PROPOSED TE ARA MANGAWHERO
PHASE TWO TRAILS
ASSESSMENT OF ENVIRONMENTAL EFFECTS



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Report prepared by: Rowan Sapsford

Director

Roam Consulting Limited

Cover Image: Looking south from Massey Flat down the Mangawhero Awa headwaters

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1 Project Introduction

1.1 Assessment Development

Ehara taku toa i te toa takitahi, engari kē he toa takitini

Ngā Waihua o Paerangi Trust (the Trust) is seeking Department of Conservation (DoC) and Regional Council permissions for a proposed walking and cycling, shared use trail on the southern face of Mount Ruapehu to act as an extension to the Mountains to Sea Great Ride.

This assessment has been developed collectively with the Trust and key technical experts. Key cultural, ecological and engineering etc information has been provided to ROAM to enable a comprehensive assessment of the proposed trail to support decision makers to fully understand its effects (both positive and negative) on the environment.

For the sake of this report, the proposed trail and its effects have been broken down into its component parts to fit the legislative requirements of the statute it will be considered against. This is not indicative of the approach taken to design the trail; the design approach has considered the trail as a whole within the important cultural, physical and social elements of Ruapehu Maunga. This integrated and holistic approach is vital to ensure that the Te Ara Mangawhero can proceed in a manner that truly respects and reflects the importance of the maunga whose slopes it climbs, the ngahere where it will find a home and the awa whose ihi it passes on to those who use the trail.

1.2 Purpose of this Assessment

The purpose of this document is to provide an assessment of the potential environmental effects associated with Phase 2 of the proposed Te Ara Mangawhero (TAM) Trail to be developed on the lower slopes of Mount Ruapehu, above Ohakune.

Te Ara Mangawhero will be an extension of the Mountains to Sea – Ngā Ara Tūhono – and the government's Ngā Haerenga New Zealand Cycle Trails project.

Phase 2 is a 12.18 km shared use, dual direction trail that will traverse the lower slopes of Mt Ruapehu adjacent to the upper section of the Ohakune Mountain Road. As well as forming the start of the Mountains to Sea Great Ride, the trail will be a new part of the Round the Mountain (RTM) track and remove the existing 3km section of road from that multiday walking experience.

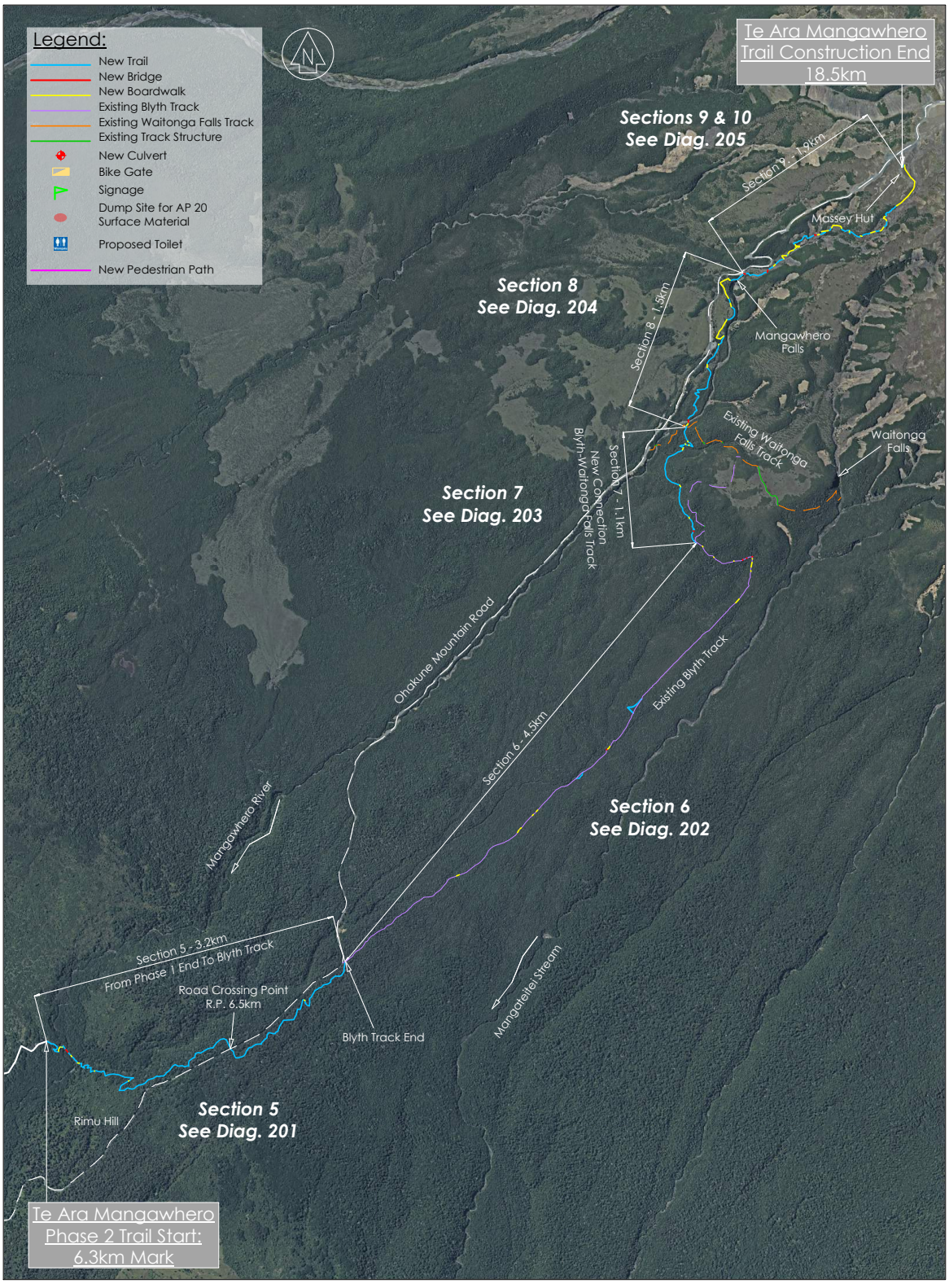
The proposed trail will generally be an easy grade 3 trail that enables a high level of access by users of a wide range of ages and abilities. As the trail is a shared use trail, its design considers dual use and dual flow of users. The design has incorporated a range of tools to facilitate safe use by people on foot and on bikes.

The width of the completed trail will be 0.9 metres for the majority, extending to 1.5 metres where terrain permits to allow for easy passing and shared use. The trail will have an all-weather compacted gravel and boardwalked surface. The proposed Phase 2 trails are shown on Figure 1.

This assessment has been prepared for Ngā Waihua o Paerangi Trust (the Applicants).

An assessment of effects on the environment is required to accompany any application for resource consent from Horizons Regional Council under the provisions of Section 88 of the Resource Management Act (the RMA) and is prepared in accordance with the Fourth Schedule of the RMA.

This assessment also meets the requirements of Section 17S of the Conservation Act 1987 to accompany a concession application to the Department of Conservation.



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Rev	Date	Amendment	By	Chk	App
A	12/08/24	First Issue	AJW	DS	DS

Project Title: Te Ara Mangawhero Trail

Drawing Title: Phase Two Construction Trail Sections Overview

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FIGURE 1 LOCATION AND ROUTE OF PROPOSED TRAILS

It is considered that this assessment also includes the details required to progress a Works Approval for the development of the proposed trail within Tongariro National Park as per Section 4.1.16.3 of the Tongariro National Park Management Plan (TNPMP).

This application sets out:

i. The background to the development – the need for the project, and other relevant background considerations

ii. A description of the proposal including its location and context within the surrounding environment

iii. Statutory Context – an overview of the Resource Management Act, and Conservation Act requirements and relevant statutory plan provisions

iv. Assessment of Effects – the assessment of the environmental effects, including any mitigation measures

v. Engagement – a description of the consultation and engagement undertaken

The appendices contain additional supporting information about the anticipated effects of the proposed trail and also contains a Construction Management Plan (Appendix 12) that sets out in more the detail the physical works provided and the construction technique.



2 Applicant Details

2.1 Full name of registered company or individual

Ngā Waihua o Paerangi Trust

2.2 Address of Registered Office

Te Pae Tata

43a Ruapehu Rd

PO BOX 195

Ohakune 4625

2.3 Contact Person

Helen Leahy

Pou Ārahi

Helen@ngatirangi.com

2.4 Consultant Representative

Rowan Sapsford – ROAM Consultancy

rowan@roamconsulting.co.nz

3 Proposal Details

3.1 General Description

The application is for the development of **Phase 2** of the proposed extensions to the Mountains to Sea (M2C) Great Ride.

The extensions to the M2C Great Ride have been proposed by Ruapehu District Council (RDC), in conjunction with key partners including Ngāti Rangi, Uenuku and Ohakune 2000.

RDC and partners have been working with central government to enable the development of these extensions to the M2C trail. To date, this work has resulted in a partial amendment to the TNPMP enabling the consideration of the development of the trail within TNP. The parties have also secured $6.5 million from the Government (Provincial Growth Fund and New Zealand Cycle Trail Extension and Enhancement Fund) for the development of the trail. This funding has been granted based on the economic, social and health benefits associated with the proposed trail extensions.

Ngāti Rangi, via Ngā Waihua o Paerangi Trust is taking this trail project to the next stage to enable the development of **Phase 2** of the Te Ara Mangawhero Trail.

For the purposes of trail planning, the M2C extensions have been broken into three discrete sections as follows:

1. **Te Ara Mangawhero** is a shared use 21.3km trail located on the flanks of Mt Ruapehu, connecting Tūroa to Ohakune. The proposed grade 2–3 trail will traverse alpine, sub alpine and forested areas within the vicinity of the Tūroa Mountain Road. It will connect to the existing M2C section - 'The Old Coach Road'.
2. **Horopito Trail (Section 3)**
3. **Te Hangaruru (Section 6)**

These sections are shown on Figure 2.

The Te Ara Mangawhero section will extend the existing M2C trail to meet the key objective of developing a single contiguous and engaging journey from Mount Ruapehu to Whanganui and the Tasman Sea. This objective will promote the Great Ride as an epic and linked journey from the upper slopes of Mount Ruapehu (located in Tongariro National Park, a dual World Heritage area) to the Whanganui River (adjoining the Whanganui National Park) and on to the Tasman Sea. It is anticipated that the development of these trails will resolve current trail legibility issues, improve trail access and differentiate it from other regional attractions through the delivery of a linked and coherent multiday ride located in iconic landscapes.

The proposed M2C extensions will:

- Improve the user experience by making the wider trail easier to understand through the linking of trail gaps
- Reinforce the brand by having a true trail start on Mt Ruapehu
- Provide for greater marketing and economic development opportunities through the development of a more visible product close to existing communities and destinations (i.e. Tūroa, Ohakune, Horopito and National Park).

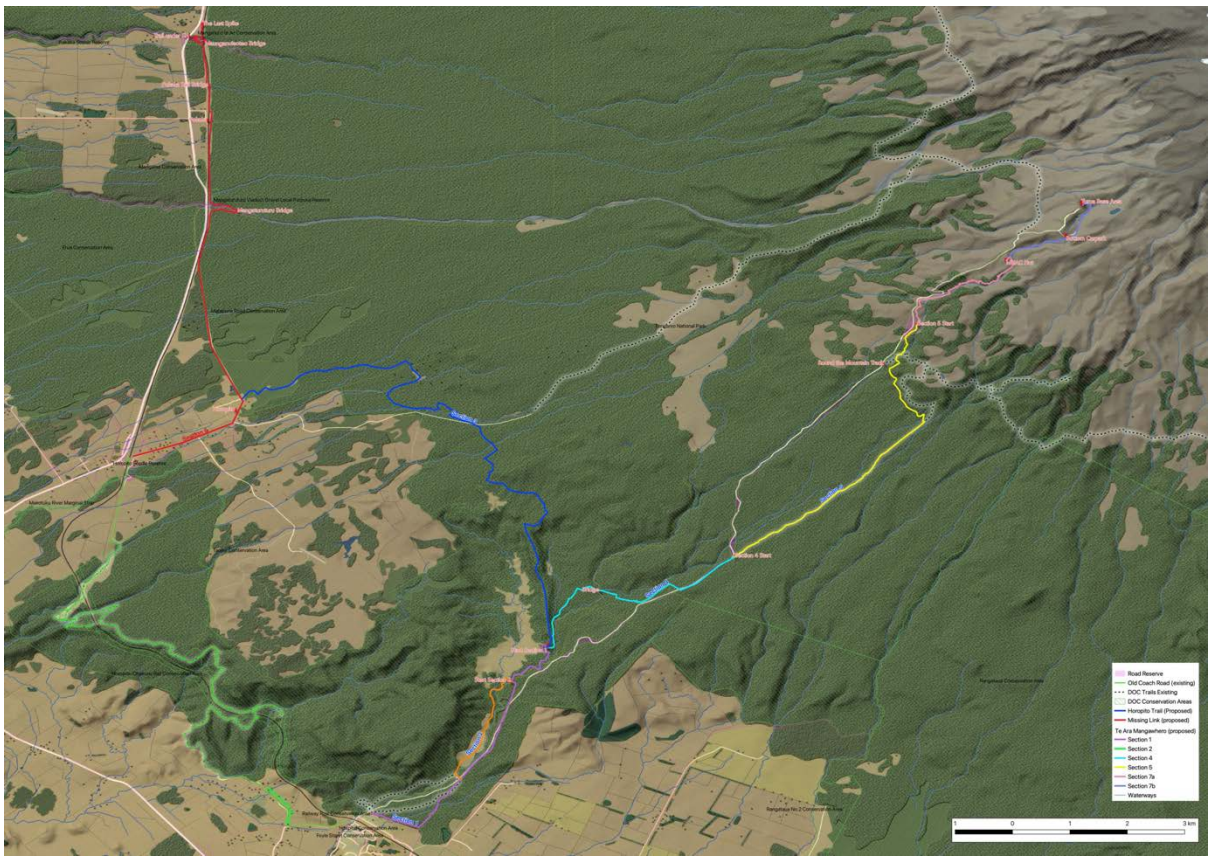


FIGURE 2 FULL MOUNTAINS TO SEA EXTENSIONS

A feasibility assessment undertaken to support the 2020 PGF funding application for the M2C extensions (which can be viewed here: https://1drv.ms/b/s!AuzhLTR2aYJz2DgITf-_VXDHDnyN?e=QYd6XH) has identified measurable benefits, including the economic benefits of out-of-region visitors using the trail, health benefits and consumer surplus benefits from local and domestic users.

The case demonstrated that the proposed extensions will benefit the Ruapehu District's economy.

Ten years after the full trail extension is completed, it is forecast to attract 58,007 users per annum. Of this, 47,461 will be from outside the region including 6,548 internationals[1].

A summary of the key business case findings is shown in Figure 3.

Outcome	Regional benefits	National benefits
Users	About 7,818 locals are expected to use the trail in the year after it is completed, increasing to 10,546 by year 10. By year 5, about 35,065 New Zealanders from outside the region are expected to ride the trail, increasing to 40,913 by year 10. About 4,133 international visitors are expected to ride the trail once it is completed, increasing to 6,548 in year 10.	
Visitor expenditure	The trails are expected to generate about $2.75 million per annum in additional visitor expenditure regionally by year 10.	The proposed trails are expected to generate about $342,000 per annum in additional visitor expenditure nationally by year 10.

[1] Trail user numbers were forecast prior to the Covid-19 pandemic.

Construction and operational jobs	The trail is expected to generate up to 31 full time jobs over the four-year construction phase and sustain an average of 65 full time jobs each year over 10 years.	
CBA	The trail will have a net present value of $7.85 million, a benefit: cost ratio of 2.6, and an internal rate of return of 24 percent.	The trail will have a net present value of ($1.2 million), a benefit: cost ratio of 0.9, and an internal rate of return of 4 percent.
Visitor benefits	The present value of visitor spend is estimated at $12.6 million per annum.	The present value of visitor spend is estimated at $1.6 million per annum.
Health benefits	The trail is expected to contribute $0.16 million in health benefits per annum.	The trail is expected to contribute $2.2 million in health benefits per annum.
Consumer surplus	The trail is expected to contribute about $0.1 million in consumer surplus per annum.	The trail is expected to contribute about $3.7 million in consumer surplus per annum.

FIGURE 3 BUSINESS CASE SUMMARY

Construction of the trail will occur in a phased approach. This is to ensure that development occurs in a manner consistent with the TNPMP and, more importantly, to ensure a precautionary approach is taken in developing the trail in more sensitive areas further up Ruapehu Maunga. These stages are:

1. **Phase 1:** Trail sections Lower Bennett and Punch, Upper Bennet and Punch (Part) and Campground (Section 1 (part) and Section 2)
2. **Phase 2:** Trail sections Upper Bennett and Punch (part), Horopito, Blyth to Mangawhero and the alpine sections.
3. **Phase 3:** Te Hangaruru

Phase 1 and Phase 3 are consented and currently under development.

This application is for the development and management of Phase 2 trails only as shown on Figure 1.

Appendix 1 shows more detailed plans of the proposed 12.18 km trail route, including breaking the trail down into the following sections, that make up **Phase 2**. Note that Sections 1 – 4 of the trail have been constructed as part of Phase 1 of the Te Ara Mangawhero trail.

Section	Length
Section 5 – Mangawhero to Blyth Track	3,227m
Section 6 – Existing Blyth Track	4,449m
Section 7 – Blyth Track to Waitonga Falls (RTM) Track	1,100m
Section 8 – RTM to Mangawhero Falls	1,486m
Section 9 – Mangawhero Falls to Massey Flat	1,919m
	12,181m

TABLE 1 PHASE 2 TRAIL SECTIONS

For the purposes of considering the proposed Phase 2 trails against Map 10 of the Tongariro National Park Management Plan, the Phase 2 trails all form part of the trail shown in red (identified as the Waitonga Falls – Blyth Track) and part of the trail shown in green (identified as the Turoa to Waitonga Track). Note that the

Phase 2 trail is only proposed to be developed to the Massey Hut location and not all the way to Turoa as shown on Map 10.

3.2 Subject Site and Tenure

The proposed trail alignment is on the southern face of Mount Ruapehu, north of Ohakune. Phase 2 of the project starts at Rimu Hill (the end of the consented Stage 1 section of Te Ara Mangawhero) and ends at Massey Flat (Massey Hut).

The proposed Te Ara Mangawhero Tail (Phase II) alignment is located within the forested areas (Podocarp and Beech Forest) and alpine areas of Ruapehu, and includes four crossing points over the Mangawhero River (three within the alpine area and one within the Podocarp Forest). The alignment also includes multiple smaller bridging points over gullies, channels and tributaries which feed into the Mangawhero River.

The proposed trails traverse land tenure set out in Table 2TABLE 2 Affected Tenure

Property	Status	Ownership/Management	Phase 2 Trail Sections
A Tongariro National Park	National Park	Crown/ Department of Conservation	Sections 1 - 4
B Formed Ohakune Mountain Road	Legal road	Ruapehu District Council	Sections 5 and 9

TABLE 2 Affected Tenure

3.3 Permissions Required

Given the tenure and associated statutory management mechanisms in place, the proposal requires several statutory permissions from local and central government before it can proceed. The required permissions are as follows:

Permission and Authority	Statutory documents	Phase 2 Trail Sections	Activities	Description
Concession from the Department of Conservation	National Parks Act 1980 Conservation Act Tongariro National Park Management Plan Taupō Tongariro Conservation Management Strategy	Sections 5-9	Development of a shared use trail within TNP by Ngā Waihua o Paerangi Trust. Management of the trail by Ngā Waihua o Paerangi Trust. Ownership of the trail and associated structures by Ngā Waihua o Paerangi Trust.	A concession is required for third parties to develop and manage facilities on public conservation land and for use of aircraft in the development of the trail.

Permission and Authority	Statutory documents	Phase 2 Trail Sections	Activities	Description
			Use of aircraft to develop the trail and non-commercial photography to capture the trail development process and to promote the use of the trail.	
Department of Conservation Major Works Approval	Department of Conservation Tongariro National Park Management Plan	Sections 5-9	To undertake the construction works to build the proposed trail within TNP.	A works approval is required for any physical works carried out within TNP. The nature of the works means that the application will be processed as a 'Major Works Approval' which will require public notification.
Horizons Regional Council Resource Consent – land use	Resource Management Act Horizons One Plan	Sections 5-9	The clearance of indigenous vegetation, undertake works around rivers and bridge construction.	Resource consent is required for the development of bridges over the Mangawhero awa and associated tributaries, clearance of indigenous vegetation and earthworks adjacent to waterways.
Horizons Regional Council Resource – land use	Resource Management Act National Environmental Standards for Freshwater	Sections 8 and 8	Works around wetlands	Resource consent is required for the development of the trail and associated boardwalks adjacent to wetlands.

TABLE 3 Statutory Permissions Required

This assessment has been developed to support the Resource Consent, Concession and Works Approval applications.

3.4 Details of Development

Phase 2 of Te Ara Mangawhero Trail (c.12 kilometres long) is proposed to continue from the end of the first phase at "Rimu Hill" (c.800 metres asl), along the Blyth Track, then traverse alongside the Mangawhero River, to

the upper slopes of Ruapehu, finishing at the Massey Hut (c.1,460 metres asl) about three kilometres below Tūroa Ski Field.

Most of the proposed trail footprint is within areas that do not have current or existing tracks and are generally unmodified by human activities. Historically, some logging and haulage was undertaken in Section 5 at “Rimu Hill”.

Section 6 is intended to follow part of the existing and historic Blyth Track. Blyth Track was formed in about 1915-1920, using corduroy technique (Ritchie 2024). This involved cutting and laying slabs of timber (from pahautea (Libocedrus bidwillii) trees) horizontally across the track, to provide traction and stability in swampy areas. The Blyth Track was the main bridle track up the mountain prior to construction of the Ohakune Mountain Road.

The proposed trail is intended to meet the criteria for Trail Grade 3 (may include sections of Grade 2), as per the New Zealand Cycle Trail Design Guide (2024) and standards for off-road cycle tracks on land managed by the Department of Conservation (DOC 2020). These criteria include details on maximum uphill gradient and trail width.

The average width of the completed trail will be 0.9 metres, extending to 1.5 metres where terrain permits to allow for easy passing and shared use. The maximum width of the construction alignment, including batters, will be 2.0 metres.

Boardwalks will be used in sections of sensitive terrain, such as wetlands, unconsolidated volcanic soilfields, or dense areas of tree roots. Boardwalks will also be used to provide switch-backs trails in areas of steep terrain (such as Section 9). In addition, boardwalks will be used along parts of Section 6 - Blyth Track where there is severe erosion and/or a desire to retain visibility of the historic 'corduroy' (logs placed horizontally across the track surface).

Locations of proposed bridges are shown in Figure 1 and are summarised in Table 4. The use of culverts has been avoided.

Section	Segment	Name	Length (m)	Start Chainage (m)	End Chainage (m)
5	5.8.B	Bridge (Mangawhero River)	24	6627	6651
6	6.14.B	Bridge (Tributary)	10	11888	11898
	6.27.B	Bridge (Creek)	5	13592	13597
	6.29.B	Bridge (Creek)	4	13631	13635
	6.31.B	Bridge (Creek)	6	13661	13667
7	7.2.B	Bridge (Creek)	8	14124	14132
	7.8.B	Bridge (Creek)	15	14831	14846
8	8.3.B	Bridge (Mangawhero River)	20	15156	15176
9	9.1.B	Bridge (Mangawhero River)	14	16620	16634
	9.3.B	Bridge (Mangawhero River)	19	16792	16811
	9.13.B	Bridge (Tributary)	14	17344	17358

TABLE 4 BRIDGES

3.5 Trail Development

Appendix 12 is the Construction Management Plan (CMP). The CMP contains the detail of trail structure and design and that sets out the approach to developing the trail.

The proposed trail will predominantly be a NZCT Grade 3 trail. This grade enables a high level of access by users of a wide range of ages and abilities while still maintaining the important values at place. As the trail is a shared use trail, the design has incorporated a range of tools to facilitate safe use by people on foot and on bike.

The proposed trail development will traverse and showcase a wide range of ecologically and culturally significant forest, river margin and alpine habitats on the lower slopes of Ruapehu. The proposed route has been designed to avoid and minimise the potential for adverse effects on the important natural, historic, cultural values of the location.

Design of the trail and associated outdoor structures and ongoing maintenance is to be in accordance with SNZ HB 8630:2004 New Zealand Handbook Tracks and Outdoor Visitor Structures, and the New Zealand cycle trail design guide https://www.mbie.govt.nz/assets/new-zealand-cycle-trail-design- guide.pdf.

This is a specification for the Department and other agencies responsible for the management of tracks and outdoor visitor structures. It provides guidance on 'track service standards' relative to visitor (user) characteristics and the type of recreational opportunity being provided, and guidance for the engineering design of structures. Many other standards relate to design and construction of various elements of outdoor structures, and these are referred to in SNZ HB 8630.

The trail will comply with the standards for a Day Visitor – Walking Track for Cyclists/Mountain-Bikers and Pedestrians.

3.5.1 Use of Helicopters

Helicopters will be used in the development of the trail. These will be used to fly in structures, such as bridges, boardwalks and gravel to key areas. The use of helicopters in this instance is to reduce the overall disturbance to the environment by reducing unnecessary disturbance at bridge sites.

Helicopter operations will be managed by Dodge Construction.

Helicopters and pilots will be used from the following companies:

- Midwest Helicopters NZ (https://www.midwesthelicopters.co.nz) using Airbus As350 B@ and Airbus AS350 B3 helicopters
- Beck Helicopters (http://www.heli.co.nz) using a Bell UH1 Iroquois

Further information on the location and use of Helicopters can be found in the CMP in Appendix 12.

3.5.2 Filming

The applicants would like to undertake filming of the trail development and also undertake filming to promote the use of the trail. The purpose of the filming during the development stage is to capture the story of the trails development as part of a wider process of recording the heritage of the trail. From time to time, the applicants or their representatives may wish to undertake filming on the trail for the purposes of promoting the trail. In both cases it is anticipated that filming will take place via still and video photography.

Film crews will stay on formed trails as much as possible and where it is necessary to leave formed trails they will avoid walking on sensitive habitat.

The film crew will follow the Code of Practice for Filming on Public Conservation Lands, developed by Film New Zealand and the Department of Conservation.

No drones will be used for filming on PCL.

3.6 Trail Management

Working with Dodge Construction, the Trust will manage the design and construction of the trail and will own the trail and associated structures on completion.

The proposed sections of trail are on easy topography, are easily accessible, are close to an existing population centre. Maintenance has been a key factor in trail design and choice of materials (such as FRP). These factors mean the trail will be relatively straightforward and cost effective to maintain, even in an alpine area.

Management and maintenance of the trail will be undertaken by the Trust utilising their trail management team and supported by the community and the Mountains to Sea Trust. Funding for trail management will come, from a range of sources including the Trust and the Mountains to Sea Trust who receive annual funding from central government to manage and maintain the trail.

The Level of Service (LOS) for the management of the trail will be to ensure the trail meets the DOC and New Zealand Cycle Trail standards. As a great ride, the trail will be subject to regular audits and an ongoing user reporting survey.

The Trust will work with the Mountains to Sea Trust to ensure the trail is managed and marketed to a standard that meets the New Zealand Cycle Trails and the Department's requirements.

A proactive approach to sustainable trail management will be taken. This starts with the design and build of the trail and structures. The trail will be built to be robust and resistant to key impacts that are likely to affect the trail surface and overall trail integrity. This will primarily be water management. It is important to note that the sections of trail proposed to be developed are in a relatively easy topography, meaning that water flow along the length of the trail is not anticipated to be a significant issue.

Boardwalks and subsurface drainage will be used in areas which are likely to be subject to ongoing water issues. This is set out in more detail in the CMP.

Culverts are not proposed to be used, instead those parts of the trail that are likely to be subject to running water are bridged or board walked. This will mean that any water is less constrained and flows are kept as close as possible to natural levels. Prioritising boardwalks and bridges, reduces the risk of culvert blowouts in the case of a high rainfall event.

Ongoing maintenance requirements for the bridges will include two-yearly checks by suitably trained inspectors and six-yearly checks by an appropriately qualified bridge engineer.

All structures are required to have an engineering design and approval to Department of Conservation standards. This includes all bridges, handrails and board walks.

The Trust have their offices in Ohakune at the base of the maunga. They are well placed to respond quickly and efficiently to any trail issues that may arise. This will include inspecting the trail after wind, rain and/or heavy snowfall events to check for any windfall or slumping. Bridges and other structures will be checked after any peak flow events too.

As the trail will form part of the Nga Haerenga Great Rides, there will be monthly feedback from the trail survey. This feedback will be assessed monthly and used to inform any maintenance works. Likewise, NZCT has quality assurance tools such as the Trail Warrant of Fitness that assesses a range of trail factors including trail surface quality. These assessments will be done regularly by a NZCT assessor and will provide additional feedback on

trail management. As a Great Ride, the trail will have access to a range of additional funds. The annual Trail Manager fund provides annual operational funding of $45,000 and the Extreme Events fund provides support when sections of trail have been damaged by extreme events such as storm damage, fire, flooding or single event vandalism.

As a Great Ride, the trail will be insured under the New Zealand Cycle Trails Great Ride Insurance scheme which can be viewed HERE.

Additional information about these funds can be found here: https://www.mbie.govt.nz/immigration-and-tourism/tourism/tourism-funding/nga-haerenga-the-new-zealand-cycle-trail/nzct-funding/ .

Additional information about trail development and maintenance can be found in the Construction Management Plan in Appendix 12.



4 History of Proposal and Other Sites Considered

Investigations and planning of the proposed trail started in 2014 by the local community. At the time the local community group, Ohakune 2000, led investigations into the development of the proposed Ohakune Mountain Road trail. This has included consultation with iwi, former Ohakune Mountain Road builders, adjoining property owners and hunters. They undertook a comprehensive desktop study using underlying cadastral data, historical maps and reports. They also completed a detailed field investigation and identified a potential trail route that has been plotted using GPS.

This proposed route was reviewed by Evan Freshwater and Jonathan Kennett from New Zealand Cycle Trail Inc. in March 2016. They noted that the trail is likely to be enormously popular with bikers and has the potential to be a unique and significant attraction for Ohakune. However, due to the status of the area as a national park and a dual World Heritage Area, they recommended that further investigation should be undertaken by a 'master trail builder' to confirm that a sustainable route and trail can be developed. This was done in May 2016 by two NZCT accredited Master Trail Builders who reviewed the proposed route and provided feedback to the project team. The proposed route at the time was subsequently amended to take on board the feedback provided.

A feasibility assessment was prepared in 2016 by Perception Planning Limited for the Department of Conservation (the Department) to inform a proposed amendment to the Tongariro National Park Management Plan (TNPMP). A copy of this assessment can be viewed here: https://1drv.ms/b/s!AuzhLTR2aYJz3zrpSF42N7_Xp3t8?e=5JwKaf . While a strong focus of the report was an assessment of the proposed trail against the Department's statutory instruments, it also included an assessment of the proposed route, environmental and cultural impacts and a market and economic assessment. Page 10 of the 2016 feasibility noted the following drivers for the trail:

- A series of safety audits undertaken on the Ohakune Mountain Road by the Ruapehu District Council (RDC) and the New Zealand Transport Authority (NZTA)[2], demonstrated that the road does not meet the required safety standards for the user groups of the road (vehicles, bicycles, pedestrians). Road design criteria were drawn up in 2012 for the realignment of the road that met minimum design criteria standards, but that excluded other users (walkers and bikers) from the carriageway. This was done to minimise the environmental impact on the vegetation adjacent to the road by further widening the road. However, this meant that a separate walking and biking trail was needed. This option was supported by the Department, local iwi (Ngāti Rangi and Ngāti Uenuku) and the local community[3].
- The Manawatu-Whanganui Regional Growth Study published jointly by The Ministry of Business, Innovation and Employment (MBIE) and The Ministry of Primary Industries in 2015[4], prioritised eight opportunities for economic and social growth in the region. The first of these opportunities was the development of tourism and visitor services – with the initial emphasis on the development of mountain bike trails by introducing an additional trail on the Turoa side of Mt Ruapehu. The report went on to estimate that if this initiative and two others suggested in the region increased visitor spend by 10%, the regional GDP would be boosted by $63m a year and add 71 jobs directly and indirectly.
- The Round the Mountain track maintained by the Department requires walkers to walk 3.5km along the Ohakune Mountain Road between Whanganui Corner and the Waitonga Falls carpark. Although no

[2] Pers Com: Warren Furner, Ruapehu District Council Roading and Economic Development Manager

[3] The roading upgrade work has subsequently occurred

[4] The Manawatu-Whanganui Regional Growth Strategy http://www.mbie.govt.nz/about/whats-happening/news/2015/manawatu-whanganui-growth-study-published/?searchterm=manawatu-whanganui-growth-study%2A

negative comments have been made on the Department's website about this, negative comments have been seen in the hut books. There is an opportunity to enrich the visitor's experience and increase safety on the road by taking the walkers off this section of road and directing them towards the proposed new trail.

- The Mountains to Sea Cycleway (part of the New Zealand Cycle Trail) starts at the Turoa skifield carpark and ends in Whanganui. The Ohakune Mountain Road is thus part of this cycleway. There is an opportunity to take bikers off the road to enrich their visitor experience and increase safety on the road by offering an off-road trail.
- The numbers walking the Tongariro Alpine Crossing have increased on an annual basis, putting pressure on the track surface and the services offered to walkers. There is no alternative day walk in the immediate area in the event of bad weather or in the event of an eruption (and the track closure that has followed an eruption in the past).

In 2016, a partial review of the TNPMP was initiated which involved a public consultation process under Sections 46 and 47 of the National Parks Act 1980. This review included a submission process which was advertised nationwide with public hearings held in Ohakune in 2017. The review enabled the development of Te Ara Mangawhero, the Horopito Trail and those sections of the Missing Link that fall within the national park. The partial review was approved by the New Zealand Conservation Authority on 23 April 2018.

This process represented an acceptance of the appropriateness of these trails by the Department, provided that they are developed and managed in accordance with the revised TNPMP.



FIGURE 4 PROPOSED ROUTE OF SECTION 10

The key alternative route considered for the trail at the outset was an extension of the Ohakune Mountain Road carriageway to include a wider shoulder for use by walkers and cyclists. This option was not supported by iwi

and others due to the environmental impact associated with the road widening. Further discussion on this can be found in Section 2.2 of the 2016 feasibility assessment.

In recent times several route options have been considered for the TAM. Consideration of route options has been driven by ensuring that the trail minimises the effects on the values of the location. The current corridor was settled on by the Trust early in 2024. A decision was made to not develop the trail between Massey Flat and Turoa (Section 10) as shown on Map 10 of the TNPMP. The initial route of Section 10 is shown on Figure 4. The development of Section 10 has not been progressed due to a range of factors including:

- The visual impact of the proposed trail.
- Increasing cultural impacts by developing the trail further up the Maunga.
- Instability of the terrain and the associated challenges with stabilising the trail corridor.
- Ongoing maintenance of this section would be harder.
- Potential impact on alpine ecosystems.



FIGURE 5 MAY 2024 HIKOI

In May 2024 a two day hikoi took place to review the trail corridor and confirm the final trail route. This hikoi included surveyors, master trail builders, engineers, ecologists, landscape experts, trail planners and iwi representatives. This approach meant that the trail route was revised and redesigned on the basis of the advice received at place. Surveyors captured the results of the korero that took place. The objective of the hikoi was to identify and record a sustainable trail route that would reflect and respect the important cultural, ecological, visual and historic values at place. A subsequent trail inspection was carried out by archaeologists who provided further guidance, with specific reference to the Old Blyth Trail.

The resulting trail was marked on site using flagging tape, and was electronically surveyed and mapped. The maps identify the proposed location of the trail (new and existing), boardwalks, signs, bridges and other structures. These maps were reviewed by the subject experts and revised. They were then provided to DOC staff for review.

The final proposed route was used to inform ecological, visual and archaeological assessments. More detailed structure designs, and geotechnical and hydrological assessments were also developed.

4.1 Fiberglass Reinforced Polymer Boardwalks

A key outcome of both hikoi was the recommended adoption of the use of Fibreglass Reinforced Polymer (FRP) boardwalks, rather than boardwalks constructed from treated timber. This represented a significant change to trail design from previous thinking. There was a general consensus from those who were present at the hikoi that FRP was a better product than treated timber. This view was based on the following points:

- The grid texture of the FRP would let more light to the underlying vegetation and therefore reducing the impacts on the important alpine species that would be under the trail.
- Foundations and construction will have a smaller physical foot print than wooden boardwalk.
- FRP can be coloured in recessive tones (as advised by the visual expert) meaning that it will not be as prominent in the landscape. The grid decking will also allow underlying vegetation to grow through the decking which will further soften the structures.
- FRP is visually permeable meaning that on the Old Blyth Track, trail users will be able to view the underlying corduroy.
- Proven efficacy in alpine areas – Kosciusko National Park in Australia.
- The product is lighter meaning that it is easier and quicker to install and will not require as much lifting time by helicopters.
- The textured surface means that an additional anti-skid surface will not have to be placed on top of the decking. Plastic or wire anti-skid mesh (both wire and plastic are used on boardwalks on the RTM) which is most commonly used for boardwalks will require replacement every two to three years.
- The panels can be easily replaced if damaged. This is quicker and easier to do than if it was a wooden boardwalk.
- Longer lifespan than timber and more resilient to climatic effects.

5 Statutory Assessment

The following statutory assessment considers both the Resource Management Act 1991 and the Conservation Act 1987 which are relevant to this proposal and the permissions sought.

The following statutory documents are considered directly relevant to the concession and works approval applications:

- National Parks Act 1980 (the Act);
- Conservation Act 1987
- Tongariro National Park Bylaws 1981;
- General Policy for National Parks 2005;
- Tongariro / Taupo Conservation Management Strategy 2002-2012 (CMS);
- Tongariro National Parks Management Plan 2006-2016 (TNPMP);
- Tongariro National Park Amendment 2018 (Amendment).

The following statutory documents are considered directly relevant to the resource consent applications that will be lodged with Horizons Regional Council:

- The Resource Management Act 1991
- National Policy for Freshwater Management 2020
- National Environmental Standards for Freshwater 2020
- The Horizons One Plan

The following statutory document is considered relevant to both applications:

- Ngāti Rangi Claims Settlement Act 2019

5.1 National Parks Act 1980 and General Policy for National Parks 2005

The purposes of national parks, as set out at Section 4 of the Act, are the preservation in perpetuity for their intrinsic worth and for the benefit, use and enjoyment of the public areas of New Zealand that contain scenery of such distinctive quality, ecological system, or natural features so beautiful, unique or scientifically important that their preservation is in the national interest[5].

The principles for national park management are set out in Sections 4, 5 and 5A of the Act and Section 6 of the Conservation Act 1987. There is a clear hierarchy of considerations for decision makers, with the primary focus of the legislation being preservation and protection of natural and historic values in their natural state: while providing for, or fostering, recreation and public access for the benefit of users, from their interaction with the underlying natural resources.

The 2017/18 partial review of the TNPMP was guided by the National Parks Act and the General Policy for National Parks. The proposed amendment was considered consistent with the higher order statutory framework on the basis the activity of mountain biking is considered part of the valid recreation opportunity spectrum within the national park, and the infrastructure development associated with it maintains or enhances park values. The policy approach taken ensures a precautionary, staged approach to track development, disciplined monitoring and review of development and use, and formalised reporting and feedback to the governance

[5] Derived from Section 4(1) National Parks Act 1980

entity for Tongariro National Park. The cultural values of Tongariro National Park will be sustained through the involvement in the trail by Ngāti Rangi.

On this basis, the principle of establishing a shared use trail along the alignment set out in Map 10 of the Amendment has been confirmed against national level statutory documents. This application therefore considers the detail of the proposed trail route and its construction and associated effects against the relevant provisions of the TNPMP and the CMS.

5.2 Tongariro National Park Management Plan

Tongariro National Park is a nationally significant area with Dual World Heritage status for cultural and geological reasons. The Park is a major tourist attraction and has sites such as the Tongariro Crossing which have high international use for outdoor recreation. The Park is nationally important for skiing with three ski areas, two of them of international standard. Other recreation opportunities include ski mountaineering, climbing, snow caving, nature study, photography, hunting and tramping.

The objective of the Tongariro National Park Management Plan in respect to recreation management is to facilitate public benefit, use and enjoyment of the Park by providing for a variety of low-impact recreational activities, where this is consistent with the primary objective of protecting the natural character of the Park.

The Plan (Section 3.1) identifies eleven principles that reflect the core values of the Park as follows:

- *To protect Tongariro National Park in its natural state in perpetuity;*
- *To manage Tongariro National Park consistent with conservation legislation and General Policy;*
- *To protect the taonga – the peaks of Tongariro National Park;*
- *To ensure World Heritage obligations are met and given effect to;*
- *To give effects to the principles of the Treaty of Waitangi;*
- *To provide for co-operative conservation management;*
- *To provide for public enjoyment of natural and cultural heritage;*
- *To protect the ancestral, historical, archaeological and cultural heritage landscape of Tongariro National Park;*
- *To reflect the values of the park partners in management;*
- *To minimise infrastructure to that <u>essential</u> to provide for visitors' benefit, use and enjoyment of the park [emphasis added]; and*
- *To honour existing legal agreements.*

The key management policies and philosophies highlighted within the TNPMP are hierarchical in nature. They give effect to the requirements of the National Parks Act 1980. The protection ethic inherent in the Plan principles cannot be derogated from in decision making. While both documents highlight fostering recreation and essential infrastructure for visitor use and enjoyment, these occur in the context of the overarching protection requirement.

The Plan was amended in 2018 to specifically provide for the development of a shared use trail along the route identified in map 10 of the Amendment. That route is the same as set out in this application. The Amendment established specific direction in the TNPMP on the nature of the trail, its development, use and management. On this basis the development and management of the proposed trail has been predicated by the partial Amendment of the Plan and as such the following assumptions are made:

- The concept of the trail being developed and managed by a third party is accepted, albeit in a manner in line with relevant plan policies relating to how this is to be done.
- Provisions in Section 4.1.1 of the TNPMP relating to limiting concessionaire infrastructure to amenities areas etc and whether activities could be conducted outside of the Park have been addressed through the partial amendment and do not need to be 'argued' through the trail concession.
- The concept of locating a shared use trail in the Park and people being able to ride bikes (including E-bikes) on it is has been agreed in principle.

These points do not mean that the trail is to be developed as of right on a permitted basis. The plan sets out the expectations around the development and management of the trail including ensuring that it does not adversely affect the important values of the Park.

A detailed assessment of the proposed trail development and its management against the relevant provisions of the TNPMP is set out in Appendix 5. This assessment is undertaken in a manner cognisant of the three assumptions set out above.

The following assessment is of those parts of the Plan that are considered to be particularly relevant to the proposed development.

5.2.1 Plan Section 4.3.2.4 Tracks

The amendment resulted in a number of changes to Section 4.3.2.4 of the Plan. Foremost of these changes was the addition of the new objective C as follows:

To enable family-friendly mountain bike recreation opportunities where they cannot be more appropriately located outside of the national park and where they are compatible with the protection of the cultural and natural values of the park and the enjoyment of it by other recreation users.

The proposed trail is to be developed as a shared trail at a grade generally consistent with the NZCT standard for grade 3 cycle trails. The trail has been designed to a grade 3 standard as opposed to grade 2 largely due to gradient as opposed to the trail being more 'technical'. Overall the trail will support a high level of access by users on foot and on bike with a wide range of ages and abilities. The detailed trail planning and design has been informed by ecological, visual, historical and cultural assessments to ensure the trail will be compatible with the important cultural and natural values of the Park.

As a shared use trail, the design of the trail has been carried out to support the safe use of the trail by walkers and bikers. This has included having a trail width of 0.9 -1.2m, designing for expansive sight lines, avoiding blind corners and not having long straights where people on bikes could generate too much speed going downhill. The 'share with care' message will be reiterated on and off the trail on signage, marketing and collateral etc. The use of the NZCT Trail Guidelines will support the shared use approach as they have been developed for dual direction shared use trails.

Section 6 of the trail is the only part of the phase 2 which is currently a formed trail. The Old Blyth Trail is currently classified by the Department as a 'Tramping Track' (TRAVI-TRTR) and is assigned to visitor group 'Back Country Adventurers'. This is despite the trail being a front country trail close to Ohakune and easily accessed off a busy road. The strategic intentions tool (2020) estimated[6] that the total annual visitor numbers were 1,000 users per annum. This is an average of 2.7 users per day. These low numbers and classification are attributed to the poor standard of large sections of the trail. Discussions with Departmental works officers have indicated

[6] There are no counters on the trail.

that there is currently no planned investment on the Old Blyth Track[7]. On this basis it is anticipated that the quality of the trail will continue to degrade (primarily through water damage) and usage will further decline.

