

STORMWATER DESIGN AT WHANGANUI PRISON: A REHABILITATION JOURNEY

R. Ferguson¹, E. Robertson², A. Millar², T. Brockbank³

¹ *Tonkin & Taylor*

² *Ara Poutama Aotearoa / Department of Corrections*

³ *Beca / Advisor to WPTWEG*

E tangi ana a Ranginui.
E tangi ana a Papatūānuku.
E rere mai ana ngā roimata.
Rere ki uta, rere ki tai.
Rere ki ngā repo, ngā roto kei waenganui.
Mā tātou e tiaki ngā waimouri, ngā waimana, ngā waiora, ngā wairua.
Hei whangai i te rangi.
Hei whāngai i te whenua.
Hei whāngai i te tangata.
Tīhei Mouri ora.

ABSTRACT

Whanganui Prison discharges stormwater directly to the sensitive but degraded receiving environments of Lake Wairua, Lake Pauri, and surrounding wetlands. An application by Ara Poutama Aotearoa / Department of Corrections (Ara Poutama) to renew the existing discharge consent was lodged in 2013. This provided an opportunity for Ara Poutama to think differently about the way it manages stormwater, about its own role as an environmental steward, and about its role in helping communities achieve broader aspirations. The consent was granted in November 2022 following extensive information gathering, concept development, consultation, and collaboration, in which Tangata Whenua aspirations and the unique operational requirements of a prison came to shape the stormwater design process.

This paper describes the evolution of stormwater treatment design at Whanganui Prison over the last ten years. It illustrates how the way in which the problem is defined, and the perspectives behind this, drives the design response and, ultimately, the nature of the outcomes. When elements of importance to local Tangata Whenua and the wider community were captured alongside the operational and security requirements of the prison, and site investigations improved understanding of contaminant sources, the initial design criteria widened to include environmental objectives and outcomes that were embedded in te ao Māori.

Central to this journey was Ara Poutama's partnership with Tangata Whenua through the establishment of the Whanganui Prison Tangata Whenua Engagement Group (WPTWEG). This vital collaboration shifted the focus of stormwater treatment from simply meeting regulatory requirements to ensuring that the health of the lakes was at the centre of all decisions. Tangata Whenua opposition to the notion of stormwater, however "clean", discharging directly into a waterbody saw the early treatment concept mature into a comprehensive stormwater management philosophy that accounts for Tangata Whenua

values as well as regulatory requirements, and euro-centric best practice engineering considerations.

Under the guidance of the WPTWEG, a hybrid design – currently under construction – was developed in which water sensitive design and nature-based elements were adopted to reinstate some aspects of the natural water cycle that had been lost. Rainwater harvesting and a naturalised outfall are proposed to further contribute to this outcome.

Ara Poutama's journey has illustrated that modern stormwater management extends beyond simply technical or engineering solutions. When guided by the principles of Te Mana o te Wai and the values of Tangata Whenua, stormwater management decisions and resource management consents can lead to a variety of positive outcomes beyond those typically aimed for to ensure acceptable environmental effects in a conventional sense.

KEYWORDS

Stormwater treatment, water quality, Te Mana o te Wai, Iwi partnerships, nature-based solutions, water-sensitive design, tikanga, kaitiakitanga, Tangata Whenua values, co-design, holistic design.

FOREWORD

The karakia presented at the outset of this paper is a gift bestowed from Tangata Whenua. It offers cultural and spiritual safeguarding for our extended Whanganui Prison Stormwater project team. It acknowledges the profound natural forces and interconnected waterways that bind us. It encapsulates a Māori worldview to guide our endeavours and reminds us of our duty to safeguard our precious resources – our waterways – which in turn safeguards and sustains us – the people.

WPTWEG also seeks to convey the following statement, which encapsulates the environmental, cultural, and indigenous context of the project while emphasising the fundamental significance of partnerships in realising the positive outcomes evident in the project today.

Tēnā koutou katoa

Lake Wiritoa and Lake Pauri are taonga of immeasurable importance to local Tangata Whenua. These once pristine dune lakes have answered the physical thirst of generations and nourished the essence of our culture and community. Our journey now is to restore the lakes and safeguard their future. We are guided by the profound wisdom of our indigenous cultural values assessments and the recommendations from our Mātauranga Māori report. The resource consent conditions for Whanganui Prison are the cornerstone of our journey. We are grateful to all our partners in this endeavour. Their dedication and experience ensure that te mana o te wai, te mouri o te wai, and the wellbeing of the lakes remain at the forefront of our decisions. The outcomes we achieve represent a weaving of Mātauranga, engineering, science, and innovation. We are the kaitiaki of our heritage and environment, and in our collective efforts, we shape a brighter, more sustainable future for all. Ko te wai te ora o ngā mea katoa - Water is the life of all things

*Ngā mihi nunui,
The Whanganui Prison Tangata Whenua Engagement Group (WPTWEG)*

1 INTRODUCTION

Whanganui Prison occupies a 46-ha site in Kaitoke, approximately 8 km south-east of Whanganui and 3.5 km from the west coast. The prison was first established in 1978. It is one of New Zealand’s medium-sized prisons accommodating minimum to high security male prisoners. The prison is situated on land designated for such use in the Whanganui District Plan. The surrounding landuse is a mix of production forest and pastoral and cropping farmland with an underlying sand dune geology (Figure 1).



