply resilience story for Hutt City about why a new reservoir is needed. Demonstrate why this location is the most viable/value for money for ratepayers.
Disruption to residents from investigations and large-scale construction disruption.	Understand individual property owner concerns and develop mitigations where possible. Work closely with affected residents and give them opportunity to have their say through engagement process.
Visual impact of new reservoir on landscape.	Highlight replacement planting.
Access to properties	Individual access and reinstatement agreements as required.
Access to firebreaks	Work closely with user groups to understand concerns and keep access as open as possible.
Lack of publicly available information/ways to get informed.	Front foot comms and ensure website is easy to find and updated regularly. Regular updates to residents, 2 x drop in sessions with the experts.
Miscommunication about the pipeline leading people to think the Community Engagement in regards to the reservoir is "useless" - "You are proceeding with it anyway".	

Measurement

We will measure the effectiveness of our communications through a variety of mechanisms:

- Resident feedback via website and letter
- Resident feedback from face-to-face meetings
- Attendance at community days
- Feedback received through the WWL Customer Hub

If needed, we will adapt our approach according to what our data is telling us.

Tactics and timing

Timing	Task	Responsible	Status
June ‘23	Comms plan to WWL for approval	John D	
June ‘23	Comms plan to HCC and briefing	Dan/HCC	
July ‘23	• Support project team engaging with most affected residents for social impact and recreation assessments • Develop collateral and promote online survey of Fairfield/Naenae community through Naenae Residents Association	Dan/Project team	
July/August ‘23 (TBC depending on lodgement date and notification period	Update comms collateral to support community consultation for NOR and resource consent • Directly affected residents letter + Naenae residents Association • Project flyer • Advertorial based on project flyer • Community drop in session information board text • Renderings and images for information boards • Designed version of information boards • Website material and project inbox • Feedback form • Media release • FAQs • Project public presentation	Alice/John/Lewis	Complete
July/August ‘23	Select venue/date/time for community drop in (to be held two weeks into 4-week notification period (TBC Sept 2023)	Dan	Complete
July/August ‘23	Book drop in venue	Dan Ormond	Complete
August ‘23	Approve comms collateral and share with HCC for information	Paul/Alistair/Dan Ormond/WWL	

Timing	Task	Responsible	Status
TBC	Book meetings to brief: - Mayor's office - Community Advisory Group - Naenae Residents Association	John/Alistair	Assuming a general presentation and overview of engagement approach is enough as comms collateral will still be WIP.
TBC	Briefing meetings - Mayor's office - Community Advisory Group - Naenae Residents Association		
	Print collateral (flyers, letters, boards)	Latitude	
	Letters to affected residents	TBC –	
	Flyer drop Media release Publish web pages Advertorial		
	Community drop in session		
	Follow up meetings/calls/emails as required	Project team/Lesley	
Pipeline	**Site investigations** – overarching Notification letter explaining the purpose of the site investigations and their timeframe. Targeted audience: pipeline residents' wider community	JLD/Dan	JLD to draft. Review by Dan. Approval by WWL (managed by Dan).
Pipeline	**Site investigations –** Extra details in relation to each site investigation. Targeted audience: pipeline residents' local communities	JLD/Dan	JLD to draft. Review by Dan. Approval by WWL (managed by Dan).
Pipeline	**Pre-Construction communication** – overarching Notification letter Targeted audience: pipeline residents' wider community		JLD to draft. Review by Dan. Approval by WWL (managed by Dan).
Pipeline	**Pre-Construction communication** – Extra details in relation to each section of works. Targeted audience: pipeline residents' local communities	JLD/Dan	JLD to draft. Review by Dan. Approval by WWL (managed by Dan).