The proposed upgrades to this section are anticipated to increase use of the trail by 57 people a day.

Section 8 will form a new off road section of the RTM removing a long on road section of that journey. This will significantly enhance the experience, and enjoyment of users of that trail.

Policy 4.3.2.4.4 was added into the Plan through the Amendment and sets out the following requirement:

Allow for the development and operation of shared-use of the Waitonga Falls- Blyth Track, Old Coach Road Loop Track, and Maungaturuturu Link Track, where:

> *a) the protection of visitor safety and enjoyment is provided for;*
>
> *b) departmental standards for Grade 2 (easy) cycle trails or equivalents are met; and*
>
> *c) the Department has sought advice from the Tongariro/Taupo Conservation Board with respect to route selection, track development and environmental impact assessment.*

Policy 4.3.2.4.6 requires that a and b should be complied with when developing the trail.

As noted above, the proposed trail will be an intermediate grade that enables a high level of access by users of a wide range of ages and abilities. As the trail is a shared use trail, its design considers dual use and also dual flow of users. The design has incorporated a range of tools to facilitate safe use by people on foot and on bike. These include:

1. The trail will be built 1.5m wide where the terrain permits to allow easy passing and shared use.
2. Boardwalk sections should be built to a minimum 1.2m wide.
3. Grade reversals will be used often to manage rider speed on longer straight sections of trail.
4. Long straight sections will be minimised to reduce rider speed.
5. Corners will be, where possible, open with good sightlines to ensure that all users have maximum visibility of the trail and other users.
6. There will be signage at trail heads and along the trail stating and describing the trail grade, risks and reminding users that it is a shared use trail and to share with care.
7. The easy grade trail means that it does not passively promote high speed use by riders and supports dual direction (i.e. climbing as well as descending).

The proposed trail has been designed to meet a Grade 3 standard to ensure protection of the important cultural and ecological values at place. This has resulted in a trail which is generally steeper than Grade 2 (5 degrees for the majority of its length). The track width, structure width and design will be consistent with Grade 2, as will be the even trail surface. From a technical ability perspective the trail will be a Grade 2 trail however the gradient will mean that it will need to be defined as a Grade 3 trail. The majority of the trail will be 'easy' with the Grade 3 aspects considered 'Intermediate'. On this basis it is my view that the trail will still be able to be accessed by a wide range of people on bikes with intermediate experience. The use and application of the NZCT Trail Guidelines will support the shared use approach as they have been developed for dual direction shared use trails.

[7] Pers Coms, Charlotte Fletcher and Ray Bond.

In respect to ongoing management of the trail, it will be managed to the stated grade. This is important to ensure that the stated grade on trail head signage (which also reflects the level of user risk) reflects the actual experience that will be had by users. The 'advertised' risk will reflect the actual risk. There will be a description of the stated grades provided on trail head signage. This will ensure that uses are aware of all the risks associated with the trail and its use.



FIGURE 6 SECTION OF EXISTING OLD BLYTH TRAIL

The risk posed by people on bikes to people on foot has been raised through the engagement process (section 8.3), specifically to existing users on the Old Blyth Track. Section 6 of the trail is the only part of the phase 2 which is currently a formed trail

The proposed upgrades to this section are anticipated to increase use of the trail to 57 people a day. This section of the trail will be designed to Grade 3 (gradient) standards and support safe mixed use. The resulting trail will be upgraded to be more in line with a front country trail experience and present less risk to users.

A presentation on the proposed trail was made to the Tongariro Taupō Conservation Board on the proposed Phase 2 trails on October 18, 2024.

Policy 4.3.2.4.10 considers opportunities for parties other than the Department to develop the tracks and for them to be constructed, maintained and managed under a concession or management agreement. Accordingly, the tracks are proposed to be developed and managed by the Trust under a concession from the Department.

As per Policy 4.3.2.4.11, independent mountain biking and e-biking will be allowed free of charge on the proposed trails.

Policy 4.3.2.4.12 sets out a number of priorities for the trail as follows:

a) ensure the protection of visitor safety and enjoyment;

b) promote awareness of park values including values of significance to tangata whenua and how to avoid adverse effects on these;

c) promote awareness of desired behaviours when using a shared-use track to protect the experiences of, and avoid creating hazards for, others;

d) meet departmental standards for Grade2 (easy) cycle trails or equivalents; and

e) address the transfer of infrastructure assets, restoration of developed sites to original state, or reassignment of management functions upon expiry of the concession or management agreement.

Matters a, c and d are discussed above.

The trail development project has also included planning for storytelling and interpretation around the important values associated with the Park. The storytelling component will be developed as part of future phases of the trail development process. Involvement by Ngāti Rangi in the development and management of the trail means that consideration of these values will be an intrinsic part of the trail development and management process.

While the concession application is for a period of 30 years, it is not anticipated that this will be the life of the trail and associated assets. Like existing trails in the Park, the proposed trail will have a greater lifetime than the initial term sought via the concession. On that basis restoration is not anticipated but, given the nature of the development, the trail could be restored naturally if use and maintenance of the trail is stopped. Structures, such as bridges, boardwalks and signage, are discrete items that can be deconstructed and removed from the environment without creating wider effects. It is also important to note that as tāngata whenua, Ngāti Rangi have a permanent relationship with the land.

The proposed trail will not meet Grade 2 standards. The reasons for this are discussed above.

Policy 4.3.2.4.13 sets out the following matters which the Department should do on receipt of a concession application for the trail development:

a) require consideration of the policies in *Section 4.4.1 Concessions General*;
b) seek advice from the Tongariro/Taupo Conservation Board;
c) require a project plan that demonstrates the sustainable operation of the proposed mountain bike tracks over the long term; and
d) require a full environmental impact assessment undertaken by appropriately qualified specialists.

Section 4.4 of the TNPMP contains a comprehensive set of objectives and policies relating to concessions within the Tongariro National Park. Section 4.4 asks several key questions that each concession application will need to respond to. These questions are discussed in more detail in Appendix 5. In summary, the concession application meets the requirements in Section 4.4.

A presentation on the proposed trail was made to the Tongariro Taupō Conservation Board on the proposed Phase 2 trails on October 18, 2024.

Discussion on the management of the proposed trail by the applicant is contained in Section 3.6 of this report.

As part of the trail planning process, an ecological, landscape, visual, historical and cultural assessment was undertaken for the trail. These assessments can be found in Appendix 7 and Appendix 8 of this report. These reports have formed an integral part of the wider environmental impact assessment.

Policy 4.3.2.4.14 directs that the development of tracks should be undertaken on a staged basis as follows: (1) Old Coach Road Loop Track, (2) Maungaturuturu Link Track, (3) Waitonga Falls-Blyth Track and (4) Turoa-Waitonga Falls Track.
The trails that are proposed to be developed through this application are the upper section of the Waitonga Falls-Blyth Track and the section of the Turoa-Waitonga Falls Track to Massey Hut. Work has been initiated on the other sections of the trail.

5.2.2 Plan Section 4.1.2 He Kaupapa Rangatira

He Kaupapa Rangatira is the principal means by which the Treaty principles and objectives will be implemented and achieved in the Park. It is a practical and pragmatic expression of the relationship between Ngāti Tūwharetoa, Ngāti Rangi and the Department. This section is relevant to this application as the Applicant is Ngāti Rangi. Of specific relevance are the following Objectives in 4.1.2:

1. 4.1.2.2.a To recognise and actively promote the exercise by iwi of tino rangatiratanga over their land and resources, and taonga of significance to them.
2. 4.1.2.2.b To identify with iwi opportunities for them to exercise an effective degree of control over traditional resources and taonga that are administered by the department, where this is not inconsistent with legislation. Note: “An effective degree of control” may vary from full authority at one end of the spectrum to a right to be consulted at the other end.
3. 4.1.2.5.a To recognise and actively promote the exercise of kaitiakitanga by iwi in respect of their land, including resources and taonga of significance to them and under the control of the department.
4. 4.1.2.5.b To facilitate the exercise of kaitiakitanga by iwi in respect of traditional resources and taonga of significance to them where these are administered by the department.
5. 4.1.2.6.a To identify with iwi the means to provide opportunities for partnership and participation in conservation management, particularly in respect of traditional land, resources, and taonga administered by the department.
6. 4.1.2.6.b To develop an active relationship of co-operation, utmost good faith, and mutual respect between the department and iwi and to reflect the importance and quality of that relationship in the culture of the department and all of its operations.

If granted, the concession will be one of the first concessions in TNP held by iwi for the development and management of a physical asset in the Park. Currently there are skifields, motels etc owned and operated by clubs and companies, however nothing owned by iwi. With Ngāti Rangi managing the trail on the slopes of Ruapehu Maunga, a significant opportunity would be provided for the iwi to exercise Kaitiakitanga and an effective degree of control of a key asset within the Park. This opportunity ‘provided’ to iwi by the Department would be a practical and pragmatic expression of the important relationship between iwi and the Maunga.

5.2.3 4.1.16 Works Approvals

All works undertaken within the Park, beyond basic maintenance, require approval by the Department as land administrator (a ‘works approval’). The intention of that approval is to allow the Department to consider works

at a broad strategic level, to consider their cumulative effects over time, and to consider the specific effects of the proposal in relation to the values of the Park.

This AEE supports applications by the Ngā Waihua o Paerangi Trust to build and manage the trails proposed. This allows the Department to consider the effects of the development of the trail and its ongoing management by Ngāti Rangi. As the proposed physical works result in permanent infrastructure over 100m^2 and are outside of the amenities area then the approval needs to be considered as a 'major' application as per policy 4.1.16.3. As the application is of a scale that necessitates the development of an EIA, it will have to be notified.

Dual notification of the concession and works approval is requested in this instance to provide for a more efficient process for the Applicant, the Department and those third parties who may wish to submit on the application.

5.2.4 4.3.2.12 Mountain Biking

Section 4.3.2.12 of the TNPMP was amended through the partial review process. These amendments focused on enabling the use of the proposed trails by people on bikes, and concession activities relating to guided mountain biking on specified trails within the Park.

It is important to note that the concession and works approval is for the development of a trail that will be used by people on bikes and on foot. This has informed the detailed design and route of the trails as lodged to ensure consistency with nationally recognised guidelines.

5.3 Tongariro-Taupō Conservation Management Strategy

The proposed trails are located within the Tongariro–Taupō CMS area. The 2002–2012 Tongariro-Taupō Conservation Management Strategy (CMS) covers the Tongariro National Park and surrounding area. Section 2.1.2 of the CMS contains six key principles as follows:

- *Protection and enhancement of the natural environment;*
- *Protection of historic resources managed by the Department;*
- *Development of an effective conservation partnership with tangata whenua;*
- *Fostering recreation use of public conservation land [emphasis added];*
- *Limiting non-recreation commercial use of public conservation land; and*
- *Enhancing advocacy outcomes and community relations.*

Those CMS provisions which are directly relevant to the proposed development are assessed in Appendix 6.

5.4 Statutory Assessment - Conservation Summary

The key management policies and philosophies highlighted within the CMS and TNPMP are hierarchical in nature. They give effect to the requirements of the Conservation and National Parks Acts. The protection ethic inherent in the CMS and TNPMP principles cannot be derogated from in decision making. While both documents highlight fostering recreation and essential infrastructure for visitor use and enjoyment, these things occur in the context of the overarching protection requirement.

The application has been assessed against the relevant provisions of both of these plans. This assessment is set out in Appendix 5 and Appendix 6.

The project proposal is considered consistent with this framework on the basis the activity of off road biking is considered part of the valid recreation opportunity spectrum within the national park, and the infrastructure development associated with it maintains or enhances park values. This has been confirmed through the

amendment to the TNPMP that specifically enabled these activities to occur in the location proposed through this application. The proposed development is consistent with the policy approach set out in the Plan and CMS and ensures a precautionary, staged approach to track development.

The proposed trail will not meet the Grade 2 standard anticipated in the TNPMP. The trail will be Grade 3 as developing a Grade 2 trail would not be sustainable in the alpine environment. The key factor which makes the trail Grade 3 is gradient. The proposed trail meets the Grade 2 standards in most other areas (trail width and surface etc). It is not considered to be a technical trail and will still be accessible to a wide range of people.

The cultural values of Tongariro National Park have been considered through the cultural assessment in Appendix 7. Ngā Waihua o Paerangi Trust have identified that as they will be responsible for construction and kaitiakitanga of ongoing management and maintenance of the trail they are satisfied that cultural impacts have either been mitigated or can be managed.

5.5 Resource Management Act 1991

The following sections consider the proposed development against relevant sections of the Resource Management Act 1991 (RMA). This assessment is relevant to the resource consents required for the trail development.

5.5.1 Part II Purpose and Principles

The purpose and principles of the Resource Management Act 1991 are set out in Part II of the RMA. Part II is a relevant consideration in assessing the application.

5.5.1.1 Section 5

Section 5 sets out that the purpose of the RMA is to promote the sustainable management of natural and physical resources. In the RMA, 'sustainable management' means:

> *managing the use, development, and protection of natural and physical resources in a way, or at a rate, which enables people and communities to provide for their social, economic, and cultural wellbeing and for their health and safety while –*
>
> *(a) sustaining the potential of natural and physical resources (excluding minerals) to meet the reasonably foreseeable needs of future generations; and*
>
> *(b) safeguarding the life-supporting capacity of air, water, soil, and ecosystems; and*
>
> *(c) avoiding, remedying, or mitigating any adverse effects of activities on the environment.*

The proposed development is considered consistent with Section 5 of the RMA in that its effects on the natural and physical resources of the site will be less than minor.

5.5.1.2 Section 6

Section 6 of the RMA outlines matters of national importance that need to be recognised and provided for by the consent authority (Horizons Regional Council) in exercising functions and powers under the RMA. The following matters are of national importance:

(a) the preservation of the natural character of the coastal environment (including the coastal marine area), wetlands, and lakes and rivers and their margins, and the protection of them from inappropriate subdivision, use, and development;

(b) the protection of outstanding natural features and landscapes from inappropriate subdivision, use, and development;

(c) the protection of areas of significant indigenous vegetation and significant habitats of indigenous fauna;

(d) the maintenance and enhancement of public access to and along the coastal marine area, lakes, and rivers;

(e) the relationship of Māori and their culture and traditions with their ancestral lands, water, sites, waahi tapu, and other taonga;

(f) the protection of historic heritage from inappropriate subdivision, use, and development;

(g) the protection of protected customary rights.

The proposal will provide for the preservation of the natural character of the river and its margins with sensitive trail and bridge design. An ecological assessment demonstrates the effects on the significant indigenous vegetation and habitat of the site and a visual assessment identifies the effects on Outstanding Natural Features. The proposal will enhance public access to the Mangawhero Awa. The proposed trail has been designed in a manner conscious of the relationship of Māori with the ancestral lands, water, sites, wāhi tapu, other taonga and customary rights. The proposed trail is also conscious of the heritage values of the Old Blyth Trail, and will enable greater use of that trial while protecting aspects of its important features. The proposal is consistent with Section 6 of the RMA.

5.5.1.3 Section 7

Section 7 outlines other matters to which particular regard should be given by the consent authority, which are:

(a) kaitiakitanga;

(aa) the ethic of stewardship;

(b) the efficient use and development of natural and physical resources;

(ba) the efficiency of the end use of energy;

(c) the maintenance and enhancement of amenity values;

(d) intrinsic values of ecosystems;

(e) [Repealed]

(f) maintenance and enhancement of the quality of the environment;

(g) any finite characteristics of natural and physical resources;

(h) the protection of the habitat of trout and salmon;

(i) the effects of climate change;

(j) the benefits to be derived from the use and development of renewable energy

The development of the trail will support Ngāti Rangi as active kaitiaki of the that part of the maunga where the trail is proposed. Efforts have been made to identify a sustainable trail route and building techniques to reduce the effects of the trail on the environment (including ecosystems and freshwater habitat) . Amenity values are considered in the landscape assessment in Appendix 9. ts location in an area valued for recreation and in close association with other recreation activities is an efficient use of the resources of the site.

5.5.1.4 Section 8

Section 8 requires the principles of Te Tiriti o Waitangi (the Treaty of Waitangi) to be taken into account when considering an application for resource consent.

The proposal will enable Ngāti Rangi to be active kaitiaki in that part of the maunga and their role as Applicant will ensure that the important cultural values of the site are safeguarded.

5.5.1.5 Part II Summary

Overall, it is considered that the proposed development is an efficient use of a natural and physical resource in a manner that provides for the protection and enhancement of nationally important landscape and natural value areas. It will enable the use of an area by locals and visitors in a manner that respects the important cultural, environmental and historical values of the site. The proposal will enable Ngāti Rangi to better fulfil their role as active kaitiaki of the Maunga.

The proposal is considered consistent with Part II of the Resource Management Act (the RMA), and the RMA would be better served with approval rather than declining of the proposal.

5.5.2 Section 88 – Making an Application

Section 88 sets out the requirements for making a resource consent application under the Resource Management Act. Section 88(2)(b) requires applicants to include the information relating to the activity, including an assessment of the activity's effects on the environment. It is considered that the application meets all the requirements of Section 88. The assessment of effects is proportionate to the scale of potential effects that may be attributed to the proposal in accordance with Section 88(2)(b).

5.5.3 Section 104 Consideration of Resource Consent Applications

Section 104 of the RMA requires (subject to Part II of the Act) a consent authority to have regard to the matters in Section 104 when considering resource consent applications. Section 104 states:

1. When considering an application for a resource consent and any submissions received, the consent authority must, subject to Part 2, have regard to-
   a. Any actual and potential effects on the environment of allowing the activity; and
   b. Any relevant provisions of
      (i) national environmental standard:
      (ii) other regulations:
      (iii) a national policy statement:
      (iv) a New Zealand coastal policy statement:
      (v) a regional policy statement or proposed regional policy statement:
      (vi) a plan or proposed plan; and
   c. any other matter the consent authority considers relevant and reasonably necessary to determine the application.

2. When forming an opinion for the purposes of subsection (1)(a), a consent authority may disregard an adverse effect of the activity on the environment if the plan permits an activity with that effect.

The actual and potential effects of the project are assessed in Section 7 of this document. The planning documents relevant to this project are outlined in Section 5.

5.5.4 Activity Status

The activity status of the proposed activity under the Horizons One Plan is a **Discretionary Activity**. The One Plan definition of vegetation clearance excludes *"activities undertaken within the boundaries of any area of*

land held or managed under the Conservation Act 1987 or any other Act specified in Schedule 1 to that Act (other than land* held for administrative purposes) that are consistent with a conservation management strategy, conservation management plan, or management plan established under the Conservation Act 1987 or any other Act specified in Schedule 1 to that Act"*.

In the case of the proposed indigenous vegetation clearance, this will only occur within Tongariro National Park which is managed under the National Parks Act 1980. The National Parks Act is specified in Schedule One of the Conservation Act. As noted in section 3.3, for the activity to proceed it will require a concession and works approval to be issued by the Minister of Conservation. This approval will confirm the consistency of the activity with the relevant plans established under the conservation and national parks acts.

If this activity was being undertaken outside of public conservation land or without the express permission of the relevant management plans then the activity status would be a non-complying activity.

It should be noted that even if the activity status was non-complying, the proposed activity would comply with both Section 104D a and b of the RMA, and as such be appropriate for the consent authority to grant.

5.5.5 Section 104B: Determination of applications for discretionary or non-complying activities.

This application is considered to be a Discretionary Activity under rule 13-7 and 17-3 of the Regional Plan.

Section 104B states that after considering an application for a resource consent for a discretionary activity or non-complying activity, a consent authority—

(a) may grant or refuse the application; and

(b) if it grants the application, may impose conditions under section 108.

For the reasons set out in this report Council can grant the application and apply those conditions which they see fit.

5.6 National Policy Statement for Freshwater Management 2020

The proposed development will involve bridge development over and land disturbance adjacent to Te Mangawhero Awa and its tributaries.

Ngāti Rangi is the Applicant on the basis that they wish to ensure they have oversight of the development and management of the trail in an area that is very important to them. The Mangawhero Awa is of fundamental importance to Ngāti Rangi, as is the need to protect the mana and mouri of the awa and the wellbeing of the surrounding environment.

The approach taken by Ngāti Rangi in the trail design and its development is rooted in tikanga and kawa that is consistent with the principles of Te Mana o te Wai, as articulated in Section 1.3 of the NPSFM, specifically:

- *Mana whakahaere:* being the power, authority and obligations of Ngāti Rangi to make decisions that maintain, protect, and sustain the health and well-being of, and their relationship with, the Mangawhero awa.
- *Kaitiakitanga*: the obligation of Ngāti Rangi to preserve, restore, enhance, and sustainably use the Mangawhero awa for the benefit of present and future generations.
- *Manaakitanga*: the role of Ngāti Rangi as mana whenua to show respect, generosity, and care for the Mangawhero awa and for others.
- *Governance*: the importance of enabling Ngāti Rangi to take greater responsibility and exercise their authority to make decisions about the Mangawhero awa in a way that prioritises the health and well-being of freshwater now and into the future.

An assessment of the relevant objectives and policies contained in the NPSFM can be found in Appendix 3 of this report.

The proposed development meets the requirements of the NPSFM.

5.7 National Environmental Standards for Freshwater 2020

The NES-F came into force on 3 September 2020 and regulate activities that pose risks to health of freshwater and freshwater ecosystems.

Section 42 of the NES-F identifies that the construction of a wetland utility within 10m of a natural inland wetland is identified as a Restricted Discretionary Activity.

Section 42 relates to the following activities:

(1) Vegetation clearance within, or within a 10 m setback from, a natural inland wetland is a restricted discretionary activity if it is for the purpose of constructing a wetland utility structure.
(2) Earthworks or land disturbance within, or within a 10 m setback from, a natural inland wetland is a restricted discretionary activity if it is for the purpose of constructing a wetland utility structure.

A wetland Utility Structure is defined under the NES-F as

> *(a) means a structure placed in or adjacent to a wetland whose purpose, in relation to the wetland, is recreation, education, conservation, restoration, or monitoring; and*
>
> *(b) for example, includes the following structures that are placed in or adjacent to a wetland for a purpose described in paragraph (a):*
>
> > *(i) jetties:*
> >
> > *(ii) boardwalks and bridges connecting them:*
> >
> > *(iii) walking tracks and bridges connecting them:*
> >
> > *(iv) signs:*
> >
> > *(v) bird-watching hides:*
> >
> > *(vi) monitoring devices:*
> >
> > *(vii) maimai*

The shared use trail and associated structures (Boardwalks and Bridges) is captured under b (ii) and b (iii).

The proposed activity requires restricted discretionary resource consent under section 42 of the NES-F. Accordingly this application should be considered against the requirements of that section of the NES.

5.7.1 Assessment Against NES-F

Section 56 of the NES-F sets out the matters which discretion is to be applied to for the proposed activity. While the assessment contained in the original application (including the ecological assessment) discusses these matters. These matters are covered off below.

Section 56 (a) the extent to which the nature, scale, timing, intensity, and location of the activity may have adverse effects on:

(i) the existing and potential values of the natural inland wetland, its catchment, and the coastal environment; and

(ii) the extent of the natural inland wetland; and

(iii) the seasonal and annual hydrological regime of the natural inland wetland; and

(iv) the passage of fish in the natural inland wetland or another water body:

These matters have been adequately covered off by Wildlands (2024). The activity itself, including the nature, scale, timing etc has been set out in the wider report (including the associated Construction Management Plan). I note that designs of boardwalks were not included in this application.

Section 56 (b) whether there are practicable alternatives to undertaking the activity that would avoid those adverse effects:

Section 56 (c) the extent to which those adverse effects will be managed to avoid the loss of the extent of the natural inland wetland and its values:

Section 56 (d) other measures to minimise or remedy those adverse effects:

The process for identifying the proposed trail route is set out in this report. Consideration has also been given (in Wildlands 2024) to avoid and or minimise effects on the environment, including wetlands This includes actively avoiding wetlands and the use of boardwalks to reduce any effects on their margins. The use of FRP for boardwalks will also better protect wetland species which may be under the boardwalks.. The use of carefully placed boardwalks is also proposed in areas adjacent to wetlands where they will avoid or minimise ecological effects on those wetlands.

Section 56 (e) how any of those adverse effects that are more than minor may be offset or compensated for if they cannot be avoided, minimised, or remedied:

The Wildlands Report has identified that there will not be effects which are more than minor on identified wetlands.

Section (ea) the extent to which the effects of the activity will be managed through applying the effects management hierarchy:

As per the response to Sections 56 B – D above, the design of the proposed trail is consistent with the NPS-FM effects management hierarchy. The approach has included, avoiding wetlands where possible and where this is not possible then minimising effects using boardwalks.

Section (f) the risk of flooding upstream or downstream of the natural inland wetland, and the measures to avoid, minimise, or remedy that risk:

Given the nature of the wetlands and the location and design of the proposed trail, there will be no additional risk of flooding from the proposed development.

Section (g) the social, economic, environmental, and cultural benefits (if any) that are likely to result from the proposed activity (including the extent to which the activity may protect, maintain, or enhance ecosystems).

The proposed trail will have social, economic, environmental and cultural benefits. These are set out in Section 7 of this report.

5.8 Horizons One Plan

Notified in 2007, the One Plan is the 'one stop shop' resource management planning document for the Horizons Region. It combines the Regional Policy Statement, Regional Plan and Coastal Plan. The One Plan defines how the natural and physical resources of the region, including freshwater, air, productive land and natural ecosystems, will be cared for and managed by the Regional Council in partnership with Territorial Authorities and the community.

The One Plan is separated into two parts as follows:

- Part I is the Regional Policy Statement. It sets out regionally significant resource management issues, and outlines objectives, policies and methods that will address them.
- Part II is the Regional Plan, which includes the rules for natural and physical resource use in the region.

5.8.1 Horizons One Plan Part One

Appendix 3 contains an assessment of the proposed activity against the relevant objectives and policies in Part 1 of the One Plan.

The proposed activity is consistent with these statutory provisions on the basis that the effects on the environment will be minor.

5.8.2 Horizons One Plan Part Two

The proposed activity has been assessed against the provisions of the Horizons One Plan. The trail development process will involve the following activities which are regulated through the One Plan. The proposed activities and relevant One Plan rules are set out below in Table 5.

Activity	Description	Relevant One Plan Rules	Activity Status
Earthworks	Land disturbance adjacent to waterways.	LF Land R8 vegetation clearance and land disturbance due to activities not able to meet LAND-R6 or RP-LF-LAND-R7	Discretionary Activity
Bridges and Structures over waterways	Eleven bridges will be developed over the Mangawhero Awa and its tributaries.	LF-AWBD-R54 Structures* and disturbances involving a reach of river* or its bed* with RP-SCHED2 Values of Natural State, Sites of Significance - Aquatic and Sites of Significance – Cultural Within a reach of river^ or its bed^ with a Schedule B Value of Natural State: The erection, placement or extension of any structure^ in, on, under or over the bed^ except for lines, cables and ropeways that are suspended above the water^ and do not require a support structure^ in, on, over or under the bed^ of the river^	Discretionary Activity

TABLE 5 PROPOSED ACTIVITIES AND ASSOCIATED ONE PLAN RULES

As noted above, indigenous vegetation clearance will take place within conservation lands and are therefore exempt from the Regional Plan. Appendix 8 of this report does however contain a comprehensive Assessment of Ecological Effects carried out by Wildlands (Wildlands 2024). Wildlands 2024 concludes that the Implementation of appropriate planning, design, construction, and ongoing management, will ensure that potential adverse ecological effects can be avoided or reduced to minor or less than minor[8].

[8] Pg 60 Wildlands 2024

5.8.3 Earthworks

Rule LF LAND R8 relates to vegetation clearance and land disturbance that does not comply with rules LAND-R6 or RP-LF-LAND-R7 and is specifically triggered due to the proposed earthworks associated with the construction of the proposed bridges, being within 5m of a bed of a permanently flowing river and adjacent to wetlands.

Information on the nature of these earthworks and the associated Erosion Control and Sediment Plan is set out in the attached Construction Management Plan (Appendix 12).

Wildlands 2024 (Appendix 8) notes that the removal of indigenous vegetation, earthworks along the proposed alignment, and installation of bridges and boardwalks may lead to increased potential for sediment run-off during heavy rain events[9].

Section 11.7.1 of Wildlands 2024 sets out several trail construction and maintenance guidelines to be employed through the development and management of the trail. These include the following:

1. An Erosion and Sediment Control Plan should be prepared and implemented for the proposed trail. A Contaminant Management Plan should be prepared for the management of hazardous substances and any spills associated with the trail.
2. A distinct focus on minimising adverse effects from erosion will be needed for wetlands, rivers and streams, and low-stature vegetation and/or bare ground within alpine areas, including lahar landforms, both during and following trail construction.
3. Detailed guidelines for reducing erosion and sediment run-off are provided in the Department of Conservation's guidelines for cycle track construction and maintenance.

Trail development and management will include those practices to ensure that the erosion effects from the proposal are less than minor.

5.8.4 Bridges

The proposed trail will involve the development of bridges and boardwalks that will be constructed over or adjacent waterways and wetlands. Locations, detailed designs and construction methods are set out in Appendix 12. The bridge designs are typical of walking and cycling bridges used in other parts of the conservation estate throughout Aotearoa. Geotechnical and hydrological assessments have been undertaken at key bridge locations to ensure the proposed sites are physically suitable for the construction and ongoing presence of the proposed bridges. This Geotechnical Assessment is attached to the CMP in Appendix 12.

All bridges will be bank to bank with no disturbance of river beds.

All bridges will be inspected every six years by qualified engineers to ensure they meet appropriate DOC and Building Act standards.

Construction of the bridges and boardwalks will ensure that there is no sediment entering waterways or wetlands.

As discussed in Appendix 12 the boardwalks will be constructed out of FRP to reduce the disruption to wetlands.

5.9 Ngāti Rangi Claims Settlement Act 2019 – Te Waiū-o-Te-ika

Te Waiū-o-Te-Ika is a legal framework for the Whangaehu River catchment from Te Wai ā moe to the sea, incorporating its tributaries and all its physical (including mineral) and metaphysical elements, as an indivisible and living whole. The framework focuses on recognising, promoting, and protecting the health and wellbeing of

[9] Page 44 Wildlands 2024

the awa, and the intrinsic relationship of Ngā Iwi o Te Waiū-o-Te-Ika with the awa and the responsibility of those iwi to care for, protect and use the awa in accordance with thier kawa, tikanga, and ritenga.

A full assessment of the proposal against Te Waiū-o-Te-Ika Ngāti Rangi can be found in Appendix 11. This assessment concludes that the establishment of the proposed trail will result in renewed and enhanced connection and kaitiakitanga which benefits health and wellbeing – physically, spiritually, culturally, and economically. Placing the taiao at the forefront of decision-making minimises the degradation of mouri of the waterways and enables improvements in the ecology and mouri of the surrounding areas by providing better opportunities for pest control. The combined effect is raised individual and community inspiration, sustenance, prosperity, and growth now and for future generations. Holistically speaking, as the mouri of the taiao and mana of individuals and communities will be enhanced, the mana of Te Waiū-o-Te-Ika will be uplifted.

The outcomes of the development of the proposed areas of Te Ara Mangawhero entwine as an integrated management approach to uphold the intrinsic values that represent the essence of Te Waiū-o-Te-Ika, therefore giving effect to Te Mana Tupua and Ngā Toka Tupua.



6 Consideration of Other Relevant Matters

The following are relevant to the determination of the appropriateness of the proposed development.

6.1 Ngāti Rangi Taiao Management Plan, 2014

An assessment of this proposal against the Ngāti Rangi Taiao plan has been developed by Ngāti Rangi and can be found in Appendix 7. This assessment notes the following:

The Te Ara Mangawhero route has been designed to maximise the use of previously disturbed sites/areas and to avoid and minimise the potential for adverse effects on intact indigenous ecosystems. To respect the sensitive nature of the natural landscape the trail construction methodology is based on the wellbeing of the taiao. New opportunities for the control of pest plants and pest animals to complement existing conservation management in the local area will result from the establishment of the trail. The aim is to build a sustainable trail that blends with the environment, has minimal impact, resists erosion through proper design, and enhances the mouri of the area.

The trail will traverse and showcase a wide range of ecologically and culturally significant forest and river margin habitats on the lower slopes of Ruapehu. Positioning of interpretation is crucial not only to add to the trail experience but also in providing an opportunity for important natural, cultural and historical korero associated with the land and the trail to be told. Enabling recreational access will create connection, health and wellbeing benefits, and enable greater environmental and conservation outcomes.

6.2 Other Strategic Documents

The proposed trail has been recognised through the Accelerate 25 Growth Prosperous Manawatu and Whanganui document and the 2017 Ruapehu Regional Visitor Development Plan. In both instances the proposed trails have been identified as important initiatives for the region.

The Manawatū Whanganui Economic Action Plan (2016) identified tourism as the critical Ruapehu growth opportunity. Ruapehu is a destination with the natural 'greater outdoors' and nature-based resources, landscapes and assets sought by visitors. The location has good proximity to over three million New Zealanders and is favoured by many New Zealanders as a holiday location of choice, especially for those who are interested in outdoor activities. Ruapehu is also close to the international gateways of Auckland and Wellington Airports.

The proposed trails have been identified in the Ruapehu Regional Visitor Development Plan as one of the five iconic destination-growing and experience investments of immediate importance. These projects are considered by the Ruapehu 400 organisation as capable of delivering substantial regional economic development benefits to Ruapehu and the surrounding areas. The Plan identifies that the proposed trails are likely to result in increased jobs (through trail construction and direct and indirect servicing of users), social inclusion through effective training (as there will be a key focus on developing a local workforce) and enabling Māori to realise their full potential through significant participation in the trail development, operation and servicing.

7 Assessment of Environmental Effects

The matters that must be addressed pursuant to Clauses 6 and 7 of Schedule 4 of the Resource Management Act 1991 are detailed below.

The proposed development is considered to raise the following actual or potential effects on the environment:

- Positive Effects;
- Effects on Landscape and Visual Character;
- Effects on Ecology and Indigenous Vegetation;
- Effects on Recreation and Use
- Effects on Historic Values
- Effects on World Heritage Values

In assessing the actual or potential effects on the environment from the categories listed above, reliance has been placed on the various supporting reports and assessments as outlined throughout the application.

7.1 Positive Effects

The proposal is considered to result in positive effects as set out below:

7.1.1 Recreation Opportunities

There are significant recreation opportunities associated with the development of the trail through trail use. The 2020 Feasibility Assessment for the trail identified that about 7,818 locals are expected to use the full trail in the year after it is completed, increasing to 10,546 by year 10. By year 5, about 35,065 New Zealanders from outside the region are expected to ride the trail, increasing to 40,913 by year 10. Note that these figures are for the full completed trail. The presence of the completed trail will enable approximately 41,000 people to use the trail for outdoor recreational purposes by foot and on bike.

Sections 8 and 9 will form part of the Round the Mountain (RtM) track. The RtM track is a very popular multiday walk. Currently walkers have to walk 3km on the side of the Ohakune Mountain Road between Mangaehuehu and Mangaturuturu Huts. As well as making the walk safer for users it will also improve the experience so that track users can experience the alpine environment where the trail is proposed. Where the TAM will intersect the existing RTM trail barriers and signage will be erected at that intersection to ensure that people on bikes do not stray onto the walking track.

The section of trail leading to the Mangawhero Falls trail will be upgraded, through the removal of stairs and addition of boardwalks to make it a more accessible trail. This trail is popular with people making the short 200m walk to view the falls. Currently the trail has stairs (eroded in places) which makes it difficult for people with disabilities to access. The proposed upgrades in this location will make it suitable as a shared use trail but will also be able to make the short trail more accessible to people with disabilities. Signage will also be erected to ensure that people on bikes are aware of all users.

7.1.2 Tourism and Economic Development

The Manawatū Whanganui Economic Action Plan (2016) identified tourism as the critical Ruapehu growth opportunity. Ruapehu is a destination with the natural 'greater outdoors' and nature-based resources, landscapes and assets sought by visitors. The location has good proximity to over three million New Zealanders and is close to international gateways located at the Auckland and Wellington Airports.

The proposed trails have been identified in the Ruapehu Regional Visitor Development Plan as one of the five iconic destination-growing and experience investments of immediate importance. These projects are

considered by the Ruapehu 400 organisation as capable of delivering substantial regional economic development benefits to Ruapehu and the surrounding areas. The Plan identifies that the proposed trails are likely to result in increased jobs (through trail construction and direct and indirect servicing of users), social inclusion through effective training (as there will be a key focus on developing a local workforce) and they will enable Māori to realise their full potential through significant participation in the trail development, operation and servicing.

The need for these outcomes has grown considerably with the recent closure of two mills in the Ruapehu area. the closure of these mills has meant the loss of 230 local jobs.

7.1.3 Ecological

Wildlands 2024 notes the following potential for positive ecological effects:

The proposed trail will provide excellent opportunities to enhance the ecological integrity of the indigenous vegetation and habitats surrounding the trail footprint. Pest plant and pest animal management plans could be developed and implemented alongside existing conservation actions in the local area. The trail would provide opportunities to increase environmental awareness and connections amongst trail users through the use of interpretation panels etc,

The relative ease of access provided by the trail could improve opportunities for Ngāti Rangi and the local community to engage with conservation activities associated with the trail on the lower slopes of Ruapehu.[10]

7.1.4 Cultural

A cultural assessment undertaken by Ngāti Rangi has been attached to this report in Appendix 7. This report concludes with the following statements in respect to positive effects:

The Te Ara Mangawhero route has been designed to maximise the use of previously disturbed sites/areas and to avoid and minimise the potential for adverse effects on intact indigenous ecosystems. To respect the sensitive nature of the natural landscape the trail construction methodology is based on the wellbeing of the taiao. New opportunities for the control of pest plants and pest animals to complement existing conservation management in the local area will result from the establishment of the trail. There are also opportunities to enhance the recovery of indigenous vegetation within previously disturbed areas. The aim is to build a sustainable trail that blends with the environment, has minimal impact, resists erosion through proper design, and enhances the mouri of the area.

The trail will traverse and showcase a wide range of ecologically and culturally significant forest and river margin habitats on the lower slopes of Ruapehu. Positioning of interpretation is crucial not only to add to the trail experience but also in providing an opportunity for important natural, cultural and historical korero associated with the land and the trail to be told. Enabling recreational access will create connection, health and wellbeing benefits, and enable greater environmental and conservation outcomes.

7.2 Ecological and Conservation Effects

A detailed assessment of ecological effects for the proposed Phase 2 section has been prepared by Wildlands and can be found in Appendix 8. In addition to identifying effects Wildlands (2024) identifies options to avoid or minimise potential adverse effects.

The wider project area for Phase 2 is of exceptional ecological value. Tongariro National Park is recognised as a World Heritage Site for its international cultural, ecological, and landscape significance. The proposed trail will traverse through tall old-growth podocarp forest at lower altitudes, to mountain beech forest (with local

[10] Page 60 Wildlands 2024

wetlands), gradually decreasing in stature to mountain beech krummholz scrub at treeline; above which there are subalpine and alpine tussock shrublands and sparsely-vegetated gravelfields. Volcanic processes, specifically lahars, have contributed to the diversity of vegetation communities that are present alongside the Mangawhero River. A range of Threatened and At Risk indigenous plants and fauna species (including the At Risk forest ringlet butterfly, pekepeke/bats, North Island kākā and North Island brown kiwi, and indigenous lizards) occur within the project area.

Guided by Ngāti Rangi, an over-arching aim is to ensure that construction and ongoing maintenance of the trail is undertaken in a manner that ensures te taiao (the environment) is protected, preserved, and enhanced. This vision for te ao Tūroa (the environment of southwestern Ruapehu) will ensure that the project is developed in a considerate manner, with a major focus on recognising the cultural and ecological importance of the surrounding indigenous habitats and aquatic environments.

An iterative approach has been taken to selection of the trail alignment, to minimise disturbance and avoid damage to high value and vulnerable ecosystems. The alignment will avoid clearance of larger indigenous trees (>15 centimetres dbh), mountain cutty grass (Gahnia procera), and Threatened or At Risk plants. This will assist greatly with reducing potential adverse effects on indigenous fauna. The trail has also been aligned to minimise disturbance of river margins, and wetland and alpine habitats, including those associated with the stabilised mid-Holocene lahars. Boardwalks are to be used in wetland and alpine areas, and to provide protection for vulnerable tree roots. This will result in notably less ecological effects than a compacted gravel trail. Use of sensitive construction techniques, track margin rehabilitation methods, and sediment management will be very important, in particular to avoid adverse effects on aquatic fauna and whio at the four proposed crossings of the Mangawhero River. Current best-practise protocols are to be followed for managing any incidental discoveries of pekapeka/bats (including roosts), indigenous birds (including nests, eggs, and chicks), and lizards (including the invasive plague skink). Implementation of appropriate planning, design, construction, and ongoing management, will ensure that potential adverse ecological effects can be avoided or reduced to minor or less than minor.

7.3 Cultural Effects

A cultural assessment undertaken by Ngāti Rangi has been attached to this report in Appendix 7. This report concludes with the following statements:

Ngāti Rangi has been proactively involved with Te Ara Managwhero since its inception. Given we will be responsible for construction and kaitiakitanga of ongoing management and maintenance we are satisfied cultural impacts have either been mitigated or can be managed.

We won't speak on other tribes' behalf, yet we acknowledge the interests of our whānaunga. Given the location for the development of Te Ara Mangawhero, Ngāti Rangi deems it appropriate for Ngā Waihua o Paerangi Trust to apply for approvals to build, manage and maintain the trail.

On this basis it is considered that the proposed trail is appropriate to be developed in respect to the important cultural values of the site.

7.4 Recreation Effects

The recreation effects associated with the development of the trail were considered during the partial amendment of the TNPMP which identified the trail in the Plan. That assessment informed the decision to amend the TNPMP and provide for the development of a shared use trail.

The effects on existing recreation users in the Park have been considered in the design of the trail. As noted above, overall the recreation effects are expected to be positive, however there are potential conflict issues that could arise. This conflict could be between users of the proposed trail and users of existing walking trails where they overlap.

These conflicts can be addressed through a combination of trail design and signage. The proposed alignment of the trail has prioritised generally good sightlines along most of the trail. Trail users will have good visibility of other users who may be travelling along the trail in the same or opposite direction. The easy grade of the trail means there will be a low gradient and a generally wide trail which will enable passing and facilitate multidirectional use. This is an important factor as it means users are expecting to encounter others, generally altering their behaviour so they are using the trail in a more cautionary manner.

Long areas of boardwalks will have 'rest areas' where trail users can move off the trail to let others pass.

The nature of the trail and the surrounding environment is also conducive to positive use. As an easy-intermediate grade trail with high scenic qualities, the trail provides for a more relaxed rider approach rather than a faster experience that may be found on purpose-built mountain bike trails. This is similar to other parts of the M2C trail and also a similar experience to that found on the Timber Trail.

It will be important for signage to be placed at key parts of the trail, including junctions, to reinforce the status of the trail as shared use, and reminding all users to share with care. Signage will be couched in positive terms to facilitate positive use.

Section 9 of the trail will be shared with the Round the Mountain Trail. That section of the RTM is currently on the Ohakune Mountain Road. Removing the 3km section of the trail from the road will significantly enhance the user experience of walkers using the trail.

A toilet will be developed at the bottom of the Old Blyth Trail. This is an approximate midpoint for the wider trail and provides a suitable stopping point for those who are walking or biking the trail. Toilets are also proposed at Massey Flat to be used by trail users (including RTM users). There are also toilets at Turoa Skifield and on the OMR at the entrance to the Park and Trail as well as located at the campground. These toilets are considered adequate to cater to users of the trail.

The mixed use aspect of the trail and safety for users is discussed, with specific reference to the Old Blyth Trail, in section 5.2.4. In addition to that discussion, it is noted that the proposed trail will increase the use of that trail. It is acknowledged that this will represent a significant change in the character and experience associated with that trail by current users. The physical works proposed to the trail will mean that it will become a front country experience able to be completed by users with a much wider experience base. These works will address the current erosion issues on the trail resulting in a more accessible and maintained asset. The trail will be busier, with user numbers anticipated to increase from 2.7 users per day to 57 in the first year after opening. Again, this represents a significant change of experience to existing users, however it is considered to be an experience which is fit for purpose for a front country trail that is located adjacent to a busy road and settled area. It will also result in a significant increase in the number of people recreating within this area.