Figure 1. Environmental setting of Whanganui Prison

Stormwater runoff originating from the prison, primarily from impervious roads and roofs, is currently managed via a reticulated pipe network. This runoff ultimately flows off-site through a dual outfall into a stream situated between Lake Pauri and Lake Wiritoa (Figure 2). Stormwater from the prison has discharged in this manner since the establishment of the prison.

The receiving dune lakes are highly esteemed as taonga and hold significant indigenous and cultural value for Tangata Whenua (Ngā Wairiki Ngāti Apa, Ngāti Rangiwakaturia, Ngāti Tumango, Ngāti Tūpoho). Additionally, they are recognised as important recreational environments by the community. However, there is growing concern about the ecological health of these lakes. They are classified by Horizons Regional Council as being in a state of “poor ecological condition” and at risk of further deterioration.

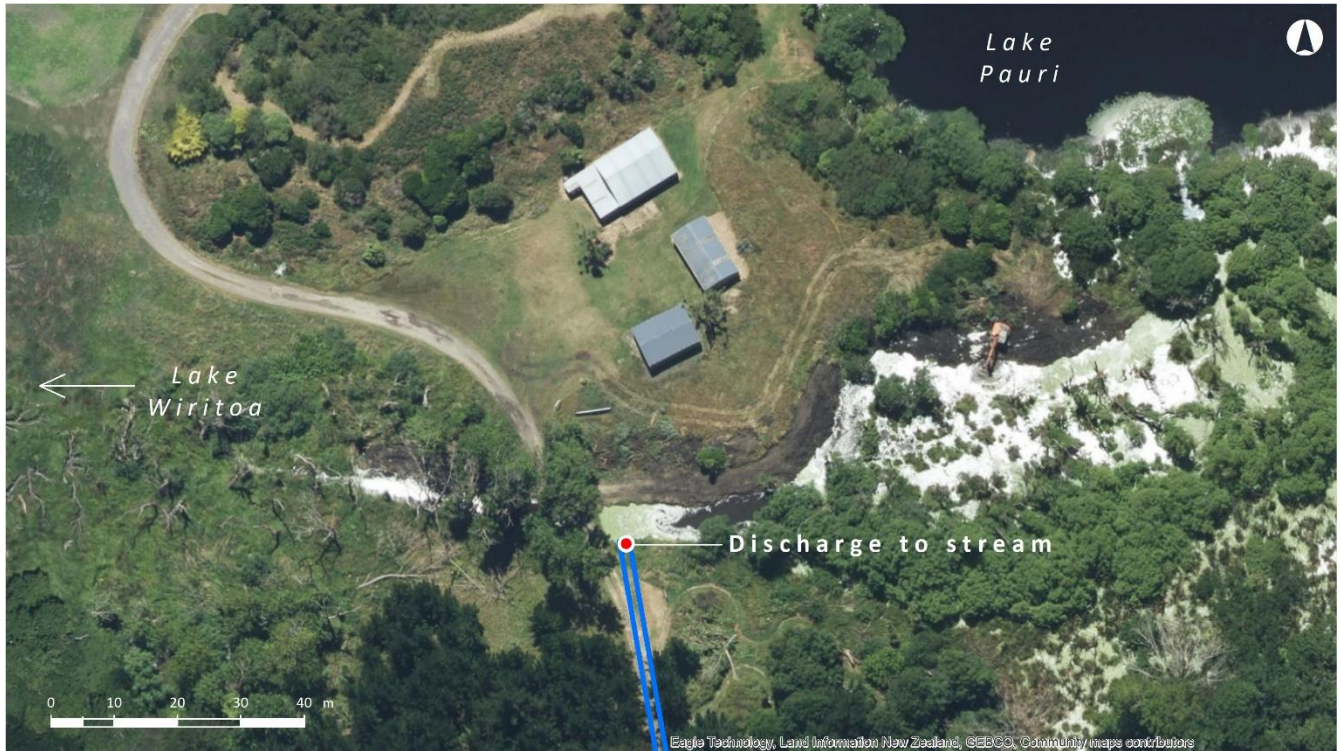


Figure 2. Whanganui Prison stormwater discharge setting

It is against this background that, in 2013, Ara Poutama applied for resource consent to continue discharging stormwater to the stream between the lakes. The application included a proposal to design and construct a proprietary filter system, which experts advised Ara Poutama would lead to minimal adverse effects on the environment. While Ara Poutama was advised that the residual effects of stormwater discharge on the lakes would be minimal (due to the nature of the discharge, the effects of dilution, and the non-prison source of lake contaminants), clear opposition from Tangata Whenua and community groups to the ongoing discharge to the lakes triggered a rethink by Ara Poutama as to the way in which they needed to manage stormwater.

What followed was a 10-year journey of site investigations, network upgrades, research on treatment measures, and building relationships, as the cultural context in which Ara Poutama operates gained prominence and the wellbeing of the lakes was placed at the forefront of all decisions. This process shifted the perspective on the role of water in the environment, shaped the design aspirations, and paved the way for the hybrid stormwater treatment system that was eventually consented and is currently being constructed (as at April 2024).