Investment in the Old Blyth Trail will also enable the ongoing use of the trail well into the future. The present condition of the Blyth track varies from good to virtually walking in an entrenched wooden-bottomed (corduroyed) stream with numerous awkward 'step-downs' where the water has scoured out deep holes. Large sections of the track are entrenched and boggy with no or inadequate side drainage so that run-off literally runs down the track especially in the lower 3km. With no proposed investment in this trail, its condition is expected to deteriorate over time which would further reduce use of the trail.

Additional development is proposed by Ngāti Rangi at the start of the trail as part of their Southern Gateway project. This will not only lead to the development of a cultural hub at that location but also provide a more formal gateway and associated parking and transport etc facilities at the start of the proposed trail. This project is being progressed in parallel to the proposed trail and is being planned in a collaborative fashion with the Department. That project will be progressed via separate permissions as they fall outside of TNP.

Overall the proposed trail will have positive impacts on the recreation values of the area by enhancing recreation assets and increasing the number of people recreating at place.

7.5 Landscape and Visual effects

A landscape assessment was undertaken by the Isthmus Group (Isthmus 2024) and is attached as Appendix 9. Isthmus 2024 assesses the proposed trail development's effects on the natural character, landscape and visual amenity values of the site and the wider landscape setting. The specific effects considered by the assessment are:

*a) **Natural Character** effects*

i. Effects on the natural character of wetlands

ii. Effects on the natural character of the Mangawhero River and its margins

*b) **Landscape** effects:*

i. Overall effects on landscape

ii. Effects on landscape values associated with Tongariro National Park ONFL and World Heritage Site

*c) **Visual Amenity** effects:*

i. Effects on public views within the immediate, localised and wider setting of the site; including:

a) Views from crossing points (where the trail alignment crosses an existing road or track)

b) Views from Ohakune Mountain Road

c) Views from the wider setting (Ohakune settlement)

*d) **Construction** Effects*

*e) **Cumulative** Effects*

The assessment considered the specific characteristics of the site which contribute to these wider values, and identified key aspects of the project which will influence the nature and extent of adverse effects:

- Vegetation removal and required earthworks, as influenced by the alignment, required path standards (width) and the sequencing of path types. The project shaping and ground truthing related to these aspects is described within the project description.
- Measures that retain existing patterns of hydrology, including for wetland areas and in the design for river crossings.
- The design detail of individual trail types and bridges, including such matters of scale, colour and materials used and their make-up, number of components and their connections as well as the transitions between

trail types. These details will influence both the overall fit of the trail within the wider landscape and, at a finer grain, the physical and visual 'footprint' and its dominance; as is relevant to natural character, landscape and visual amenity effects.

Isthmus (2024) identified that Mount Ruapehu and the broader Tongariro National Park ONFL have significant landscape and ecological values including those connected to whakapapa, creation narratives and ongoing association for mana whenua and other iwi

The assessment concluded that on assessment against the natural character, landscape character and visual amenity values of the site, and the proposed development will result in:

- No more than Low adverse effects on the natural character of wetlands along the alignment.
- No more than Low adverse effects on the natural character of the Mangawhero River margins.
- Low positive effects on the landscape values.
- Effects on the Tongariro National Park Outstanding Natural Landscape values are appropriate.
- No more than Low adverse effects on visual amenity.
- No more than Low adverse construction effects.
- The project will not result in cumulative effects.

The proposed alignment has been developed to avoid and minimise adverse effects. The National Park is well suited for the proposed trail. Any natural character, landscape or visual amenity effects arising from the proposal on the receiving environment are appropriate.[11]

7.6 Historic Effects

The proposed trail has been assessed by Neville Ritchie who is a Senior Heritage Advisor with the Department of Conservation. This assessment included a field inspection on 10 June 2024. Paul Mahoney, a Senior Heritage Advisor with the Department of Conservation, also attended this inspection. A copy of Mr Ritchie's report can be found in Appendix 10.

Mr Ritche's report focussed on the effects of the proposed trail on the Old Blyth Track, especially the many intact sections of corduroying along the route. In respect to the potential effects on the Old Blyth Track, Mr Ritchie concludes the following:

A comparative analysis has revealed that Blyth track is the premier historic corduroyed pack track and walking track in New Zealand but because of the deficiencies outlined above[12] the route is in poor condition now and can be expected to get worse in future.

The key feature is the extensive corduroying which gives the track its special character. Given its historic significance, it is desirable that a good portion of the better sections are retained.

To ensure that the special character of the Old Blyth Trail is retained, Mr Ritchie recommends the following:

1. *Where there are good sections of relatively flat corduroying build the TAM to one side of the corduroying by metaling or boardwalk construction and let runoff continue to run down the corduroying as at present which seems to be both preserving the timber and keeping it free of vegetation growth. These should not be a few token short sections but some good long photogenic and representative sections each minimally c100m in*

[11] Page 46 Isthmus 2024

[12] As set out on Page 29 of Mr Ritchie's report

length. These sections should be identified prior to the trail being developed and inspected by a suitably qualified and experienced archeologist. They will retain the historic character of the upgraded track, and users will be able to see and appreciate long sections of the corduroying more or less as they were laid.

2. *Build the proposed FRP boardwalks over the sections of corduroying where there are changes of elevations and scoured holes. The corduroying will be 'preserved' under the boardwalks and users will see sections of it either by looking through the boardwalks or sticking out to the sides.*
3. *A film and photographic record should be made of the Blyth track as it exists now as a record and for future story-telling.*
4. *As noted not far off the lower end of the Blyth track is the site of a conscription evaders hut. The collapsed remains of the hut don't warrant creating a side track to it but an interpretation panel beside the TAM telling the story about conscientious objectors would be another point of visitor interest on the TAM.*

Recommendations one to three have been reflected in the CMP and will be part of the process to develop the trail. Recommendation four will be discussed further with mana whenua as part of the development of the story telling strategy as whether it is considered an appropriate story to be told on the maunga.

7.7 Water Quality and effects on the awa

The ecological assessment (Appendix 7) identifies potential effects on waterways and aquatic habitat of the proposed development as follows:

"Erosion and sedimentation could have major ecological effects but, with appropriate construction techniques and management, these effects can be reduced to no more than minor."

The ecological assessment recommends a number of opportunities to avoid or minimise potential adverse ecological effects in section 11. These include minimising erosion and sediment run-off and effects on aquatic fauna. These 'opportunities' have been referenced in the CMP to ensure that there are no effects on the awa.

7.8 World Heritage

Tongariro National Park is one of only 29 sites in the world with dual World Heritage status. In 1990 it received World Heritage status for its natural landscape values and in 1993, under a criteria change, the special significance of the Park's mountains and cultural landscape to the Tūwharetoa and Whanganui people was recognised.

Normally, proposals within World Heritage sites are assessed against the 'statement of universal values' for the site, however the statement for this site is still being developed. In these circumstances, the proposal will need to be assessed against the values as described at the time of nomination and the natural and cultural criteria under which these sites have gained status. These are contained in the following two nomination documents:

Nomination of Tongariro National Park New Zealand for inclusion in the WORLD HERITAGE LIST, prepared for the World Heritage Committee by the Department of Lands and Survey, New Zealand, December 1986.

- Nomination of Tongariro National Park by the Government of New Zealand for inclusion in the WORLD HERITAGE CULTURAL LIST, May 1993
- Where proposals have the potential to impact on the values of World Heritage sites, the proposal needs to be referred to the World Heritage Centre.

On review of the World Heritage nomination documents, the values the Park was nominated for are the volcanic landscapes in the Park and the significant cultural associations and importance of the mountains to

Māori. Assessments would be undertaken of the cultural, landscape and ecological values of the Park to understand the potential impact of the proposal on these values that make the Park globally important.

The development of the trail is likely to have a very localised visual effect and would not impact on the macro landscape features of the Park. Given the scale of the work proposed, the development will not have a large visual impact greater than any other trail in the Park.

The Applicant does not anticipate that the trail will adversely impact on the important iwi values and associations. This is primarily due to the involvement of local iwi throughout the process, including in route selection.

The trail will still need to be developed in a manner that respects iwi values, so a cultural impact assessment is recommended as part of the works approval process. The storytelling component of the trail provides an opportunity for local iwi to tell their stories first hand, allowing users of the area to have a better understanding of the important cultural values that are recognised by the Park's World Heritage status.

It is important to note that UNESCO advocates for buffers to World Heritage sites to ensure that adjacent development does not impact on the values that make these locations important[13]. The decision not to widen the carriageway of the Ohakune Mountain Road to accommodate walkers and bikers has meant that environmental damage to an area surrounded by the World Heritage area has been avoided.

7.9 Use of Helicopters

The use of helicopters is not likely to have any associated adverse effect on the values of the Park or on other park users. From time to time, Helicopters will be visible from the Ohakune Mountain Road and will be active on the Old Blyth Track, transporting materials. This will result in additional noise etc during the times when the machines are active. Unlike daily scenic flights, this will not be an ongoing activity. Helicopters are required to develop a public recreation asset.

The actual flight paths of these machines will be confirmed closer to the point of construction. It is anticipated that the project manager will actively work with local DOC staff on this matter.

7.10 Effects Summary

Overall, the adverse effects of the proposal are expected to be minor. The activity has the potential to result in positive effects on ecological values, to enhance the recreational offerings, and to enable social and economic effects to ensue.

[13] World Heritage Papers 25. World Heritage and Buffer Zones: International Expert meeting on World Heritage and Buffer Zones. Davos, Switzerland March 2008.

8 Consultation and Engagement

There has been significant engagement by the Applicant with key stakeholders throughout the planning and design of this development. The following section sets out the nature of this engagement.

Letters of support from stakeholders can be found in Appendix 12.

8.1 Iwi

The following iwi have associations to this area and have been engaged with throughout the planning for the trail and the development of the permissions applications.

8.1.1 Ngāti Rangi

Ngāti Rangi as Applicant supports the development of the trail.

8.1.2 Ngāti Uenuku and Ngāti Haua

The applicant has been engaging with both Ngāti Uenuku and Ngāti Haua in the development of this project and neither have indicated that they are opposed to the project. They will provide feedback directly to the relevant statutory authority.

8.2 Department of Conservation

Ngāti Rangi has worked with the Department of Conservation throughout the development of these applications. This has included weekly hui with local DOC staff to update them on the progress of the project and planning.

A summary of engagement with the Department is set out in Appendix 2.

8.3 Other Parties

The project team has also kept representatives from UNESCO World Heritage, Forest and Bird New Zealand, Project Tongariro, the Tongariro Tramping Club and the Federated Mountain Clubs up to date on the project. This has included providing them a copy proposed route of the trail and seeking their feedback.

These parties were opposed to all or part of the partial review of the TNPMP that enabled the consideration of the TAM to be developed. A summary of the feedback received from these parties is set out in Appendix 2.

While Federated Mountain Clubs are supportive of the proposed trail, there are concerns held by the other groups relating to the development of a bike trail in an alpine area, the impacts of the trail on the natural values of the location and risk to users of the Old Blyth Trail. In respect to the development of a mountain bike trail in the proposed location, the suitability of that has been determined through the partial plan change process. The presence of a shared use trail (which is different from a mountain bike specific trail) in the location proposed is consistent with the TNPMP. As noted in Section 5.2, the appropriateness of the development of a trail for the use of bikes has been established. These effects have been front of mind in the design process for the trail and are considered by ecological and landscape experts. Those experts have concluded that the effects of the trail will be minor or less than minor.

The mixed use aspect of the trail and safety for users is discussed, with specific reference to the Old Blyth Trail, in section 5.2.4. In addition to that discussion, it is noted that the proposed trail will increase the use of that trail significantly. It is acknowledged that this will represent a significant change in the character and experience associated with that trail by current users. The physical works proposed to the trail will mean that it will become a front country experience able to be completed by users with a much wider experience base. These works will

address the current erosion issues on the trail result in a more accessible and maintained asset. The trail will be busier with user numbers anticipated to increase from 2.7 users per day to 57 in the first year after opening. Again, this represents a significant change of experience to existing users, however it is considered to be an experience which is fit for purpose for a front country trail that is located adjacent to a busy road and settled area. This change will increase the recreation value of the trail to a wider group of people.



9 Notification

As noted in Sections 4 and 5 of this report, the concept of a shared use trail in this location was publicly discussed through the partial review of the Tongariro National Park Management Plan. That process included a public submission process and public hearings. That process essentially agreed the concept of the trail while this application looks at the detail of the trail development and management and associated effects.

9.1 Concession Notification

The Conservation Act 1987 section 17SC specifies that the Minister must publicly notify every application for—

1. (a) A lease; or
2. (b) A licence for a term (including renewals) of more than 10 years.

As the application is for a period of greater than 10 years it must be publicly notified by the Department.

9.2 Works Approval Notification

As the proposed physical works result in permanent infrastructure over 100m^2 and are outside of the amenities area then the approval needs to be considered as a 'major' application as per policy 4.1.16.3 of the TNPMP. As the application is of a scale which necessitates the development of an EIA then it will have to be notified as per policy 4.1.16.9 of the TNPMP.

9.3 Resource Consent Public Notification

Under Section 95A of the RMA the resource consent application is not precluded from public notification.

Section 95A specifies that a consent application must be publicly notified if it is required to be publicly notified by the District/Regional Plan or a rule in a NES, or the Council decides that the activity will have or is likely to have adverse effects on the environment that are more than minor (in accordance with Section 95D), or the Applicant requests public notification. The Applicant is not requesting public notification and public notification is not required by the Regional Plan or a NES rule.

Section 95D(a) requires Council to disregard any effect on persons who own or occupy land on which the activity will occur or any land adjacent to the subject site. Also Section 95D(b) allows Council to disregard the effects related to the permitted baseline.

As discussed in Section 7 of this report, it is considered that the effects of the proposal are less than minor. There are no special circumstances that necessitate public notification and public notification will be undertaken by the Department of Conservation for the concession and works approval applications.

9.4 Resource Consent Limited Notification

Section 95B specifies the criteria for limited notification of resource consent applications. The proposal is not precluded from limited notification by the Regional Plan or a NES rule.

Under Section 95E Council must determine whether any persons are affected, including protected customary rights groups or persons who have a statutory acknowledgment over the area of the proposal. In this instance the Applicant is Ngāti Rangi and the project is to be carried out within an area of importance to Ngāti Uenuku and Ngāti Haua (see section 8.1) who are aware of the proposed development.

Under Section 95E(1) of the RMA a person is considered affected in relation to an activity if the activity's adverse effects on the person are minor or more than minor (but are not less than minor). The proposed development is within Crown land managed by the Department of Conservation and Ruapehu District Council. The interests in these lands and the people who use them is represented by these parties. The view of the Department of Conservation will be through their statutory processes under the Conservation and National Park Acts. As noted above, this will involve a notified process whereby members of the public will be able to provide comment on the appropriateness of the proposed development. The Department's process will be considering the effects of development on ecological (terrestrial and aquatic), historic, cultural and recreational values of the site. Notification of the resource consent application will be duplicating this process and in this case, notification of the application is not considered necessary.



10 Conclusion

A concession, works approval and resource consent are sought by Ngā Waihua o Paerangi Trust for the establishment of phase 2 of the Te Ara Mangawhero shared use trail and associated structures within Tongariro National Park.

This trail will be an extension of the Mountains to Sea Great Ride and a new section of the Round the Mountain Track.

The proposed development has been considered against a number of statutory documents relevant to the permissions sought. This assessment has shown that the proposed development will be generally consistent with the requirements set out in those documents.

A number of technical assessments have also been undertaken and summarised in this report. These assessments note that the effects of the proposed development on the environment and values of the site are anticipated to be minor or less than minor.

We certify that the information contained herein is in accordance with the requirements of the Resource Management Act 1991 and that the Applicant has a legal obligation to comply with any Conditions imposed should the Application be approved and given effect to.

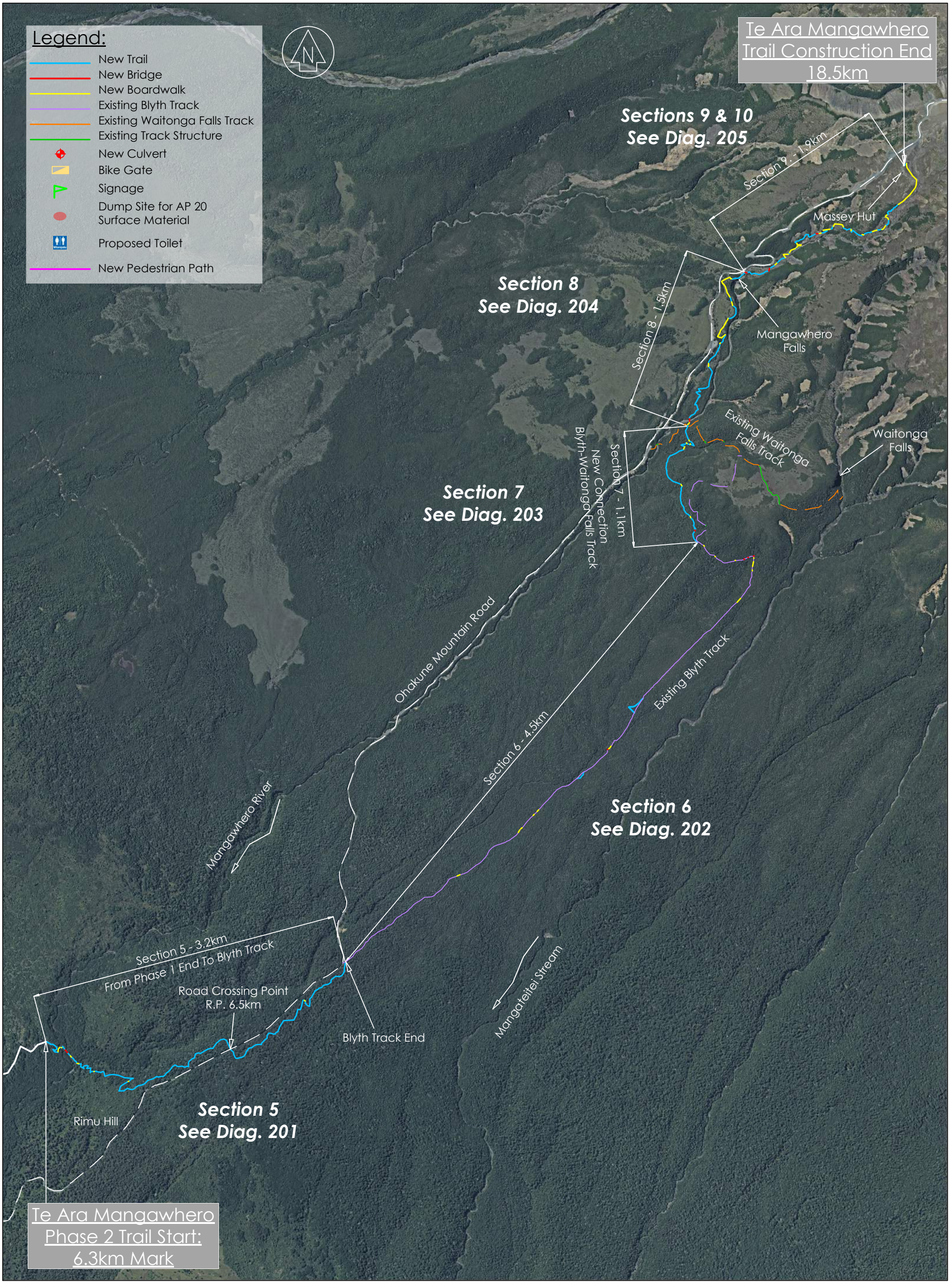
Rowan Sapsford

Roam Consulting Limited

Thursday, 31 October 2024



Appendix 1. Route of Proposed TAM Phase 2



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Rev	Date	Amendment	By	Chk	App
A	12/08/24	First Issue	AJW	DS	DS

Project Title
Ngā Waihua o Paerangi Trust
Te Ara Mangawhero Trail

Drawing Title
Phase Two Construction Trail Sections Overview

Surveyed	D.Sherrit	Sept-Nov 23	DS
Designed	C.J.Olmi	01/12/23	CJO
Drawn	A.White	12/08/24	AJW
Checked	D.Sherrit	12/08/24	DS
Approved	D.Sherrit	12/08/24	DS

Status **INFORMATION**

Scale A3 1:22500 | A3

Drawing Number 210700-200 | Rev A

Legend:

- New Pedestrian Path
- New Trail
- New Bridge
- New Boardwalk
- Existing Blyth Track
- Existing Waitonga Falls Track
- Existing Track Structure
- New Culvert
- Bike Gate
- Signage
- Dump Site for AP 20
- Surface Material
- Proposed Toilet

Section 9
Diag. 205

Section 8
Diag. 204

Section 7
Diag. 203

Section 6
Diag. 202

Section 5
Diag. 201

Waitonga Falls

Road

Mountain

Mangawhero River

Ohakune

Mangateitei Stream

A

B

Locality Plan

Scale 1:50000

Section 5/6 Transition

POWER

Existing Blyth Track Carpark

Turoa Ski Field Power Cable (Ground)

Wharepaku

5.20.W
Boardwalk
8m

5.21

Ohakune Mountain Road

5.18
Ohakune Mountain Road
R.P. 6.5km existing sealed road
New 2 x 300Ø culverts in existing table drains

5.19

225m min. Sight Distance

5.17

250m min. Sight Distance

Turoa Ski Field Power Cable (Ground)

Diag. 201 B

Phase 1
Last Segment
(4.4)

5.4.W
Boardwalk
11m

5.8.B
Mangawhero Bridge
24m

5.5

5.6.W
Boardwalk
3m

5.3

5.7

5.1

5.10.W
Boardwalk
10m

5.9

5.12.W
Boardwalk
12m

5.11

5.2.W
Boardwalk
14m

5.13

5.15

5.14.W
Boardwalk
3m

5.16.W
Boardwalk
5m
(Tree roots)

5.17

Mangawhero River

Ohakune Mountain Road

Rimu Hill

Phase 2
Trail Construction Start:
6.3km Mark

Diag. 201 A

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Rev	Date	Amendment	By	Chk	App
A	12/08/24	First Issue	AJW	DS	DS

Project Title
Ngā Waihua o Paerangi Trust
Te Ara Mangawhero Trail

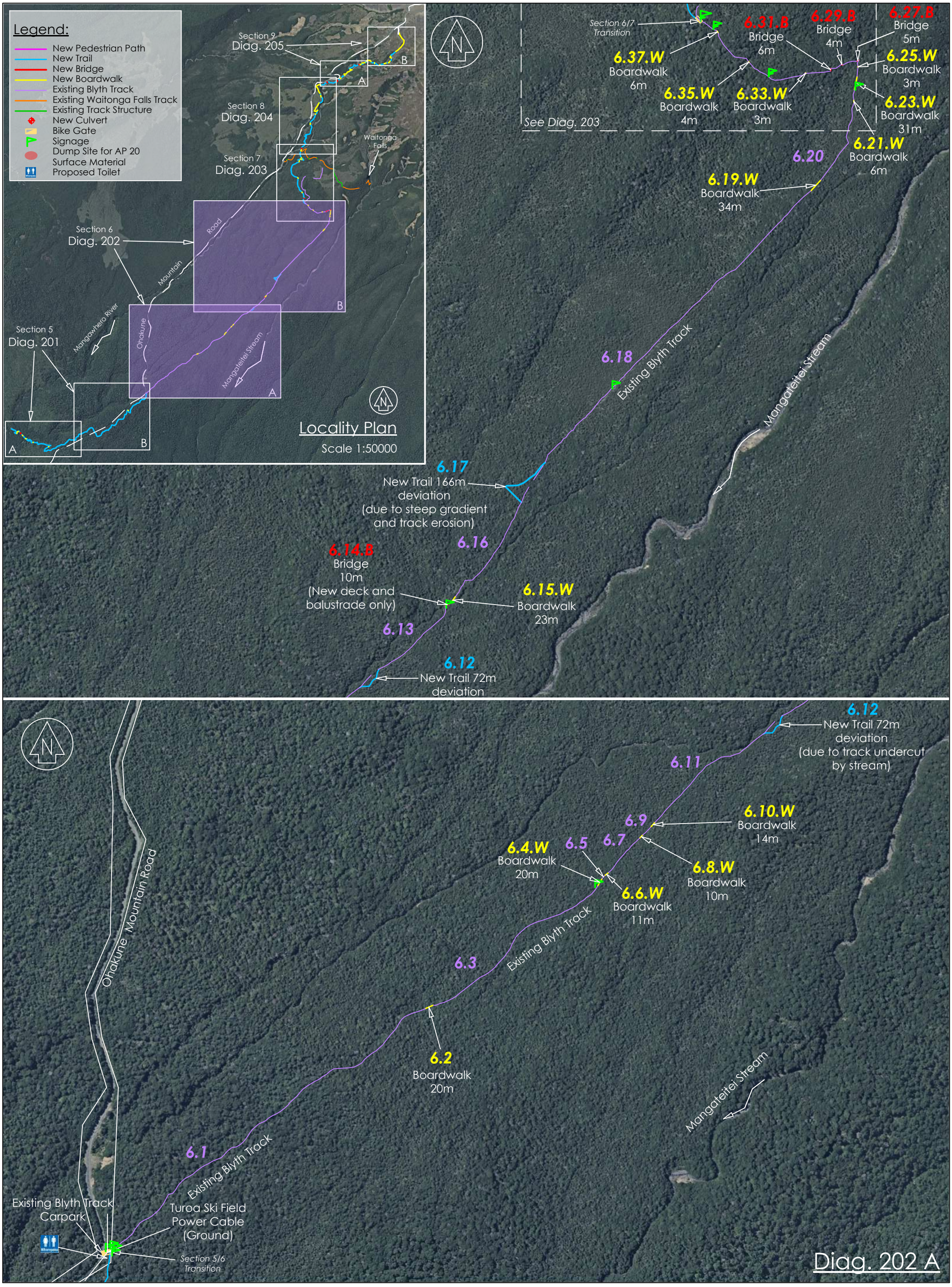
Drawing Title
Phase Two Construction
Trail Section Detail

Surveyed	D.Sherrit	Sept-Nov 23	DS
Designed	C.J.Olmi	01/12/23	CJO
Drawn	A.White	12/08/24	AJW
Checked	D.Sherrit	12/08/24	DS
Approved	D.Sherrit	12/08/24	DS

Status **INFORMATION**

Scale A3 1:4000 | A3

Drawing Number 210700-201 | Rev A



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Rev	Date	Amendment	By	Chk	App
A	12/08/24	First Issue	AJW	DS	DS

Project Title
Ngā Waihua o Paerangi Trust
Te Ara Mangawhero Trail

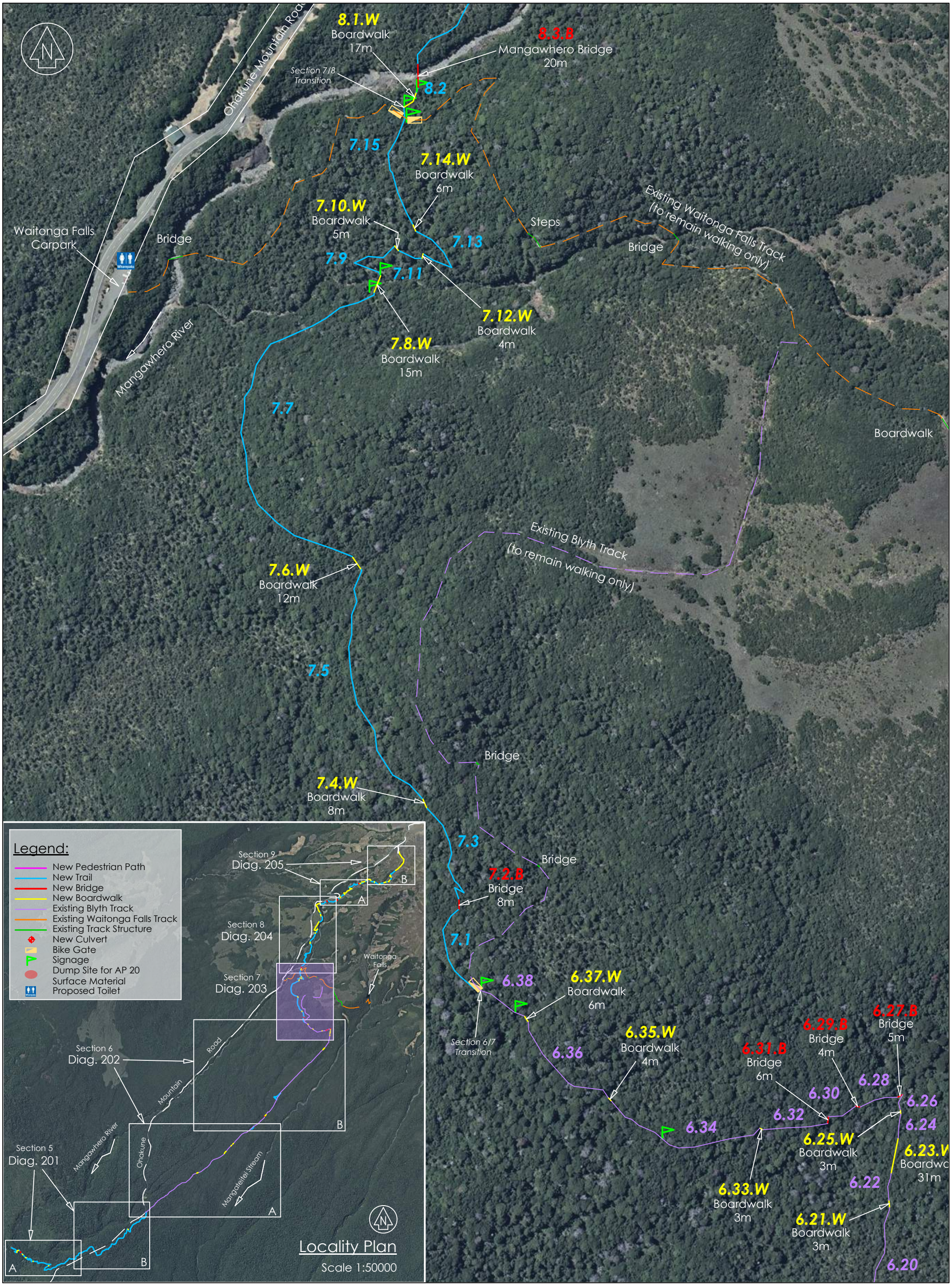
Drawing Title
Phase Two Construction
Trail Section Detail

Surveyed	D.Sherrit	Sept-Nov 23	DS
Designed	C.J.Olmi	01/12/23	CJO
Drawn	A.White	12/08/24	AJW
Checked	D.Sherrit	12/08/24	DS
Approved	D.Sherrit	12/08/24	DS

Status **INFORMATION**

Scale A3 1:8000 | A3

Drawing Number 210700-202 | Rev A



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Rev	Date	Amendment	By	Chk	App
A	12/08/24	First Issue	AJW	DS	DS

Project Title
Ngā Waihua o Paerangi Trust
Te Ara Mangawhero Trail

Drawing Title
Phase Two Construction
Trail Section Detail

Surveyed	D.Sherrit	Sept-Nov 23	DS
Designed	C.J.Olmi	01/12/23	CJO
Drawn	A.White	12/08/24	AJW
Checked	D.Sherrit	12/08/24	DS
Approved	D.Sherrit	12/08/24	DS

Status INFORMATION

Scale A3 1:3000 | A3

Drawing Number 210700-203 | Rev A

Legend:

- New Pedestrian Path
- New Trail
- New Bridge
- New Boardwalk
- Existing Blyth Track
- Existing Waitonga Falls Track
- Existing Track Structure
- New Culvert
- Bike Gate
- Signage
- Dump Site for AP 20
- Surface Material
- Proposed Toilet

Section 9
Diag. 205

Section 8
Diag. 204

Section 7
Diag. 203

Section 6
Diag. 202

Section 5
Diag. 201

Waitonga Falls

Road

Mountain

Ohakune

Mangawhero River

Mangateitei Stream

A

B

Locality Plan

Scale 1:50000

Section 8/9 Transition

Existing steps to be ramped

8.15

9.2

9.1.B
Mangawhero Bridge
14m

8.14.W
Boardwalk
195m

Mangawhero Falls

8.13

8.12.W
Boardwalk
25m

8.11

8.10.W
Boardwalk
174m

Barrier
15m

8.9.W
Elevated Boardwalk
and Barrier
25m

8.8

8.7.W
Boardwalk
7m

8.6

Mangawhero River

Ohakune Mountain Road

8.5.W
Boardwalk
20m

8.4

8.1.W
Boardwalk
17m

8.3.B
Mangawhero Bridge
20m

Section 7/8 Transition

8.2

Existing Waitonga Falls Track

7.15

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Rev	Date	Amendment	By	Chk	App
A	12/08/24	First Issue	AJW	DS	DS

Project Title
Ngā Waihua o Paerangi Trust
Te Ara Mangawhero Trail

Drawing Title
Phase Two Construction
Trail Section Detail

Surveyed	D.Sherrit	Sept-Nov 23	DS
Designed	C.J.Olmi	01/12/23	CJO
Drawn	A.White	12/08/24	AJW
Checked	D.Sherrit	12/08/24	DS
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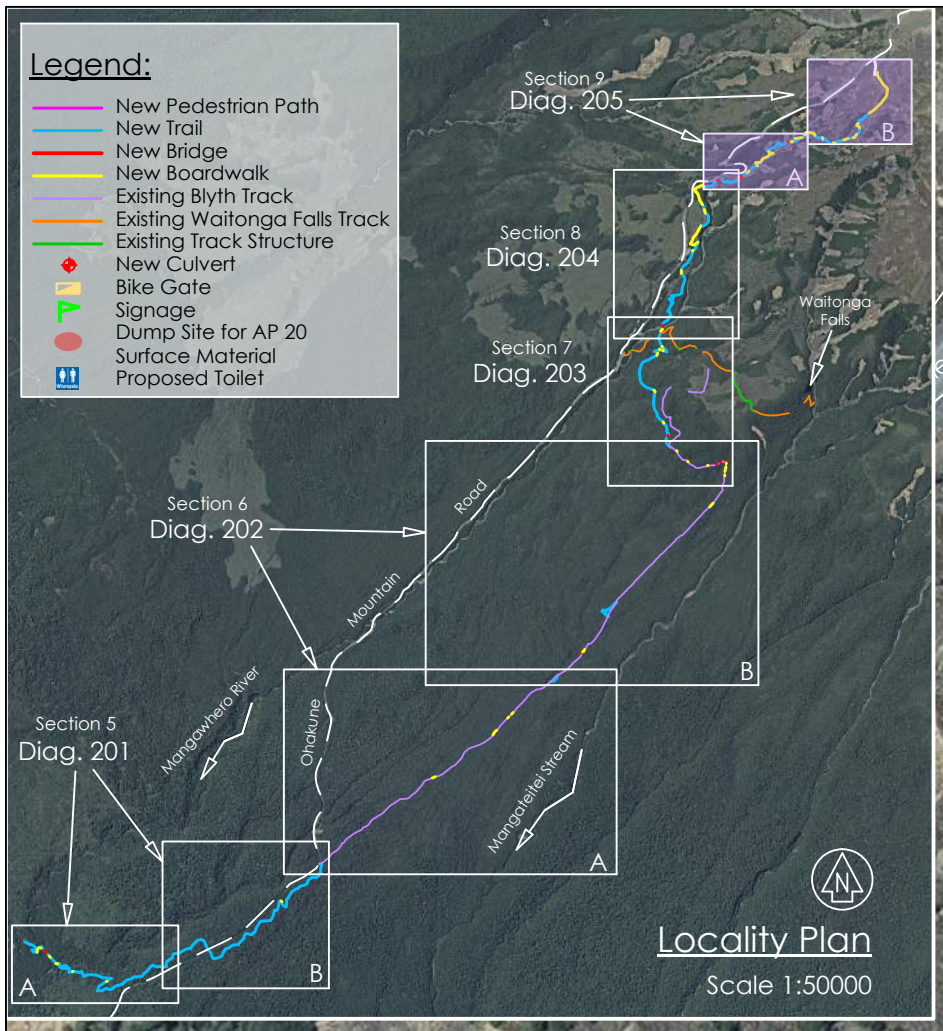
Status **INFORMATION**

Scale A3 1:3000 | A3

Drawing Number 210700-204 | Rev A

Legend:

- New Pedestrian Path
- New Trail
- New Bridge
- New Boardwalk
- Existing Blyth Track
- Existing Waitonga Falls Track
- Existing Track Structure
- New Culvert
- Bike Gate
- Signage
- Dump Site for AP 20
- Surface Material
- Proposed Toilet



Locality Plan

Scale 1:50000

Existing access road (gravel)

Phase 2
Trail Construction End:
18.5km

Massey Hut

Barriered Boardwalk 340m

Mangawhero River

9.32 9.31.W 9.30 9.29.W Boardwalk 46m 9.28 9.27.W Boardwalk 36m 9.26 9.25.W Boardwalk 30m 9.24 9.23.W Boardwalk 12m 9.22 9.21.W Boardwalk 10m 9.20 9.19.W Boardwalk 85m

Diag. 205 B

9.18 9.15.W Boardwalk 13m 9.13.B Bridge 14m 9.16 9.14 9.12 9.17.W Barriered Boardwalk 46m

Ohakune Mountain Road

9.11.W Barriered Boardwalk 85m 9.10 9.9.W 50m Boardwalk with 30m Barrier 9.8 9.7.W Boardwalk 57m 9.6 9.5.W Boardwalk 16m 9.4 9.3.B Bridge 18m 9.2 8.15 9.1.B Mangawhero Bridge 14m

Section 8/9 Transition

Diag. 205 A

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Rev	Date	Amendment	By	Chk	App
A	12/08/24	First Issue	AJW	DS	DS

Project Title
Ngā Waihua o Paerangi Trust
Te Ara Mangawhero Trail

Drawing Title
Phase Two Construction
Trail Section Detail

Surveyed	D.Sherrit	Sept-Nov 23	DS
Designed	C.J.Olmi	01/12/23	CJO
Drawn	A.White	12/08/24	AJW
Checked	D.Sherrit	12/08/24	DS
Approved	D.Sherrit	12/08/24	DS

Status **INFORMATION**

Scale A3 1:2500 | A3

Drawing Number 210700-205 | Rev A



Trail Section Details

Section	Segment	Name	Length (m)	Start Chainage (m)	End Chainage (m)	Description
5	5.1	New Trail	171	6358	6529	
	5.2.W	Boardwalk	14	6529	6543	New
	5.3	New Trail	7	6543	6550	
	5.4.W	Boardwalk	11	6550	6561	New
	5.5	New Trail	10	6561	6571	
	5.6.W	Boardwalk	3	6571	6574	New
	5.7	New Trail	53	6574	6627	
	5.8.B	Bridge	24	6627	6651	New over Mangawhero River
	5.9	New Trail	28	6651	6679	
	5.10.W	Boardwalk	10	6679	6689	New
	5.11	New Trail	60	6689	6749	
	5.12.W	Boardwalk	12	6749	6761	New
	5.13	New Trail	221	6761	6982	
	5.14.W	Boardwalk	3	6982	6985	New
	5.15	New Trail	326	6985	7311	
	5.16.W	Boardwalk	5	7311	7316	New
	5.17	New Trail	1022	7316	8338	
	5.18	New Trail	9	8338	8347	Ohakune Mountain Road intersection
	5.19	New Trail	756	8347	9103	
	5.20.W	Boardwalk	8	9103	9111	New
	5.21	New Trail	474	9111	9585	
6	6.1	Existing formed trail	973	9585	10558	Existing Blyth Track
	6.2	Boardwalk	20	10558	10578	New
	6.3	Existing formed trail	486	10578	11064	Existing Blyth Track
	6.4.W	Boardwalk	20	11064	11084	New
	6.5	Existing formed trail	9	11084	11093	Existing Blyth Track
	6.6.W	Boardwalk	11	11093	11104	New
	6.7	Existing formed trail	108	11104	11212	Existing Blyth Track
	6.8.W	Boardwalk	10	11212	11222	New
	6.9	Existing formed trail	27	11222	11249	Existing Blyth Track
	6.10.W	Boardwalk	14	11249	11263	New
	6.11	Existing formed trail	333	11263	11596	Existing Blyth Track
	6.12	New Trail	72	11596	11668	Deviation
	6.13	Existing formed trail	220	11668	11888	Existing Blyth Track
	6.14.B	Bridge	10	11888	11898	New Deck Only
	6.15.W	Boardwalk	23	11898	11921	New
	6.16	Existing formed trail	277	11921	12198	Existing Blyth Track
	6.17	New Trail	166	12198	12364	Deviation
	6.18	Existing formed trail	890	12364	13254	Existing Blyth Track
	6.19.W	Boardwalk	34	13254	13288	New
	6.2	Existing formed trail	207	13288	13495	Existing Blyth Track
	6.21.W	Boardwalk	3	13495	13498	New
	6.22	Existing formed trail	24	13498	13522	Existing Blyth Track
	6.23.W	Boardwalk	31	13522	13553	New
	6.24	Existing formed trail	22	13553	13575	Existing Blyth Track
	6.25.W	Boardwalk	3	13575	13578	New
	6.26	Existing formed trail	14	13578	13592	Existing Blyth Track
	6.27.B	Bridge	5	13592	13597	New
	6.28	Existing formed trail	34	13597	13631	Existing Blyth Track
	6.29.B	Bridge	4	13631	13635	New
	6.3	Existing formed trail	26	13635	13661	Existing Blyth Track
	6.31.B	Bridge	6	13661	13667	New
	6.32	Existing formed trail	57	13667	13724	Existing Blyth Track
	6.33.W	Boardwalk	3	13724	13727	New
	6.34	Existing formed trail	148	13727	13875	Existing Blyth Track
	6.35.W	Boardwalk	4	13875	13879	New
	6.36	Existing formed trail	104	13879	13983	Existing Blyth Track
	6.37.W	Boardwalk	6	13983	13989	New
	6.38	Existing formed trail	45	13989	14034	Existing Blyth Track
7	7.1	New Trail	90	14034	14124	
	7.2.B	Bridge	8	14124	14132	New
	7.3	New Trail	106	14132	14238	
	7.4.W	Boardwalk	8	14238	14246	New
	7.5	New Trail	227	14246	14473	
	7.6.W	Boardwalk	12	14473	14485	New
	7.7	New Trail	346	14485	14831	
	7.8.B	Bridge	15	14831	14846	New
	7.9	New Trail	67	14846	14913	
	7.10.W	Boardwalk	5	14913	14918	New
	7.11	New Trail	22	14918	14940	
	7.12.W	Boardwalk	4	14940	14944	New
	7.13	New Trail	74	14944	15018	
	7.14.W	Boardwalk	6	15018	15024	New
	7.15	New Trail	110	15024	15134	Intersection with Waitonga Falls Track
8	8.1.W	Boardwalk	17	15134	15151	New
	8.2	New Trail	5	15151	15156	
	8.3.B	Bridge	20	15156	15176	New over Mangawhero River
	8.4	New Trail	509	15176	15685	
	8.5.W	Boardwalk	20	15685	15705	New
	8.6	New Trail	154	15705	15859	
	8.7.W	Boardwalk	7	15859	15866	New
	8.8	New Trail	69	15866	15935	
	8.9.W	Boardwalk	25	15935	15960	New elevated and barriered
	8.10.W	Boardwalk	174	15960	16134	New, 15m barrier
	8.11	New Trail	127	16134	16261	
	8.12.W	Boardwalk	25	16261	16286	New
	8.13	New Trail	34	16286	16320	
	8.14.W	Boardwalk	195	16320	16515	New
	8.15	New Trail	105	16515	16620	
9	9.1.B	Bridge	14	16620	16634	New over Mangawhero River
	9.2	New Trail	158	16634	16792	
	9.3.B	Bridge	19	16792	16811	New over Mangawhero River
	9.4	New Trail	42	16811	16853	
	9.5.W	Boardwalk	16	16853	16869	New
	9.6	New Trail	69	16869	16938	
	9.7.W	Boardwalk	57	16938	16995	New
	9.8	New Trail	13	16995	17008	
	9.9.W	Boardwalk	50	17008	17058	New with 30m barrier
	9.1	New Trail	10	17058	17068	
	9.11.W	Boardwalk	85	17068	17153	New barriered
	9.12	New Trail	191	17153	17344	
	9.13.B	Bridge	14	17344	17358	New
	9.14	New Trail	7	17358	17365	
	9.15.W	Boardwalk	13	17365	17378	New
	9.16	New Trail	70	17378	17448	
	9.17.W	Boardwalk	46	17448	17494	New barriered
	9.18	New Trail	31	17494	17525	
	9.19.W	Boardwalk	85	17525	17610	New
	9.2	New Trail	62	17610	17672	
	9.21.W	Boardwalk	10	17672	17682	New
	9.22	New Trail	105	17682	17787	
	9.23.W	Boardwalk	12	17787	17799	New
	9.24	New Trail	63	17799	17862	
	9.25.W	Boardwalk	30	17862	17892	New
	9.26	New Trail	34	17892	17926	
	9.27.W	Boardwalk	36	17926	17962	New
	9.28	New Trail	51	17962	18013	
	9.29.W	Boardwalk	46	18013	18059	New
	9.3	New Trail	119	18059	18178	
	9.31.W	Boardwalk	340	18178	18518	New barriered
	9.32	New Trail	21	18518	18539	Massey Hut - Trail End 18.5km

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Rev	Date	Amendment	By	Chk	App
A	12/08/24	First Issue	AJW	DS	DS

Project Title

Ngā Waihua o Paerangi Trust
Te Ara Mangawhero Trail

Drawing Title

Phase Two Construction
Engineering Table

Surveyed	D.Sherrit	Sept-Nov 23	DS
Designed	C.J.Olmi	01/12/23	CJO
Drawn	A.White	12/08/24	AJW
Checked	D.Sherrit	12/08/24	DS
Approved	D.Sherrit	12/08/24	DS

Status **INFORMATION**

Scale A3 Not To Scale | A3

Drawing Number 210700-206 | Rev A

Appendix 2. Third Party Engagement

Other parties

Organisation - contact	Response
Forest and Bird – Amelia Geary Via emails.	Does not support the development of a mountain bike trail above the bush line due the fragile and erodible nature of the mountain. The engineering of the trail will be different than if it is a walking trail. Can't offset or compensate irreplaceable alpine wetlands and vegetation, and the trail will zigzag across highly erodible alpine scree slopes etc. This has huge visual as well as ecological implications that are unacceptable in a dual world heritage national park.
Federated Mountain Clubs - Megan Dimozantos Via email	Supportive of the trail, and in particular, pleased it is being built by tangata whenua.
UNESCO - Derek Kelly (local UNESCO rep) Via email and follow up phone discussion	Concerns re the impact that visitors and cyclists might have on native land, mammals, i.e.. the Short Tailed and Long Tailed Bats, and also what impact, if any, there might be on Kiwi in the forested covered areas of Mount Ruapehu.
Tongariro Tramping Club – Terry Fenn Via Email	No response
Project Tongariro – Paul Green	Need to ensure that the trail is completed to a high / safe standard for bikers and most importantly protects the environment. And plans should also ensure walkers on the Blyth Track don't have their experience and safety compromised. Need to ensure that there are good and experienced trail builders involved in design build and also monitoring / reviewing of the process. The track is in some of the most sensitive environment in the National Park and the ' high speed' use it is being built for poses additional issues? The Old Blyth Track needs be safe for both descending bikers and walkers. This is one of the most challenging projects to have been undertaken in the National Park and has very high risk. The decision having been made to build it we must all ensure it is not only successful for mountain bikers but protects the environment , the integrity of the historic Blyth track and its traditional users.
Massey University Alpine Club - Joseph Fleming	Wants to be kept in the loop regarding any planned alternations around the MUAC hut. Having a trail start at the MUAC hut was identified as a 'promising idea'.