This paper describes the way in which the perception of what stormwater is changed from a notion of simply discharging runoff to a more sophisticated response based on improved knowledge of the site and surrounding land characteristics and activities, and a strengthening partnership with Tangata Whenua. It summarises the evolution of the stormwater treatment approach in considering this change, from proprietary filtration devices only (initial consent application), to a hybrid design that incorporates nature-based systems to bring about multi-beneficial outcomes for people and the environment (consented and in construction).

2 STORMWATER NETWORK AND SITE CONSTRAINTS

The prison site comprises four catchments which are drained by a piped network built in the 1970s (Figure 3). It is characterised by significant hydraulic constraints and security requirements that influence the nature of treatment measures able to be retrofitted to the network. High winter rainfall combined with high groundwater levels further limit the methods available for managing stormwater on the site.



Figure 3. Prison catchments and piped stormwater network

The network is characterised by shallow pipes running at flat grades. These features limit the type of treatment measures that are able to be retrofitted without causing upstream surcharging of the network. Additionally, the need to maintain lines of sight and restrict opportunities for hiding contraband rules out the type of highly vegetated treatment systems that typically characterise a nature-based stormwater management approach. These limitations formed the starting point for developing a stormwater treatment concept for the site.

3 THE REHABILITATION JOURNEY

Key milestones on the Ara Poutama journey helped steer the process towards the outcomes seen today. Key messages that accompany the milestones chart the evolution from a traditional approach to stormwater management at the time of consent application to the fully collaborative relationship and hybrid design that is now under construction. These milestones and messages are summarised in Figure 4 and expanded on in the sections that follow.

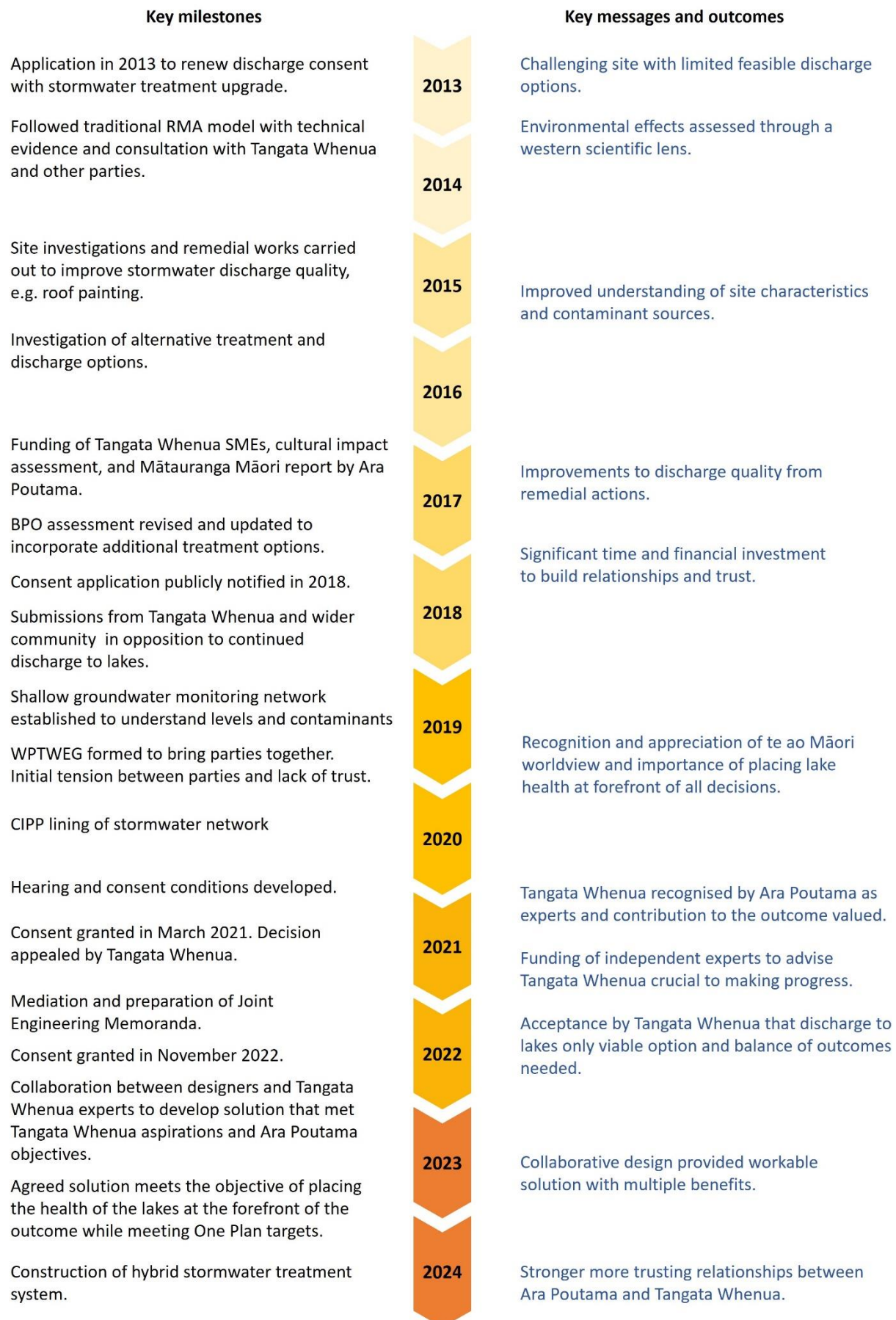


Figure 4. Timeline of key project milestones and messages
Stormwater Conference & Expo 2024

3.1 BACKGROUND

The journey began in June 2013 with an application for renewal of the stormwater discharge consent. This followed the traditional RMA model in which the technical aspects of managing stormwater were central, and environmental impacts were determined in a very “western” manner. However, Ara Poutama sought to improve the site’s existing stormwater management beyond the status quo in which stormwater was managed without water quality treatment. With this objective in mind, Ara Poutama launched feasibility and investigation studies into various stormwater treatment devices, including gross pollutant traps (GPTs), proprietary devices, and several other alternatives.