Department of Conservation

Date	Type and purpose
10 April 2024	Face to face hui with DOC staff at Whakapapa to introduce the project and proposed process and get initial feedback and guidance.
10 June 2024	Historic assessment of the proposed trail route with Neville Ritchie and Paul Mahoney (DOC).
17 June 2024	Presentation to local DOC staff on the status of the project including the hikoi and process and timeframes from here.
3 July	Phone discussion with Lynette Trewavas regarding the concession process, time frames and DOC expectations re information and technical assessments.
16 August 2024	Email to Fiona Wilson with a copy of the Archaeological report and revised trail route seeking feedback and a date for a combined site visit.
25 September 2024	Hikoi with DOC staff to view the proposed route and discuss key aspects of its design and development.
26 September 2024	Email to DOC staff a copy of the draft Ecological Report for review and comment.

Appendix 3. National Policy Statement for Freshwater Management 2020

Assessment of the proposed development against the Objectives and Policy in Part 2 of the NPSFM.

NPSFM Objective 2.1

The design of the proposed trail and associated structures prioritises the protection of the Mangawhero awa. The awa is a central component of the trail and its importance to Ngāti Rangi and the wider community is reflected in the name of the trail. The trail planning process has minimised the number of river crossings required, and where crossings are still required they are in locations that have previously been disturbed or have previously been subject to development. Bridge design will mean that there will not be any disturbance of the bed of the awa. The CMP also sets out the bridge and trail development process to ensure that there will be no sedimentation of the awa during the trail development process or ongoing.

As discussed in Section 7, the development of the trail is likely to result in social and economic benefits for the local communities and wider. There will also be benefits to Ngāti Rangi who will be the trail developers and who will be managers of the trail once the development is complete. Ngāti Rangi will be actively managing an important asset on the slopes of Ruapehu Maunga.

NPSFM Policy 2.2

As discussed in Section 5.6, the proposed development and specifically the involvement of Ngāti Rangi embodies many important aspects of Te Mana o te Wai (Policy 1). The project provides an important opportunity for Ngāti Rangi to be more actively involved in the management of the Mangawhero awa (Policy 2). The design of the trail and its structures means there will be no adverse effects on the Mangawhero awa or the wider catchment and associated receiving environments (Policy 3).

All structures will be built and located with consideration of the effects of climate change (Policy 4).

Locations that have been previously disturbed or subjected to development have been identified for bridge development to reduce impacts on the values of the Mangawhero awa (Policy 7 and 8).

It is anticipated (see Section 13 of the ecological assessment in Appendix 7) that the development of the trail and associated trapping opportunities is likely to have a positive effect on whio populations that live on the Mangawhero awa (Policy 9).

As set out in Section 3.6, the trail and associated structures will be regularly monitored and maintained to ensure there are no offsite effects that may impact on the Mangawhero awa (Policy 13).

As discussed in Section 7, the development of the trail is likely to result in social and economic benefits for the local communities and wider. There will also be benefits for Ngāti Rangi, the trail developers and managers who will be actively managing an important asset on the slopes of Ruapehu Maunga (Policy 15).

Appendix 4. Horizons One Plan Assessment

Regional Policy Statement
RMIA-O1: Te whakahaere rauemi (resource management) and associated kaupapa (policies)
Objective 2.1 requires that the mauri of natural and physical resources is had regard to, to enable iwi to provide for their social, economic and cultural wellbeing. Kaitiakitanga must also be given particular regard to as well as the relationship of iwi with their ancestral lands and waters, sites and waahi tapu and other taonga. The application has been developed by Ngāti Rangi. The detailed design of the trail has been undertaken in consideration of the tikanga referred to in Objective O1. The trail would not be developed if Ngāti Rangi, as mana whenua, were not comfortable that these matters were adequately reflected in the proposed trail. As discussed in Section 4 of this document, the original route of the trail has been amended to ensure that it will not disturb wāhi tapu sites and other areas of cultural importance. The development of the trail will also enable Ngāti Rangi to be more active kaitiaki in an area that has been historically managed by the Crown. The development of Te Ara Mangawhero enables Ngāti Rangi to strengthen their relationship with their ancestral lands, waters (specifically the Mangawhero awa), sites and other taonga. The impacts on the mouri of water has been a significant part of the route planning process. This has included ensuring that bridging locations and design are conscious of the important cultural values of the awa. This has included reducing the potential crossing points and locating the remaining ones at areas that have previously been disturbed. The bridge design and associated sediment management means that there will be no direct physical effect on the awa from the structures, the trail or their development.
RMIA-P3: 5-1: Te Mauri o ngā wai and associated kaupapa (policies)
The proposed trail and associated structures will be developed adjacent and over the Mangawhero Awa. The Mangawhero Awa is central to the kaupapa of the trail and its story. The awa is immensely important to Ngāti Rangi . The proposed development will be within the reach of water identified in Schedule B of the RPS as Whau_3d. The values associated with that reach in Schedule B include Life Supporting capacity, aesthetics, contact recreation, mauri, natural state and sites of significance – aquatic. These values reflect the quality of the water in the awa and also the relatively undisturbed state of the surrounding environment. These values, in addition to those of Ngāti Rangi for the awa, have been a guiding factor in the design of the trail and associated structures. The trail will only be developed in riparian areas where it is necessary to cross the awa. In all other cases the trail will be routed out of riparian areas to ensure the awa is not unnecessarily disturbed by the development of the trail or its ongoing use. The bridge design and associated sediment controls mean there will be no direct physical effect on the awa from the structures, the trail or their development. This is a key part of the kaupapa of the trail and its development. The proposed trail and its development is consistent with the management objectives of the respective individual values associated with Whau_3d. There will be no effects on the quality of the water within any awa, and the bed of awa will also not be disturbed.

Regional Policy Statement
ECO-O1 Te kanorau koiora taketake (Indigenous biological diversity) and associated kaupapa (policies)
ECO-P1 requires that areas of significant indigenous vegetation and significant habitats of indigenous fauna are protected and that indigenous biological diversity is maintained, including enhancement where appropriate. The proposed trail will traverse rare and threatened habitats and there will be an element of indigenous vegetation clearance associated with the trail development. This clearance will be minimal and restricted to vegetation that has a DBH of less than 15cm. An ecological assessment has been developed to inform the trail development process and is attached as Appendix 8. This assessment concludes that with appropriate planning, design, construction, and ongoing management, will ensure that potential adverse ecological effects can be avoided or reduced to minor or less than minor.
NFL-O1: Ngā tohu kōhure, ngā mata whenua motuhake me te āhuatanga māori (outstanding natural features and landscapes, and natural character) and associated kaupapa (policies)
The proposed trail has been assessed by a suitably qualified and experienced landscape architect. The outcomes of this assessment can be viewed in the Landscape Assessment report in Appendix 9. That assessment concludes that the proposed alignment has been developed to avoid and minimise adverse effects. The National Park is well suited for the proposal trail and any natural character, landscape or visual amenity effects arising from the proposal on the receiving environment are appropriate
HCV-O1 6-3: Ngā taonga tuku iho o mua (historic heritage) and associated kaupapa (policies)
Trail planning has included the assessment of the impacts of the trail on the Old Blyth Track. The track does have important heritage values associated with it.. The impact of the trail on these features is discussed in Section 7.6 of the report and in the Archaeological Evaluation and Impact Assessment in Appendix 10. The assessment identified ways that the trail can be developed in a manner that protects the historic values of the trail. Section 5.3.3 of the CMP (Appendix 12) includes references to conditions to implement the recommendations of the archaeological assessment. Ngāti Rangi, as the Applicant and tāngata whenua, were involved in all aspects of trail planning, including inspecting the route to consider any impacts on sites of cultural significance.

Appendix 5. Tongariro National Park Management Plan Assessment

Tongariro National Park Management Plan
4.4.2.6 Aircraft
The Plan has an objective relating to the use of aircraft to generally minimise their use within the Park. Policy allows aircraft to operate in the park with minimal restriction where required for park management and for activities, which would benefit park management, where undertaken by the department or a concessionaire authorised by the department to carry out these activities. Helicopters will be used to facilitate the development of the trail to enhance visitor opportunities. The helicopters will be used in areas which are not currently accessible by the public and as such will not compromise the experience of other users. The use of aircraft for trail development will only be undertaken where it will avoid greater environmental effects than if aircraft were not otherwise used. This will include flying in large structures, such as bridges. Transportation of such structures on ground and emplacing them without the use of helicopters would lead to a greater level of disturbance to the environment, specifically around water ways.
4.1.2 He Kaupapa Rangatira
The relevant objectives and policies are discussed in Section 5.2.2.
4.1.3 Landscape
The proposed trail has been assessed by a suitably qualified and experienced landscape architect. The outcomes of this assessment can be viewed in the Landscape Assessment report in Appendix 9. That assessment concludes that the proposed alignment has been developed to avoid and minimise adverse effects. The National Park is well suited for the proposal trail and any natural character, landscape or visual amenity effects arising from the proposal on the receiving environment are appropriate
4.1.7 Plants
An ecological assessment has been developed to inform the trail development process and is attached as Appendix 8. This assessment includes consideration of rare and endangered species and the potential effects on these species.
4.1.8 Animals
An ecological assessment has been developed to inform the trail development process and is attached as Appendix 8. This assessment concludes that with appropriate planning, design, construction, and ongoing management, will ensure that potential adverse ecological effects can be avoided or reduced to minor or less than minor. There will be no infrastructure developed on the beds or rivers. All bridges will be designed so that they do not disturb the river bed.
4.1.9 Historical Resources
Trail planning has included the assessment of the impacts of the trail on the Old Blyth Track. The track does have important heritage values associated with it.. The impact of the trail on these features is discussed in Section 7.6 of the report and in the Archaeological Evaluation and Impact Assessment in Appendix 10.

The assessment identified ways that the trail can be developed in a manner that protects the historic values of the trail. Section 5.3.3 of the CMP (Appendix 12) includes references to conditions to implement the recommendations of the archaeological assessment.

Ngāti Rangi, as the Applicant and tāngata whenua, were involved in all aspects of trail planning, including inspecting the route to consider any impacts on sites of cultural significance.

4.1.10 Local Authorities

Concurrent applications are being lodged with both the Department of Conservation and Horizons Regional Council for resource consent to clear indigenous vegetation, build bridges and undertake earthworks adjacent to waterways.

4.1.11 Community Relations

As discussed in Section 5.2.2 of this report, the proposed trail is to be managed and maintained by the Trust utilising their trail management team. This will result in benefits to the iwi including being able to act as more active kaitiaki within the Park. The wider community has also been actively involved in the planning of the trail since the inception of the trail concept in 2014. There is a strong level of interest in the development of the trail from local communities.

The establishment of the trail will provide additional opportunities for community conservation initiatives in the Park, specifically through the development of traplines and other pest management activities.

4.1.13 Park Interpretation and Public Information

The long term project will include a strong storytelling element. The objective of this is to share the important values of the place with trail users. This aspect of the trail experience will be developed by Ngāti Rangi at a later stage.

4.1.14.1 Volcanic Hazards

The route of the proposed track is not associated with any known historic lahar paths. As such, the probability of a lahar is low, but the consequences may be high. This risk will be managed in partnership with the Department using the same methodologies applied to the many tracks located elsewhere on the volcanic plateau.

4.1.14.2 Avalanches/Erosion

Regular trail maintenance as set out in Section 3.6 will discusse**s** how the trail will be actively managed which will address any erosion effects associated with the trail.

The Geotech assessment contained within the CMP in Appendix 12 provides additional assessment of the erosion risk.

4.1.16 Works Approvals

The works approvals process is discussed in Section 5.2.3. This application is to be considered as a major works approval and contains all the information required for the Department to make an informed decision on the works proposed.

4.1.17 Waste, Discharges, Contaminants and Noise

The activity proposed is consistent with existing activities that already occur within the Park. The development of a trail to be used by people on foot and on bikes will not derogate from the wider visitor experience. The trail will not result in any additional waste generated in the Park with all trail users expected to follow the same rules to 'pack in and pack out' any rubbish they bring with them. Two wharepaku are proposed as part of this trail, both will be capture vault and will be regularly maintained with waste taken out of the Park.

Any rubbish associated with the trail development process will be removed from the Park.

All proposed works will be carried out in a manner consistent with the conditions of the concession and works approval.

4.1.18 Research and Monitoring

A counter will be installed at key sections of the trail to monitor the number and frequency of trail users.

As one of the Great Rides, users will be asked to fill out a survey providing feedback on their trail experience.

The Trust will work with the Department to undertake any monitoring of the ongoing use or effects of the trail and its users on the wider values of the Park.

4.2 Special Areas and Management Zones

The proposed trail and associated development will not be undertaken within any special areas and management zones.

4.3 Use Objectives and Policies

4.3.2 Recreation

The proposed trail will be freely accessible to people on foot and on bike.

The proposed trail will be managed in a manner that ensures it will meet relevant Departmental environmental, safety and Department trail standards. This is set out in Section 3.6.

A counter will be installed at key sections of the trail to monitor the number and frequency of trail users.

As one of the Great Rides, users will be asked to fill out a survey providing feedback on their experience on the trail.

The Trust will work with the Department to undertake any monitoring of the ongoing use or effects of the trail and its users on the wider values of the Park.

The long term project will include a strong storytelling element. The objective of this is to share the important values of the place with trail users. This aspect of the trail experience will be developed by Ngāti Rangi at a later stage.

4.3.2.3 Buildings, Structures and Utility Services

The trail infrastructure (i.e. bridges, boardwalks etc) will be of a similar design and scale to that already found within the Park. They will be constructed out of materials chosen to work with the landscape that will weather and/or blend in with the environment over time.

All structures will be developed in accordance with the relevant Departmental guidelines as set out in the construction management plan (Appendix 12).

4.3.2.4 Tracks

An assessment of these provisions is set out in Section 5.2.1 of the report.

4.3.2.6 Access for People with Impaired Mobility

The gradient and track surface will allow the trails to be traversed by mobility impaired people who have access to off road equipment.

Tongariro National Park Management Plan
The proposed trail will enhance access for people with impaired mobility, especially in section 6 and also the Mangawhero Falls trail.
4.3.2.8 Day Visitors
The proposed trails will be used by a range of users. Some will continue on with the wider Mountains to Sea trail over a number of days, however the majority will use the trail for a day use experience. The trail will be developed to a standard (i.e. Grade 3) to cater for the majority of users and will also be located in close proximity to Ohakune, meaning that their access points will be in a high amenity area outside the Park.
4.3.2.9 Tramping
The proposed new trails are shared use and will provide additional opportunities to encourage tramping in the Park, especially that part of the trail which will form the Round the Mountain trail.
4.3.2.12 Mountain Biking
An assessment of these provisions is set out in Section 5.2.4 of the report. The proposed trails have been scheduled for mountain bike use in the amendment to the Plan.
4.4 Concessions
Section 4.4 of the TNPMP contains a comprehensive set of objectives and policies relating to concessions within the Tongariro National Park. Section 4.4 asks a number of key questions that are addressed here. **Can the activity be conducted outside the Park?** In this case the activity is the development of a trail which is specifically mandated by the Plan. The question of whether the trail should be in the Park was considered through the Plan amendment process which confirmed its appropriateness. **Can the activity be conducted in an amenities area?** The activity should be undertaken along the route of the trail as set out in Map 10 of the Plan. The proposed route falls outside of the amenities area as identified in the Plan, meaning that the activity could not be conducted within an amenities area. **Whether the activity will benefit the Park, public use and enjoyment or safety, and whether the activity will have national or regional benefits;** The proposed trail will extend the existing Mountains to Sea trail to meet the key objective of developing a contiguous and engaging journey from Mount Ruapehu to Whanganui and the Tasman Sea. This objective will promote the Great Ride as an epic and linked journey from the upper slopes of Mount Ruapehu (located in Tongariro National Park, a dual World Heritage area) to the Whanganui River (located in the Whanganui National Park) and on to the Tasman Sea. It is anticipated that the development of these trails will resolve current trail legibility issues, improve trail access and differentiate it from other regional attractions through the delivery of a linked and coherent multiday ride located in iconic landscapes. The proposed extensions will: • improve the user experience by making the wider trail easier to understand through the linking of trail gaps • reinforce the Mountains to Sea brand by having a true trail start on Mt Ruapehu

- provide for greater marketing and economic development opportunities through the development of a more visible product close to existing communities and destinations (i.e. Tūroa, Ohakune, Horopito and National Park).

These benefits are set out in the feasibility report and associated funding applications submitted to the government to secure funding to develop the trail. These measurable benefits include the economic benefits of out-of-region visitors using the trail, health benefits and consumer surplus benefits from local and domestic users.

The Economic Case clearly demonstrates that the proposed trails will significantly benefit the Ruapehu District's economy.

The benefits from the proposed trails are realised through its users. These users are made up of local and out-of-region recreational users. Out-of-region users can also be split into domestic and international visitors who could use the trail for a part of the day (single-day) or for several days (multi-day).

Once fully completed, the proposed trails are forecast to attract an additional 27,100 recreational users from outside the region. International visitors will account for 3,605 (11%) of those users.

Importantly, the development and management of the trail will give Ngāti Rangi an opportunity to take a more active role in managing assets on Ruapehu Maunga.

The purpose of the trail was to remove walkers and bikers off the Ohakune Mountain Road. Currently those walking the round the mountain trail have a 3km walk on the Mountain Road. Similarly, those cyclists who choose to start their Mountains to Sea journey from the top of Tūroa have to ride on the Ohakune Mountain Road to get from Tūroa to the start of the Old Coach Road section of the trail. The development of the trail will remove the necessity of these vulnerable users sharing the road with cars etc.

Whether the activity will have an effect on indigenous plants and animals, natural features, scenic values, sites of historical or cultural interest, on soil stability, on water quality, and the natural state of the park, and implications for further development that might result.

Environmental, historical and cultural effects associated with the trail development process are set out in Section 7 of the report. The assessment concludes that the level of effect associated with the activity is appropriate.

This disturbance and development will align with the route set out in Map 10 of the Park and does not create a precedent for any further trails to be developed off this route. Any further development or works would need to be considered through the concession and works approvals process in any case.

What effect the activity will have on other park users, natural quiet, other activities already taking place in the park, or the ability of staff to manage the park, and is it consistent with the reasonable demands of existing legitimate public usage;

The presence of the trail and its use has been considered by the Department through the amendment process. The trail and its use by people on foot and on bike has been legitimised through the amendment process.

The development of the trail is estimated to result in increased use of the Park by those using the trail on bike and/or foot. This increase in use will be largely focused on the route of the trail but it is anticipated that it will attract more people to the Park and surrounding area generally. Given the location of the trails, this increased use will be focused around the settlement of Ohakune located outside of the Park. It is also reasonable to expect that, along with the additional trail users, there will also be a flow on effect of growth in visitors to the southern part of the Park and recreational assets located in that area.

It is not anticipated that this use will impact on the ability of Department staff to manage the Park, especially given that the trail itself is to be managed by the Trust and not the Department.

Whether the Applicant is well-enough equipped – in terms of expertise and finance, for example – to carry through and complete the proposal in a safe and proper manner;

The Applicant will be working with experienced trail developers and trail managers. The approach for developing the trail is set out in the CMP in Appendix 12.

Management of the trail will be undertaken in the same way as Phase 1 of the trail which has already been agreed to by the Department.

4.4.3.2 Signs

Wayfinding and interpretation signs will be developed and put in place along the trail to facilitate the use of the trail and also to communicate the important stories and values to trail users. The location of key wayfinding signs is identified in the trail map in Appendix 1 of this report. The signs will be similar to other signs associated with recreation activities found in the Park.

Appendix 6. Taupō Tongariro CMS Objective Assessment

The following table assesses the proposed development against the relevant provisions in the TTCMS.

Taupō Tongariro Conservation Management Strategy
3.1.2 Management of Historic Resources
Trail planning has included the assessment of the impacts of the trail on the Old Blyth Track. The track does have important heritage values associated with it. The impact of the trail on these features is discussed in Section 7.6 of the report and in the Archaeological Evaluation and Impact Assessment in Appendix 10. The assessment identified ways that the trail can be developed in a manner that protects the historic values of the trail. Section 5.3.3 of the CMP (Appendix 12) includes references to conditions to implement the recommendations of the archaeological assessment. Ngāti Rangi, as the Applicant and tāngata whenua, were involved in all aspects of trail planning, including inspecting the route to consider any impacts on sites of cultural significance.
3.1.6 Restoration / Rehabilitation
In the event that the trail and associated infrastructure is no longer required, it will be decommissioned with structures removed and the trail area allowed to regenerate back to a natural state.
3.1.8 Natural hazards
Bridges will be located a suitable height above rivers so that they will not be affected by high flows during flood events etc. Initial trail planning work has included geotechnical assessments which have not identified any issues for the Phase 1 trails.
3.2.2 Protected Species
The ecological assessment (Appendix 8) identifies that a range of Threatened and At Risk indigenous plants and fauna species (including whio) are known to occur within the vicinity. The assessment concludes that with appropriate management, all of the potential ecological effects of this stage of the proposed Te Ara Mangawhero Trail can be avoided or reduced to less than minor. The suggested conditions in the assessment to achieve this outcome have been included in the attached CMP (Appendix 12) as key requirements in the development and management of the trail.
3.5 Recreation Management
The proposed trail will introduce a new recreation asset into the TNP. This asset is expressly provided for by the TNPMP via the partial amendment process. The proposed trail development will include trail counters to monitor use of the trail by people on foot and bikes.
3.5.2.1 Visitor Access
The proposed trail will be a new recreation asset which will provide an additional opportunity for public to access the conservation estate on foot and by bike. The proposed trail will enhance walking and biking access to the area.

Trail planning has included consideration of the effects of this proposal in respect to the important natural and historical values of the site.

3.5.2.2 Aircraft use

Objectives and policy relating to the use of aircraft on PCL are included in section 3.5.2.2 of the CMS. The relevant Objective permit aircraft landings on public conservation land for management and emergency purposes and where this enhances visitor opportunities without compromising the experience of others.

Helicopters will be used to facilitate the development of the trail to enhance visitor opportunities. The helicopters will be used in areas which are not currently accessible by the public and as such will not compromise the experience of other users.

The use of aircraft for trail development will only be undertaken where it avoids greater environmental effects than if aircraft were not otherwise used. This will include flying in large structures, such as bridges. Transportation of such structures on ground and emplacing them without the use of helicopters would lead to a greater level of disturbance to the environment, specifically around water ways.

Hughes 300 helicopters will not be used.

3.5.2.4 Mountain Bikes

The proposed trail will be a new mountain biking opportunity on public conservation land. The assessments included in the wider report consider the impacts of this trail on the wider natural, historic and visitor values of the area. On review, it is considered that these values will not be adversely compromised and that the recreation/visitor values will be enhanced.

The trails proposed are specified in the TNPMP as amended through the partial review process. As noted in the wider report, the amendment process authorised the consideration of the trails to be developed and used by people on bikes.

Departmental guidance on bike trails will be used to guide the design of the proposed trails.

Monitoring is to be undertaken by the Department (as per the TNPMP) in respect to any effects on the physical environment and visitor experience. Given the nature of the trail and its proposed use, it is not anticipated that there will be any ongoing effects of the trail being in place. The location, design and maintenance of the trail will be such that there will be no ongoing physical impacts from the trail. People on bikes are unlikely to stray from the trail into the wider environment.

The trails are new so it is not anticipated that there will be effects on the current experience except for those very short sections where the trails intersect with the existing Mangawhero Forest Trails. Signs will be put in place informing people on bikes that these trails that are not shared use are not to be used by people on bikes. The trails themselves are to be designed to be shared use and will include design elements that facilitate safe shared use.

3.6.3 Conservation Awareness

The trail will be promoted through local and national channels by the trail manager and also by New Zealand Cycle Trails as it forms part of a Great Ride.

It is anticipated that trail interpretation / storytelling will include messaging about conservation and also the important cultural elements and stories associated with the trail and the wider Ruapehu Maunga.

Taupō Tongariro Conservation Management Strategy
3.7 Kaupapa Māori
The relevant objectives and policies are discussed in Section 5.2.2
3.8.2 Non-Recreation Concessions
3.8.2.4 Easements
It is noted that there are no specific provisions within the CMS document relating to the licence to establish and manage the trail. The provisions relating to Easements are the closest direction in the CMS. The objective of the easement provisions is, 'To grant easements only where they will not significantly compromise natural or historic values or public use and their purposes cannot reasonably be achieved by other means on private land.' As noted above, the right to develop the trail and have it managed by a third party is established through the amendment to the TNPMP. The appropriateness of developing the trail on the proposed route rather than off conservation land was established through that statutory process. The wider assessment contained in this report demonstrates that the proposed trail and its management by Ngāti Rangi will not compromise the natural and historic values of the land or public use. The development of the trail will enhance public use of the land. Associated implementation policies require an EIA which sets out alternatives. This is discussed in Section 5.2 of this EIA document.

Appendix 7. Cultural Assessment

Te Ara Mangawhero Cultural Impact Information

NGĀTI RANGI

Ngāti Rangi is an iwi based on the southern slopes of Matua te Mana or Ruapehu. Our cultural identity is linked to his essence, the lifeblood of our people cascades as waters from his slopes, and his peaks above are our sacred altar. The vision statement for Ngāti Rangi is:

"Kia mura ai te ora o Ngāti Rangi ki tua o te 1,000 tau.

Ngāti Rangi continues to vibrantly exist in 1,000 years".

Our vision statement stands as a testament to our role and responsibility to be active tāngata tiaki for our environment to ensure our descendants, in 1,000 years have clean water, fresh air, and healthy land. Our maunga Ruapehu is the mātāpuna, the source of our waterways from the mountain to sea; their clarity, their uniqueness, their quality, and their voices speak to our wairua, give life to our lands, and are our lifeblood.

Ngāti Rangi Group Structure

Key kaumātua and Ngāti Rangi claimants with the endorsement of the Whanganui River Māori Trust Board established the Ngāti Rangi Trust in 1992. The Trust was established to coordinate and manage iwi affairs and progress the settlement of Treaty grievances.

Following an internal review, a restructure was confirmed and launched in 2008. The change included:

a. The establishment of Te Kāhui o Paerangi (the Ngāti Rangi rūnanga): A marae and pahake representative body constituted under Ngāti Rangi kawa and tikanga; and

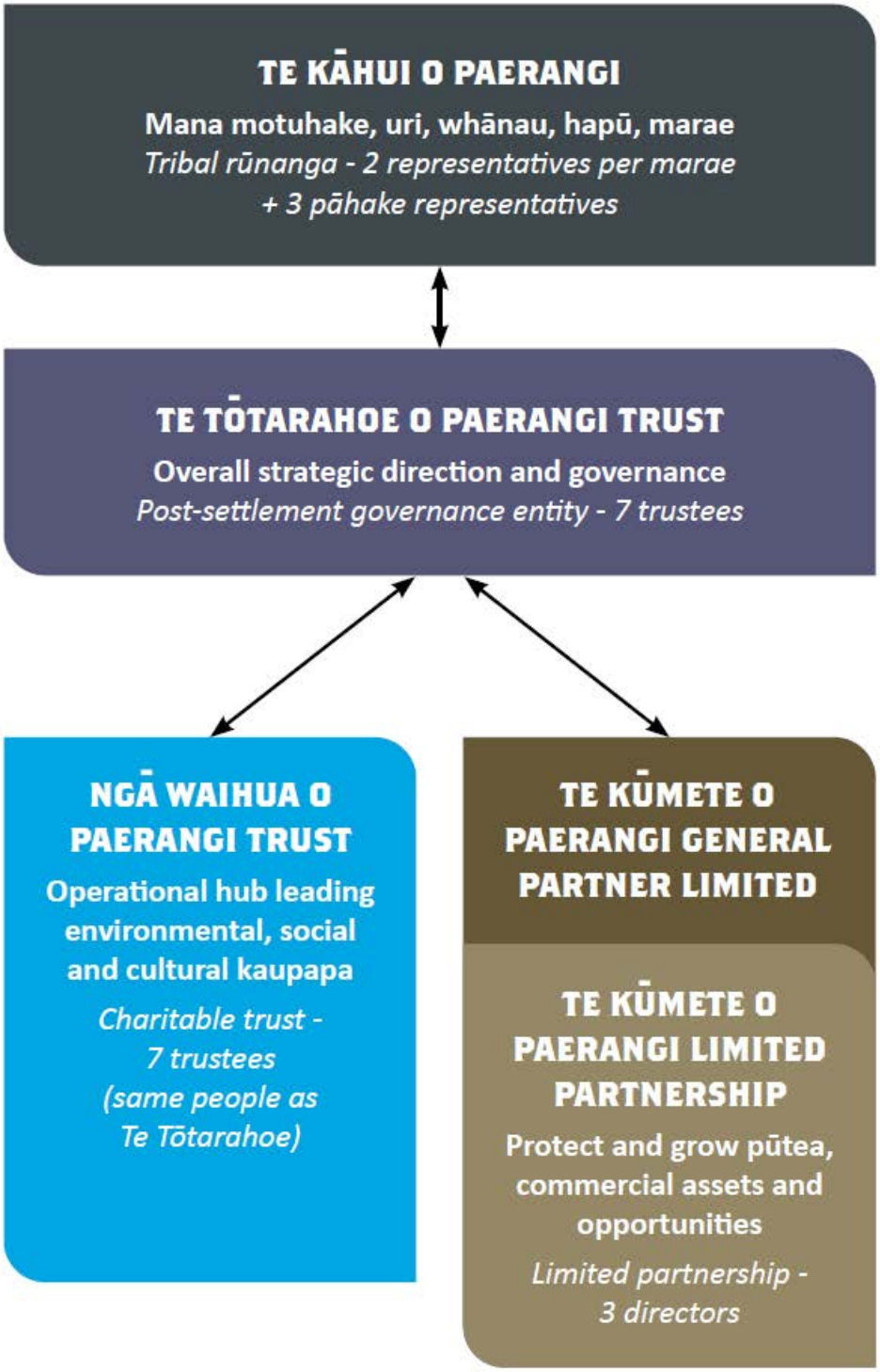
b. The restructure of the Ngāti Rangi Trust (known as Te Tōtarahoe o Paerangi): A legal authority that represents the interests of the rūnanga and iwi and upholds the tribes' legal responsibilities.

Following mandate, settlement negotiations between the Crown and representatives of Ngāti Rangi about the historical Treaty of Waitangi claims of Ngāti Rangi took place. The deed of settlement, Rukutia te Mana, was signed in March 2018 and became legislated in September 2019. As part of the settlement:

- Te Tōtarahoe o Paerangi was established as the entity to implement the terms of Rukutia te Mana, and receive and manage the settlement redress, on behalf and for the benefit of Ngāti Rangi.
- The name Ngāti Rangi Trust was changed to Ngā Waihua o Paerangi Trust.
- Te Kūmete o Paerangi was established to protect and grow the post-treaty settlement funds as well as its commercial assets and opportunities.
- Pae Whakahaumaru are one of five teams who are the tangata tiaki active guardians of the taiao in relation to pest control trail building and maintenance actively working on the whenua.

This structure is set out in the diagram on the following page.

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Te Ara ki te Moungaroa

Te Ara ki te Moungaroa 2035 sets a clear vision and purposeful mission that will enable Ngāti Rangi to develop into a vibrant community for generations to come. The 2020-2025 strategic plan defines a pathway towards achieving our collective aspirations to grow as an iwi and community. Te Ara ki te Moungaroa is revised on a regular basis.

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Our holistic approach to achieving our vision covers four key pillars:

- **Ngāti Rangitanga:** Strengthening cultural identity and whanaungatanga, deepening our knowledge and connection to our history, tikanga and kawa; celebrating our culture and inspiring purpose.
- **Rau Kotahi**: Supporting whānau to achieve their aspirations by equipping them with the necessary skills, knowledge, and experience to reach their potential and navigate life confidently through Ngāti Rangitanga and Te Ao Tūroa.
- **Te Ao Tūroa:** Nurturing the oranga of our taiao and connection to our maunga, wai and whenua; leveraging our understanding of our taiao to transform whānau wellbeing.
- **Tari:** Ensuring we have the right capability and capacity to successfully deliver this strategy.

These pillars are achieved through the team in Ngā Paepae o Rangi (Pae Whakahā, Pae Whakakā, Pae Whakatō, Pae whakangā and Pae Whakahaumaru).

Te Aronga, our how;

"E kōkiri tahi ana a Ngāti Rangi i ngā kaupapa hei oranga mō te katoa.

Together Ngāti Rangi will grow itself and its communities".

Ngāti Rangi Claims Settlement Act 2019

The Ngāti Rangi Claims Settlement Act came into force in September 2019.

The negotiations were guided by the aspirations of Ngāti Rangi uri. These included the importance of the Crown's long-overdue recognition of our mana motuhake, and of aligning the settlement with our kaupapa, including our vision, aspirations and values.

Ngāti Rangi negotiated our settlement with the Crown based on the following principles:

- Kia mau ki te wairua o te Tiriti o Waitangi
  To uphold the spirit of the Treaty of Waitangi
- Ahakoa haere te Karauna ki whea, ka haere hoki a Ngāti Rangi
  Where the Crown goes, so goes Ngāti Rangi
- Ka whakaae te Karauna ki te mana motuhake o Ngāti Rangi
  Acknowledgement of the mana motuhake o Ngāti Rangi
- Ka whakaora anō tō mātau mana kia toitū a Ngāti Rangi me ngā hapū, ngā whānau me ngā tini uri
  Restoration of a cultural, environmental, economic, family and social base for NgātiRangi

The settlement framework is named after Ruapehu, Te Whare Toka o Paerangi. There are six interlinked poupou; two are Treaty settlement specific and the remaining four are aligned to our iwi strategy (outlined above) and our multigenerational goal of 'vibrantly existing in 1,000 years.

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Te Hohourongo and Te Matapihi are the Treaty settlement specific pou, they recognise a focused approach to work together in partnership under the Ngāti Rangi Claims Settlement Act with the Crown, crown representative Ministries and organisations.

- **Te Hohourongo:** Reconciliation by way of acknowledgment and apology from the Crown.
- **Te Matapihi:** Partnership and relationship agreements with the Crown.

These pou combined with the pillars of Te Ara ki te Moungaroa interlink as mechanisms towards a sustainable and holistic approach for the betterment of our environment, our culture and the health and wellbeing of our people and our community.

Ngāti Rangi Taiao Management Plan 2014

The Ngāti Rangi Taiao Management Plan 2014 outlines our key requirements regarding environmental and cultural expectations for our rohe.

The framework of our Taiao Management Plan is based on the structure of a whare. The utilisation of the whare to structure the plan is likened to our eponymous ancestor Paerangi-i-te-Whare-Toka and his House of Stone. The plan offers an invitation for people to enter the house of Ngāti Rangi, to view our tikanga and understand our thoughts, viewpoints and responsibilities. The plan is divided into five sections; these emulate the different structural components of a whare:

1. **Te Roro Whare** – The Verandah of the House
   This refers to the outline, purpose, overall vision and the desired outcomes we seek.
2. **Te Tatau** – The Entranceway
   Te Tatau depicts who we are, and the values and guiding principles we hold to.
3. **Ngā Pou o te Whare** – The Pillars of the House
   This section is the central element of the plan and contains our perspectives on issues and the care and management of the taiao within our tribal boundaries.
4. **Ngā Heke Kōrero** – Rafters
   Ngā Heke Kōrero outlines the process of making a submission, as a guide for individual hapū and whānau members of Ngāti Rangi.
5. **Te Pani Kōkōwai** – The Final Touches
   Te Pani Kōkōwai are the final statements of Ngāti Rangi to conclude the document.

To expand on Ngā Pou o te Whare, the pillars of the house are structurally important as the key elements in the stability and support of a sound building. Without these pillars, the whare will crumble. Utilising the atua as our pillars aid in our interaction not only with the atua but also with our kaitiaki and tūpuna. We view ourselves as a reflection of the universe; therefore using this helps us to aspire to the beauty, brilliance and ultimately the purity of the atua. The pillars are ordered in terms of their whakapapa, and are outlined below:

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- **Ranginui:** Ranginui governs our skies and is ultimately the backdrop of our vistas. He stands higher than the peaks of Matua te Mana and his presence is seen and felt throughout the universe.
- **Papa-tū-ā-nuku:** Papa-tū-ā-nuku is our ultimate mother, the mother of all things; she is planet earth. Her fertility and life force are a constant gift that sustains us.
- **Tāne-nui-a-rangi:** As overlord of the ngahere, Tāne-nui-a-rangi (or Tāne Mahuta) is a significant ancestor of Ngāti Rangi. He governs the realm of the forest and all the indigenous plants and creatures that dwell within.
- **Tangaroa-i-te-wai-māori:** The waters of Tangaroa-i-te-wai-māori are the bloodlines of Papa-tū-ā-nuku. These waters flow along her slopes and nourish Ngāti Rangi not only with a constant supply of mouri but with kai and freshwater.
- **Rongomātāne:** Rongomātāne governs the realm of cultivated foods, which is a major activity in our region.
- **Rūaumoko:** Rūaumoko is the youngest child of Rangi and Papa; he was clutched to Papa's breast during the separation of Rangi and Papa. Earthquakes and volcanic activity are a result of Rūaumoko and his movements within the earth.
- **Matua te Mana:** Otherwise known as Ruapehu, Matua te Mana is central to the cultural and spiritual identity of Ngāti Rangi. He is the stronghold for Ngāti Rangi, is beloved among his people and is referred to by uri as Koro Ruapehu, the tribal grandfather.

The different pillars used to categorise our issues are interlinked not only because they are our whanaunga, but because impacts that occur in one area also impact other areas of the environment, and ultimately on us as an iwi. The pillars outline our approaches to caring for our environment to ensure it endures for a thousand years and more.

TE ARA MANGAWHERO

As tangata tiaki, the maintenance and improvement in the quality of our air, water, and whenua are a mechanism for the management of a sustainable and holistic environment that we strive for as a people.

Ngāti Rangi recognises that our world is changing and for our vision **"Kia mura ai te ora o Ngāti Rangi ki tua o te 1,000 tau – Ngāti Rangi continues to vibrantly exist in 1,000 years"** to come to fruition, we need to ensure that the health and wellbeing of the environment are at the forefront of all decisions.

It is our responsibility to ensure that the quality of our environment is of a better state, but at the very least, no worse than the conditions that exist currently, for future generations. To fulfil these responsibilities we look for opportunities to be true tangata tiaki of our natural world.

Lands within our rohe provide Ngāti Rangi with the perfect environment to achieve positive results and make a difference in the lives of our people and community.

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Initially, we saw Te Ara Mangawhero as an opportunity to improve safety for users of the Ohakune Mountain Road (especially pedestrians and cyclists) without the significant environmental impacts of widening the road. We now see the opportunities for ourselves and our communities in taking a lead role in this mahi.

Ngāti Rangi has been involved in the Te Ara Mangawhero kaupapa for over a decade; from initial discussion and active participation in the original working group, contributions to the Tongariro National Park Management Plan change process, and more recently, involvement in planning processes and leading detailed trail design and construction methodology mahi.

Ngā Waihua o Paerangi Trust (Ngāti Rangi's operational hub leading environmental, social and cultural kaupapa) and the former Ngāti Rangi Trust have socialised and discussed the concept of Te Ara Mangawhero with Te Tōtarahoe o Paerangi and Te Kāhui o Paerangi throughout our 10-plus years of involvement with the project. Te Kumete o Paerangi our commercial entity and Te Kāhui o Paerangi our iwi runanga who represent the marae and hapu of the iwi.

Referring back to the Ngāti Rangi Group Structure, Te Tōtarahoe o Paerangi is our post-treaty settlement governance entity, its role is to uphold the mana o te iwi and to protect our aspirations by acting on behalf of and in the beneficial interests of Ngāti Rangi.

Keeping us grounded in our tikanga and values is the core kaupapa of Te Kāhui o Paerangi, the Ngāti Rangi rūnanga. This body is the matua or principal body of our iwi and provides constructive guidance for the respective organisations that implement our tribal aspirations. As the representative voice of our marae, its purpose is to:

- Provide strategic and political leadership for Ngāti Rangi iwi;
- Uphold the kawa and tikanga of Ngāti Rangi;
- Advocate for our marae and their respective hapū; and
- Promote sustainable environmental decisions based on the principles that evolve from our kawa and tikanga.

Following Treaty settlement Te Kūmete o Paerangi was established to protect and grow the settlement funds as well as its commercial assets and opportunities to support our aim to be active guardians of all our whenua under the gaze of Ruapehu by enhancing our taiao, communities, and the mana whenua of Ruapehu.

Ngā Waihua o Paerangi Trust actively facilitated the detailed trail design and construction methodology mahi with the support of Te Tōtarahoe o Paerangi and Te Kāhui o Paerangi, to apply for approvals to build, manage and maintain Te Ara Mangawhero. Gaining these approvals will enable Ngāti Rangi to be true tangata tiaki of our natural world in this location.

Referencing Te Ara ki te Moungaroa and our 2020-2025 strategic plan, within the Te Ao Tūroa pillar our strategic priorities are:

- Enhance and protect the oranga of our taiao.
- Nurture a strong connection between uri and our maunga, wai and whenua.
- Establishing the mechanisms to maintain connections to maunga, wai and whenua.

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The development of Te Ara Mangawhero will help to directly achieve these strategic priorities. Our broad holistic approach to the development enables the protection and enhancement of the oranga of our taiao in this area. Construction of the trail offers initial opportunities for connection with our maunga, wai and whenua along with longer-term opportunities to maintain these connections through the ongoing operation and maintenance of the trail.