Ara Poutama also recognised the aspirations of the community and Tangata Whenua for Lake Pauri and Lake Wiritoa, encompassing environmental, recreational, cultural, and other dimensions. It was paramount for Ara Poutama that any proposed engineering solutions or non-engineering initiatives, such as planting, weed removal, or lake health restoration efforts, would contribute in some capacity towards fulfilling these broader aspirations.

The consenting process was slowed for several years as Ara Poutama sought additional engineering input and explored alternative options for stormwater disposal, investigated the source and nature of contaminants in its stormwater discharge, assessed the condition of its stormwater network, and undertook mitigation works.

Water quality sampling had indicated elevated zinc levels that were attributed to degraded galvanised roofs. Initial actions undertaken to improve stormwater quality therefore included painting those roof areas in relatively good condition and replacing those in poor condition with Colorsteel.

To better quantify the depth, flow direction, and quality of the shallow groundwater, 16 piezometers were installed across the prison and neighbouring properties (Figure 5). Groundwater monitoring indicated the presence of high nutrient concentrations. Further investigations of nutrient sources confirmed these were predominantly from the surrounding agricultural areas and historical feedlots rather than the prison site itself.



Figure 5. Piezometer network at Whanganui Prison
Stormwater Conference & Expo 2024

The aged and deteriorated stormwater pipe network within the prison was found to be susceptible to groundwater infiltration. This allowed nutrient-laden groundwater flowing through the site to enter the network and then be discharged directly to the receiving waters from the prison outfall. Modelling revealed that the stormwater network was in effect hastening and concentrating the discharge of nutrients to the lakes that was already occurring via more diffuse pathways.

Engagement with Horizons Regional Council regarding this issue, and in particular whether Ara Poutama was responsible for contaminated groundwater which it had not generated and which naturally ended up in the same receiving environment, was met with a response that Ara Poutama was responsible for anything which was discharged from its pipe network, including infiltrated flows. In response, during 2019 and 2020, Ara Poutama undertook cured-in-place pipe lining of 2,700 m of the piped stormwater network.

While these actions achieved good outcomes in terms of improved stormwater quality, they did not lead to a modelled improvement in lake health because the groundwater flow direction meant that the contaminants generated within the wider agricultural catchment, while no longer entering the prison network, still made their way to the lakes. Attention shifted towards exploring further treatment options, with the application being notified in 2018.

Throughout the engagement process, the community, Tangata Whenua, and stakeholders expressed their disapproval of continued stormwater discharge into the lakes. Ara Poutama continued investing significantly in specialist advice across various disciplines to address these concerns.

3.2 PROPOSED BPO TREATMENT CONCEPT

A Best Practicable Option (BPO) assessment for stormwater management at the prison was prepared by the project team¹. An initial 19 potential options were condensed to eight via a multi-criteria analysis (MCA) process in which options were scored and ranked according to engineering best practice.

The BPO process determined that the most effective stormwater management solution involved treating the water using proprietary filters and then discharging it into the stream connecting Lake Pauri and Lake Wiritoa. This was evident in the top three scoring options:

- Option 12: Discharge to stream connecting Lake Pauri and Lake Wiritoa with a gravity outfall pipe with treatment (using a proprietary filter). Ranked second equal.
- Option 16: Discharge to stream connecting Lake Pauri and Lake Wiritoa with an enhanced wetland with proprietary filter. Ranked second equal.
- Option 19: Discharge to the stream connecting Lake Pauri and Lake Wiritoa while upgrading the stormwater network to exclude groundwater and nutrient contaminants at source plus treatment filter (using a proprietary filter) and green outfall. Ranked first.

The proposed options needed to be adaptable to retrofit within the existing stormwater pipe network. Due to operational requirements and site constraints, only a small fraction of the BPO report options explored strategies to eliminate, minimise, mitigate, or reduce stormwater discharge volume or flow rates. Very few incorporated water-sensitive design principles or sought to mimic natural hydrological processes on site.

¹ The project team was a multi-disciplinary group comprising terrestrial and freshwater ecologists, planners, experts in water quality and stormwater engineering, hydrogeologists, and cultural advisors.

Alternative discharge locations, such as directly to the coast or to on-site storage, were dismissed due to physical or engineering constraints, or the ecological characteristics of alternative receiving environments. A treatment concept was developed on the basis of these findings to meet the required treatment standard while adhering to operational and hydraulic limitations. Water-sensitive design techniques such as bioretention systems (raingardens) were excluded primarily due to the high groundwater table.

The proposed BPO concept comprised Up-Flo devices as the chosen proprietary filter, distributed across the four branches of the network (Figure 6). This arrangement was specified to meet the water quality targets for receiving waterbodies prescribed in Horizons Regional Council's One Plan. The filters were sized to treat the water quality flow rate, with bypass of excess flows directly to the outfall.