Specific to Te Ao Tūroa Rukutia te Mana focuses on the interdependent relationship between the environment and people and the use of all resources based on our principles. The settlement redress includes:

- An integrated framework for the Whangaehu River catchment called Te Waiū-o-Te-Ika.
- A comprehensive Conservation Partnership Framework, including governance and management arrangements with the Department of Conservation.
- Special arrangements concerning pākohe, pākere, onewa and matā which recognise Ngāti Rangi's connection with these taonga.

The redress ensures that:

- Fundamental change is made to how our awa and whenua are viewed, cared for and managed, putting the health and wellbeing of our awa and whenua at the forefront of decision-making.
- The Crown continues to be actively engaged with and responsible to us for our awa and whenua.
- The decades of struggle Ngāti Rangi has put into advocating for the voice of our awa and whenua are reflected.

Te Waiū-o-Te-Ika is a legal framework for the Whangaehu River catchment. The framework focuses on recognising, promoting, and protecting the health and wellbeing of the awa, and the intrinsic relationship of Ngā Iwi o Te Waiū-o-Te-Ika with the awa and our responsibility to care for, protect and use the awa in accordance with our kawa, tikanga, and ritenga. The area of development for Te Ara Mangawhero lies within Te Waiū-o-Te-Ika. Holistically speaking, as the mouri of the taiao and mana of individuals and communities will be enhanced by the development, the mana of Te Waiū-o-Te-Ika will be uplifted.

As mentioned above, the settlement arrangements include a comprehensive Conservation Partnership Framework with the Department of Conservation. Included in this framework is a partnership agreement, known as Te Mana Paenga. Te Mana Paenga focuses on how the Department and Ngāti Rangi will work together to ensure Ngāti Rangi perspectives, kawa, tikanga and ritenga are integrated into conservation management over conservation lands across the Ngāti Rangi rohe.

Additionally, Tongariro National Park is a dual World Heritage area. This status recognises the Parks important Māori cultural and spiritual associations as well as its outstanding volcanic features. It is our view that the importance of our Māori culture is not held in equal status

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and has continued to lag behind volcanic landscape feature values, public recreational use, and tourism for many decades.

For the true intent of the cultural heritage of Tongariro National Park to be fully realised and elevated to equal status with the other values of the park tangata whenua need to provide for our self-development of our cultural resources and to deliver our own cultural experiences. This is truly the only way to put an authentic cultural face and heart to these values. Tangata whenua developed, tangata whenua trained and tangata whenua delivered.

The land for the development of Te Ara Mangawhero lies within Tongariro National Park. While this land isn't included in the partnership agreement of Te Mana Paenga we believe the intent of the agreement to honour the spirit of partnership required under Te Tiriti o Waitangi in a manner that recognises and respects the kawa, tikanga and ritenga of Ngāti Rangi remains important.

Concerning Te Ara Mangawhero, the following pillars from the Ngāti Rangi Taiao Management Plan are of paramount importance:

- **Papa-tū-ā-nuku**
  The health of Papa-tū-ā-nuku, our eternal mother, is central to our health and wellbeing as humanity. She is the ultimate provider; we depend on her fertility and her gifts for survival. Ngāti Rangi is concerned about the unsustainable use and exploitation of Papa-tū-ā-nuku and her gifts, particularly around how the whenua is used and managed and the pollution and waste that accompanies use. As tāngata tiaki, we are duty-bound to ensure care and reciprocity are actioned.

- **Tāne-nui-a-rangi**
  Ngāti Rangi's history has been centred in the realm of Tāne, as we are people of the ngahere. The protection of native flora and fauna is paramount to Ngāti Rangi, but so too is the protection of our customary needs. The balance between this give-and-take relationship needs to be restored to enable the protection of our taonga as well as ensure our cultural practices are not jeopardised. Our concerns vary in nature from the health and wellbeing of the forest as a whole to the customary use of the forest by Ngāti Rangi through to the use of the forest by others.

- **Tangaroa-i-te-wai-māori**
  Tangaroa-i-te-wai-māori is the embodiment of freshwater within our region. He is present in the numerous waterways that run along the back of Papa-tū-ā-nuku; he is the lifeblood of Ngāti Rangi. Water is a fundamental element of all facets of life and is essential to our health and wellbeing. Our waterways provide us with a constant supply of mouri to replenish and revitalise our iwi. We have huge concerns over the state of our freshwater and its mouri, and how this impacts Ngāti Rangi as an iwi.

- **Matua te Mana**
  Matua te Mana is our ancestral maunga. Matua te Mana is more commonly referred to as Ruapehu and is the source of our cultural and spiritual identity. Ruapehu is the anchor for us to our whenua, and he exists as the stronghold of our people. From Te Wai ā-moe and Ruapehu's slopes our waterways spring forth, which carry mouri and mana directly to our landscape, and our people. The main concerns we as Ngāti Rangi have here are based on the use and management of our maunga.

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The Ngāti Rangi Taiao Management Plan outlines our approaches to caring for our environment to ensure it endures for a thousand years and more. We advocate for these approaches to be taken into account during the preparation of applications and in decision-making processes such as resource consent and concession applications.

The Te Ara Mangawhero route has been designed to maximise the use of previously disturbed sites/areas and to avoid and minimise the potential for adverse effects on intact indigenous ecosystems. To respect the sensitive nature of the natural landscape the trail construction methodology is based on the wellbeing of the taiao. New opportunities for the control of pest plants and pest animals to complement existing conservation management in the local area will result from the establishment of the trail. There are also opportunities to enhance the recovery of indigenous vegetation within previously disturbed areas. The aim is to build a sustainable trail that blends with the environment, has minimal impact, resists erosion through proper design, and enhances the mouri of the area.

The trail will traverse and showcase a wide range of ecologically and culturally significant forest and river margin habitats on the lower slopes of Ruapehu. Positioning of interpretation is crucial not only to add to the trail experience but also in providing an opportunity for important natural, cultural and historical korero associated with the land and the trail to be told. Enabling recreational access will create connection, health and wellbeing benefits, and enable greater environmental and conservation outcomes.

As tangata tiaki, Ngā Waihua o Paerangi Trust and Pae Whakahaumaru will establish, manage andmaintain Te Ara Mangawhero. This will nurture a strong and maintained connection with ourmaunga, wai and whenua enabling care and reciprocity for the location while providing employment and growth opportunities for local people.

Leading the detailed trail design and construction methodology mahi has ensured Ngāti Rangi values have been integrated and weaved through the design of Te Ara Mangawhero. The trail design alongside sensitive construction methodologies has ensured approaches from the Ngāti Rangi Taiao Management Plan have been met. Therefore, cultural effects have either been mitigated or can be managed.

SUMMARY

Ngāti Rangi has been proactively involved with Te Ara Managwhero since its inception. Given we will be responsible for construction and kaitiakitanga of ongoing management and maintenance we are satisfied cultural impacts have either been mitigated or can be managed.

We won't speak on other tribes' behalf, yet we acknowledge the interests of our whānaunga. Given the location for the development of Te Ara Mangawhero, Ngāti Rangi deems it appropriate for Ngā Waihua o Paerangi Trust to apply for approvals to build, manage and maintain the trail.

This document has been developed by Ngāti Rangi to support the environmental assessment of Te Ara Mangawhero. Information in this document remains the intellectual property of Ngāti Rangi. The document and its contents may not be used outside of this intent without the express permission of Ngāti Rangi.

Appendix 8. Assessment of Ecological Effects

Assessment of ecological effects for a proposed shared use trail on the slopes of Mount Ruapehu: Phase 2 - Rimu Hill to Massey Hut

Contract Report No. 5405i

Providing outstanding ecological services to sustain and improve our environments

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Assessment of ecological effects for a proposed shared use trail on the slopes of Mount Ruapehu: Phase 2 - Rimu Hill to Massey Hut

Contract Report No. 5405i

October 2024

Project Team:

Angela McQuillan – Field assessment and report author

William Shaw – Field assessment, report author, technical advisor, and peer review

Samantha King - Report author (herpetofauna)

Prepared for:

Ngā Waihua o Paerangi Trust

Te Pae Tata

Ohakune

Reviewed and approved for release by:



_____

31/10/2024
W.B. Shaw
Director/Lead Principal Ecologist
Wildland Consultants Ltd

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Head Office
99 Sala Street, PO Box 7137, Te Ngae, Rotorua Ph 07-343-9017 Fax 07-343-9018 Email: rotorua@wildlands.co.nz

www.wildlands.co.nz

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1.0 Introduction

Te Ara Mangawhero Advisory Group in Ohakune is proposing to develop a family-friendly, shared use walking and mountain biking trail within Tongariro National Park, from Tūroa Ski Field to Ohakune (*c.*18.5 kilometres). Construction of Te Ara Mangawhero Trail would complete a gap in the Mountain to Sea (Ngā Ara Tuhono) Cycle Trail. Ngā Ara Tuhono is one of the 23 Great Rides of the New Zealand Cycle Trail (Ngā Haerenga). The vision for Ngā Ara Tuhono is to provide connected pathways for recreational use from Tongariro National Park, along the Whanganui River, to the Tasman Sea at Whanganui.

The first phase of Te Ara Mangawhero Trail (6.3 kilometres-long) is currently under construction. It extends from the Ngāti Rangi office in Ohakune (about 620 metres above sea level, a.s.l.), along the lower slopes of Ruapehu Maunga to end near the Mangawhero River, at about 800 metres a.s.l. Most of this section is to be located in previously-disturbed areas associated with the historic Bennett and Punch tramlines and/or the existing Ohakune water supply pipeline.

The second phase of Te Ara Mangawhero Trail (*c.*12 kilometres long) is proposed to continue from the end of the first phase at "Rimu Hill", along the historic Blyth Track, then traverse alongside the Mangawhero River, to the mid-upper slopes of Ruapehu Maunga, finishing at the Massey University Alpine Club Hut (hereafter referred to as the "Massey Hut") about three kilometres below Tūroa Ski Field.

Ngā Waihua o Paerangi Trust (formerly Ngāti Rangi Trust) commissioned Wildland Consultants to provide an evaluation of the proposed route for the second phase of Te Ara Mangawhero Trail and an assessment of the potential ecological effects, as part of an assessment of effects for the following permissions processes:

- Department of Conservation concession.
- Department of Conservation works approval.
- Horizons Regional Council resource consent.

This report provides an assessment of ecological effects for the proposed trail, including options to avoid or minimise potential adverse effects.

2.0 Background

Wildland Consultants has previously provided the following assessments and reporting for sections of the Mountains to Sea (Ngā Ara Tuhono) Cycle Trail project, within Tongariro National Park:

<u>Ecology</u>

- Desktop ecological assessment of the proposed trail alignments (May 2020, Wildland Consultants 2020a).
- Attendance and verbal contributions at a hui with Ngāti Rangi and the Department of Conservation (DOC) in Ohakune (November 2020).
- Attendance and technical advice on a field evaluation of the section of trail from Tūroa Skifield to the Ohakune Mountain Road (November 2020, Wildland Consultants 2020a).
- Provision of follow-up advice on a 'trail deviation process' (November 2020, Wildland Consultants 2020b).

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- Site visit and ecological assessment for the first phase of Te Ara Mangawhero Trail (Wildland Consultants 2021).
- Site visit and ecological assessment for the proposed Te Hangaruru Trail, from Horopito to the Makatote River (Wildland Consultants 2022a).
- Provision of a protocol for incidental lizard discovery during construction of Te Ara Mangawhero Trail and Te Hangaruru Trail (Wildland Consultants 2023a and b, and 2024).

Landscape

- Protocols for the Tūroa alpine section of trail (May 2020, Wildland Consultants 2020c).
- Attendance and verbal contributions at a hui with Ngāti Rangi and DOC in Ohakune (November 2020).
- Attendance and technical advice on a field evaluation of the section of trail from Tūroa Skifield to the Ohakune Mountain Road.
- Site visit and landscape assessment for the proposed Te Hangaruru Trail, from Horopito to the Makatote River (Wildland Consultants 2022b).

Other assessments relating to ecological and landscape impacts of the proposed Te Ara Mangawhero Trail include Carylon (2017), Scrimgeour *et al.* (2017), and Singers and Bayler (2017).

3.0 Project context

Existing information on the ecological context and ecological values of the project area was compiled and evaluated in Wildland Consultants (2020a).

The proposed Te Ara Mangawhero Trail is within the southern part of Tongariro Ecological District. This Ecological District contains both active and dormant volcanoes at the southern end of the volcanic plateau, including the highest mountain in the North Island, Ruapehu (2,797 metres a.s.l.), and a ring plain formed by extensive lahars (McEwen 1987). Close to two thirds of the Ecological District retains indigenous vegetation cover (Leathwick *et al*. 1995).

Much of Tongariro Ecological District is within Tongariro National Park, an area of international cultural and natural landscape significance and is recognised as a dual World Heritage Site. Iwi of the volcanic plateau have a special relationship with the maunga/mountains of Tongariro National Park.

The proposed trail is within Ruapehu District, in the Manawatū-Whanganui Region. Statutory documents relevant to the proposed trail include the Tongariro National Park Management Plan (DOC 2006, 2011, and 2018[1]), Tongariro Taupō Conservation Management Strategy[2], and the Horizons (Manawatū-Whanganui) Regional Council One Plan[3].

[1] Accessed at https://www.doc.govt.nz/about-us/our-policies-and-plans/statutory-plans/statutory-plan-publications/national-park-management/tongariro-national-park-management-plan/, 17 July 2024.

[2] Accessed at https://www.doc.govt.nz/about-us/our-policies-and-plans/statutory-plans/statutory-plan-publications/conservation-management-strategies/tongariro-taupo/, 17 July 2024.

[3] Accessed at https://www.horizons.govt.nz/publications-feedback/one-plan, 17 July 2024.

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4.0 Methods

4.1 Existing information

Relevant literature, reports, and data sets were reviewed to determine the ecological values that are present within the general area. An earlier desktop assessment (Wildland Consultants 2020a) and site-based assessment (Singers and Bayler 2017) of the proposed Te Ara Mangawhero Trail were key information sources.

Sources of information used by Wildland Consultants (2020a) and referred to in this report included:

- Bioweb Flora Database (Department of Conservation; accessed May 2020) for records of threatened plants.
- The eBird Database maintained by Cornell University, which has bird records for sites within New Zealand (accessed May 2020).
- Department of Conservation New Zealand Bat Database (accessed May 2020) for records of pekapeka/bats.
- Bioweb Herpetofauna Database (Department of Conservation; accessed May 2020) for records of lizards.
- New Zealand Freshwater Fish Database (NZFFD, NIWA 2020[1]; accessed August 2019), for records of freshwater fish (indigenous and introduced) and freshwater invertebrates within waterways.

For this report about Phase 2 of Te Ara Mangawhero Trail, a further search of the following sources was undertaken to update existing information:

- The citizen science website, iNaturalist (https://inaturalist.nz/), was searched for records of lizards and plants.
- Bioweb Herpetofauna Database (Department of Conservation; accessed July 2024) for records of lizards.
- Checklist of indigenous vascular plants recorded from Tongariro National Park (collation sourced from NZPCN[2]; accessed July 2024).

A detailed review of non-vascular indigenous plants and indigenous terrestrial invertebrates present was beyond the scope of this project.

4.2 Site visits

High resolution aerial imagery (Manawatū-Whanganui 0.3 m Rural Aerial 2021-2022) of the project area (Phase 2 of Te Ara Mangawhero Trail) was obtained. A digital file of the proposed trail route (provided by Cheal Consultants) was overlain onto the imagery and printed at a scale suitable for field use (1:2,000).

Sections of the proposed trail route of Phase 2 were visited on foot. Sections 8 and 9 were inspected on 22 May 2024 and Sections 5-7 were visited on 23 May 2024. The proposed trail route had been marked with flagging tape by the surveying team prior to these visits. Site visits were undertaken in

[1] Accessed at https://nzffdms.niwa.co.nz/download.
[2] Accessed at https://www.nzpcn.org.nz/publications/documents/tongariro-national-park/.

the company of the following people to share ideas, align project aims, and develop a good understanding of the ecological values present:

- Ngāti Rangi representatives (Dayle Brooks and Te Hiiringa Mareikura) and project team members.
- Ngāti Rangi kaitātari taiao/ecologist (Dr Michael Morris).
- Master trail builder (Matt Dodge, Dodge Contracting) and trail builders.
- Planner (Rowan Sapsford, Roam Consulting).
- Surveyor (Dean Sherrit, Cheal Consultants).
- Civil engineer (Jake Saathof, Cheal Consultants).
- Landscape architect (Simon Button, Isthmus Group).
- Independent environmental advisor (ex-DOC) with executive local experience (Herwi Scheltus).

An iterative process was applied in the field, to evaluate each section of the proposed alignment, and to alter the alignment to avoid or minimise potential ecological effects.

Vegetation and habitat types present within the project area were identified and described following the vegetation classification methodology of Atkinson (1985). Vegetation and habitat types and key features were mapped using the aerial photographs and digitised with ArcGIS Pro 3.3.0.

All vascular plant species observed during the site visits were recorded and are listed in Appendix 1. Incidental observations of key non-vascular plant taxa were recorded and are listed in Appendix 2.

Incidental observations of avifauna were recorded during the site visits. Representative photographs were taken of the vegetation and habitat types, proposed trail and bridge locations, and key ecological features (Appendix 3).

4.3 Assessment of ecological effects

Ecological features and values and potential ecological effects of the proposed trail route were assessed both during the site visits and during the report preparation stage. Features and values were evaluated on a site-specific basis along the potential alignment, taking account of the scale and extent of potential effects.

Options to avoid, minimise, or mitigate any adverse effects were evaluated.

4.4 Changes to proposed trail route

During the May 2024 site visits, discussions were held between attendees about site-specific details of the proposed trail route. Where it was collectively identified that ecological effects could be avoided or minimised, adjustments to the trail alignment were made on-site, and then marked by the surveyors both on the ground by repositioning flagging tape and using GPS. More than 16 changes to the proposed trail that were made on-site during the site visits, including:

- A minor deviation to avoid local patches of a key liverwort species in silver beech-mountain beech forest (Vegetation and Habitat Type 3 in this report) (Section 5; near Boardwalk 5.20.W).
- Use of boardwalks instead of deviations from the existing Blyth Track (Section 6; Boardwalk 6.2, 6.4.W, 6.6.W, 6.8.W, and 6.10.W).
- Use of additional boardwalks along the existing Blyth Track (Section 6; Boardwalk 6.19.W, 6.23.W, and 6.25.W).

- Decrease in the length of a deviation from the existing Blyth Track (Section 6; 6.17).
- Removal of deviations from the existing Blyth Track (Section 6; 6.19, and 6.31).
- Use of the existing trail for upper part of Section 8 (8.15) at Mangawhero Falls rather than constructing a new section of trail.
- Repositioning of the proposed alignment and the use of boardwalk to avoid wetland (Section 9; 9.19.W) (wire rush-tangle fern-red tussock-bog pine rushland and fernland (Vegetation and Habitat Type 9 in this report)).
- Alteration of the route and the use of boardwalks to reduce ecological effects on an area of mid-Holocene lahar (Section 9; 9.28 and 9.30) (Curled-leaved inaka/bristle tussock shrubland and rockland (Vegetation and Habitat Type 8 in this report)).

Based on the discussions about how to avoid or minimise ecological effects, at least three changes to the proposed trail route were also made by the surveying team following the May 2024 site visits, including the following:

- Use of boardwalks instead of culverts in (Section 5; Boardwalk 5.6.W and 5.14.W).
- Reposition large lengths of Section 8 away from areas of wetland (mānuka/tangle fern-red tussock fernland (Vegetation and Habitat Type 7 in this report)) and instead into mountain beech-pahautea forest (Vegetation and Habitat Type 4 in this report) (Sections 8.4 to 8.14).

The changes identified above are in addition to the following changes to the proposed trail route that were made since earlier desktop assessments (Singers and Bayler 2017; Wildland Consultants 2020a) and prior to the May 2024 site visits:

- Alignment of Section 7 was moved upslope slightly. This means that this section no longer includes a length of trail within silver pine-mountain beech forest and scrub (Vegetation and Habitat Type 5 in this report). Section 7 is now entirely within mountain beech-pahautea forest (Vegetation and Habitat Type 4 in this report) which typically has less boggy ground than the silver pine-mountain beech forest and scrub.

- A section of trail that was originally proposed from Massey Hut to Tūroa Skifield has been removed from the plans. This decision was made, in part, to avoid damage and erosion of the steep (>35°) volcanic boulderfield (an Endangered ecosystem type, as per Holdaway *et al.* 2012), and associated alpine to sub-alpine vegetation and habitats.

- Use of Fibre Reinforced Polymer (FRP) for boardwalks and decking of bridges, in addition or as an alternative to timber, was identified as an option since the earlier assessment.

5.0 Overview of the proposed trail

5.1 Overview

The following sections have been compiled based on information supplied by the client in May to June 2024.

The proposed trail (*c.*18.5 kilometres) will be an all-season shared cycleway and walkway that will provide a loop track from the Ngāti Rangi office on the northeastern side of Ohakune to the Mangawhero Campsite (lower slopes of Ruapehu, Phase 1), and a northern extension (Phase 2) to the

upper slopes of Ruapehu that would provide an iconic starting point for the Mountains to Sea Cycle Trail (Ngā Ara Tuhono) (Figure 1).

The proposed alignment of Phase 2 is located on public conservation land within Tongariro National Park. This phase of the proposed trail is approximately 12 kilometres long. The trail is intended to be used by public for walking and biking, and will be able to be used in both directions. It will be suitable for a wide range of ages and abilities.

For the purposes of this report, the second phase of the proposed Te Ara Mangawhero Trail has been divided into the following sections (Sections 1-4 are within Phase 1 on the lower slopes):

- Section 5: Phase 1 end (Rimu Hill) to Blyth Track, *c.*3.2 kilometres. Approximately 800-920 metres above sea level (asl).
- Section 6: Existing Blyth Track, *c.*4.5 kilometres, *c.*920-1,200 metres asl.
- Section 7: New connection Blyth-Waitonga Falls Track, *c.*1.1 kilometres. Approximately 1,200 metres asl.
- Section 8: Existing Waitonga Falls Track to Mangawhero Falls, *c.*1.5 kilometres, *c.*1,200-1,300 metres asl.
- Section 9: Mangawhero Falls to Massey Hut, *c.*1.9 kilometres, *c.*1,300-1,460 metres asl.

A suitably qualified and experienced Master Trail Builder from Dodge Contracting[1] will lead the trail construction. They will train, oversee, and work alongside kaimahi (staff) to ensure that appropriate techniques are used. Kaimahi from a local company, Pae Whakahaumaru (previously Ruapehu WorX), will also be involved in trail construction, to provide local upskilling and employment opportunities, particularly for members of the Ngāti Rangi iwi. Pae Whakahaumaru started in 2020 and is guided by Ngāti Rangi, and a taiao (environmental) management team with experience in the Ruapehu area since 1992. Kaitātari taiao/ecologist from Ngāti Rangi (Dr Michael Morris) has been involved in route selection for the trail.

5.2 Proposed trail footprint

Phase 2 of Te Ara Mangawhero Trail (*c.*12 kilometres long) is proposed to continue from the end of the first phase at "Rimu Hill" (*c.*800 metres asl), along the Blyth Track, then traverse alongside the Mangawhero River, to the upper slopes of Ruapehu, finishing at the Massey Hut (*c.*1,460 metres asl) about three kilometres below Tūroa Ski Field.

Most of the proposed trail footprint is within areas that do not have current or existing tracks, and are generally unmodified by human activities. Historically, some logging and haulage was undertaken in Section 5 at "Rimu Hill". There is evidence of pre-European fires within Section 8 (Singers and Bayler 2017).

Section 6 is intended to follow part of the existing and historic Blyth Track. Blyth Track was formed in about 1915-1920, using corduroy technique (Ritchie 2024). This involved cutting and laying slabs of timber (from pahautea (*Libocedrus bidwillii*) trees) horizontally across the track, to provide traction and stability in swampy areas. The Blyth Track was the main bridle track up the mountain prior to construction of the Ohakune Mountain Road.

[1] https://www.dodgecontracting.co.nz/ Based in Clive, Hawkes Bay.

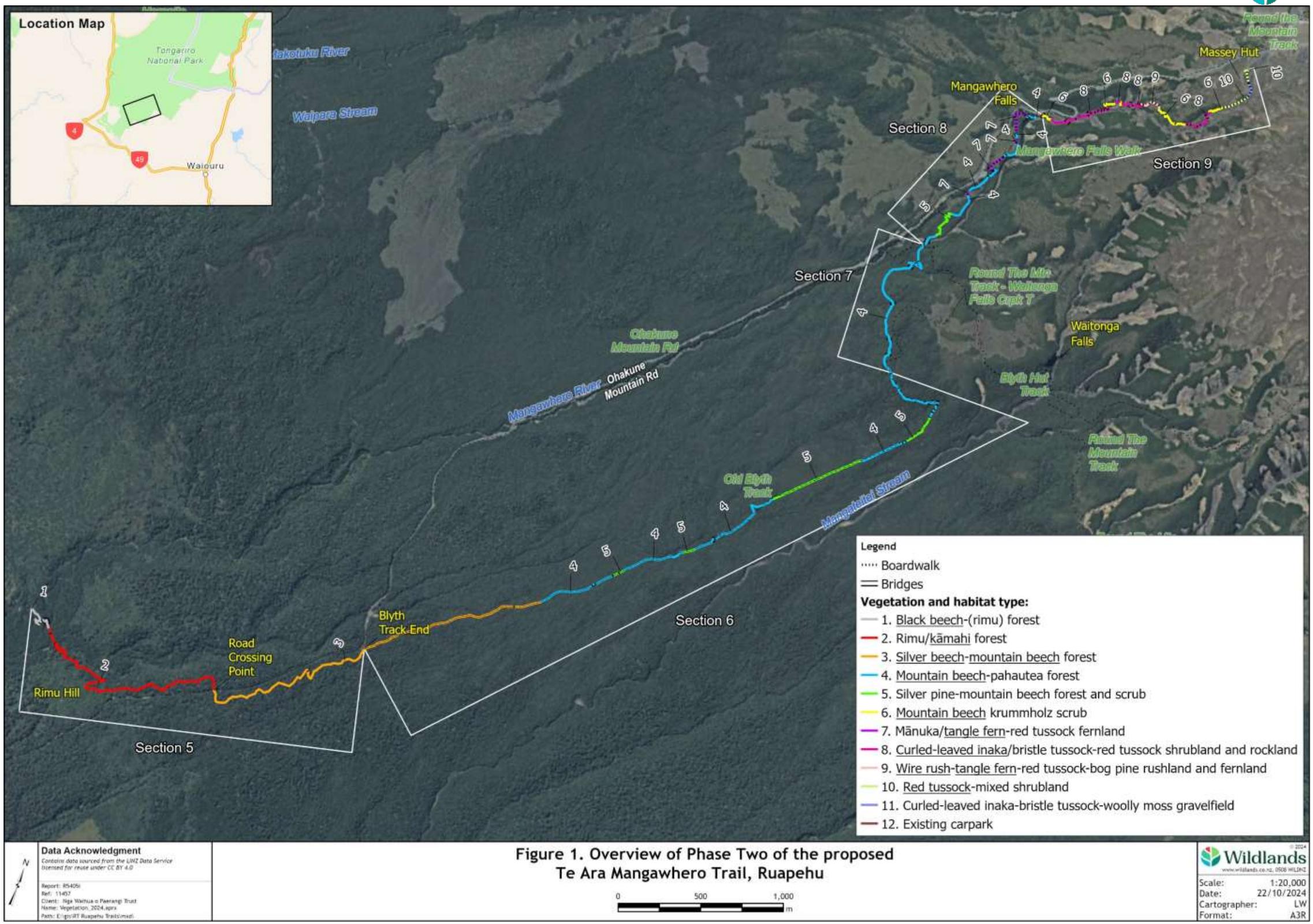


Figure 1. Overview of Phase Two of the proposed Te Ara Mangawhero Trail, Ruapehu

The proposed trail is intended to meet the criteria for Trail Grade 3 (may include sections of Grade 2), as per the New Zealand Cycle Trails Design Guide (Ngā Haerenga New Zealand Cycle Trails 2024) and standards for off-road cycle tracks on land managed by the Department of Conservation (DOC 2020). These criteria include details on maximum uphill gradient and trail width.

The average width of the completed trail will be 0.9 metres, extending to 1.5 metres where terrain permits to allow for easy passing and shared use. The maximum width of the construction alignment, including batters, will be 2.0 metres.

The trail will cross the Mangawhero River at four locations, each requiring a new bridge: one crossing in each of Sections 5 and 8, and two crossings in Section 9. Smaller bridges will be used for stream crossings. Bridges would be *c.*1.2 metres wide.

Boardwalks will be used in sections of sensitive terrain, such as wetlands, unconsolidated volcanic soilfields, or dense areas of tree roots. Boardwalks will also be used to provide switch-backs trails in areas of steep terrain (such as Section 9). In addition, boardwalks will be used along parts of Section 6 - Blyth Track where there is severe erosion and/or a desire to retain visibility of the historic 'corduroy' (logs placed horizontally across the track surface).

Locations of proposed bridges and boardwalks are shown in Figure 1 and are summarised in Table 1. The use of culverts has been avoided.

Table 1 – Proposed bridges along Te Ara Mangawhero Trail, Phase 2, upper slopes of Mount Ruapehu (as per plans by Abseil Access[1]).

Name of Bridge (as per map provided by Cheal Consultants August 2024)	Section of Trail	Length of Bridge (metres)	Style of Bridge
Bridge 5.8B (Mangawhero River)	5	24	Suspension
Bridge 6.14.B (tributary)	6	10	New deck and balustrade only
Bridge 6.27.B (creek)	6	5	Rigid span
Bridge 6.29.B (creek)	6	4	Rigid span
Bridge 6.31.B (creek)	6	6	Rigid span
Bridge 7.2.B (creek)	7	8	Rigid span
Bridge 8.3B (Mangawhero River)	8	20	Rigid span
Bridge 9.1B (Mangawhero River)	9	14	Rigid span
Bridge 9.3B (Mangawhero River)	9	18	Rigid span
Bridge 9.13.B (tributary)	9	14	Rigid span

5.3 Construction methodology

The over-arching philosophy is that trail construction will be undertaken in a sensitive manner, with a major focus on recognising the cultural and ecological importance of the surrounding indigenous

[1] Martin Wilson (Abseil Access) on 25 June 2024, based on site visit on 22 June 2024.

habitats and aquatic environments. A key aim will be to avoid and minimise the potential adverse effects of trail construction and ongoing maintenance on te taiao (the environment). Construction of the trail will be overseen by a suitably qualified and experienced Master Trail Builder from Dodge Contracting. The construction methodology is being finalised, but will likely include the following steps:

- The trail will be built to a Grade 3 (Intermediate) New Zealand Cycle Trails design specification (Ngā Haerenga New Zealand Cycle Trails 2024) (see Appendix 4). This means that the trail may be narrow (0.9 metres wide for 90% of the trail) with hills to climb. The gradient of the trail is intended to be 0-8.8% for at least 90% of the trail; 8.8-12.3% for no more than 100 metres at a time; and a maximum of 17.5% for no more than 10 metres at a time.
- The design of the trail has incorporated features to enable safe shared use by people on foot and on bike, travelling in both directions.
- There may be some wider and flatter Grade 2 (Easy) sections (0.9-1.5 metres wide for single trail and minimum 2.2 metres wides for double trail sections of trail).
- The maximum width to be disturbed during construction is likely to be up to two metres in places. This includes the trail width (average 0.9 metres) and construction batters.
- Final "setting out" of the trail route to ensure that appropriate detailed design considerations are addressed. The kaitātari taiao/ecologist from Ngāti Rangi will be involved on-site in deciding the final route of the trail, with kaumātua in attendance where possible.
- The Ngāti Rangi kaitātari taiao/ecologist will identify any indigenous shrubs and tree species (less than two metres in height) or understorey plants that could be successfully transplanted from the trail footprint. Once approved, the identified plants will be removed for replanting in identified restoration areas before construction is started.
- The intention is for the trail to meander through existing indigenous vegetation. As much as possible, indigenous trees larger than 15 centimetres diameter at breast height (dbh; breast height is 1.35 metres above ground surface level) will be left undisturbed and the existing root structures of mature trees will be protected from damage.
- Helicopter-drop locations may be used to deliver supplies to the construction front for Section 6 - Blyth Track. Existing clearings or gaps in the forest canopy can be used for helicopter-drop locations. For locations less than one kilometre from roads or access points, materials will be transported using tracked low-ground-pressure dumpers (to a maximum size of 1.8 tonnes, 1.4 metres wide).
- Vegetation clearance will be undertaken within the trail footprint using arboriculture tools e.g. chainsaws and hand tools.
- Vegetative material that is cleared will be scattered along the trail margins, where suitable, avoiding the formation of large piles of debris.
- Where possible, the intention is to use construction methods that involve minimal or no excavation. No excavation will be undertaken in wetlands. No blasting (explosives) of rock will be used.
- The completed trail surface will include lengths of gravel, and boardwalks made from Fibre Reinforced Polymer (FRP)[1] and/or timber.
- Where the ground is suitably dry, shallow surface excavation will be undertaken within the trail footprint using hand tools and/or machines such as a small excavator (tracked, low-ground pressure

[1] Potential supplier of FRP decking: FRP Limited https://frp.co.nz/fibreglass-product-range/grating-range/. Accessed 5 August 2024.

machinery; to a maximum size of 1.8 tonnes[1], 1.4 metres wide; to minimise compaction). All earthworks machinery will stay within the trail footprint.

- Hand tools may be the preferred method for shallow excavation in parts of Section 6, in order to preserve areas of the historic corduroy for trail users to view.
- There may be drilling of exposed rock in Section 9, in order to attach boardwalks to secure foundations, by pinning (bolting) them.
- Careful sediment controls will be implemented at all bridge sites, using coir logs or similar (as per the Erosion Sediment Control Plan; to be prepared, will be similar to the plan for Phase 1 (du Plessis 2021)). Any soil or substrate that is removed will be used as fill for other sections of the trail (e.g. boulder mesh nets as bridge struts) or placed in areas of minimal ecological impact within the final trail alignment (such as recently disturbed areas) and then rehabilitated. Excess material will not be side-cast or disposed of loosely.
- Controls will be implemented for the use of hazardous substances, such as oil and diesel/petrol, during construction and trail maintenance.
- Formation of the surface of the trail, on flat to sloping, dry ground:
  - The trail surface will be crowned with the surface sloping towards each side at a gradient of approximately 4%, which will prevent a trenched/dished trail surface developing from use over a short period of time. A small proportion of the length of the trail will traverse slopes. Therefore, to manage water, an outward-sloping trail surface will be used, in preference to a crowned or inward sloping surface which could require an inside drain and use of culverts. This will assist any water to run across the trail and not down the trail, thereby minimising ongoing maintenance needs. Rolling grade dips will be installed at suitable locations, as needed, to divert water off the trail surface.
  - A compacted gravel surface will be established. Weed-free gravel (AP 60 scoria base course and AP 20 volcanic top course material) is to be sourced from a local quarry near Ohakune. Aggregate would then be spread using a mini loader.
- Boardwalks will be used in sections of sensitive terrain, such as wetlands, steep slopes, exposed bare rock, and along the Blyth Track. Boardwalks will be constructed from FRP decking (Plate 1), or timber, similar to existing boardwalks nearby on this side of Ruapehu (Plate 2). If FRP is used, a natural colour will be chosen, to align with the surrounding landscape.
- No excavation will be undertaken in wetlands.
- Boardwalks will be installed on timber piles. For boardwalks that will be less than one metre above ground level, piles will be installed in stages, using a small excavator[1] reaching forward to drill the pile holes, installing a length of boardwalk, and then moving over the constructed boardwalk to start the next length.
- There will be a few sections of boardwalk that will be greater than one metre above ground (mainly in Section 9 - Mangawhero Falls to Massey Hut). The above method for boardwalk installation will not work as the small excavator will not have sufficient reach. In these cases:
  - The excavator will drive directly on the ground and drill the holes, which will involve a minor degree of disturbance by crushing of vegetation. If benching is needed to ensure that the excavator can operate on a flat surface, all benching (using soil, gravel, or timber) will be removed as soon as each section of boardwalk is completed, and the natural ground surface and vegetation will be rehabilitated immediately following completion of each section of boardwalk.

[1] A 1.2-1.8 tonne excavator is preferred over a larger excavator because a larger excavator will generally result in more severe ecological effects.

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Plate 1 – Example of Fibre Reinforced Polymer (FRP) boardwalk, New South Wales, Australia. Photograph supplied by Rowan Sapsford, 20 May 2024.



Plate 2 – Example of existing timber boardwalk through a tangle fern (*Gleichenia* sp.) and wire rush (*Empodisma minus*) wetland on the Round the Mountain Track, near the junction of the Old Blyth Track. Photograph by Rowan Sapsford, 17 June 2024.

- Where the terrain is too steep (e.g. Vegetation and Habitat Types 10 and 11 in Section 9) or ground is too saturated (e.g. Vegetation and Habitat Type 7 in Section 8, and Vegetation and Habitat Type 9 in Section 9), a temporary scaffold will be erected for the excavator to drive onto, and from there drill the pile holes and install boardwalk decking. The use of scaffolds in steep and/or saturated areas will enable disturbance of vegetation to be avoided in these most vulnerable habitats.

- Four large bridges are proposed to enable crossing of the Mangawhero River (see Table 1). Handrails will be installed as fall protection for pedestrians and cyclists. Any steel beams will be coated with approved natural colours to align with the surrounding natural landscape. Decking for bridges will be FRP or timber. All of the proposed bridges will span entirely over the waterways in such a way that the waterway under the bridge is not reduced and potential effects are avoided or kept to a minimum. Where land disturbance activities are carried out, erosion and sediment control will be provided on-site during construction. Concrete foundations will be precast offsite where possible. Precast components and steel beams will be lifted into place using a helicopter.
- All smaller bridges will use a similar construction methodology to the large bridges and boardwalks.
- Where possible, all boardwalks and bridges will be constructed offsite and dropped into place by helicopter. Larger bridges will be air-lifted as components and assembled on-site.

6.0 Vegetation and habitats

Twelve broad vegetation and habitat types were identified along the proposed trail[1]. Vegetation and habitats within each section of the trail are mapped in Figures 2-6 and listed in Table 2, with descriptions of the types provided below. Representative photographs of vegetation and habitats are presented in Appendix 3.

Table 2 – Vegetation and habitat types along the proposed alignment of Te Ara Mangawhero Trail, Phase 2, upper slopes of Mount Ruapehu.

Vegetation and Habitat Type	Length of Proposed Trail (km)	Sections of Proposed Trail
1. Black beech-(rimu) forest	0.29	5
2. Rimu/kāmahi forest	1.69	5
3. Silver beech-mountain beech forest	2.38	5 (1.24 km), 6 (1.15 km)
4. Mountain beech-pahautea forest	4.32	6 (2.33 km), 7 (1.15 km), 8 (0.85 km)
5. Silver pine-mountain beech forest and scrub	1.16	6 (0.91 km), 8 (0.25 km)
6. Mountain beech krummholz scrub	0.59	9
7. Mānuka/tangle fern-red tussock fernland	0.36	8
8. Curled-leaved inaka/bristle tussock-red tussock shrubland and rockland	0.83	9

[1] These types are based on Singers and Bayler (2017), with updates from the 2024 site visits.

Vegetation and Habitat Type	Length of Proposed Trail (km)	Sections of Proposed Trail
9. Wire rush-tangle fern-red tussock-bog pine rushland and fernland	0.13	9
10. Red tussock-mixed shrubland	0.27	9
11. Curled-leaved inaka-bristle tussock-woolly moss gravelfield	0.09	9
12. Existing carpark	0.03	8
GRAND TOTAL (km)	**12.13**	

6.1 Black beech-(rimu) forest

The lower part of Section 5 of the proposed trail is on the true right side of the Mangawhero River, within black beech/tawhairauriki (*Fuscospora solandri*) forest that contains infrequent rimu. Podocarps have been selectively logged from some of this forest. Trees within this area are about 10-15 metres tall.

Piupiu/crown fern, hook grasses (*Carex uncinata*), and *Astelia fragrans* are common in the understorey, with scattered saplings of the canopy tree species, mountain horopito (*Pseudowintera colorata*), and occasional *Raukaua anomalus*, ngutukākāriki/Prince of Wales feathers (*Leptopteris superba*), and hūpiro (*Coprosma foetidissima*).

6.2 Rimu/kāmahi forest

Approximately half of Section 5 of the proposed trail is within forest that comprises large emergent rimu (*Dacrydium cupressinum*) above a canopy dominated by kāmahi (*Pterophylla* (*Weinmannia*) *racemosa*; *c.*10-15 metres tall). There are also occasional emergent matai (*Prumnopitys taxifolia*). This forest type occurs between 600 and 950 metres asl. Rimu within these forests are over 30 metres tall, the largest of which have diameters over 100 centimetres.

Other tree species scattered amongst the kāmahi include makomako (*Aristotelia serrata*), pōkākā (*Elaeocarpus hookerianus*), putaputawētā (*Carpodetus serratus*), and tōī/mountain cabbage tree (*Cordyline indivisa*). Broadleaved tree/shrub species (including kanono (*Coprosma autumnalis*) and horoeka (*Pseudopanax crassifolius*)), toetoe (*Austroderia fulvida*), and tree ferns are present in modified patches, along historic corridors where logs were hauled out of the forest for timber in the 1900s. The groundcover is dominated by leaf litter, with scattered patches of piupiu/crown fern (*Lomaria discolor*) and infrequent bush rice grass (*Microlaena avenacea*). A few tree ferns of whekī-ponga (*Dicksonia fibrosa*) are present in the understorey.

6.3 Silver beech-mountain beech forest

Forest dominated by silver beech/tawhai (*Lophozonia menziesii*) and mountain beech/ tawhairauriki (*Fuscospora cliffortioides*) is present in the upper part of Section 5 and the lower part of Section 6 of the proposed trail between approximately 950 and 1,050 metres asl. Trees within these areas of forest are *c.*20-30 metres tall. One of the few stands of red beech/tawhairaunui (*Fuscospora fusca*) in Tongariro National Park is present locally near the entrance to the Blyth Track from Ohakune Mountain Road. Tōī/mountain cabbage tree are present infrequently.

The understorey is dense and undisturbed. Shrubs of mountain horopito are common, intermixed with frequent rōhutu (*Neomyrtus pedunculata*) and *Coprosma pseudocuneata*. There are occasional *Coprosma tenuifolia* and putaputawētā. Saplings of pōkākā are common, along with a few rimu saplings.