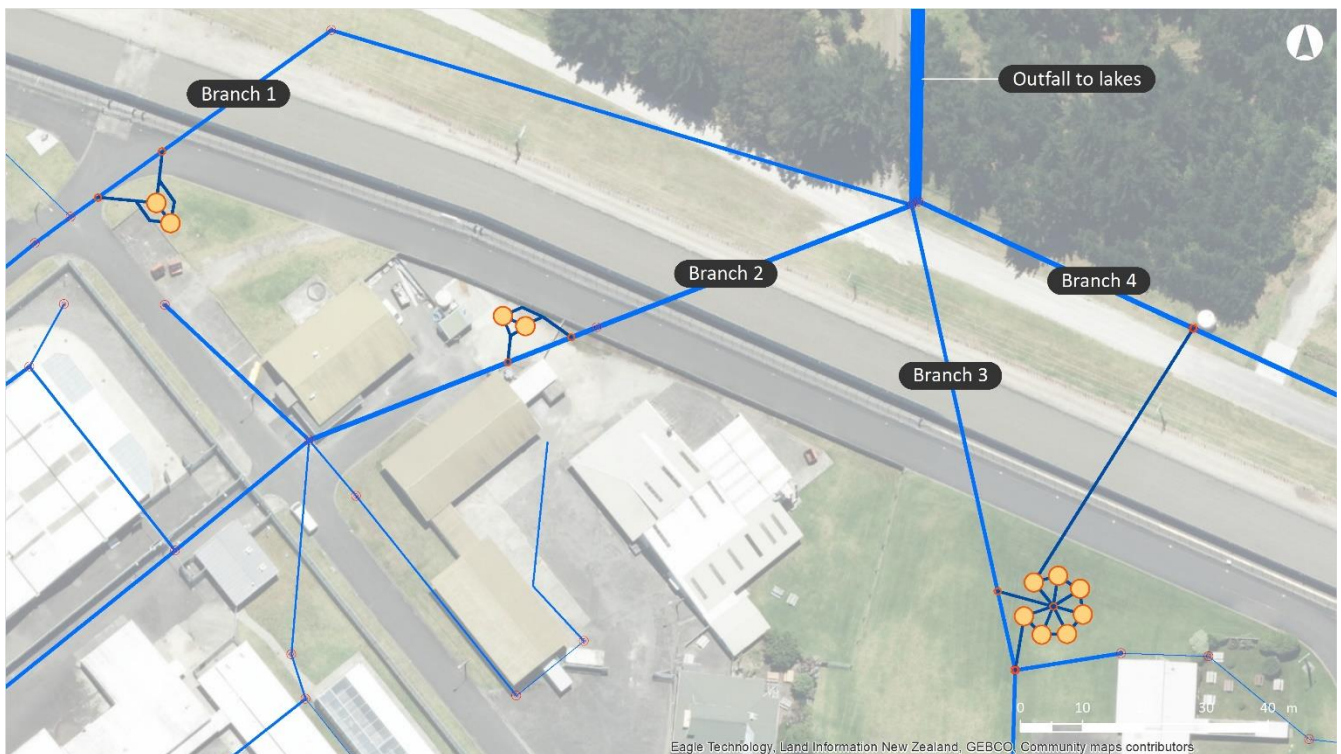


Figure 6. Initial treatment concept based on proprietary filters

Despite initial concerns, the level of treatment outlined in the Best Practicable Option (BPO) would meet the water quality targets of the One Plan for Lake Wairitua for most contaminants, with only total phosphorus and dissolved zinc concentrations exceeding the targets during stormwater sampling in December 2019. Because of this, Ara Poutama introduced weed harvesting and sediment removal as supplementary measures, demonstrating a net environmental benefit by further reducing nutrient levels beyond their own contribution of these to Lake Wairitua.

Although the specified water quality targets were being met under this option, Tangata Whenua expressed frustration that the proposed option focused primarily on achieving environmental compliance from an engineering and regulatory standpoint. They believed that the BPO assessment overlooked broader perspectives related to the social, cultural, and spiritual welfare of the lake, including the significant importance and value of the lakes to Tangata Whenua. As a result, Tangata Whenua remained opposed to this option.

3.3 TANGATA WHENUA RELATIONSHIP

Ara Poutama had been engaging with Tangata Whenua throughout the consenting process and had been advised that the right parties were around the table. However, it was brought to their attention in 2018 that additional Tangata Whenua and Hapū groups were also mana whenua. The participation of these groups ultimately led to the formation of the Whanganui Prison Tangata Whenua Engagement Group (WPTWEG).

The WPTWEG terms of agreement were finalised in 2020 to bring the parties together to work towards a common goal. The WPTWEG comprised the Tangata Whenua and Hapū groups: Te Rūnanga o Tūpoho, Ngāti Tumango & Ngāti Tūpoho Hapū of Putiki Wharanui Marae, Ngāti Rangiwakaturia Hapū of Whangaehu Marae, and Te Rūnanga o Ngā Wairiki Ngāti Apa, as well as Ara Poutama.

Early interactions within the WPTWEG were characterised by significant tension and a mutual lack of trust between Tangata Whenua and Ara Poutama. Communication often appeared disjointed, with both parties seemingly talking past each other rather than finding alignment. Additionally, there was a perceived lack of confidence in the advice provided to Tangata Whenua by the Ara Poutama-appointed Subject Matter Experts (SMEs).