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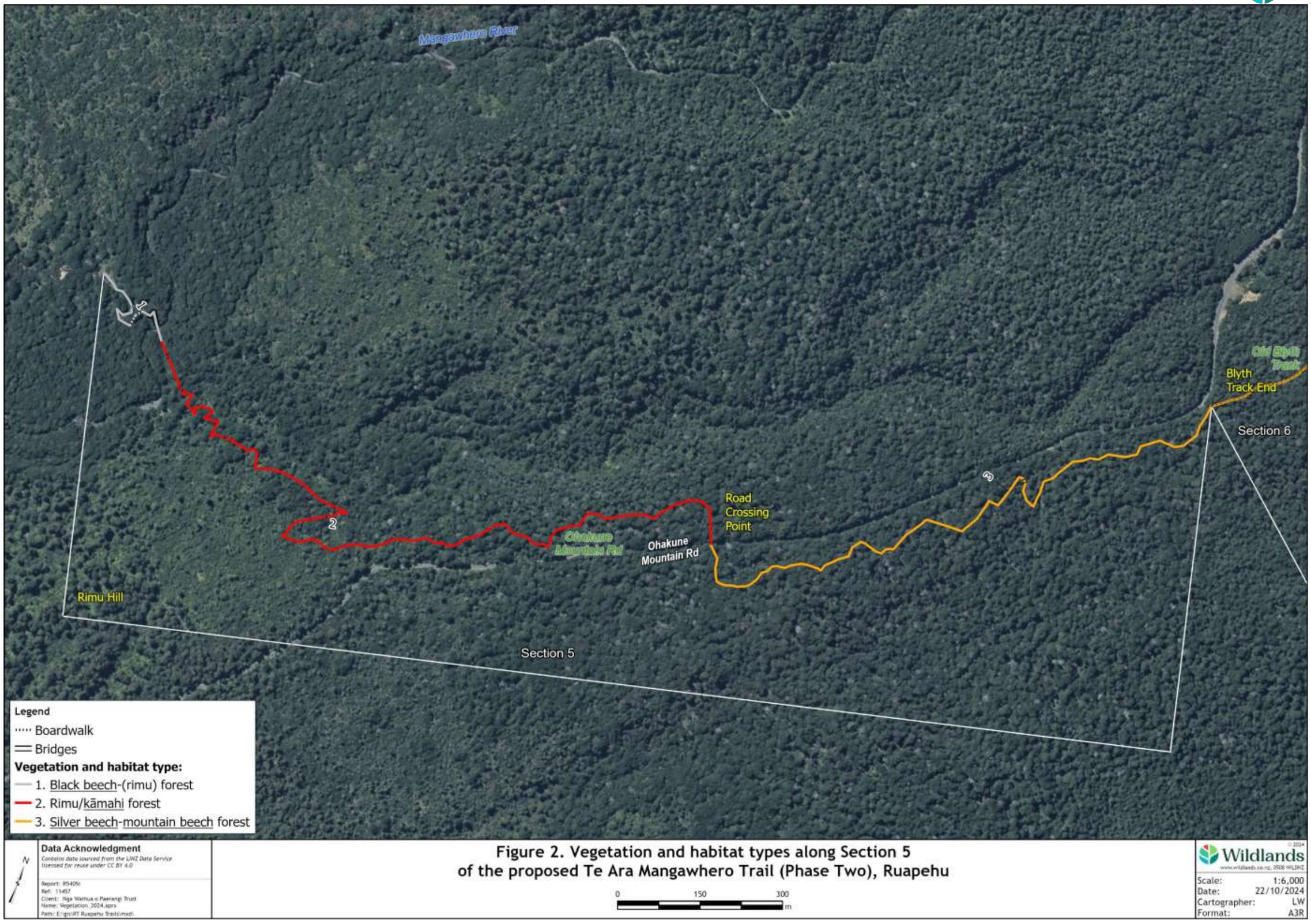


Figure 2. Vegetation and habitat types along Section 5 of the proposed Te Ara Mangawhero Trail (Phase Two), Ruapehu

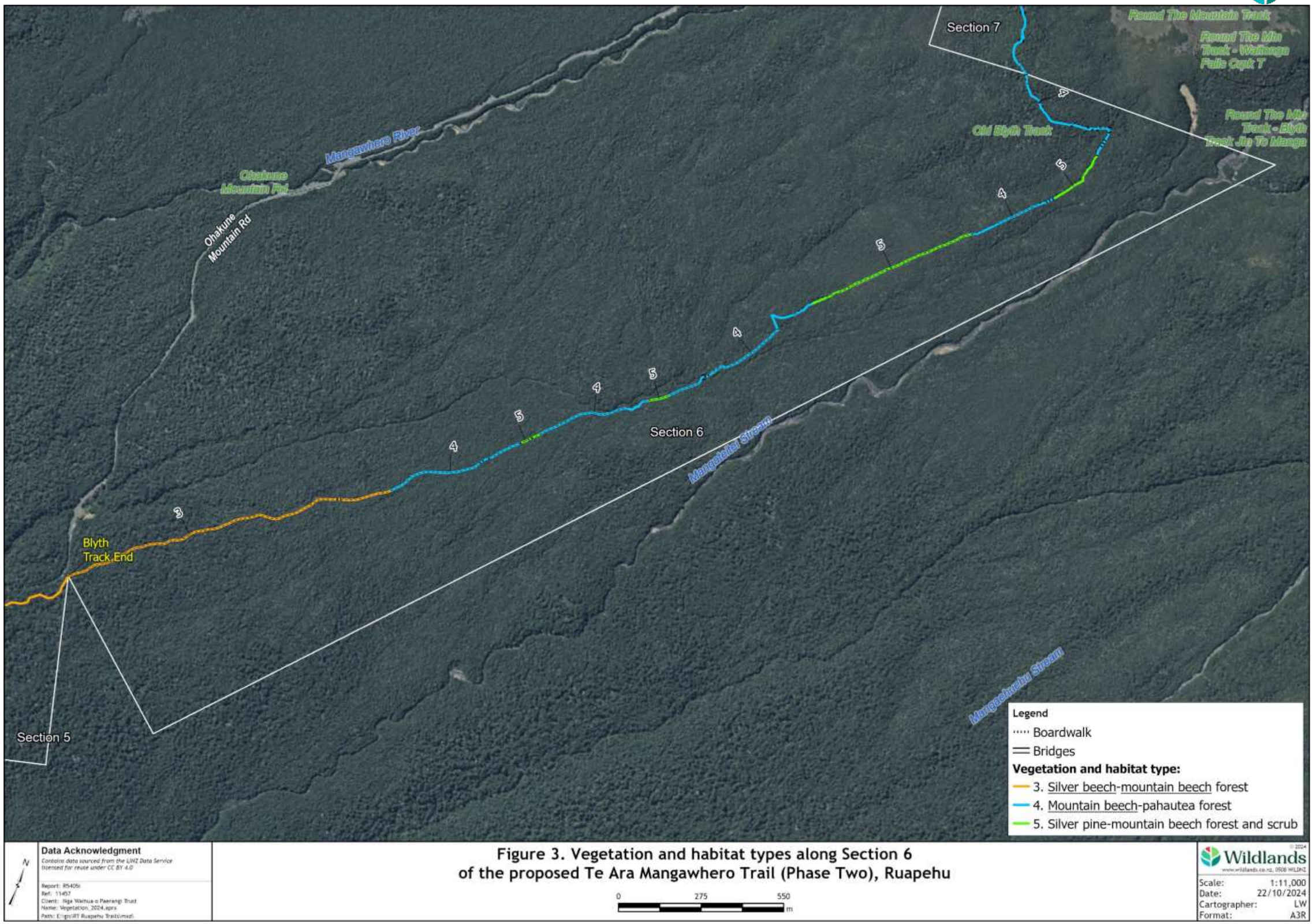


Figure 3. Vegetation and habitat types along Section 6 of the proposed Te Ara Mangawhero Trail (Phase Two), Ruapehu

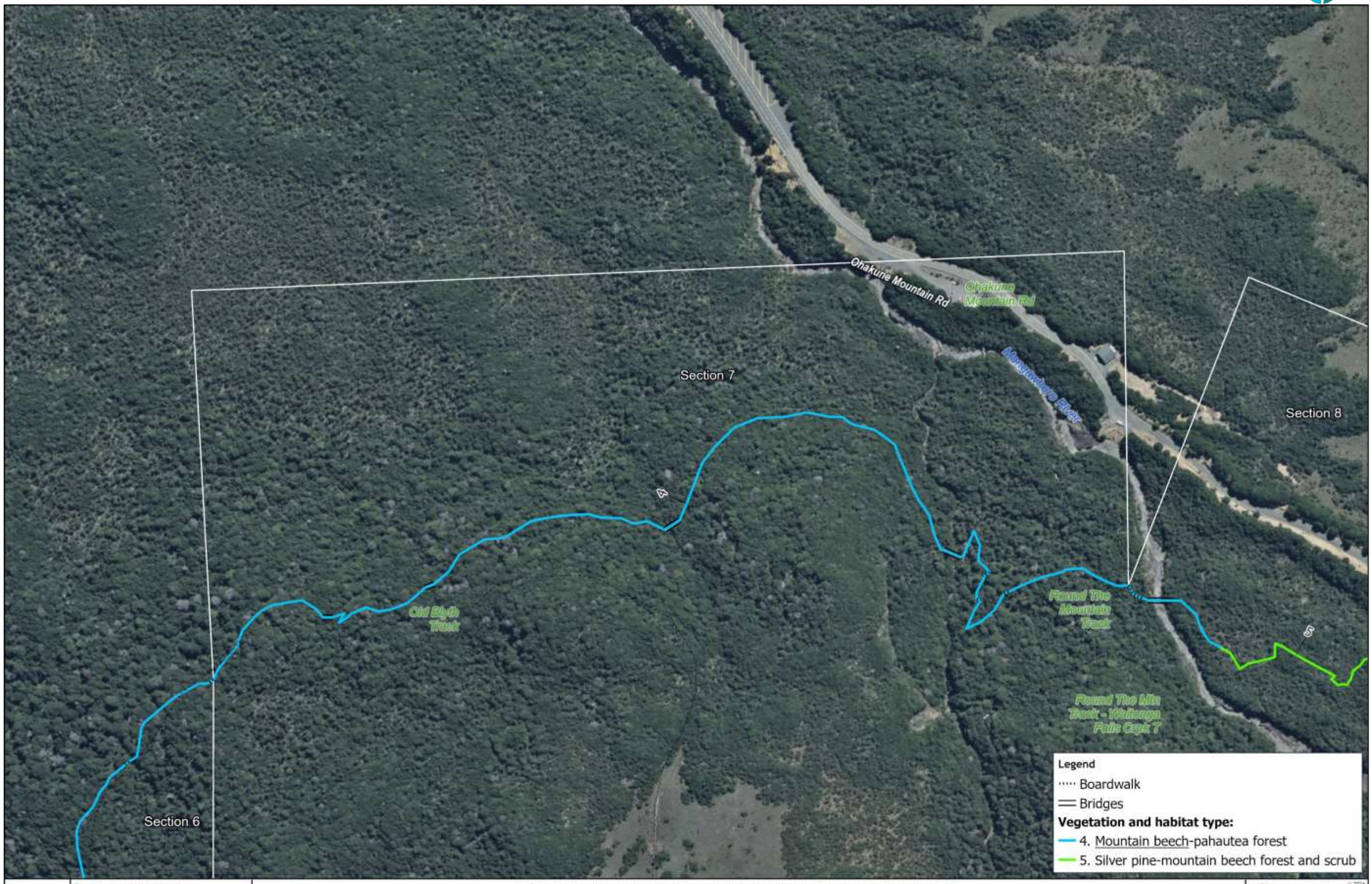


Figure 4. Vegetation and habitat types along Section 7 of the proposed Te Ara Mangawhero Trail (Phase Two), Ruapehu

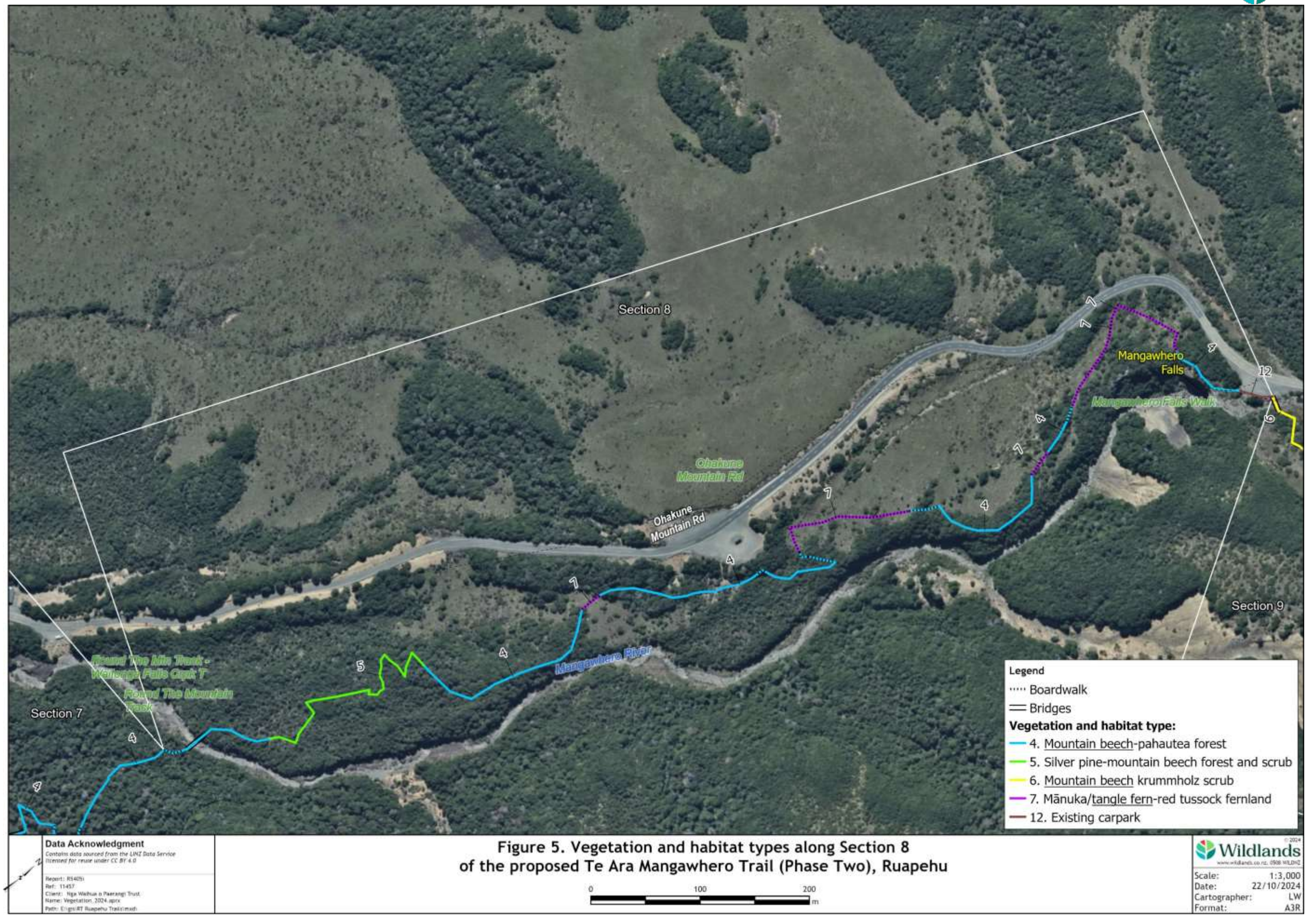


Figure 5. Vegetation and habitat types along Section 8 of the proposed Te Ara Mangawhero Trail (Phase Two), Ruapehu

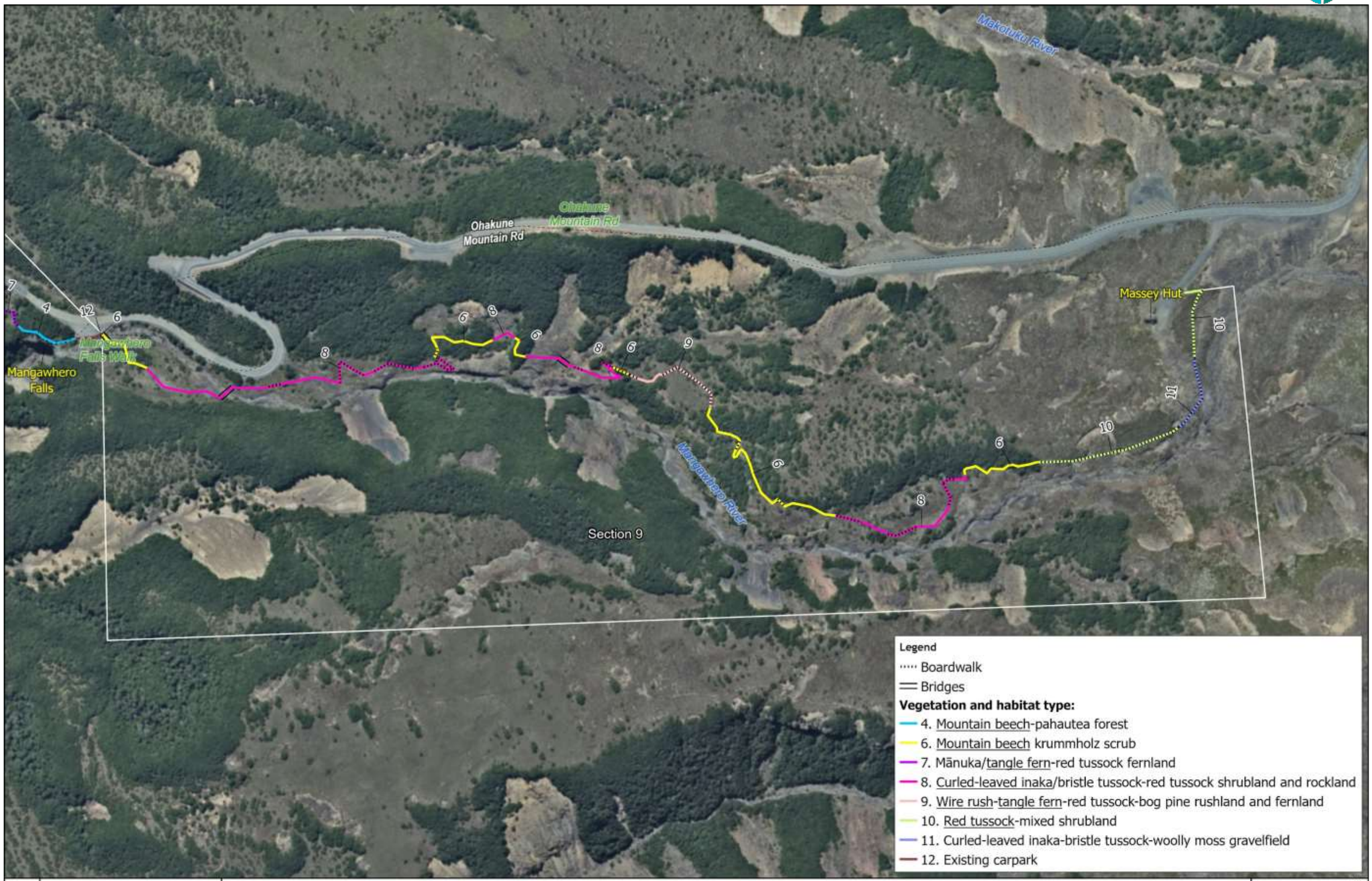


Figure 6. Vegetation and habitat types along Section 9 of the proposed Te Ara Mangawhero Trail (Phase Two), Ruapehu

The ground cover is generally dominated by bush rice grass with occasional piupiu/crown fern, although mauri (*Astelia grandis*) and *Sticherus cunninghamii* are common in a few places. Local patches (*c.*2 × 2 metres) of the leafy liverwort, *Schistochila appendiculata* are present on the ground in shallow gullies and low-lying areas.

6.4 Mountain beech-pahautea forest

All of Section 7 and parts of Sections 6 and 8 of the proposed trail contain forest (*c.*20 metres tall) dominated by mountain beech with pahautea (*Libocedrus bidwillii*) present occasionally. Hall's tōtara (*Podocarpus laetus*) and mountain toatoa are also scattered throughout. This forest type occupies a sub-alpine zone from approximately 1,000 metres asl to the tree line. Orihou (mountain five finger, *Pseudopanax colensoi* var. *colensoi*) becomes increasingly common at lower altitudes.

Saplings of mountain beech are abundant in the understorey, along with shrubs including hūpiro (*Coprosma foetidissima*), *Coprosma pseudocuneata*, kāpuka (*Griselinia littoralis*), and rōhutu. The ground cover comprises leaf litter with scattered plants of *Gahnia procera* (mountain cutty grass), kiokio (*Parablechnum novae-zelandiae*), and bush rice grass, and patches of *Sticherus cunninghamii* and mosses (including *Dicranoloma* spp.). *Astelia* aff. *nervosa* is present in boggy areas where drainage is poor. Patches of bryophytes (mosses and liverworts), lichens, and filmy ferns (including *Hymenophyllum multifidum and H. malingii*) are common on tree trunks, growing epiphytically.

Along the existing Blyth Track (Section 6 of proposed trail), this forest type is sometimes on boggy ground, with occasional pōkākā, and abundant *Gahnia procera*, *Astelia grandis*, and *Sticherus cunninghamii* in the understorey.

On the margins of the Mangawhero River (Section 8 of proposed trail), ferns (including small kiokio *Parablechnum procerum*) and shrubs (including manuka *Leptospermum scoparium*, prickly mingimingi *Leptecophylla juniperina* var. *juniperina*, and *Veronica odora*) are scattered amongst the boulders and rocks.

6.5 Silver pine-mountain beech forest and scrub

Mixed forest and scrub of silver pine (*Manoao colensoi*) and mountain beech occur in several poorly-drained areas along Sections 6 and 8 of the proposed trail, between 975 and 1,200 metres asl. Pink pine (*Halocarpus biformis*) and mountain toatoa (*Phyllocladus alpinus*) are also present throughout. These areas have a variable canopy, generally ranging from 4-6 metres tall. The understorey contains abundant *Gahnia procera*, mānuka, and mauri (*Astelia grandis*). *Dracophyllum subulatum* is present occasionally. Mosses (including *Sphagnum cristatum*) dominate the groundcover, with local areas of tangle fern (*Gleichenia dicarpa*) and *Sticherus cunninghamii*. In particularly wet areas, vegetation is of shorter stature, and wire rush (*Empodisma minus*), comb sedge (*Oreobolus pectinatus*), and *Carex punicea* are common.

6.6 Mountain beech krummholz scrub

This vegetation type occurs at the tree line in Section 9 of the proposed trail. Mountain beech trees are stunted due to ecophysiological constraints, and are less than approximately three metres tall. In places, relatively small patches of mountain beech forest and scrub are intermixed with clearings, such that the canopy of mountain beech is discontinuous. These clearings typically comprise Vegetation and Habitat Type 8: curled-leaved inaka/bristle tussock shrubland and rockland; or similar.

The understorey is relatively open. Saplings of mountain beech, and shrubs of *Coprosma pseudocuneata* are present. Leaf litter dominates the ground cover, with patches of mosses and filmy

ferns scattered throughout. Small trees of orihou (mountain five finger) and mountain toatoa, and shrubs of *Olearia nummularifolia* and *Veronica odora*, are present in sheltered places such as on the margins of mountain beech forest and scrub.

6.7 Mānuka/tangle fern-red tussock fernland

The upper part of Section 8 of the trail is proposed to cross areas of wetland, dominated by tangle fern (*Gleichenia dicarpa*) and alpine tangle fern (*G. alpina*), intermixed with frequent red tussock (*Chionochloa rubra* subsp. *rubra* var. *rubra*). Shrubs of mānuka (to *c.*2 metres tall) and saplings of mountain toatoa are scattered throughout, particularly in drier areas. Large tussocks of *Gahnia procera* are present occasionally. Other species that are intermixed throughout the fernland include wire rush (*Empodisma minus*), bog pine (*Halocarpus bidwillii*), the mountain daisies, *Celmisia incana* and *C. spectabilis* subsp. *spectabilis*, snow tōtara (*Podocarpus nivalis*), and curled-leaved inaka (*Dracophyllum recurvum*).

There appear to have been fires through at least part of this area during pre-European times, i.e. prior to 1840 (Singers and Bayler 2017). Occasional burnt spars that are likely from indigenous conifers (such as bog pine) remain present.

6.8 Curled-leaved inaka/bristle tussock-red tussock shrubland and rockland

This vegetation and habitat type is located in the lower and mid parts of Section 9 of the proposed trail. The habitat is formed from stabilised mid-Holocene lahars (*c.*5,000 years ago) (Lecointre *et al.* 1998) and contains sparsely vegetated shrubland amongst patches of exposed bed rock, boulders, and gravel. Well-delineated terraces are present, including part of one of very few mid-Holocene deposits that are preserved in the western Ruapehu plain and the only post-A.D. 1850 deposits (Lecointre *et al.* 1998).

Curled-leaved inaka and bristle tussock (*Rytidosperma setifolium*) are the dominant plant species present. Red tussock is also present and becomes increasingly abundant at higher altitudes, such as in the mid- upper- parts of Section 9 of the proposed trail. Other species that are common include low shrubs (*c.*0.5-1 metre tall) of mānuka, *Epacris alpina*, and snow tōtara; and the bryophyte, woolly moss (*Racomitrium lanuginosum*). There are occasional tussocks of *Gahnia procera*, patches of the mountain daisy *Celmisia incana*, and occasional small trees of mountain beech. Shrubs of *Olearia nummularifolia*, *Brachyglottis bidwillii*, and *Veronica odora* are present in sheltered places such as on the margins of mountain beech forest.

Between the slopes on the side of the Mangawhero gully and the mounds/terraces of lahar debris there are shallow depressions. Small wetlands dominated by wire rush, tangle fern, red tussock, and bog pine are present locally in areas of poor drainage, such as these depressions.

6.9 Wire rush-tangle fern-red tussock-bog pine rushland and fernland

Several wetlands are located along Section 9 of the proposed trail. These wetlands are dominated by wire rush, red tussock, tangle fern and alpine tangle fern, and bog pine, in varying proportions. Curled-leaved inaka is scattered throughout and there are a few large tussocks of *Gahnia procera*. The mountain daisy, *Celmisia incana* is present infrequently. In local areas of standing water, *Carpha alpina* and comb sedge (*Oreobolus pectinatus*) are present.

Shrubs and small trees of bog pine, mountain toatoa, and snow tōtara are common on the wetland margins, along with occasional shrubs of mānuka and *Olearia nummularifolia*, and patches of mountain beech krummholz scrub.

6.10 Red tussock-mixed shrubland

Above the tree line in Section 9 of the proposed trail, including near the Massey Hut, there is low-stature shrubland with abundant red tussock. A diversity of indigenous shrub species is present including: curled leaved inaka, *Olearia nummularifolia*, whipcord hebe (*Veronica tetragona*), *Brachyglottis bidwillii,* snow tōtara, and *Veronica venustula*. Bog pine, pygmy pine (*Lepidothamnus laxifolius*), and mountain toatoa, are present infrequently, as well as patches of bristle tussock and mountain daisies, particularly *Celmisia incana*. This vegetation and habitat type is likely associated with deep ash soils. There are a few slips above the Mangawhero River that are largely unvegetated.

6.11 Curled-leaved inaka-bristle tussock-woolly moss gravelfield

On steep slopes (>35^{o}) above the tree line in the upper part of the Mangawhero River, there is gravelfield with scattered boulders, stones, and a sparse cover of low-stature indigenous vegetation. A short part of Section 9 of the proposed Te Ara Mangawhero Trail will be within this habitat type. Curled-leaved inaka, bristle tussock, and patches of woolly moss are scattered throughout. Other species present include *Gaultheria colensoi* and the mountain daisy, *Celmisia incana*. There are a few unvegetated slips above the river.

6.12 Existing carpark

In Section 8, immediately before the transition to Section 9, the proposed trail will be located along the outer margin of the existing carpark for Mangawhero Falls.

7.0 Flora

7.1 Vascular plant species

During the site visits, a total of 104 vascular plant species, including 101 indigenous and three exotic plant species, were recorded as naturally occurring at the site (Appendix 1).

Two of the indigenous vascular plant species that were recorded have a national-level threat classification (as per de Lange *et al.* 2024):

- *Isolepis crassiuscula*; At Risk-Naturally Uncommon.
- *Ourisia vulcanica* (mountain foxglove, an alpine flowering herb); At Risk-Naturally Uncommon.

A further one Threatened and eight At Risk indigenous plant species have previously been recorded within or near to the proposed alignment of Phase 2 of the proposed trail (see Table 3; for more detail refer to Wildland Consultants 2020a). This includes three At Risk orchid species, four At Risk mistletoe species, and two shrub species that are typically epiphytic: kohurangi[1] (*Brachyglottis kirkii* var. *kirkii;* Threatened-Nationally Vulnerable) and Kirk's kōhūhū (*Pittosporum kirkii*; At Risk-Declining).

Two of the species recorded (mānuka and rōhutu) belong to the Myrtaceae plant family, which is at risk of infection by myrtle rust (*Austropuccinia psidii*), a fungal disease that arrived in Aotearoa New Zealand in May 2017. At the time of the 2017 threat assessments (de Lange *et al.* 2018), a precautionary principle was applied for the classification of indigenous species, based on the potential

[1] Kohurangi has not been recorded in this general area since the early 2000's (Lois Allison-Cooper, Department of Conservation, pers. comm., 9 October 2024).

for devastating impacts (e.g. scenescence, and plant death) from myrtle rust. Based on more recent data, mānuka and rōhutu are very rarely reported with myrtle rust infections in the wild, so the threat statuses of both of these species have been downgraded to Not Threatened (de Lange *et al.* 2024). Mānuka and rōhutu are otherwise relatively common and widespread within Tongariro Ecological District.

Table 3 – Threatened and At Risk indigenous plant species[1] recorded within or near the alignment of the proposed Te Ara Mangawhero Trail, Phase 2, upper slopes of Mount Ruapehu.

Common Name	Scientific Name	Threat Classification	Preferred Habitat	Relevant Section of Trail
Threatened				
Kohurangi	*Brachyglottis kirkii* var. *kirkii*	Threatened-Nationally Vulnerable	Epiphyte in forest canopy, below 1,000 metres asl. Typically growing amongst perching lilies (*Astelia* spp.).	5 & lower part of 6
At Risk				
Greenhood	*Pterostylis humilis*	At Risk-Naturally Uncommon	Mountain beech forest (Singers and Bayler 2017).	All
-	*Isolepis crassiuscula*	At Risk-Naturally Uncommon	Alpine wetlands.	6, 8, & 9
Kirk's kōhūhū	*Pittosporum kirkii*	At Risk-Declining	Epiphyte in forest canopy, below 1,000 metres asl. Typically growing amongst perching lilies (*Astelia* spp.).	5 & lower part of 6
Mountain foxglove	*Ourisia vulcanica*	At Risk-Naturally Uncommon	Curled-leaved inaka-bristle tussock-woolly moss gravelfield (Singers and Bayler 2017).	9
Pygmy orchid	*Townsonia deflexa*	At Risk-Naturally Uncommon	Known to occur in mountain beech forest, on the Waitonga Falls Track, upper section of Blyth Track, and at Mangawhero Falls[2]; Sections 7 and 8 of the proposed trail.	All
Red mistletoe	*Peraxilla tetrapetala*	At Risk-Declining	Beech forests of all types. Known to grow on mountain beech on the Waitonga Falls Track, Section 7 of the proposed trail (Singers and Bayler 2017).	All
Saprophytic spider orchid	*Corybas cryptanthus*	At Risk-Naturally Uncommon	Rimu/kāmahi forest within the proposed trail alignment is one of the only known locations for this species in Tongariro National Park (Singers and Bayler 2017).	5

[1] National-level threat classifications as per de Lange *et al.* 2024).

[2] Records sourced from iNaturalist NZ. Search *Townsonia deflexa*. Accessed at https://inaturalist.nz/observations?nelat=-39.21081883884433&nelng=175.68596606901508&place_id=any&subview=map&swlat=-39.502825379086765&swlng=175.25955920866352&taxon_id=410202, 17 July 2024.

Common Name	Scientific Name	Threat Classification	Preferred Habitat	Relevant Section of Trail
Scarlet mistletoe	*Peraxilla colensoi*	At Risk-Declining	Beech forests of all types. Known to grow on silver beech at lower end of Blyth Track, Section 6 of the proposed trail (Singers and Bayler 2017).	All
White mistletoe	*Tupeia antarctica*	At Risk-Declining	Recorded from rimu/kāmahi forest at Rimu Hill, Section 5 of the proposed trail. Likely to grow on putaputawētā (Singers and Bayler 2017).	5
Yellow mistletoe	*Alepis flavida*	At Risk-Declining	Beech forests of all types within the vicinity of the proposed track (Singers and Bayler 2017).	
Not Threatened				
Rōhutu	*Neomyrtus pedunculata*	Not Threatened (Threatened-Nationally Critical, as per de Lange *et al* 2018)	Understorey of all types of beech forest.	All
Mānuka	*Leptospermum scoparium*	Not Threatened (At Risk-Declining, as per de Lange *et al* 2018)	Early successional or disturbed areas. Known from margins of the Mangawhero River, tangle fern-red tussock fernland, curled-leaved inaka/bristle tussock shrubland and rockland.	All

7.2 Non-vascular plants

During the site visits, a total of 10 genera of non-vascular indigenous plants were recorded naturally-occurring at the site (Appendix 2), including five mosses, one liverwort, and four lichens.

A detailed review of the non-vascular plants present was beyond the scope of this project. The taxa listed will be a mere snapshot of the diversity of non-vascular flora within or near the proposed alignment of Phase 2 of the proposed trail, because identification of non-vascular plants was only undertaken incidentally in the field. Collection and careful diagnostics by microscope are often needed to confirm the identity of bryophytes and lichens to species level.

7.3 Pest plants

One of the three exotic plant species that were recorded as naturally occurring at the site is an environmental pest plant: Chilean fire bush (*Embothrium coccineum*). Another is a nuisance plant: sealfheal (*Prunella vulgaris*).

One small tree of Chilean fire bush (*Embothrium coccineum*, *c.*2 metres tall) was recorded during the site visit, between boulders in an area of curled-leaved inaka/bristle tussock shrubland and rockland (Vegetation and Habitat Type 8) near the proposed alignment in Section 9 (at NZTM E1816109 N5645008). Chilean fire bush (Plate 3) is a pest plant in Aotearoa New Zealand (McAlpine and Howell 2024). It is an evergreen to semi-deciduous tree (up to 10 metres tall) with tubular scarlet flowers. Its leaves are simple (up to 20 cm long), glabrous, leathery, and lance-shaped. Chilean fire bush can be

dispersed by seed and vegetative tubers. It is tolerant of cold and exposed environments, such as banks, slopes, and open roadsides.



Plate 3 – Foliage and flowers of Chilean fire bush (*Embothrium coccineum*). 22 May 2024. Photograph by D. Glenny © Landcare Research 2012[1].

Chilean fire bush can form dense patches that can exclude and compete with indigenous plant species. Chilean fire bush currently has a limited natural occurrence in Aotearoa New Zealand[1]. There are planted ornamental specimens of Chilean fire bush in Ohakune[2], which are likely to have provided a seed source for the naturalised record near the proposed trail alignment.

A very few patches of sealfheal (*Prunella vulgaris*) were recorded alongside the existing Blyth Track (Plate 4). Patches were generally about 20 × 20 cm and were recorded at the following locations:

- One patch at Bridge 6.27.B.
- Two patches on the Blyth Track, downhill from Bridge 6.27.B. at NZTM E1815774 N5642966.

Sealfheal is a low-growing exotic herb, with square stems, and distinctive purple flowers that emerge on a short spike above the ground in early- to mid- summer. Sealfheal is often a weed of ornamental lawns. It can reproduce from seeds as well as vegetatively via stolons. The patches alongside Blyth Track could potentially have established from seeds or plant material attached to the footwear of people using the track, or carried by other animals.

[1] Breitwieser I., Heenan P.J.; Nelson W.A., Wilton A.D. eds. (2010-2024) *Flora of New Zealand Online – Weed Profile - Embothrium coccineum* (based on Heenan 2010). Accessed at https://www.nzflora.info/factsheet/Weed/Embothrium-coccineum.html, 17 July 2024.

[2] Records sourced from iNaturalist NZ. Search Chilean fire bush. Accessed at https://inaturalist.nz/observations?nelat=-38.897210922533745&nelng=175.85829668974225&place_id=any&subview=map&swlat=-39.589582937257205&swlng=175.20495348905865&taxon_id=319327, 17 July 2024.



Plate 4 – Patches of sealfheal (*Prunella vulgaris*; 20 × 20 cm) on the margin of the existing Blyth Track, near Bridge 6.27.B within the proposed route of Te Ara Mangawhero Trail (Section 6) in mountain beech-pahautea forest (Vegetation and Habitat Type 5). NZTM E1815774 N5642966. 23 May 2024.

8.0 Fauna

8.1 Avifauna

During the site visits, one indigenous bird species was recorded, North Island kākā (*Nestor meridionalis septentrionalis*), which is classified as At Risk-Recovering (as per Robertson *et al.* 2021). Poor weather conditions during the site visits reduced the number and diversity of bird species that were observed.

One Threatened and eight At Risk indigenous bird species (threat status as per Robertson *et al*. 2021) have been previously recorded in the general vicinity of the proposed trail (for more detail refer to Wildland Consultants 2020a).

Whio (*Hymenolaimus malacorhynchos*, Threatened-Nationally Vulnerable) have been released in to the Mangawhero River, upstream of Ohakune, and at least one known pair continues to use this part of the river. Whio tend to nest under logs and in associated vegetation along river margins. High water quality and fast-flowing rivers with sufficient ongoing control of introduced mammalian predators (particularly stoats, *Mustela erminea*) are key factors in the survival and success of whio.

Indigenous birds that are relatively common within the area include toutouwai/North Island robin (*Petroica longipes*), tītitipounamu/North Island rifleman (*Acanthisitta chloris granti*) (both At Risk-Declining), pōpokatea/whitehead (*Mohoua albicilla*), and tūī (*Prosthemadera novaeseelandiae novaeseelandiae*). North Island kākā, karearea/bush falcon (*Falco novaeseelandiae*; Threatened-Nationally Increasing) and North Island brown kiwi (*Apteryx mantelli*) are also present.

8.2 Pekapeka/bats

It is highly likely that indigenous long-tailed bats (*Chalinolobus tuberculatus*; Threatened-Nationally Critical, as per O'Donnell *et al*. 2022) and central short-tailed bats (*Mystacina tuberculata rhyacobia*; At Risk-Declining) utilise habitats below treeline, along the proposed trail alignment, at least periodically, based on previous records within the vicinity (for more detail refer to Wildland Consultants 2020a).

Suitable locations for bat roosts are present along the proposed trail alignment (Plate 5). Pekapeka/bats typically roost (rest during the day-time and breed) in crevices, such as in trees under flaking bark or in hollows or branch junctions, or amongst clusters of epiphytes.



Plate 5 – Hollows in a large tree that may provide suitable locations for bat roosts, nest sites for arboreal birds such as North Island kākā, and habitat for lizards on the margin of the existing Blyth Track, within the proposed route of Te Ara Mangawhero Trail (Section 6) in mountain beech-pahautea forest (Vegetation and Habitat Type 5). NZTM E1815683 N5642681. 23 May 2024.

8.3 Lizards

It is highly likely that at least one indigenous lizard species, northern grass skink (*Oligosoma polychroma*; Not Threatened), is present in the trail, Phase 2 project area (Table 4). Elegant gecko (*Naultinus elegans*) and barking gecko (*N. punctatus*), or a hybrid of these two species, as well as forest gecko (*Mokopirirakau granulatus*) are present within the surrounding forest (Singers 2017).

The locations identified as suitable for bat roosts (see above), along the proposed trail alignment (Plate 5), may also provide suitable habitat for lizards.

Records for indigenous lizards within *c.*20 kilometres of the site and within the central North Island in particular are limited, which is likely a reflection of the highly modified environment and a lack of formal surveys. For this reason, records older than 20 years were included in the database search (Table 4).

Table 4 – Results from a search of the Department of Conservation Bioweb Herpetofauna Database within a 20 kilometre radius of the site and assessment of the likelihood of the presence of these species within the Phase 2 project area. Conservation status is from Hitchmough *et al.* (2021). Records older than 20 years were included in the database search. The likelihood of occurrence for each species is given, based on their known habitat preferences and distribution.

Species	Common Name	Conservation Status	Record Distance (km) and year	Preferred Habitats	Likelihood of Occurrence
Oligosoma polychroma	Northern grass skink	Not Threatened	11 km (2012)	Range of grassy and rocky areas.	Highly likely
Naultinus punctatus	Barking gecko	At Risk-Declining	8 km (1998)	Coastal and lowland forest, and scrubland. Often found in trees like mānuka, kānuka, and other dense vegetation.	Possible
Naultinus elegans	Elegant gecko	At Risk-Declining	-	Coastal and lowland forest, and scrubland. Often found in trees like mānuka, kānuka, and other dense vegetation.	Possible
Mokopirirakau granulatus	Forest gecko	At Risk-Declining	13 km (2010)	Scrubland, forest, creviced rock outcrops, and rocky scrub from the coast to alpine areas.	Possible
Mokopirirakau 'southern North Island'	Ngahere gecko	At Risk-Declining	-	Coastal and lowland scrubland and forest (may exist above tree line).	Possible
Oligosoma robinsoni	Crenulate skink	At Risk-Declining	-	Coastal and lowland forest edges, scrubland, grassland, pasture, fernland, boulder beaches and duneland.	Possible
Dactylocnemis pacificus	Pacific gecko	Not Threatened	-	A range of coastal and lowland environments.	Possible
Oligosoma ornatum	Ornate skink	At Risk-Declining	-	Coastal and lowland native forest, scrubland, and grassland.	Possible

Species	Common Name	Conservation Status	Record Distance (km) and year	Preferred Habitats	Likelihood of Occurrence
Oligosoma aff. *Infrapunctatum* 'Southern North Island'	Kupe skink	Threatened-Nationally Critical	-	Edges of coastal native forest, scrubland, grassland (including exotic grasses), pasture and duneland (in coastal, lowland, and possible montane, subalpine and alpine areas).	Unlikely
Oligosoma aeneum	Copper skink	At Risk-Declining	-	Forest, scrubland, beaches, pasture, and gardens.	Unlikely
Oligosoma zelandicum	Glossy brown skink	At Risk-Declining	-	Native forest, scrubland, farmland, rock banks, grassland, wetland and gardens.	Unlikely
Oligosoma microlepis	Small-scaled skink	Threatened-Nationally Vulnerable	-	Open rocky habitats (especially pumice fields), such as scree, outcrops, cliffs, boulder banks, farmland and dense vegetation.	Unlikely

Northern grass skink are abundant throughout the mid-lower North Island, and can be found in highly modified sites, including exotic pasture and riparian vegetation where there is a variety of vegetation types such as rank grass, scrub, and woody debris. Suitable habitat is present within Te Ara Mangawhero Trail project area.

The project area is situated along the geographical boundary of the known distribution ranges of the barking gecko (*Naultinus punctatus*; At Risk-Declining) and elegant gecko (*Naultinus elegans*; At Risk-Declining). It is possible that Te Ara Mangawhero Trail is within both of these species' distribution range. Both barking and elegant gecko are primarily tree-dwelling (arboreal) and therefore, may be present in the areas of the site where there is mature indigenous forest, as well as areas of scrub and shrubland.

Te Ara Mangawhero Trail is also situated along the geographical boundary of the known distribution ranges of forest gecko (*Mokopirirakau granulatus*; At Risk-Declining) and Ngahere gecko (*Mokopirirakau* 'southern North Island'; At Risk-Declining). If *Mokopirirakau* spp. are present, it is most likely that the species would be forest gecko, rather than Ngahere gecko, but it is possible that the project area is within both of these species' distribution ranges. Both forest and Ngahere gecko are generalist species (e.g. inhabiting scrub, shrubland, forest, and rock fields) but frequently utilise arboreal habitats. Therefore, it is possible that both species are present within indigenous forest and shrubland habitat.

Ornate skink (*Oligosoma ornatum*; At Risk-Declining) are also possibly present in areas of indigenous forest and shrubland, particularly those with relatively dense vegetation and an abundance of leaf litter.

Pacific gecko (*Dactylocnemis pacificus*; Not Threatened) may be present in areas of scrub and forest, as well as areas with rocky outcrops and bluffs.

Crenulate skink (*Oligosoma robinsoni*; At Risk-Declining) may possibly be present in areas of scrub, shrubland, or dense grassland. This species also takes refuge under areas of dense foliage or logs and rocks. There are observations approximately 16 kilometres away from 2003, and earlier, that are described as 'Newmans speckled skink'. It is likely that these observations were either misidentified, or are from prior to the revision of the 'speckled skink' taxonomy; therefore, it is likely that these records are 'crenulate skink'.

Although unlikely, small-scaled skink (*Oligosoma microlepis*; Threatened-Nationally Vulnerable) could be present. Small-scaled skink mainly inhabit sunny rocky habitats, sometimes including those that are modified or marginal. Areas of rocky substrates exposed to sun or riparian areas with pebble or boulder banks provide suitable habitat for the small-scaled skink. However, given its threat status, it is unlikely that this species will be detected within the proposed trail area.

Other species unlikely to be present include glossy brown skink (*Oligosoma zelandicum*; At Risk-Declining), copper skink (*Oligosoma aeneum*; At Risk-Declining), and Kupe skink (*Oligosoma* aff. *infrapunctatum* 'Southern North Island'; Threatened-Nationally Critical). Kupe skink are known from discrete populations throughout the central North Island, and may be present in areas of exotic grassland, rockland, and tussockland. Their threat ranking is likely a result of a lack of formal targeted surveys, and small known population sizes. Glossy brown skink and copper skink both typically inhabit areas of indigenous forest, shrubland and grassland, particularly areas with dense vegetation and an abundance of leaf litter. Despite the limited records within the area, there is a chance a remnant population may be present, although it will be difficult to detect these species at low densities.

Plague skinks (*Lampropholis delicata*; Introduced and Naturalised; Unwanted Organism) have been observed within the wider Ruapehu area, and are slowly spreading throughout the North Island. There

is a possibility that this species may be present within the proposed trail site. If this species is present/discovered at this site, it is important that MPI biosecurity protocols are followed to ensure that spread of this organism is minimised/reduced.

8.4 Aquatic fauna

Rivers and streams that drain from Mount Ruapehu and the sounding area are of high ecological value. Indigenous freshwater fish species and freshwater invertebrates that are likely to occur in the Mangawhero River and tributary streams include longfin eel (*Anguilla dieffenbachii*), torrentfish (*Cheimarrichthys fosteri*), kōaro (*Galaxias brevipinnis*) (all At Risk-Declining as per Dunn *et al*. 2018), kākahi (freshwater mussels; *Echyridella menziesi*) (At Risk-Declining as per Grainger *et al.* 2018), and kōura (*Paranephrops planifrons*; Not Threatened).