As an example, Tangata Whenua expressed frustration at not being fully consulted or collaboratively involved in formulating the BPOs or evaluating them using the MCA. They were concerned that options closely aligned with Tangata Whenua values and Mātauranga were not thoroughly explored due to operational constraints at the prison, despite their potential to enhance indigenous and cultural wellbeing and the mouri of Lake Wiritoa, Lake Pauri, and the connecting stream. This frustration stemmed from comments in the BPO report stating that indigenous and cultural aspects were not considered in the MCA analysis. Tangata Whenua felt that a comprehensive stormwater discharge solution integrating indigenous and cultural wellbeing, Tangata Whenua values, and Mātauranga was overlooked in both the BPOs and the stormwater discharge application. They believed that earlier and more effective engagement, including indigenous cultural assessments and co-designed options, could have addressed their concerns before and during the development of the BPO report.

On the other hand, Ara Poutama and the designer believed that incorporating a cultural layer should follow a thorough Cultural Impact Assessment (CIA) conducted by Tangata Whenua and funded by Ara Poutama. This CIA should comprehensively evaluate and address each option within the BPO through an indigenous lens. The findings could then be integrated into the existing MCA. They argued that determining the best practicable option hinges on evaluating feasibility. If an alternative lacks practicality from an engineering standpoint, it is deemed unfeasible, regardless of its cultural significance. Therefore, they considered the option selected in the BPO report to be the most feasible option available.

Ara Poutama considered that they had been making significant attempts at meaningful engagement over several years. However, they had not received any feedback which could result in a design solution as the feedback had consistently been that the application was opposed. Ara Poutama was frustrated at the advice it was receiving from experts that there was no viable alternative solution within the framework of the BPO at the time, alongside a lack of possible solutions being offered by Tangata Whenua.

This left Ara Poutama in the potentially challenging situation of having an operational prison removed from its prison network due to an inability to dispose of its stormwater. Ara Poutama was also frustrated at the perception that it was being held accountable for the entire lake health quality despite being a very small contributor to it. The lack of a catchment-wide approach to lake health and management of non-point source discharges

by the Regional Council was frustrating to Ara Poutama who considered that an overly punitive approach was being taken to this application, as the only point source discharge to the lake environment.

3.4 RELATIONSHIP BREAKTHROUGH

A fundamental shift in the relationship occurred when Ara Poutama agreed to fund two CIAs (Poipoia Ltd, 2020a; Poipoia Ltd, 2020b), a Mātauranga Māori report (Brockbank, 2020), and additional SMEs to advise Tangata Whenua on engineering (Troy Brockbank), indigenous cultural impact assessment (Tina Porou), planning (Greg Carlyon), and legal matters (Tom Bennion Law & Whāia Legal). These experts were independent from those who were advising Ara Poutama. Ara Poutama was to have no visibility of the matters which were being recommended to Tangata Whenua by the advisors. This required a shift in approach and openness by Ara Poutama who needed to be willing to pay for services it had no visibility of and for services which had the potential to lead to greater challenges in the future.

The Mātauranga Māori report provided Ara Poutama and their SMEs with a better understanding of the issues of particular importance to Tangata Whenua, and allowed Ara Poutama and its advisors to bridge the gap between western science and te ao Māori. Tangata Whenua were able to interpret technical information through an indigenous and cultural lens and were able to utilise western science advice with greater confidence as it came from an advisor solely accountable to them. By procuring the services of an engineer with a strong foundation in te ao Māori (Troy Brockbank), the parties were able to steer towards an outcome that met their respective objectives.

This support was recognised as a crucial milestone in the journey, enabling Ara Poutama to grasp the indigenous and cultural ramifications of stormwater management and the broader Māori worldview, while also aiding Tangata Whenua in understanding Ara Poutama's stance, constraints, and limitations, which ultimately led to certain options being deemed the only viable solutions.

An effort to refocus the proposed option with the lakes' wellbeing and health at the centre, along with the idea of a "hybrid" design to accommodate indigenous and culturally significant water management features, was introduced by both parties. However, these initiatives were not thoroughly explored due to previous feasibility investigations and analyses discounting them, and the regulatory timeline also necessitated moving forward. This resulted in a breakdown of the relationship between Ara Poutama and Tangata Whenua, leaving them at an impasse.

Ara Poutama felt at this point that they had exhausted all avenues for gaining consensus with Tangata Whenua and so continued with the consent application and requested a hearing from Horizons Regional Council (Horizons).

3.5 HEARING, CONSENT, AND APPEAL

A hearing was convened in November 2020, with independent commissioners appointed by Horizons. The Regional Council recommended that the application be declined. The discharge consent was granted in March 2021, subject to conditions.

In April 2021, Tangata Whenua, represented by Te Rūnanga o Tūpoho and Te Rūnanga o Ngā Wairiki Ngāti Apa, filed an appeal with the Environment Court against the Panel's decision to grant the resource consent to Ara Poutama. Both appellants submitted objections to the consent application, citing their lack of confidence that the consent conditions adequately addressed their concerns. Subsequently, the parties were instructed by the Environment Court to engage in mediation to collaboratively seek a resolution.