8.5 Notable indigenous terrestrial invertebrates

Tongariro National Park is a key location for te pēpepe pōuri/forest ringlet butterfly (*Dodonidia helmsii*; At Risk-Relict[1])(Wheatley 2017). The dominant food plant of their caterpillars is mountain cutty grass (*Gahnia procera*), which is present in Sections 6-9 of the proposed trail. This plant species is abundant in the mountain beech forest, and higher altitude tussock fernland and shrublands on these upper slopes of Mount Ruapehu.

A detailed review of the indigenous terrestrial invertebrates present was beyond the scope of this project. A wide range of invertebrate taxa will be present, including alpine-adapted species.

9.0 Summary of ecological values

9.1 Overview

This second phase of Te Ara Mangawhero Trail will involve construction of approximately 12 kilometres of trail, from Rimu Hill to Massey Hut, on the upper slopes of Maunga Ruapehu. The entire length of the proposed trail is within Tongariro National Park, which is recognised as a World Heritage Site for its international cultural, ecological, and landscape significance.

As a whole, the project area of Phase 2 Te Ara Mangawhero Trail, at Ruapehu is of **exceptional** ecological value. The proposed trail will traverse through a natural altitudinal and geological gradient of ecosystems; from tall podocarp forest at lower altitudes, to mountain beech forest (with local wetlands), gradually decreasing in stature to mountain beech krummholz scrub at treeline; above which there are subalpine and alpine tussock shrublands and sparsely-vegetated gravelfields. Volcanic processes, specifically lahars, have contributed to the high diversity of vegetation communities that are present within this project area. Ecosystems associated with lahars are naturally rare in New Zealand and, due to the volcanic nature, they have a patchy distribution globally (Crisafulli *et al.* 2015). Wetlands have been greatly reduced in extent as a result of landscape modification of by people, and high-quality wetlands that remain intact, such as those within the project area, are of very high importance. Most of the proposed trail footprint (with the exception of Section 6 - Blyth Track) is within areas that have very little modification by people, and do not have existing official tracks. All vegetation and habitat types present are dominated by indigenous species, with very few exotic pest plants present. In general, the high-quality and intact, lowland to alpine ecological gradients that

[1] Threat status follows Hoare *et al*. (2017).

support a wide diversity of ecosystem types within the proposed Phase 2 trail footprint are of tremendous biological and conservation importance.

With this general context in mind, the ecological values of each section of the proposed Phase 2 trail have been assessed in more detail, based on the vegetation habitats and fauna present. Ecological values are considered to be **high** within the podocarp and beech forest (Sections 5-8), particularly notable at wetlands and river margins; and **very high** within the higher altitude (Section 9) areas, particularly alpine tussock shrublands and gravelfields, solidified lahar deposits, river margins, and wetlands. A summary of the ecological values of each trail section is presented in Table 5, with further details of the assessments thereafter.

Table 5 – Summary of ecological values of vegetation and habitats along the proposed alignment of Te Ara Mangawhero Trail, Phase 2, upper slopes of Mount Ruapehu.

Section of Proposed Trail	Vegetation and Habitat Type(s)	Ecological Value	Key Reasons
Section 5: Phase 1 end (Rimu Hill) to Blyth Track, *c.*3.2 kilometres	1. Black beech-(rimu) forest 2. Rimu/kāmahi forest 3. Silver beech-mountain beech forest	High	• Undisturbed tracts of emergent podocarp and beech forest • High-quality river and river margin habitats • Habitat for Threatened and/or At Risk birds, pekapeka/bats, and lizards • Habitat for Threatened and/or At Risk-plants
Section 6: Existing Blyth Track, *c.*4.5 kilometres	3. Silver beech-mountain beech forest 4. Mountain beech-pahautea forest 5. Silver pine-mountain beech forest and scrub	High	• Wetland forest and scrub • Elevational gradient of beech forest types • Habitat for Threatened and/or At Risk birds, pekapeka/bats, lizards, and butterfly • Habitat for Threatened and/or At Risk-plants
Section 7: New Connection Blyth-Waitonga Falls Track, *c.*1.1 kilometres	4. Mountain beech-pahautea forest	High	• Undisturbed tract of beech forest • Habitat for Threatened and/or At Risk birds, pekapeka/bats, lizards, and butterfly • Habitat for At Risk-plants
Section 8: Existing Waitonga Falls Track to Mangawhero Falls, *c.*1.5 kilometres	4. Mountain beech-pahautea forest 5. Silver pine-mountain beech forest and scrub 7. Mānuka/tangle fern-red tussock fernland 12. Existing carpark	High	• Wetland forest and scrub • Wetland tussock fernland • Undisturbed tracts of beech forest • High-quality river and river margin habitats • Habitat for Threatened and/or At Risk birds, pekapeka/bats, lizards, and butterfly • Habitat for At Risk-plants
Section 9: Mangawhero Falls to Massey	6. Mountain beech krummholz scrub 8. Curled-leaved inaka/bristle	Very high	• Lahar and volcanic boulderfield ecosystems • Wetland tussock fernland

Section of Proposed Trail	Vegetation and Habitat Type(s)	Ecological Value	Key Reasons
Hut, *c.*1.9 kilometres	tussock-red tussock shrubland and rockland 9. Wire rush-tangle fern-red tussock-bog pine rushland and fernland 10. Red tussock-mixed shrubland 11. Curled-leaved inaka-bristle tussock-woolly moss gravelfield		• Undisturbed tracts of beech forest at treeline • Alpine tussock shrubland and gravelfields • High-quality river and river margin habitats • Habitat for Threatened and/or At Risk birds, lizards, and butterfly • Habitat for At Risk-plants

9.1.1 Threatened and uncommon ecosystems

Six vegetation and habitat types identified along the proposed route meet the criteria for Threatened, At Risk, or Rare habitats as defined in Schedule 6 of the Horizons One Plan[1]:

- Podocarp/black beech/mountain beech forest - Threatened (Vegetation and Habitat Type 1 in Section 5, Vegetation and Habitat Type 4 in Sections 6, 7, and 8).
- Podocarp/kāmahi forest - At Risk (Vegetation and Habitat Type 2 in Section 5).
- Mountain beech forest or treeland - At Risk (Vegetation and Habitat Type 6 in Section 9).
- Bog and fen wetland - At Risk, and Seepage wetland - Rare (Vegetation and Habitat Type 5 in Section 6; Vegetation and Habitat Types 5 and 7 in Section 8; Vegetation and Habitat Type 9 and parts of Type 8 in Section 9).
- Riparian margin - At Risk (at proposed bridge locations, particularly crossing Mangawhero River - a Site of Significance - Aquatic[2], recognised for whio) (Sections 5, 8, and 9).
- Boulderfields of volcanic rock - Rare (Vegetation and Habitat Types 10 and 11, and parts of Type 8 in Section 9).

Six vegetation and habitats identified along the proposed route of Phase 2 Te Ara Mangawhero Trail are naturally uncommon, as per Williams *et al.* (2007) or otherwise rare at a national level, and some of these are nationally Endangered ecosystems (as per Holdaway *et al.* 2012).

- Vegetation and Habitat Types 10 and 11, and parts of Type 8 in Section 9: Volcanic boulder field (naturally uncommon), Endangered.

- Vegetation and Habitat Type 8 in Section 9: Volcanic debris flow or lahar (naturally uncommon).

[1] Horizons One Plan, RP -SCHED6 - Indigenous biological diversity. https://www.horizons.govt.nz/CMSPages/GetFile.aspx?guid=a5e024c2-ebd0-4989-b4f6-655b6811c3d3 Accessed on 26 August 2024.

[2] Horizons One Plan, RP -SCHED2 - Surface water management values. Table 26. https://www.horizons.govt.nz/CMSPages/GetFile.aspx?guid=a5e024c2-ebd0-4989-b4f6-655b6811c3d3 Accessed on 26 August 2024.

- Wetlands: Only *c.*10% of the historical extent of wetlands remain in Aotearoa New Zealand (Dymond *et al.* 2021). Vegetation and Habitat Type 5 in Section 6; Vegetation and Habitat Types 5 and 7 in Section 8; Vegetation and Habitat Type 9 and parts of Type 8 in Section 9. Seepage wetlands are Endangered, while blanket mires (bogs and fens) are Vulnerable (as per Holdaway *et al.* 2012).

9.2 Section 5 - Phase 1 end to Blyth Track

Section 5 of the proposed trail will be located within three forest types that are of high ecological value: black beech-(rimu) forest, rimu/kāmahi forest, and silver beech-mountain beech forest.

Black beech-dominant forest within the final section (Section 4) of Phase 1 of the proposed trail has been heavily affected by logging activity associated with the Bennett and Punch tramline. However; within Section 5 of Phase 2, rimu remain present (albeit scattered infrequently) in the black beech forest indicating that logging was less intensive in this area. Black beech-(rimu) forest (Vegetation and Habitat Type 1) is present on lahar deposits alongside the Mangawhero River (Singers 2017) and retains a high-level of natural character and representativeness (i.e. typical of the ecosystem type that would be expected in this location (refer to Davis *et al.* 2016 for further definitions)).

Rimu/kāmahi forest is present above the lahar pathway associated with the Mangawhero River (Singers 2017). In this general area, referred to as Rimu Hill, logging and hauling for timber was undertaken in the 1900s. Kāmahi and a range of broadleaved tree/shrub species currently dominate these modified areas. However, sizeable tracts of large emergent podocarps, most notably rimu and mataī, remain present within the proposed trail footprint and where logging was not undertaken.

Silver beech-mountain beech forest within this section of the proposed trail is unmodified.

Threatened indigenous birds are known to utilise habitats within these forests, including karearea/bush falcon (Threatened-Nationally Increasing), North Island kākā (At Risk-Recovering), tītitipounamu/North Island rifleman, kākāriki/yellow-crowned parakeet (*Cyanoramphus auriceps*), toutouwai/North Island robin (all three are At Risk-Declining), and North Island brown kiwi.

It is likely that Threatened and/or At Risk indigenous pekapeka/bats and lizards utilise habitats within these forests.

Uncommon plants (such as mistletoes and shrub epiphytes) are known to be present. In particular, white mistletoe (*Tupeia antarctica*; At Risk-Declining) has been recorded growing on putaputawētā at Rimu Hill. Rimu/kāmahi forest within this vicinity is one of the only known locations for the ground-dwelling saprophytic spider orchid, *Corybas cryptanthus* (At Risk-Naturally Uncommon), in Tongariro National Park.

9.2.1 Mangawhero River and tributary Streams

The proposed alignment will cross the Mangawhero River at four locations, one crossing in each of Sections 5 and 8, and two crossing in Section 9. There will be at least six crossings of tributary streams/ creeks (see Table 1).

Mangawhero River and tributary streams within the project area are of high ecological value. They provide good quality habitat for indigenous freshwater fish and invertebrates. Whio (Threatened-Nationally Vulnerable) are known to utilise fast-flowing sections of the Mangawhero River, and may use some of the tributary streams on occasion.

9.3 Section 6 - Existing Blyth Track

Following the existing footprint of the Blyth Trail, Section 6 of the proposed trail will be located within three forest types that are of high ecological value: silver beech-mountain beech forest, mountain beech-pahautea forest, and silver pine-mountain beech forest and scrub.

The silver pine-mountain beech forest (Vegetation and Habitat Type 5) is of particular note. The best remaining examples of this vegetation type in the North Island occur within Tongariro National Park (Singers and Bayler 2017). Silver pine-mountain beech forest is a type of wetland forest, associated with areas of impeded soil drainage.

Mountain beech-pahautea forest and silver beech forest types are relatively widespread within Tongariro National Park and other medium to high elevation areas throughout the North Island and rest of New Zealand. Despite this, the Blyth Track provides an easily accessible route for visitors to view a good quality example of the transitional patterns in beech forest types that are associated with the natural gradient in elevation at Mount Ruapehu (the section of Blyth Track to be used for the proposed trail is from *c.*920 metres asl to *c.*1,200 metres asl).

Threatened indigenous birds are known to utilise habitats within these forests, including species listed as present in Section 5 of the proposed trail (see Section 9.2 above). Mātātā/North Island fernbird (*Bowdleria punctata vealeae*) may also use wetland habitats.

It is likely that Threatened and/or At Risk indigenous pekapeka/bats and lizards utilise habitats within these forests.

Te pēpepe pōuri/forest ringlet butterfly (At Risk-Relict) may be present, as the dominant host plant *Gahnia procera* is scattered to abundant.

Beech trees within this proposed section of the trail are known to provide habitat for uncommon plants; including scarlet mistletoe (*Peraxilla colensoi*), yellow mistletoe (*Alepis flavida*; both At Risk-Declining), and the ground-dwelling pygmy orchid, *Townsonia deflexa* (At Risk-Naturally Uncommon).

9.4 Section 7 - New Connection

Section 7 of the proposed trail will be located entirely within mountain beech-pahautea forest (Vegetation and Habitat Type 4), away from existing tracks. This section of the proposed trail will follow the 1,200 metre-contour level, from the intersection with the existing Blyth Track, to the Round the Mountain/Waitonga Falls access track.

Although mountain beech-pahautea forest is relatively widespread within Tongariro National Park, this tract is of high ecological value, because it retains a high-degree of natural character and representativeness.

Threatened indigenous birds are known to utilise habitats within these forests, including species listed as present in Section 5 of the proposed trail (see Section 9.2 above).

It is likely that Threatened and/or At Risk indigenous pekapeka/bats and lizards utilise habitats within these forests. Te pēpepe pōuri/forest ringlet butterfly (At Risk-Relict) may be present.

Beech trees within this proposed section of the trail are known to provide habitat for uncommon plants, including red mistletoe (*Peraxilla tetrapetala*; At Risk-Declining) and the ground-dwelling pygmy orchid, *Townsonia deflexa* (At Risk-Naturally Uncommon).

9.5 Section 8 - Waitonga Falls Track to Mangawhero Falls

After crossing Mangawhero River (*c.*1,200 metres asl), Section 8 of the proposed alignment will be positioned roughly parallel to Ohakune Mountain Road, to *c.*1,300 metres asl at the entrance to Mangawhero Falls Carpark. While largely within mountain beech-pahautea forest, the trail will cross through mānuka/tangle fern-red tussock fernland in four places, as well as one area of silver pine-mountain beech forest and scrub. Collectively, these habitat types are of high ecological value.

The areas of mountain beech-pahautea forest are largely unmodified, provide important habitat and vegetation cover alongside the Mangawhero River, and retain a high-degree of natural character and representativeness.

The silver pine-mountain beech forest and mānuka/tangle fern-red tussock fernland are wetland habitats, associated with areas of impeded soil drainage.

Threatened indigenous birds are known to utilise habitats within these forests, including species listed as present in Section 5 of the proposed trail (see Section 9.2 above).

Threatened and/or At Risk indigenous pekapeka/bats and lizards may utilise habitats within these forests. Te pēpepe pōuri/forest ringlet butterfly (At Risk-Relict) is likely to be present, including within the tussock fernland.

Uncommon plants present within the beech forest and scrub may include red mistletoe (*Peraxilla tetrapetala*; At Risk-Declining) and the ground-dwelling pygmy orchid, *Townsonia deflexa* (At Risk-Naturally Uncommon). Wetland areas support a suite of plants that are suitably adapted to waterlogged soil.

9.6 Section 9 - Mangawhero Falls to Massey Hut

Section 9 of the proposed trail will be within sub-alpine to alpine habitats that are unmodified and of very high ecological value. Two crossings of Mangawhero River (both at *c.*1,300 metres asl) are proposed for this section.

In the lower half of this section, most of the trail footprint will be within patches of shrubland, tussockland, amongst exposed bed rock, boulders, and gravel (curled-leaved inaka/bristle tussock-red tussock shrubland and rockland; Vegetation and Habitat Type 8). The trail will also traverse patches of mountain beech krummholz scrub (Vegetation and Habitat Type 6). Near the middle of this section, the proposed trail will follow the outer edge of a notable wetland, dominated by wire rush and tangle fern (Vegetation and Habitat Type 9). In the upper half of this section, there will be longer parts of the trail within mountain beech krummholz scrub. There will be a substantial climb in the trail within an area of well-preserved stabilised mid-Holocene lahar material (Vegetation and Habitat Type 8). The final part of the trail will follow the contour, above treeline, through red tussock-mixed shrubland and gravelfield (Vegetation and Habitat Types 10 and 11), gradually climbing to Massey Hut (*c.*1,460 metres asl).

Wetland and alpine ecosystems present in this section of the proposed trail are naturally uncommon, Endangered, or otherwise rare in Aotearoa New Zealand (see Section 9.1.1 above).

Threatened indigenous birds are known to utilise habitats within this section, including karearea/bush falcon (Threatened-Nationally Increasing).

Threatened and/or At Risk indigenous lizards may utilise habitats within this section. Te pēpepe pōuri/forest ringlet butterfly (At Risk-Relict) is likely to be present.

Due to the higher altitude and proximity to treeline, indigenous pekapeka/bats are much less likely to utilise habitats within this section of the trail, than lower altitude sections.

A suite of wetland- and alpine-adapted species are present including uncommon taxa, such as *Isolepis crassiuscula* and *Ourisia vulcanica* (both At Risk-Naturally Uncommon).

10.0 Potential ecological effects

10.1 Overview

In the absence of any efforts to avoid or minimise potential effects, the proposed trail on the mid- to upper slopes of Ruapehu Maunga (Phase 2) could have significant, to more than minor adverse ecological effects. Some effects could be long-term to permanent, such as the loss of key indigenous plant species if they are felled or cleared; while other effects will be temporary such as sound disturbance of key indigenous bird species during trail construction. Overall, the magnitude of effects could be very high, because the proposed activity is within ecosystems of high to very high ecological value. Without appropriate avoidance, remedy, or mitigation, there could be significant adverse ecological effects within the higher altitude (Section 9) areas and more than minor adverse ecological effects within the remainder of the proposed trail footprint (Sections 5-8).

Potential ecological effects of constructing the five sections of trail within Phase 2 of Te Ara Mangawhero include the following:

- Loss of indigenous vegetation and habitat for indigenous plants.
- Increased plant mortality, tree decline, and windthrow.
- Mortality or injury of indigenous fauna.
- Disturbance and displacement of indigenous fauna through noise or activity associated with construction and continual use of the trails.
- Creation of a corridor for the movement of pest plants and animals.
- Erosion, sedimentation, and contamination.
- Changes in hydrology.

These matters are addressed below.

10.2 Loss of indigenous vegetation and habitat for indigenous plants

Development of the proposed trail could result in the direct removal (loss of life) or displacement of indigenous plants, and loss or disturbance of habitats within the trail corridor.

The maximum width of the construction alignment will be two metres, including the width of the trail (average 0.9 metres) and construction batters. The maximum length of trail that could require vegetation clearance (Sections 5, and Sections 7-9), would be *c.*7.7 kilometres (note that Section 6, *c.*4.5 km) has been excluded because it will utilise the existing Blyth Track). If it is assumed that this length of Phase 2 trail was constructed at a width of two metres, this could result in a maximum area of vegetation clearance and/or disturbance of up to 1.5 hectares. The following sections of this effects assessment are based on the potential clearance of a maximum of 1.5 hectares of indigenous vegetation of high (*c.*1.16 ha) to very high (Section 9; *c.*0.38 ha) ecological value.

Any vegetation clearance would be of a linear nature. The potential adverse ecological effects of clearance of a long narrow strip of 1.5 hectares are less than the effects of clearance of a compact circular area of the same total size, i.e. 1.5 hectares. This is because, clearance of a compact area

would result in more major adverse edge effects than a linear strip to be largely set within the existing vegetation. Edge effects are defined as changes in species abundance and community structure at the interface between two contrasting habitats (e.g. Murcia 1995). Edge effects can result from increased light and associated temperature and humidity, and wind exposure differentials between the interior and exterior of a natural area. Gaps within a habitat can also create barriers that prevent or reduce movement of fauna species. Oftentimes, edge effects (e.g. plant death due to changes in microsite environmental conditions, or branch loss due to increased windthrow) can occur several decades following construction.

The long, narrow, linear vegetation clearance that could result from construction of this trail is unlikely to result in severe edge effects or loss of habitat connectivity because the distance between each side of the cleared area will be a maximum of two metres (average of 0.9 metres), and as much as possible, effort will be made to ensure that a canopy cover of vegetation is maintained above the trail. Leaf litter will continue to disperse naturally across the trail, thereby providing opportunities for ground-based indigenous fauna to move across the trail. Any edge effects are likely to be more serious within short-statured vegetation (e.g. river margins, alpine areas, wetlands) than in taller forest environments.

Nevertheless, there could be adverse ecological effects as a result of vegetation clearance within the long-narrow corridor if indigenous vegetation (of varying ecological value as discussed below) is cleared, habitat lost or disturbed, and a corridor created for the dispersal of pest plants and pest animals (see Section 10.5). There is potential for the loss of individuals of threatened indigenous plant species that occur within the trail footprint (on nearby) or on the trees and shrubs as hemiparasites or epiphytes. As indicated above, the potential severity of adverse ecological effects differs between areas of differing ecological value.

10.2.1 Higher altitude ecosystems of very high ecological value (Section 9)

Disturbance or loss of habitats, and displacement or loss of vegetation within the highly-intact plant communities in alpine areas (Section 9) could have significant adverse ecological effects. The lahar and volcanic boulderfield, wetlands, river margins, and associated high altitude ecosystems present are rare, intact, and highly vulnerable to disturbance. A suite of wetland- and alpine-adapted indigenous plants are present, including uncommon taxa, that could be at risk of loss without appropriate avoidance measures.

10.2.2 Podocarp and beech forest (Sections 5-8) of high ecological value

There could be more than minor adverse ecological effects from disturbance or loss of habitats, and displacement or loss of vegetation within the remainder of the proposed trail footprint (Sections 5-8). In particular, wetlands and river margins are highly vulnerable to disturbance. Forest tracts are also very susceptible to threats, such as clearance of threatened plant species, felling of large trees, including hosts of epiphytes or important fauna habitat/nest sites. Most of the forests within these sections of proposed trail (with the exception of Section 6 - Blyth Track) have previously had very little modification by people.

10.3 Increased plant mortality, tree decline, and windthrow

Impacts from construction of the Phase 2 Te Ara Mangawhero Trail on the long-term survival and stability of trees (and other large plants) could occur throughout the length of the trail, but are more likely to occur, and be more severe, within forest and scrub habitats.

10.3.1 Damage to adjoining vegetation

Vegetation immediately adjacent to the trail alignment may be damaged during construction, by physical contact. This may occur when construction materials are being transported, and during construction within the trail footprint. Damage may include trampling of understorey and groundcover vegetation by people and machinery, and impact or cut damage to bark or branches of adjacent trees.

Any damage to trees or shrubs adjacent to the trail, particularly the bark of trunks, large branches and roots, becomes a potential site for attack by fungal pathogens and/or insects. Damage to bark or branches can also result in reduced nutrient and water uptake, loss of structural integrity (New Zealand Farm Forestry Association 2009), and dieback. Such damage, if of sufficient severity and extent, may therefore lead to rapid or gradual declines in health and the eventual death of a wide range of tree and shrub species.

If construction results in damage to trees that are to be retained adjacent to the trail, decay could begin that will not have a noticeable effect on canopy health or tree stability for several decades. In general, any damage caused to ancient emergent trees (e.g. podocarps, including rimu within Vegetation and Habitat Types 1 and 2), wetland trees and shrubs (e.g. silver pine/manoao), and slow-growing alpine plant species (e.g. *Brachyglottis bidwillii*) will generally be worse than damage caused to shorter-lived and faster-growing plants. Damage to adjoining vegetation could result in at least moderate ecological effects.

10.3.2 Damage to plant roots

Roots of plants (particularly trees) both within and adjacent the trail footprint could be damaged during construction. This is particularly likely where a gravel trail surface is to be constructed (e.g. Section 5) because the ground surface may need to be prepared using hand tools and a small excavator[1] to create a benched trail alignment. Where boardwalks and bridges are to be constructed, there will tend to be comparatively more localised and, overall, less severe disturbance of the ground surface and tree roots, because supporting posts for these structures will be installed at point locations.

The extent of tree roots is strongly influenced by vegetation and soil type, with widely-spaced trees on well-drained soils having larger root mats. There are two main types of tree roots: lateral roots are larger diameter roots that can extend a long distance from the trunk and are important for tree stability, whilst feeder roots/surface roots obtain nutrients from the leaf litter (humus) and upper-most soil layers. For example, mature, widely-spaced rimu trees on well-drained soils can have lateral roots extending out to twice the radius of the tree crown (Norton *et al.* 1988).

Root loss or damage can reduce nutrient and water uptake efficiency, and increase the vulnerability of a tree to wind throw, fungal pathogens, invertebrate damage (New Zealand Farm Forestry Association 2009). The effects of root loss can be expected to be proportional to the area of the root system of a tree that is affected. An excavated trail which passes along one side of a tree trunk could, potentially, effect 50% of the root system of a tree, if excavation (of humus and/or soil) results in the loss of all roots affected by the trail. This degree of root loss would be likely to have a deleterious effect on the long-term health of a tree. However, if excavation depth (or lack of excavation) allows for subsurface lateral roots to pass undamaged under the trail, the extent of feeder root loss will be limited to those roots beneath the trail footprint. Feeder root loss is unlikely to significantly affect tree health if all

[1] A 1.2-1.8 tonne excavator is preferred over a larger excavator because a larger excavator will generally result in more severe ecological effects.

large lateral roots are retained, and if the trail footprint only covers a small percentage of the root system of a tree.

If trail surface material (e.g. gravel) is deposited immediately on top of the humus layer, such deeper burial of feeder roots can also lead to damage or death of feeder roots. The effects of this deeper burial of feeder roots can be expected to be proportional to the area of the root system of a plant/tree that is affected.

If large lateral roots are severed during trail construction, the steadiness of the affected plant/trees will be reduced. This would potentially increase the chances of windfall along the trail corridor.

In general, detrimental health effects from root loss or damage are likely to be more pronounced for large indigenous trees, wetland trees and shrubs, and slow-growing alpine plant species, than shorter-lived and faster-growing plants. Damage to tree roots could have major ecological effects.

10.4 Mortality, injury, and disturbance of indigenous fauna

It is possible that development of Phase 2 Te Ara Mangawhero Trail may directly disturb resident indigenous fauna, both during the construction period and by trail users after the trail is completed.

10.4.1 During construction

Indigenous fauna that are known to occur within the general area that could be either directly killed, injured, or displaced by the removal of vegetation or disturbance of habitats during trail construction, particularly larger trees, include:

- Pekapeka/long-tailed bats (Threatened-Nationally Critical).
- Tree-nesting bird species, such as North Island rifleman and North Island kākā (both At Risk).
- Wetland bird species, such as mātātā/North Island fernbird (At Risk-Declining).
- Ground-nesting bird species, such as North Island brown kiwi and whio (Threatened-Nationally Vulnerable).
- Indigenous skinks and geckos.
- Indigenous invertebrates (including the forest ringlet butterfly; At Risk-Relict).
- Freshwater taxa (including longfin eel and kākahi/freshwater mussel; both At Risk-Declining).

It is difficult to predict the potential effects of trail construction on threatened fauna species due to the multitude of other factors that may impact survival of the taxa, such as environmental changes and invasive introduced predators. Temporary fauna disturbance could occur from noise and increased human activity during construction. In general, any direct death or injury to Threatened or At Risk indigenous fauna from trail construction would be a major effect.

Where excavation or soil disturbance is proposed to create a benched trail alignment or install structures, there is potential for injury or death of ground-dwelling birds, invertebrates, and lizards.

If plants of mountain cutty grass (*Gahnia procera*) are displaced or killed there is potential for adverse effects on the forest ringlet butterfly (At Risk-Relict). The severity of such effects can be reduced by minimising the number of *Gahnia procera* plants that are destroyed.

As the removal of larger trees (>15 centimetres diameter at breast height (dbh)) is to be avoided, direct effects on indigenous tree-nesting birds, pekapeka/long-tailed bats, arboreal skinks and geckos, and arboreal invertebrates are likely to be less than minor. Most birds and invertebrates that are

potentially subject to disturbance are highly mobile and will be able to deal with localised disturbance. Tree-nesting birds such as kākā generally nest in larger trees so loss of nests will be avoided.

At the proposed bridge locations, particularly crossings of the Mangawhero River, there is potential for direct effects on whio, including disturbance of nests or habitat. Because the Mangawhero River is recognised as significant for whio[1], any adverse effects on whio would be of major significance.

Construction of the proposed bridges over the Mangawhero River (and smaller tributary streams) could affect the condition of freshwater habitats for indigenous fish and freshwater invertebrates. For example, soil erosion, spillage of gravel, or fuel from machinery that is used during construction could lead to sedimentation or contamination of waterways and wetlands (see Section 10.6 for further discussion). Construction at waterways also has the potential to disturb, or cause injury, and/or mortality to indigenous fish and freshwater invertebrates.

10.4.2 Increased human activity following construction

Although broadly located parallel to Ohakune Mountain Road, much of the length of the proposed trail footprint (with the exception of Section 6 - Blyth Track) is within areas that have relatively little modification by people, and do not have existing official access tracks.

Areas that have frequent regular use by public are Round the Mountain Track and Waitonga Falls carpark, Mangawhero Falls carpark and short walk, and Massey Hut. The historic Blyth Track is also used regularly, but due to the degraded track surface, it is likely visited by lower numbers of people compared to the other areas. There are also unofficial tracks that are used infrequently, by low numbers of people, including hunters and Department of Conservation staff servicing pest animal control stations.

Following construction and opening of Te Ara Mangawhero Trail to public, an increased number of people using the trail corridor and general area could create some further increased noise. Noise and physical disturbance may have some effects on resident indigenous birds (and to a lesser extent on other indigenous fauna and flora). Disrespectful behaviour and inappropriate activities, such as dumping of litter, dog walking, and using motorbikes on the trail, will need to be discouraged and managed appropriately. However, based on similar trails, the overall effects of increased human activity along the proposed trail route should be less than minor.

10.5 Creation of a corridor for the movement of pest plants and animals

There are currently very few exotic plants within the proposed route. Clearance of indigenous vegetation for trail construction could potentially create corridors for the dispersal of pest plants and animals. Seeds of pest plants may be dispersed by humans or other vertebrate species along the trail, resulting in the establishment of new infestations of pest plant species that already occur elsewhere in the vicinity or infestations of pest plants that are new to the local area. Any shade-tolerant pest plant or nuisance species that establish along the trail margin - for example, sealfheal, tradescantia (*Tradescantia fluminensis*) and African clubmoss (*Selaginella kraussiana*) - may then colonise adjacent habitats. Elsewhere in Tongariro National Park weeds such as heather (*Calluna vulgaris*) and gorse (*Ulex europaeus*) have spread along track margins over time.

[1] Horizons One Plan, RP -SCHED2 - Surface water management values. Table 26. https://www.horizons.govt.nz/CMSPages/GetFile.aspx?guid=a5e024c2-ebd0-4989-b4f6-655b6811c3d3 Accessed on 26 August 2024.

Similarly, pest animals, including small mammals (for example, stoats and ship rats *Rattus rattus*) and ungulates (for example, feral pigs *Sus scrofa*) may use the trails to move between habitats along the trail.

Creation of a corridor for the movement of pest plants and animals could result in **at least moderate** adverse ecological effects. However, with appropriate management and maintenance, these effects can be reduced to less than minor, and the proposed trail will provide an opportunity to be used as a route for teams of people undertaking pest plant and pest animal control (discussed further in Section 12 below).

10.6 Erosion, sedimentation, and contamination

Volcanic soils at Ruapehu are highly susceptible to erosion, particularly on steep terrain. Removal of indigenous vegetation, earthworks along the proposed alignment, and installation of bridges and boardwalks may lead to increased potential for sediment run-off during heavy rain events and rock falls in areas of steep terrain (for example, within boulderfields in Section 9). Although rock fall may endanger indigenous wildlife (for example lizards), a primary concern is related to safety issues for people.

There are examples of severe erosion on the margins of existing tracks and roads within Tongariro National Park. Alpine environmental conditions can vary from very cold, wet, and windy in winter to warm and exposed to sun during summer. Areas of exposed topsoil often become weathered and fragile due to repeated freeze-thaw cycles, compacted by **frost heave**, and ongoing exposure to wind. Indigenous plants struggle to establish naturally onto soil that has been altered in these ways (Plates 6 and 7). As such, without proper maintenance, track margins can become a site of **excessive erosion** with effects on vegetation and soil features extending beyond the immediate track or road footprint. The resulting disturbed areas often become prone to pest plant establishment.

Movement of any stockpiled soil, boardwalk and bridge materials, cement or gravel, into the surrounding natural areas or waterways may result in undesirable effects. Spills may create blockages or contamination. On-site cutting of timber, plastic mesh netting, and/or Fibre Reinforced Polymer (FRP) for decking may create fine plastic or resin particles or timber offcuts that will need to be contained and disposed of appropriately. If cement, building materials, soil, and gravel are managed appropriately, these effects are expected to be less than minor.

Hazardous substances such as oil and diesel/petrol will likely be required for machinery to be used for construction of the trail. It is important that such spills of these products are avoided.

Following construction of the trail, there is also potential for gravel (where it is used, such as in Section 5) to be eroded from the surface of the trail. Depending on the trail construction method used, there is also potential for boardwalk and bridge materials to gradually leach troublesome contaminants into the environment (e.g. arsenic from treated timber decking, microplastics from plastic mesh, or synthetic fragments from FRP) (*c.f.* Hedley 1997). This will particularly be the case if construction of the trail leads to the impediment or redirection of natural waterflows.

If there are notable erosion, sedimentation, and/or contamination issues during or following trail construction, these could have major adverse ecological effects. Effects will be particularly severe if they impact lahar landforms (particularly the highest elevation area of Vegetation and Habitat Type 8 in Section 9), wetlands (particularly Vegetation and Habitat Type 9 in Section 9), or rivers and streams, both during or following trail construction. Chronic sedimentation of freshwater or wetland ecosystems can result in the degradation of freshwater habitats for indigenous fauna and indigenous freshwater macrophytes, as well as a general decline of water quality for recreation.





Plates 6 and 7 – Examples of weathered volcanic soil and erosion undercutting vegetation to form a bank within curled-leaved inaka/bristle tussock shrubland and rockland (Vegetation and Habitat Type 8; pink line indicates proposed trail alignments) in Section 9 of the proposed Te Ara Mangawhero Trail. 22 May 2024.

10.7 Changes in hydrology

If not well-designed, -planned, and -managed, any removal of indigenous vegetation, earthworks, and installation of bridges and boardwalks for Phase 2 Te Ara Mangawhero Trail has the potential to result in changes to hydrology. Any impediment or redirection of natural waterflows could lead to surface ponding (and thereby erosion) within or adjacent to the trail. Changes in hydrology resulting from construction could have major adverse ecological effects, and are most likely to occur in the upper part of Section 6 and in Sections 8 and 9, specifically within subalpine-alpine wetlands, and scrub and forest that occur on soils with impeded drainage (for example, silver pine-mountain beech forest near the top of the Blyth Track), or at river and stream crossings. Constructing the trail through these habitats may lead to changes in the natural water table due to the impediment or redirection of waterflow. Appropriate planning is needed to ensure that there is sufficient drainage from the trail surface without causing undesirable ponding in the surrounding natural areas.

The proposed use of carefully placed boardwalks across areas of wetland (and other fragile areas) will have a far lesser impact on the ecological values of these habitats than other trail building methods, such as gravel trail surfaces atop of bunds. Boardwalks will enable water to continue to flow unimpeded, throughout the wetland areas. Gravel trails are not suitable for use in these wetlands because they would result in compaction of the substrate, potential major changes to the wetland hydrology, and more divisive splitting of the wetland habitats into smaller units.

11.0 Opportunities to avoid or minimise potentially adverse ecological effects

11.1 Overview

While there is potential for construction and subsequent use of the proposed Phase 2 Te Ara Mangawhero Trail to have adverse ecological effects on exceptionally significant ecosystems within Tongariro National Park, with appropriate management, all of these potential effects can be avoided or reduced to minor or less than minor.

A major focus for planning, construction, and use of the proposed trail is to avoid or minimise all potentially adverse ecological effects, particularly on the Mangawhero River; lower altitude old-growth indigenous forest; subalpine to alpine wetlands and shrublands; and lahar and boulderfield landforms. Construction and maintenance of the trail should be undertaken in a considerate manner that recognises the international cultural, ecological, and geological importance of these habitats and ensures the protection of the natural features that trail users will want to see and experience.

Opportunities to avoid or minimise potential adverse ecological effects of the proposed trail are identified below. Oftentimes, actions that can be undertaken will have overlapping benefits, thereby reducing several potential effects simultaneously. The early subsections below identify opportunities to avoid or minimise ecological effects, with further detail on each suggested action following.

11.2 General project management and biosecurity considerations

11.2.1 Environmentally-focused approach

The project is led by Ngā Waihua o Paerangi Trust (a subsidiary of Ngāti Rangi). As local tangata whenua, Ngāti Rangi have aspirational visions for te ao Tūroa (the environment of southwestern Ruapehu) (Ngāti Rangi Trust 2014). The over-arching philosophy is that trail construction and ongoing use will be undertaken in a thoughtful manner, with a major focus on recognising the cultural and

ecological importance of the surrounding indigenous habitats and aquatic environments. It is important that this overall intent is maintained throughout the planning, construction, and use of the trail (including removal, if ever required).

11.2.2 Ongoing project oversight and use of reputable contractors

The project manager(s) should ensure that the overall focus on environmental-protection remains a top priority throughout the various stages of the life of the trail. Efficient and effective processes will be needed to ensure smooth transfer of information between staff and contractors that are involved in the project.

During construction of the trail, the project manager should undertake regular site visits to ensure that the contractors understand and are complying with the guidelines set out in this report. If these are not followed, the project manager should reserve the right to halt operations at the work site until the contractors can demonstrate that they will comply with these measures.

Only suitably qualified and experienced contractors that have (1) a reputable track record in the delivery of high-quality work, and (2) strategies to minimise environmental damage, should be engaged to undertake the construction of the trail.

Arrangements are currently in place for a Master Trail Builder from Dodge Contracting to oversee a trail construction.

Training on the ecological values of the project area and the importance of avoiding or minimising adverse ecological effects should be provided to all contractors and personnel working on the trail. This training should aim to develop a culture amongst the project team which will enable them to make ecologically-aware decisions on a day-to-day basis.

11.2.3 Establish and maintain high biosecurity standards

All contractors should be made aware of the risks of dispersing propagules or seeds of pest plants, soil-borne pathogens, invertebrates, and pest animals such as plague skink (*Lampropholis delicata*) on earthmoving equipment and materials (including gravel) that are contaminated with soil or biological materials.

All equipment should be pressure-washed and steam-cleaned (at a temperature of greater than 100°C) before being brought into Tongariro National Park and the project area. Particular attention should be paid to the wheel wells of wheeled vehicles, the tracks of excavators and other tracked vehicles, and the under-carriages of all vehicles. Inspections of equipment should be undertaken prior to the first day that contractors work at the sites, to ensure compliance with these measures.

The importance of good biosecurity and hygienic practices should also be actively promoted with trail users (see Section 11.8). All equipment and other gear used on the trail (e.g. bikes, clothing, footwear, backpacks) should be clean and free from seeds, plant fragments, pest animals (and their eggs), and excessive dirt.

11.2.4 Use appropriate trail building guidelines

The Department of Conservation's cycle track construction guidelines (DOC 2008 and 2020), Standards New Zealand Handbook 8630 (SNZ 2004), and the Ngā Haerenga New Zealand Cycle Trails Design Guide (2024) provide industry best practice guidelines for the planning, construction, and maintenance of cycle trails. These guidelines (plus subsequent amendments) should be used, in conjunction with reference to the Tongariro National Park Management Plan (DOC 2006, 2011, and 2018), to develop a trail construction protocol for the project.

11.3 Careful planning of trail alignment and surfaces

11.3.1 Development of a final trail alignment

The alignment has been planned and developed using an iterative approach, with the overall aim of minimising disturbance and avoiding damage to high value and ecologically sensitive areas such as old-growth forest, wetlands, alpine shrublands and gravelfields, solidified lahar deposits, and river margins. More than 20 changes to the proposed trail route that have been made since the early desktop assessments (Singers and Bayler 2017; Wildland Consultants 2020a), or as a result of the May 2024 site visits, are described in Section 4.4 of this report. Overall, these actions have reduced the potential severity and extent of habitat loss, and loss of key indigenous plant species.

Based on the site visits in May 2024, the proposed trail can be aligned to avoid the clearance of larger indigenous trees (>15 centimetres dbh), mountain cutty grass (*Gahnia procera*), and Threatened or At Risk plants. The trail can be aligned to minimise damage to large lateral tree roots. The trail can also be aligned to minimise disturbance of ecologically notable areas such as wetland habitats and solidified lahar deposits. The footprint of the trail is to be kept as small as possible, with trail margins no wider than they need to be.

To ensure that only the minimum area required for the trail footprint is cleared, final "setting out" of the trail route should be undertaken on an incremental basis ahead of construction. At a minimum, the following personnel should be involved in "setting out":

- Project manager.
- Kaitātari taiao/ecologist from Ngāti Rangi[1].
- Master Trail Builder from Dodge Contracting.
- Surveyor from Cheal Consultants.

During the final "setting out" an iterative process should be followed to refine and decide the final trail alignment. This should be undertaken in late spring or summer to maximise the chance of detecting Threatened or At Risk plants (due to the presence of flowers, particularly for small orchids and shrub epiphytes), lizards, birds, and pekapeka/bats. The extent of proposed works should be physically marked with stakes and/or flagging tape prior to any vegetation removal and earthworks. No areas beyond this boundary should be used during construction, e.g. for temporary storage areas for equipment or for disposal of fill.

Only existing canopy gaps or disturbed areas near the trail route should be used for helicopter-delivery of supplies.

11.3.2 Trail surface materials

The trail surface will vary, including gravel on dry ground with flat to sloping terrain, and boardwalks in wetland or alpine areas, or to provide protection of vulnerable tree roots. Locations for the use of boardwalks have been identified (Figure 3) and there is flexibility in the planning to add additional sections of boardwalk if this is found to be necessary during final "setting out" of the route.

From an ecological perspective, both FRP and timber decking could be suitable for boardwalks and bridges on the proposed trail. Timber boardwalks are common on the Round the Mountain Track at Tongariro National Park (see Plate 2 in Section 5 of this report). When constructed well, the ecological

[1] There should be ongoing liaison between the kaitātari taiao/ecologist from Ngāti Rangi and suitable representatives from the Department of Conservation or other suitable ecologists, for advice or discussion about plants (including Threatened or At Risk taxa) and indigenous fauna.

effects are minimal. A challenge with timber decking is ensuring that sufficient tread is maintained for the purpose and life of the trail. Generally, plastic mesh is stapled to the timber surface, or grooves are cut into the timber to provide extra grip. However, plastic mesh is not generally suitable for biking trails (especially on slopes) because bikes will cause greater and more rapid wear on the plastic compared to walkers. In environments with wetlands and alpine conditions, surface grooves are unlikely to provide sufficient grip for trail users and overtime will repeatedly infill with mud and leaf litter debris.

FRP is a comparatively new product for decking, however, it has become popular for outdoor surfaces in recent years. There are examples of FRP boardwalks and bridges in Aotearoa New Zealand (including Nelson, Rotorua, and Western Bay of Plenty) and Australia (see Plate 1 in Section 5 of this report) including subalpine areas of Kosciuszko National Park. FRP decking products have a rough anti-slip surface which provides a good alternative to the plastic mesh and/or timber grooves. FRP is available in a colours that fit well into the surrounding landscape. FRP can be purchased as mesh which would help to ensure that natural drainage patterns are retained. For Section 6 of the proposed trail, use of FRP mesh could enable some of the historic corduroy on the Blyth Track to be kept visible to trail users. The potential risk of releasing synthetic fragments into the environment during trail construction using FRP, can be minimised by either using pre-cut panels of decking; cutting panels offsite prior to transporting; or by ensuring that all dust is collected onsite then disposed of appropriately by covering the ground with plastic sheets prior to cutting and using a vacuum adapter on cutting tools. Compared to timber decking, FRP is likely to require less ongoing maintenance.