3.6 MEDIATION

A series of Environment Court-mediated hui, including an expert witness conference between engineering and planning experts, were undertaken from May 2021 to early 2022. The aim of these conferences was to streamline the Court hearing process by allowing expert witnesses to collaborate and identify areas of agreement, along with providing reasons for any disagreements. This approach allowed the Court to concentrate on unresolved matters while comprehending the rationale behind points of agreement. After the conferences, a Joint Witness Statement was compiled to detail the outcomes for the public record.

Following the expert witness conference, the engineering experts representing Ara Poutama, Troy Brockbank representing the appellants/Tangata Whenua, and the planning experts (Peter Hall and Greg Carlyon) continued to hold meetings to delve deeper into collaborative design endeavours and advancements as well as amendments to the consent conditions. These sessions included soliciting input on indigenous and culturally significant design elements from Tangata Whenua and ensuring the integration of these alongside other essential design aspects that were critical to the site's operation.

Multiple Joint Engineering Memoranda (JEMs) were prepared by the engineering experts to further outline progress on a mutually agreed co-design process, delineate the agreed design outcomes, and define the pathway toward achieving them. This collaborative process represented a significant milestone and fostered the mutual trust necessary to advance the relationship.

3.7 CO-DESIGN OUTCOMES

In March 2022, whilst still in mediation, the engineering experts agreed a set of design outcomes that were intended to inform a new co-designed stormwater management approach that reflected Tangata Whenua aspirations as well as meeting the operational objectives of Ara Poutama. These outcomes have continued to be used to assess each design stage and option.

The six key principles of Te Mana o te Wai were acknowledged in the JEM as the basis for the design outcomes. This shift in emphasis represented a significant step forward in the journey and set the direction for the stormwater design. The jointly agreed design outcomes captured in the JEM were:

- Lake health is central to the design
- Water is regarded as a taonga and a precious resource
- Te Mana o te Wai
- Mouri is healthy
- Stormwater treatment performance of proprietary filters is met or exceeded
- Be practical to implement and have a reasonable maintenance requirement
- Enhance plant health
- Consider current activities on site
- Consider environmental and hydraulic constraints

The mediation agreement and JEM identified the co-design areas to progress and investigate their feasibility for the hybrid stormwater management solution for the prison. These areas included:

- Rainwater harvesting and re-use options – to reduce the volume and flow rate of stormwater leaving the site.
- Green Outfall options – to replace the existing dual pipe outfall, and final transition of mouri in the stormwater leaving the prison and entering the lakes.
- Bioretention devices in Branches 3 & 4 – for pre-treatment and conveyance of stormwater and to reduce the volume and flow rate of stormwater leaving the site through infiltration and evapotranspiration.

The proposed Green Outfall had additional co-design criteria, including:

- Water quality is not degraded (on a long-term annual average basis) because of the green outfall.
- Be practical to implement and maintain, with clear roles and responsibilities for maintenance.
- Consider the needs of all partners and stakeholders (Ara Poutama, Tangata Whenua, Recreational Boat Club, and Mountain Bike Park) as part of design.
- Set up a pathway/foundation for the future restoration of the upstream and downstream channels via the Taiao Plan (implementation phases).
- Outfall extends upstream and downstream of the existing discharge point, including the stream connecting the lakes, bridge, and culverts.
- Seek to restore/heal Papatūānuku, e.g. through removal of unused and/or superseded infrastructure.

3.8 DISCHARGE CONSENT CONDITIONS

Consent was finally granted in November 2022. This paved the way for the co-designed hybrid feasibility design to be developed through to detailed design, incorporating features of importance to Tangata Whenua as well as those required to achieve the required stormwater treatment standard.

Twenty-seven conditions of consent were imposed as part of the stormwater discharge consent, which has a consent term of 22 years. The conditions include installation of proprietary filters and bioretention systems, alongside removal of macrophytes from the lakes to meet prescribed nutrient removal targets, implementation of a Stormwater Management Plan to ensure ongoing maintenance, operation, and improvement of the system, stormwater sampling to ensure levels of dissolved and particulate contaminants downstream of the treatment system are being met against the One Plan water quality targets, and other water and sediment monitoring activities. Other conditions required the development of a Taiao Plan to enhance the wetlands adjoining the discharge channel with pest plant removal and replanting of natives. The Taiao Plan has been approved with planting due to commence in mid-2024.

The conditions prioritise placing the lakes at the forefront, emphasising respect for the mouri and mana of the receiving waterbodies. This entails managing stormwater within the prison catchment in an indigenous and culturally appropriate manner, aligned with Tangata Whenua and community values. From a design perspective, this involves creating opportunities for water to mimic natural hydrology, including options for re-use, infiltration, and evapotranspiration. Additionally, it involves allowing water to pass through the land to 'heal', restore, and transition the mouri within the water before reaching the lakes. The initial advice provided to Ara Poutama, which took these options off the table due to the

high groundwater table, was amended, and locations were identified where these initiatives were now viable.

These objectives are accomplished through engineered practices such as the implementation of swales and bioretention systems, which work to reduce the volume and peak flow rates of stormwater discharged to the lakes. Additionally, non-engineering measures include the development of a Taiao Plan for restoring the land adjacent to the lakes, landscaping and the planting of native flora, macrophyte harvesting to eliminate phosphorus from the lake, Mātauranga Māori environmental monitoring, and the provision of funding for a Kaitiaki monitor to oversee site operations.

Crucially, another condition stipulates that a rainwater harvesting scheme must be put into effect within three years of consent approval. Furthermore, a recommendation to explore options for establishing the green outfall was proposed outside the formal conditions.

4 HYBRID TREATMENT SYSTEM

4.1 DESIGN CONFIGURATION

A “hybrid” stormwater treatment design was developed that addresses the range of regulatory, operational, environmental, indigenous, and cultural objectives set out in the JEM and consent conditions. This design is currently under construction. The design comprises a mix of proprietary filter devices (Up-Flo), proprietary bioretention systems (Filterra and BioScape), swales, and an attenuation basin.

The type and location of these features reflects the aspirations of Tangata Whenua, the requirements for discharge quality compliance, and the various site constraints described in Section 2.

The general treatment arrangement, including future elements (rainwater harvesting and green outfall), is shown in Figure 7.



Figure 7. Layout of final treatment design

All treatment devices are located entirely within the prison boundaries. This is so that Ara Poutama have full control over construction and maintenance activities, as well as reducing security concerns.

Branches 1 and 2 are serviced by four Up-Flo filters. This option is driven largely by strict security and operational constraints, space constraints, high groundwater levels, high surface imperviousness, and the relatively small catchment sizes of these branches.

Branch 3 has an attenuation focus. This is achieved through eight swales and an attenuation basin. Three Up-Flo filters provide treatment of excess flows from these devices. The infiltration losses provided by the swales and basin allow for a smaller filter specification than was initially required in the filter-only BPO concept.

Branch 4 has a bioretention focus, comprising nine Filterra raingardens, one BioScape raingarden, and one swale. These systems provide treatment of runoff predominantly from carpark surfaces. Vegetated systems are feasible on Branch 4 due to this catchment being "outside the wire" and so not subject to the same security considerations as the other branches. Branch 4 also has the available fall to permit passage of flows through the filter media for discharge to the network.

The BioScape raingarden is included as an "end-of-pipe" feature due to geometric constraints to placing at-source devices such as swales higher in the catchment.

4.2 SIZING AND FUNCTION

The treatment devices (i.e. proprietary filters and bioretention systems) are located offline to the stormwater network. They are sized to pass the water quality flow rate (WQF). Flows in excess of the WQF bypass the treatment elements and are conveyed to the receiving environment.

Flows enter the Filterra raingardens at the surface via kerb cuts within the carparks. The Filterra units are sealed at the base such that all treated flows enter the piped network. Flows enter the BioScape raingarden via bubble-up systems to the surface of the filter media before infiltrating to collection drains for conveyance to the network.

Flows entering the swales and attenuation basin are able to infiltrate directly to ground. Flows in excess of the infiltrative and storage capacities of these devices spill to the network and then pass through the filters on Branch 3.

4.3 FUTURE DESIGN ELEMENTS

In keeping with the indigenous and cultural values underpinning the hybrid design, the JEM also identified opportunities for capturing and storing runoff from roof areas near the on-site plant nursery and using this water for irrigation of the nursery plants. Detailed design of the rainwater harvesting and re-use system is currently underway.

Rainwater harvesting further recognises the resource value of stormwater, rather than its conventional western perception as purely a liability. The use of rainwater for plant irrigation nourishes life with excess water entering the ground where it falls. The retention effect of re-use further reduces the burden on the piped stormwater network and hydraulic loading of the filters.

A concept has also been prepared for the naturalised green outfall channel to replace the twin piped outfall.

5 CONCLUSIONS

Ara Poutama's experience has demonstrated that when time, effort, and financial investment are put into building and fostering genuine relationships with mana whenua, and understanding values of importance to Tangata Whenua, a wider and more meaningful set of outcomes can be achieved than may otherwise be the case. By committing to a collaborative process, the initial differences that existed between the parties were resolved outside of a court process.

While Ara Poutama, as a Government Department, has always sought to do more than the minimum required of it with regard to stormwater management, the Whanganui experience has revealed the more nuanced drivers at play when different perspectives on water are brought to bear.

The provision of financial support by Ara Poutama to assist Tangata Whenua in interpreting the technical project requirements provided the fundamental shift needed to progress the relationship from one of mistrust and stagnation to a fully collaborative design process. This required fine balancing by Ara Poutama who also had a responsibility around sound fiscal management of public money. This is a challenge which is not necessarily faced by private entities.

The principles of Te Mana o te Wai that guided the design process at Whanganui have come to shape the way in which Ara Poutama approaches water management more generally and helped strengthen existing Tangata Whenua relationships. This shift in relationship is strongly reflected in the karakia which opens this paper.

The indigenous and culturally important themes of rainfall infiltration, water re-use, and ecological restoration that are captured by the consent conditions align with the principles of water-sensitive design which similarly seek to emulate natural hydrological processes within the built environment. The layering of Te Mana o te Wai with a water-sensitive design philosophy allows for a uniquely Aotearoa New Zealand approach to stormwater management that recognises and protects the special cultural and environmental contexts in which we practice.

6 REFERENCES

- Brockbank, T. (2020). Whanganui Prison Mātauranga Māori Report. WSP.
Poipoia Ltd. (2020a). Ngā Wairiki Ngāti Apa Cultural Impact Assessment.
Poipoia Ltd. (2020b). Te Rūnanga o Tūpoho Cultural Impact Assessment.