A range of trail surfaces would be ecologically-appropriate:

- Gravel surfaces are suitable for flat to gentle slopes, on dry ground such as most of Sections 5 and 7.
- Boardwalks should be used in wetlands (particularly Section 6, 8 and 9), and in fragile alpine parts of Section 9. Boardwalks should also be used, where appropriate, to avoid damage to trees/plants and their roots. With careful planning and management, FRP decking is generally likely to have lesser adverse ecological effects than timber boardwalks. Despite this, there may be short lengths of trail where timber is the best option to provide the optimal trail alignment.

11.4 Retain habitat and indigenous plants

With appropriate trail planning and construction techniques, potential adverse effects from loss of habitat and indigenous plants can be reduced to minor or less than minor. Potential effects from damage to tree/plant roots can be reduced to minor and effects from damage to vegetation adjacent to the proposed trail can be reduced to less than minor.

Although considerable effort is needed throughout the length of the trail, particular focus will be required to reduce effects on ecosystems of very high value (e.g. alpine areas in Section 9; and wetlands and river margins in Sections 5-8). Residual effects can also be expected to be slightly higher in habitats of very high ecological value than areas of high ecological value.

Actions that should be taken to retain habitats and reduce losses of indigenous plants include:

- Environmentally-focused approach to all aspects of the trail, for the life of the trail.
- Careful route selection, including on-site ecological assessments.
- Use of appropriate trail construction methods and guidelines, by reputable trail builders.
- Thoughtful selection of trail surface methods and materials, matched to habitats.
- Avoiding loss (clearance) of large indigenous trees, mountain cutty grass (*Gahnia procera*), and Threatened or At Risk plants.

- Avoiding damage to plant roots and vegetation adjacent to the trail, particularly ancient emergent trees (e.g. podocarps, including rimu within Vegetation and Habitat Types 1 and 2), wetland trees and shrubs (e.g. silver pine/manoao), and slow-growing alpine plant species (e.g. *Brachyglottis bidwillii*).
- Minimising the creation of edge effects, particularly within short-statured vegetation (e.g. river margins, alpine areas, wetlands).

11.4.1 Avoid loss of indigenous vegetation

Set out below are measures to avoid loss (clearance) and damage to indigenous vegetation (including trunks and branches of indigenous trees) within the trail footprint during construction:

- Prior to vegetation clearance, the Ngāti Rangi kaitātari taiao/ecologist should identify any indigenous shrubs and tree species (less than two metres in height) or understorey plants that could be successfully transplanted from the trail footprint. The identified plants will be removed for replanting in identified rehabilitation/revegetation/restoration areas before construction is started.
- Felling of large indigenous trees[1] (>15 centimetres dbh) should be avoided. In particular, large podocarps (including rimu, miro, mataī, Hall's tōtara, silver pine/manoao, bog pine, pygmy pine, and pahautea) and beech trees should be retained and protected from damage.
- Clearance of slow-growing alpine plant species (e.g. *Brachyglottis bidwillii* and snow tōtara) should be avoided.
- Clearance of any plants of mountain cutty grass (*Gahnia procera*), rōhutu, and/or Threatened or At Risk plants (refer to Table 3) should be avoided.
- Plants that are characteristic of wetland or alpine habitats should not be cleared, damaged, or disturbed. Boardwalks should be routed away from key plant species, as much as possible.
- Trimming of branches or stems of large trees[2], particularly podocarps and beech trees, should be avoided or kept to the minimum required to form the trail corridor.
- All vegetation clearance should be undertaken by hand. This will ensure that vegetation clearance is minimised, and enables felled branches to be placed into the surrounding area, so that any fauna such as lizards can move into the vegetation in the surrounding area.
- Vegetative material that is cleared will be scattered along the trail margins, where suitable, avoiding the formation of large piles of debris.
- If required, logs or branches can be chopped into sizeable chunks before scattering along the trail margins, but they should not be mulched.
- Physical contact with trees (large branches, and trunks in particular) should be avoided when construction materials are being transported and during construction. All equipment and machinery used during construction should be moved with care.

[1] Including both live and dead trees.

[2] Including removal of dead branches or stems that are overhanging the trail. Low-hanging branches (up to about three metres above ground level) which present a serious risk to structures or safety of trail users can be removed carefully (following procedures to check for indigenous fauna, see Section 11.6) and placed into the surrounding area.

11.4.2 Avoid damage to plant roots

Set out below are measures to avoid loss (clearance) and damage to the roots of indigenous plants within and adjacent to the trail:

- Damage to the roots of indigenous trees should be avoided or kept to a minimum. It is important that large lateral roots, in particular, are not severed during trail construction. The distances within which large surface lateral roots are likely to occur for key canopy species present are presented in Table 6. In general, the trail should be at least 2-4 metres from larger indigenous trees (>15 centimetres dbh).

Table 6 – Guidance on construction of Te Ara Mangawhero Trail, Phase 2, near large trees of key indigenous species, where large surface lateral roots are likely to be common, Mount Ruapehu.

Common Name	Scientific Name	Distance Within Which Large Surface Laterals are Likely to Be Common	Notes on Trail Construction Near Large Trees
Rimu	*Dacrydium cupressinum*	3 metres	Highly variable surface root length. Large trees in close proximity to trail should be assessed on a case-by-case basis.
Hall's tōtara	*Podocarpus laetus*	4-6 metres	Separation distance of four metres should avoid large surface roots of most trees. Some larger trees may have large surface roots out to six metres.
Miro	*Pectinopitys ferruginea*	4-8 metres	Separation distance of four metres should avoid large surface roots for most trees. Some larger trees may have large surface roots to eight metres.
Mataī	*Prumnopitys taxifolia*		
Kāmahi	*Weinmannia racemosa*	2 metres	Trail can probably be as close as 0.5-1 metres from trees less than 20 cm diameter if no large surface laterals are damaged.

- Where trail construction is constrained by an abundance of large surface roots, the trail should be realigned to avoid the roots. In places where it is anticipated that large lateral roots might extend into the footprint of the trail, a spade should be used to dig holes to assess the diameter of the roots. For roots that are larger than five centimetres, the trail should be realigned, or fill should be placed over the roots (note that only a relatively small proportion of a tree root system should ever be covered by fill) or a section of boardwalk should be used.
- If roots greater than five centimetres in diameter must be severed, no tree should have multiple large roots removed. All roots greater than three centimetres in diameter that are cut should be cleanly severed using a handsaw. Roots left with ragged or rough ends are less likely to heal, and are at greater risk from infection and ongoing decay.
- If possible, roots of indigenous trees (including trees and roots outside of the trail footprint) should not be buried under soil or track materials. That is, after any compaction of the fill material has occurred, the roots of the trees should remain at the same depth as they are currently situated. This will ensure that any erosion of the track surface does not result in the exposure, and subsequent damage, of large tree roots.
- Boardwalks should be used in sections of sensitive terrain (e.g. wetlands and alpine areas). All boardwalks should be permeable, and of sufficient height above the ground to allow for the natural

flow of water and the persistence of a humus layer (preferably with associated ground tier plants). Structural supports for the boardwalk (and bridges) should be sited to avoid large surface lateral roots.

- Where the trail cuts across a slope and requires the installation of drainage, the outflows for these drains should be designed to avoid erosion, loss of the humus layer, and exposure of plant roots.

11.4.3 Avoid damage to adjacent vegetation

Set out below are measures to avoid damage to indigenous plants adjacent to the trail:

- Care should be taken to avoid damage to the trunks and limbs of indigenous trees/shrubs that are outside the footprint of the trail, i.e. any trees that are not to be removed as part of the works.
- Species that are characteristic of wetland or alpine habitats should not be cleared, damaged, or disturbed.
- Any larger trees that do need to be removed for construction of the proposed trail should be felled into the corridor of the trail to avoid and/or minimise damage to the surrounding forest.
- Trampling of understorey vegetation beyond the trail footprint should be kept to a minimum. All construction activities should be undertaken with the aim of minimising the extent of the disturbed area.
- Existing clearings or canopy gaps near the trail route should be used for helicopter-drop locations, if needed. Additional areas of vegetation should not be cleared for this purpose.
- Soil, rocks, or any other material, should not be pushed or dumped into the surrounding natural areas along the trail during construction. In particular, such material should not be piled on top of understorey vegetation within the indigenous forest or in wetland areas.
- Vegetative material that is cleared should be scattered along the trail margins, where suitable, avoiding the formation of large piles of debris.

11.4.4 Avoid or minimise effects on wetlands and alpine areas

Vehicles, compactors, excavators[1], or tracked machinery should not be used for trail construction where wetlands are present (particularly Sections 6, 8, and 9) or within alpine areas in Section 9. This is important, to prevent compaction of wetland substrates and damage of fragile alpine habitats.

11.5 Reduce effects from corridor creation

With appropriate management and maintenance, potential adverse effects from the creation of a corridor for the movement of pest plants and animals can be reduced **to less than minor**, and the proposed trail will provide an opportunity to be used as a route for teams of people undertaking pest plant and pest animal control (discussed further in Section 12 below).

Actions that should be undertaken to reduce adverse effects from the creation of a corridor include:

- Keeping the trail footprint as narrow as possible, particularly **within short-statured vegetation** (e.g. river margins, alpine areas, wetlands).
- Establishing and maintaining high biosecurity standards.

[1] A 1.2-1.8 tonne excavator is preferred over a larger excavator because a larger excavator will generally result in more severe ecological effects.

- Appropriate trail maintenance.
- Encouraging mindful use of the trail and respect of the internationally-significant site amongst trail users.

11.6 Prevent injury, death, and displacement of indigenous fauna

With appropriate management, potential adverse effects on indigenous fauna from construction and use of the trail can be reduced to minor or less than minor.

11.6.1 Pekapeka/bats

The main priority to minimise the effects on bats is to align the trail to **avoid any removal of trees** that are >15 centimetres diameter at breast height (dbh), particularly below treeline. Based on the site visits in May 2024, it is very likely that removal of larger trees can be avoided.

If there is no way to avoid the removal of tree[1](s) that are >15 centimetres dbh, then a Bat Management Framework for sites where the presence of bats is confirmed should be followed, based on the best-practise methods available at the time of construction. This Framework should be prepared by a qualified and approved bat ecologist, endorsed by the Department of Conservation, and could include 1) pre-felling visual inspections of the tree(s) for any evidence of bats, or 2) pre-felling acoustic monitoring of potential roost trees, and 3) options for the management of any bats that are killed or injured. Tree felling should only take place between 1 October and 30 April, when weather conditions are appropriate.

11.6.2 Indigenous birds, lizards, and terrestrial invertebrates

- To minimise effects within forest and scrub areas, a canopy should be maintained above the trail, to enable fauna to continue to be able to move across the trail.
- Adverse effects on indigenous birds, lizards, and terrestrial invertebrates will be minimised if the removal of larger trees[1] (>15 centimetres dbh) is avoided.
- Any trees that contain holes or cavities that might contain nesting indigenous birds should be retained and the trail rerouted.
- North Island brown kiwi are present in the general area. If active burrows are located during construction, the trail should be rerouted to provide a minimum 20 metre buffer from the burrow.
- Vegetation clearance/construction workers should check work sites and machinery at the start of each work day, to ensure that kiwi are not present.
- Adverse effects on whio can be avoided by using suitable construction techniques at the bridge locations; constructing bridges within well-defined, small footprints; and by avoiding sediment loss into waterways (see Section 11.7).
- If chicks or eggs from the nest of an At Risk or a Threatened bird species, or a bird species that is protected under the Wildlife Act (1953) (including North Island brown kiwi), are found within the area to be subject to vegetation clearance, work should not be undertaken within this section of the trail until the chicks have fledged or until the eggs have hatched and the chicks have fledged. Work can still proceed 10 metres or more away from a nest site.
- Where possible, the removal of indigenous trees and scrub (or other vegetation) that may provide nesting sites for indigenous birds should be undertaken outside of the main nesting period for

[1] Including both live and dead trees.

indigenous forest birds (early spring to mid-summer). This will avoid unnecessary harm or distress to nesting adult birds, nestlings, and fledglings that may be present within the footprint of the proposed trail.

- The low number of lizards likely to be present on the narrow trail alignment means that a large-scale, targeted lizard salvage operation is not suggested. Foliage and other vegetative material that is cleared should be removed from the alignment and scattered in the adjacent forest, which will enable arboreal lizards to escape. A Lizard Discovery Protocol (LDP) should be prepared by a herpetologist (lizard ecologist) and implemented if lizards are discovered prior to or during vegetation clearance and trail construction works. The LDP should include guidance on actions required if any plague skink(s) are encountered. Translocation of lizards cannot be undertaken without appropriate approval from the Department of Conservation (DOC). A Wildlife Act authorisation from DOC to authorise translocation may be required as part of the LDP.
- Adverse effects on the forest ringlet butterfly can be minimised by aligning the trail to avoid clearance of plants of mountain cutty grass (*Gahnia procera*). If mountain cutty grass must be removed, it should be transplanted in suitable habitat nearby. Transplanting should be planned and undertaken under the guidance of the Ngāti Rangi kaitātari taiao/ecologist.
- Soil invertebrates which are exposed during excavation should be relocated with the substrate they were exposed within. Upon completion, leaf litter will spread naturally over the trail surface, which will improve the opportunities for terrestrial invertebrates to move across the trail.

11.6.3 Freshwater fauna

To protect the high-quality freshwater habitats of the Mangawhero River, and tributary streams, the following actions should be implemented, particularly during construction of the proposed bridges and boardwalks:

- Barriers to fish passage (including temporary diversions) should not be created.
- An Erosion and Sediment Control Plan should be prepared (see Section 11.7 below). Good sediment management is critically important to avoid sediment discharges into waterways.
- The extent and duration of earthworks in the riparian zones should be kept to a minimum, to reduce disturbance of soil, and riparian vegetation and habitats.
- Trail construction should avoid the alteration of natural drainage patterns and natural ground surface levels.
- Areas that are cleared for the trail footprint, should be formed with the trail surface as soon as possible to minimise soil erosion and disturbance.
- Any areas of vegetation that are disturbed or cleared within 30 metres of a waterway, and are not to be within the final trail footprint, should be rehabilitated (see Section 11.7 below).
- Any other large open areas that are prone to erosion, should be assessed and rehabilitation undertaken where it is suitable (see Section 11.7 below).
- Stockpiles of gravel (and any cement) should be stored securely prior to use in trail construction, to prevent leakage into natural areas or waterways. Stockpiles should be removed from the site following construction.
- No piles of soil should be left close (within *c.*20 metres) to the streams, wetlands, or river, either during or following construction. Away from waterways, any loose, heaped soil should be covered with a tarpaulin if it is to be left in place during construction. This will minimise soil runoff during rainfall events and reduce the risk of overloading sediment management devices.

11.7 Management of contaminants and erosion-prone areas

In addition to potential effects on aquatic fauna (addressed in Section 11.6 above); erosion, sedimentation, and/or contamination could have major ecological effects but, with appropriate construction techniques and management, these effects can be reduced to less than minor.

11.7.1 Trail construction and maintenance guidelines

An Erosion and Sediment Control Plan should be prepared and implemented for the proposed trail. A Contaminant Management Plan should be prepared for the management of hazardous substances and any spills associated with the trail.

A distinct focus on minimising adverse effects from erosion will be needed for wetlands, rivers and streams, and low-stature vegetation and/or bare ground within alpine areas, including lahar landforms, both during and following trail construction.

Detailed guidelines for reducing erosion and sediment run-off are provided in the Department of Conservation's guidelines for cycle track construction and maintenance (DOC 2008 and 2020) (addressed in Section 11.2 above), and include the following:

- The trail should be designed and constructed in a way that reduces the need for steep grades that are at higher risk of erosion, and minimises ongoing maintenance. Where possible, switch-backs and contouring, curved trails should be used in preference to long sections of straight trails through steep terrain. The zig-zag sections of trail that are proposed (e.g. places in Section 9) are likely to be effective at providing a gently-inclined trail surface. Monitoring and appropriate rehabilitation will be needed at zig-zag locations to prevent the formation of habitat gaps that will increase the vulnerability to edge effects and erosion.
- Sediment controls such as silt traps, coir logs, barriers, and in cases of high sediment loads, silt socks that contain sterilised hay, should be used in locations where erosion and sediment run-off is likely to occur during the construction stage of the trail.
- Where gravel is used, trail surfaces should be compacted to ensure that they do not erode quickly due to water run-off and use. A plate compactor or small roller should be used to compact trail materials, where feasible.
- On relatively level terrain, the trail should be slightly benched (*c.*4% grade) to allow water to drain from the trail into the trail margins.
- Boardwalks should be used in wetland and alpine areas, and as needed, to provide protection of vulnerable tree/plant roots.
- Soil that is excavated should not be heaped at the site for extended periods of time (i.e. greater than one week). No piles of soil should be left close (within *c.*20 metres) to the streams, wetlands, or river, either during or following construction. Away from waterways, any loose, heaped soil should be covered with a tarpaulin if it is to be left in place, to prevent water run-off from eroding the fill.
- Stockpiles of gravel (and any cement) should be stored securely prior to use in trail construction, to prevent leakage onto the forest floor, or into waterways (including rivers, streams, and wetlands).
- Spills of hazardous substances such as oil and diesel/petrol will be avoided.
- No cement, oil, and diesel/petrol should enter waterways.
- Excess soil or substrate should not be side-cast or disposed of loosely. Excess material that is excavated should be used (as fill) to level the trail in other areas. If gravel or larger rocks are

excavated, these could be used for boulder mesh nets as bridge struts or similar. No areas beyond the boundary of the final trail alignment should be used for disposal of soil or substrate.

- Any fill that is used for the trail should be compacted to an angle that is similar to the surrounding slope, then rehabilitated (see below) and/or revegetated using indigenous vegetation (for example, small ferns) or humus and surface litter (sourced from cleared vegetation within the trail footprint).
- All trail margins and fill areas will require appropriate rehabilitation and/or revegetation (see further information below).

The trail is intended to be constructed using techniques that prevent the need for drainage pipes or side-drains to be used. This will assist any water to run across the trail and not down the trail, thereby minimising ongoing maintenance needs.

11.7.2 Rehabilitation of trail margins and erosion-prone areas

Due to the volcanic soils and extreme climatic conditions (e.g. frost heave) at the site, proven-methods will need to be used for rehabilitation associated with the proposed trail, particularly in the higher altitude Sections 8 and 9. Requirements for rehabilitation and/or revegetation will vary along the length of the trail, including the following options:

- Areas that are cleared for the trail footprint, should be formed with the trail surface as soon as possible to minimise soil erosion and disturbance.
- Any areas of vegetation that are disturbed, or cleared within 30 metres of a waterway, and are not to be within the final trail footprint, should be rehabilitated (method below) and/or revegetated.
- Where suitable, trail margins and/or disturbed areas should be revegetated by planting of appropriate indigenous understorey and groundcover vegetation. Plants for revegetation should be sourced from the site (selected by the Ngāti Rangi kaitātari taiao/ecologist) and include species such as kiokio, *Astelia* sp., piupiu/crown fern, and mānuka. Seedlings and saplings of indigenous trees and shrubs should also be used for revegetation, where appropriate.
- If there are open areas that are prone to erosion or not suitable for re-planting, they should be rehabilitated (method below).
- Any other large open areas that are prone to erosion, should be assessed and rehabilitation and/or revegetation undertaken where it is suitable.

Method for topsoil rehabilitation and natural vegetation recovery

The following method has previously been used successfully to rehabilitate tracks and road margins (including Ohakune Mountain Road) in this part of Tongariro National Park (Herwi Scheltus pers. comm. May 2024). Compaction and weathering of topsoil by frost heave and ongoing exposure to wind and climatic extremes can make it very unlikely that vegetation will establish on disturbed areas at Ruapehu (see Plates 6 and 7). The following method should be used to prevent topsoil from becoming compacted or to rehabilitate already compacted areas:

- Scrape off any compacted layers so that the topsoil is soft and fluffy.
- Add a layer of dried and steam-treated lucerne (Medicago sativa) or mānuka branches overtop of the exposed soil.
- The resulting roughness will trap plant seeds and soil/ash particles that are blown by wind from the surrounding landscape. This will enable natural regeneration of indigenous vegetation to initiate and continue, at a rate that would otherwise not be possible.

Rehabilitation using this method, will lead to a more natural assemblage of plants than revegetation planting. Plants that establish from this method are also more likely to survive and achieve faster growth.

11.8 Education and management of trail users

The proposed trail will provide an opportunity for the local community and visitors to Ruapehu District to further appreciate, learn about, and engage with the natural environment of Ruapehu. The behaviour of trail users can greatly influence the enjoyment derived by other users and the level and nature of effects on park values. The provision of information using signage, pamphlets and websites can increase awareness of appropriate behaviours and what users can do to minimise their impacts. Adherence to nationally-developed codes such as Check, Clean, Dry[1]; Leave No Trace[2], and the Mountain Bikers' Code[3] can assist in achieving these outcomes.

The importance of biosecurity should be actively promoted with trail users. Education about pest animals and pest plants, and their control should be incorporated into trail signage, brochures, or any promotional material about the trail. It is important that all equipment and other gear used on the trail (bikes, clothing, footwear, backpacks) is free from seeds, plant fragments, pest animals (and their eggs), or excessive dirt. Promotion of biosecurity is particularly useful for these types of trails because it leads to an increased general awareness of this issue and trail users may often be from other parts of Aotearoa New Zealand and other countries (and may be recent arrivals here).

Trail signage should advise trail users to stay on the formed route and take all litter out with them to be disposed of properly. For example, any litter that is dropped from lunch snacks by trail users, could degrade the natural character of the environment. In addition to such signage, regular trail maintenance should be planned and include collection of any litter that has been dropped, particularly around any signage, carparks, toilet facilities, or places where trail users tend to stop often, and areas of very high ecological value such as the alpine areas, lahar deposits, wetlands, and bridges over the Mangawhero River.

Dogs are not allowed in Tongariro National Park (or inside vehicles anywhere in the Park) and will therefore be prohibited from the trail. Dogs pose a threat to indigenous fauna, and as such contradict the overall vision for the trail to encourage users to appreciate and protect indigenous biodiversity.

11.9 Trail maintenance

Upon completion (allowing six months or so for the adjacent groundcover to recover following construction), the trail should look as though it is an established and integral part of the natural environment. Actions which should be undertaken to avoid and minimise potential ecological issues associated with maintenance of the trail are provided below:

- Any trimming of vegetation[4] required for trail maintenance should be kept to a minimum and undertaken with care, in particular to avoid damaging podocarps and any indigenous trees over *c.*15 centimetres dbh.

[1] 'Check, Clean, Dry': Preventing didymo and other pests. Biosecurity New Zealand. https://www.mpi.govt.nz/outdoor-activities/boating-and-watersports-tips-to-prevent-spread-of-pests/check-clean-dry/ Accessed 17 October 2024.

[2] Leave No Trace New Zealand. https://leavenotrace.org.nz/ Accessed 17 October 2024.

[3] Mountain Bikers Code, developed by Mountain Bike New Zealand in early 2000's. https://www.mtbnz.org.nz/mtb-trail-info.html Accessed 17 October 2024.

[4] Including removal of dead branches or stems that are overhanging the trail. Low-hanging branches (up to about three metres above ground level) which present a serious risk to structures or safety of trail users can be removed carefully (following procedures to check for indigenous fauna, see Section 11.6) and placed into the surrounding area.

- During trail maintenance, if there is no way to avoid the removal of tree[1](s) that are >15 centimetres dbh, then the Bat Management Framework, Lizard Discovery Protocol, and checks for indigenous birds (including chicks or eggs) (as described in Section 11.6) should be implemented.
- Any trees or vegetation which falls onto the trail should be removed carefully and placed into the surrounding area. Care should be taken to avoid damaging vegetation adjacent to the trail.
- The entire route (particularly Sections 6, 8, and 9) should be checked annually for any erosion of soil and humus from trail margins or plant roots adjacent to the trail. If substantial erosion is occurring that could threaten stability of trees, slopes, or the trail, then this may need to be rectified.
- The entire route (particularly Sections 8 and 9) should be checked annually for the presence of any pest plant species (weeds) that are a threat to indigenous habitats, e.g. African clubmoss (*Selaginella kraussiana*) and tradescantia. Any infestations should be controlled promptly, with adequate follow-up monitoring and control to ensure eradication.

12.0 Mitigation

12.1 Overview

Potential ecological effects of the construction and subsequent use of the proposed trail, can be reduced to minor or less than minor through the use of good techniques and trail management, as outlined above. There are excellent opportunities to mitigate for any residual effects through activities that enhance the ecological integrity of the indigenous vegetation and habitats surrounding the trail. Such actions include management of pest plants and sustained pest animal control, as discussed below. Members of Ngāti Rangi and the local community could be involved in long-term maintenance and conservation activities associated with the trail.

12.2 Pest plant management

As mentioned in Section 7 of this report, there is currently a very limited diversity and abundance of pest plant species within the proposed trail footprint. At a minimum to prevent further spread, pest plants should be controlled where they are found on both sides of the length of the trail. The main aim should be to prevent the establishment of any new infestations of pest plants, and if any infestations occur, appropriate and timely control should be undertaken.

A pest plant management plan should be prepared and implemented that addresses ongoing monitoring and control priorities, and methods to contain, control, and eliminate pest plants from the trail margins. To maximise effectiveness, the pest plant management plan should be developed and implemented in coordination with the Department of Conservation and any other local parties who are currently controlling pest plants in the vicinity of the proposed trail. The plan should also align with the Pest Management Plan for Phase 1, Te Ara Mangawhero Trail.

The one small tree of Chilean fire bush (*Embothrium coccineum*) that was recorded in May 2024 should be controlled prior to construction of the trail. Any other plants of this species that are found should also be controlled. Chilean fire bush should be controlled using herbicides (e.g. cut each stem and paste with glyphosate herbicide gel). Any material that is cut off the plant (including stems, flowers,

[1] Including both live and dead trees.

fruits, or roots) should be removed from the site and disposed of appropriately. This is important because Chilean fire bush can spread from seed or tubers.

The isolated patches of sealfheal (*Prunella vulgaris*) that were recorded along the proposed alignment should also be targeted for control prior to construction of the trail. This will reduce the availability of seed for dispersal along the trail corridor.

Other environmental pest plants that are known from the wider area and have the potential to establish and spread along the proposed Phase 2, Te Ara Mangawhero Trail corridor include:

- Heather (*Calluna vulgaris*).
- Montbretia (*Crocosmia ×crocosmiiflora*).
- Cotoneaster (*Cotoneaster franchetii*).
- Lodgepole pine (*Pinus contorta*).
- Gorse (*Ulex europaeus*).
- Broom (*Cytisus scoparius*) (listed in the Progressive Containment pest management programme, Horizons Regional Council 2017).

12.3 Pest animal control

As identified in Section 10.5, the proposed trail is likely to be used as a travel route by pest animals. Consequently, sustained pest animal control should be implemented along the trail margins. Long-term intensive control of introduced pest animals would improve the quality of habitats for indigenous fauna within the surrounding area. In particular, any pest animal control along the margins of the Mangawhero River could provide enhanced protection of riparian habitats for whio.

Some pest animal control is already undertaken within the project area. Pest animal traps were observed near the lower end of Blyth Track during the site visits in May 2024. Despite this deer pellets were observed on the Blyth Track (Plate 8). Greater control of hares (and rabbits) would be beneficial in open areas above the treeline.

To maximise the effectiveness of pest animal control, a pest animal control plan could be developed and implemented in coordination with the Department of Conservation and any other local parties who are currently controlling pest animals in the vicinity of the proposed trail. The pest animal control plan should identify priorities for monitoring and control, as well as methods, e.g. kill-traps or bait stations. There will be opportunities for local companies, trail users, or community groups to sponsor or assist with the maintenance of traps.



Plate 8 – Sign of deer (pellets) on the existing Blyth Track, within the proposed route of Te Ara Mangawhero Trail (Section 6). 23 May 2024.

13.0 Conclusions

A detailed assessment of ecological effects for the proposed Phase 2 section has been prepared, including options to avoid or minimise potential adverse effects.

The wider project area for Phase 2 is of exceptional ecological value. Tongariro National Park is recognised as a World Heritage Site for its international cultural, ecological, and landscape significance. The proposed trail will traverse through tall old-growth podocarp forest at lower altitudes, to mountain beech forest (with local wetlands), gradually decreasing in stature to mountain beech krummholz scrub at treeline; above which there are subalpine and alpine tussock shrublands and sparsely-vegetated gravelfields. Volcanic processes, specifically lahars, have contributed to the diversity of vegetation communities that are present alongside the Mangawhero River. A range of Threatened and At Risk indigenous plants and fauna species (including the At Risk pēpepe pōuri/forest ringlet butterfly, pekepeke/bats, North Island kākā and North Island brown kiwi, and indigenous lizards) occur within the project area.

Guided by Ngāti Rangi, an over-arching aim is to ensure that construction and ongoing maintenance of the trail is undertaken in a manner that ensures te taiao (the environment) is protected, preserved, and enhanced. This vision for te ao Tūroa (the environment of southwestern Ruapehu) will ensure that the project is developed in a considerate manner, with a major focus on recognising the cultural and ecological importance of the surrounding indigenous habitats and aquatic environments.

An iterative approach has been taken to selection of the trail alignment, to minimise disturbance and avoid damage to high value and vulnerable ecosystems. The alignment will avoid clearance of larger indigenous trees (>15 centimetres dbh), mountain cutty grass (*Gahnia procera*), and Threatened or At Risk plants. This will assist greatly with reducing potential adverse effects on indigenous fauna. The trail has also been aligned to minimise disturbance of river margins, and wetland and alpine habitats, including those associated with the stabilised mid-Holocene lahars. Boardwalks are to be used in

wetland and alpine areas, and to provide protection for vulnerable tree roots. This will result in notably less ecological effects than a compacted gravel trail. Use of sensitive construction techniques, track margin rehabilitation methods, and sediment management will be very important, in particular to avoid adverse effects on aquatic fauna and whio at the four proposed crossings of the Mangawhero River. Current best-practise protocols are to be followed for managing any incidental discoveries of pekapeka/bats (including roosts), indigenous birds (including nests, eggs, and chicks), and lizards (including the invasive plague skink). Implementation of appropriate planning, design, construction, and ongoing management, will ensure that potential adverse ecological effects can be avoided or reduced to minor or less than minor.

The proposed trail will provide excellent opportunities to enhance the ecological integrity of the indigenous vegetation and habitats surrounding the trail footprint. Pest plant and pest animal management plans could be developed and implemented alongside existing conservation actions in the local area. The trail would provide opportunities to increase environmental awareness and connections amongst trail users.

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Appendix 1

Vascular plant species, Te Ara Mangawhero Trail, Phase 2, Mount Ruapehu

Species listed are naturally occurring at the site, and were observed during visits on 22 and 23 May 2024.

Indigenous Species

Gymnosperms

Dacrydium cupressinum	rimu
Halocarpus bidwillii	bog pine
Halocarpus biformis	pink pine
Lepidothamnus laxifolius	pygmy pine
Libocedrus bidwillii	pahautea, kaikawaka
Manoao colensoi	manoao, silver pine
Pectinopitys ferruginea	miro
Phyllocladus alpinus	mountain toatoa
Podocarpus laetus	tōtara-kuri-kōtukutuku, Hall's tōtara, mountain tōtara
Podocarpus nivalis	snow tōtara, tauhinu
Prumnopitys taxifolia	mataī

Monocot. trees and shrubs

Cordyline indivisa	mountain cabbage tree

Dicot. trees and shrubs

Aristotelia serrata	makomako, wineberry
Brachyglottis bidwillii	
Carpodetus serratus	putaputawētā
Coprosma autumnalis	kanono, raurēkau, raurākau, manono
Coprosma foetidissima	hūpiro
Coprosma pseudocuneata	
Coprosma tenuifolia	
Coriaria pteridoides	
Dracophyllum filifolium	
Dracophyllum recurvum	curled-leaved inaka
Dracophyllum subulatum	monoao
Elaeocarpus hookerianus	pōkākā
Epacris alpina	
Fuscospora cliffortioides	mountain beech, tawhairauriki
Fuscospora fusca	red beech, tawhairaunui
Fuscospora solandri	black beech, tawhairauriki
Gaultheria antipoda	tāwiniwini, koropuka, takapo, taupuku
Gaultheria colensoi	
Gaultheria depressa var. *novae-zelandiae*	
Griselinia littoralis	kāpuka
Leptecophylla juniperina var. *juniperina*	prickly mingimingi
Leptospermum scoparium	mānuka
Lophozonia menziesii	silver beech, tawhai, tawai
Myrsine divaricata	
Neomyrtus pedunculata	rōhutu
Olearia nummularifolia	
Ozothamnus leptophyllus	tauhinu

Ozothamnus vauvilliersii	
Pseudopanax colensoi var. *colensoi*	orihou, mountain five finger
Pseudopanax crassifolius	horoeka, lancewood
Pseudowintera colorata	mountain horopito
Pterophylla racemosa	kāmahi
Raukaua anomalus	
Veronica odora	
Veronica tetragona	whipcord hebe
Veronica venustula	

Dicot. lianes

Rubus cissoides agg.	tātarāmoa, tātaraheke, bush lawyer

Lycopods and psilopsids

Pseudodiphasium volubile	waewaekoukou, climbing clubmoss

Ferns

Alsophila smithii	kātote, soft tree fern
Asplenium flaccidum subsp. *flaccidum*	makawe, ngā makawe o raukatauri, drooping spleenwort
Austroblechnum colensoi	peretao, peretako, peteko
Austroblechnum penna-marina subsp. *alpina*	little hard fern
Cranfillia fluviatile	kiwikiwi, kiwakiwa, creek fern
Dicksonia fibrosa	whekī-ponga, kurīpākā
Dicksonia squarrosa	whekī
Gleichenia alpina	alpine tangle fern
Gleichenia dicarpa	matua-rarauhe, tangle fern, swamp umbrella fern
Histiopteris incisa	mātātā, water fern
Hymenophyllum bivalve	mauku, filmy fern
Hymenophyllum demissum	irirangi, piripiri, drooping filmy fern
Hymenophyllum malingii	mauku, filmy fern
Hymenophyllum multifidum	mauku, much-divided filmy fern
Hymenophyllum nephrophyllum	kidney fern, konehu, raurenga, kopakopa
Hymenophyllum pulcherrimum	mauku, filmy fern
Hymenophyllum rarum	mauku, tufted filmy fern
Hymenophyllum villosum	mauku, hairy filmy fern
Lecanopteris novae-zealandiae	
Leptopteris superba	heruheru, ngutukākāriki, ngutungutu kiwi, Prince of Wales feathers fern
Lomaria discolor	piupiu, petipeti, crown fern
Parablechnum montanum	mountain kiokio
Parablechnum novae-zelandiae	kiokio, horokio
Parablechnum procerum	small kiokio
Polystichum vestitum	pūniu, prickly shield fern
Sticherus cunninghamii	waekura, umbrella fern

Grasses

Austroderia fulvida	toetoe
Chionochloa rubra subsp. *rubra* var. *rubra*	red tussock
Microlaena avenacea	bush rice grass
Rytidosperma setifolium	bristle tussock

Sedges

Carex punicea	

Carex uncinata	kamu matau a Maui, kamu
Carpha alpina	
Gahnia procera	mountain cutty grass
Isolepis crassiuscula	
Isolepis inundata	
Oreobolus pectinatus	comb sedge
Schoenus pauciflorus	bog rush, sedge tussock

Rushes

Empodisma minus	wire rush

Monocot. herbs (other than orchids, grasses, sedges, and rushes)

Astelia fragrans	kakaha
Astelia grandis	mauri
Astelia microsperma	
Astelia aff. *nervosa*	mauri, kakaha
Libertia micrantha	mikoikoi, native iris
Luzuriaga parviflora	nohi

Composite herbs

Celmisia glandulosa var. *glandulosa*	bog mountain daisy
Celmisia incana	tikumu
Celmisia spectabilis subsp. *spectabilis*	puakaito, tikumu

Dicot. herbs (other than composites)

Ourisia macrophylla subsp. *macrophylla*	hue-o-Raukatauri
Ourisia vulcanica	mountain foxglove
Viola filicaulis	forest violet

Naturalised and Exotic Species

Dicot. trees and shrubs

Embothrium coccineum	Chilean fire bush

Composite herbs

Leontodon taraxacoides	hawkbit

Dicot. herbs (other than composites)

Prunella vulgaris	selfheal

Appendix 2

Non-vascular plant taxa, Te Ara Mangawhero Trail, Phase 2, Mount Ruapehu

Taxa listed are naturally occurring at the site, and were observed during visits on 22 and 23 May 2024.

Indigenous Bryophtes

Mosses

Dicranoloma spp.	
Dendroligotrichum tongariroense	
Sphagnum cristatum	
Racomitrium lanuginosum	woolly moss
Ptychomnion aciculare	pipe-cleaner moss

Liverworts

Schistochila appendiculata

Indigenous Lichens

Cladonia spp.	
Pseudocyphellaria spp.	
Pulchrocladia retipora	coral lichen
Usnea spp.	

Appendix 3

Site photographs

1. Black beech-(rimu) forest



Plate A3.1 – Clearing within black beech-(rimu) forest (Vegetation and Habitat Type 1) at the proposed transition of Phases 1 and 2, Te Ara Mangawhero Trail, on the northern side of Ohakune Mountain Road. 17 September 2021.

2. Rimu/kāmahi forest



Plate A3.2 – Rimu/kāmahi forest (Vegetation and Habitat Type 2) on the northern side of Ohakune Mountain Road. 23 May 2024.



Plate A3.3 – Sparse understorey within rimu/kāmahi forest (Vegetation and Habitat Type 2) on the northern side of Ohakune Mountain Road. 23 May 2024.

3. Silver beech-mountain beech forest



Plate A3.4 – A large red beech tree next to the existing Blyth Track, within silver beech-mountain beech forest (Vegetation and Habitat Type 3). 23 May 2024.



Plate A3.5 – Existing Blyth Track within silver beech-mountain beech forest (Vegetation and Habitat Type 3) that could be widened and resurfaced to form the proposed Te Ara Mangawhero Trail (Section 6). Note, dense cover of mauri (*Astelia grandis*) in the understorey. 23 May 2024.



Plate A3.6 – A patch of leafy liverwort (*Schistochila appendiculata*) on the ground in silver beech-mountain beech forest (Vegetation and Habitat Type 3). 23 May 2024.



Plate A3.7 – Silver beech-mountain beech forest (Vegetation and Habitat Type 3) on the southern side of Ohakune Mountain Road. 23 May 2024.

4. Mountain beech-pahautea forest



Plate A3.8 – *Astelia grandis* is locally abundant in the understorey of mountain beech-pahautea forest (Vegetation and Habitat Type 4) on boggy ground, alongside the existing Blyth Track (proposed Te Ara Mangawhero Trail, Section 6). 23 May 2024.



Plate A3.9 – A large podocarp (likely mataī) adjacent to the existing Blyth Track that should be avoided during construction of the proposed Te Ara Mangawhero Trail (Section 6) within mountain beech-pahautea forest (Vegetation and Habitat Type 4). 23 May 2024.



Plate A3.10 – A deviation from the existing Blyth Track is proposed, to provide a route that is further away from this overhanging bank above a stream (Te Ara Mangawhero Trail, Section 6) within mountain beech-pahautea forest (Vegetation and Habitat Type 4). 23 May 2024.



Plate A3.11 – Proposed deviation of Te Ara Mangawhero Trail (Section 6) from existing Blyth Track within mountain beech-pahautea forest (Vegetation and Habitat Type 4; pink line indicates proposed trail alignment). 23 May 2024.



Plate A3.12 – A deviation of Te Ara Mangawhero Trail (Section 6) is proposed within mountain beech-pahautea forest (Vegetation and Habitat Type 4) to avoid continued use of this severely damaged and steep section of the existing Blyth Track. Photograph by Rowan Sapsford, 23 May 2024.



Plate A3.13 – Example of existing benched surface of Blyth Track that could be widened and resurfaced to form the proposed Te Ara Mangawhero Trail (Section 6) within mountain beech-pahautea forest (Vegetation and Habitat Type 4). 23 May 2024.



Plate A3.14 – Existing corduroy on the Blyth Track, within mountain beech-pahautea forest (Vegetation and Habitat Type 4). 23 May 2024.



Plate A3.15 – Remnants of historic bridge (left), and existing low bridge with handrail (right; 6.25.B) on the Blyth Track that could be widened and resurfaced to form the proposed Te Ara Mangawhero Trail (Section 6) within mountain beech-pahautea forest (Vegetation and Habitat Type 4). 23 May 2024.



Plate A3.16 – Pooling of water below a cross-board on the existing Blyth Track (Section 6 of proposed Te Ara Mangawhero Trail) within mountain beech- forest (Vegetation and Habitat Type 4). A canopy gap on the right-side of this photograph could potentially be used as a helicopter-drop location. 23 May 2024.



Plate A3.17 – Approximate location where the proposed Te Ara Mangawhero Trail (Section 7; indicated by flagging and pink line) will divert from the existing Blyth Track. Mountain beech-pahautea forest (Vegetation and Habitat Type 4). 23 May 2024.



Plate A3.18 – Proposed Te Ara Mangawhero Trail (Section 7; pink line indicates proposed trail alignment) within mountain beech-pahautea forest (Vegetation and Habitat Type 4) near the upper end of Blyth Track. 23 May 2024.



Plate A3.19 – Approximate location where the proposed Te Ara Mangawhero Trail (Section 7) will cross the existing Waitonga Falls track. Mountain beech-pahautea forest (Vegetation and Habitat Type 4). 22 May 2024.



Plate A3.20 – Proposed location of Bridge 8.3B over the Mangawhero River (indicated by green line). Section 8 of proposed of Te Ara Mangawhero Trail. 22 May 2024.



Plate A3.21 – Proposed route of Te Ara Mangawhero Trail (Section 8, indicated by pink flagging and line) within mountain beech-pahautea forest (Vegetation and Habitat Type 4). Trail can be aligned to traverse this slope while retaining distance from the pahautea tree that is indicated by arrow. 22 May 2024.

5. Silver pine-mountain beech forest and scrub



Plate A3.22 – Existing Blyth Track within silver pine-mountain beech forest and scrub (Vegetation and Habitat Type 5). A boardwalk is proposed for this location on Te Ara Mangawhero Trail (Section 6). 23 May 2024.



Plate A3.23 – Existing Blyth Track within silver pine-mountain beech forest and scrub (Vegetation and Habitat Type 5). A boardwalk is **not** currently proposed for this location on Te Ara Mangawhero Trail (Section 6). 23 May 2024.

6. Mountain beech krummholz scrub



Plate A3.24 – Mountain beech krummholz scrub (Vegetation and Habitat Type 6) in the lower elevation half of Section 9 of the proposed Te Ara Mangawhero Trail. 22 May 2024.



Plate A3.25 – A higher elevation area of mountain beech krummholz scrub (Vegetation and Habitat Type 6). 22 May 2024.

7. Mānuka/tangle fern-red tussock fernland



Plate A3.26 – Mānuka/tangle fern-red tussock fernland (Vegetation and Habitat Type 7) in Section 8 of the proposed Te Ara Mangawhero Trail. A large tussock of *Gahnia procera* is present in the foreground. Mountain beech-pahautea forest (Vegetation and Habitat Type 4) is present in the background. 22 May 2024.



Plate A3.27 – Mānuka/tangle fern-red tussock fernland (Vegetation and Habitat Type 7) in Section 8 of the proposed Te Ara Mangawhero Trail. 22 May 2024.



Plate A3.28 – Mountain daisies, *Celmisia incana* (purple arrow) and *C. spectabilis* subsp. *spectabilis* (yellow arrow) within mānuka/tangle fern-red tussock fernland (Vegetation and Habitat Type 7) in Section 8 of the proposed Te Ara Mangawhero Trail. 22 May 2024.

8. Curled-leaved inaka/bristle tussock-red tussock shrubland and rockland



Plate A3.29 – Proposed location of Bridge 9.3B over the Mangawhero River (indicated by green lines). Curled-leaved inaka/bristle tussock shrubland and rockland (Vegetation and Habitat Type 8) is present on the southern side of the river (Section 9), with mountain beech forest in the background. 22 May 2024.



Plate A3.30 – Proposed boardwalk for Te Ara Mangawhero Trail (Section 9; pink line indicates proposed trail alignment) within curled-leaved inaka/bristle tussock shrubland and rockland (Vegetation and Habitat Type 8). 22 May 2024.



Plate A3.31 – Proposed zig-zag boardwalk for Te Ara Mangawhero Trail (Section 9; pink line indicates proposed trail alignment) within curled-leaved inaka/bristle tussock shrubland and rockland (Vegetation and Habitat Type 8). 22 May 2024.



Plate A3.32 – Waterfall within curled-leaved inaka/bristle tussock shrubland and rockland (Vegetation and Habitat Type 8; Section 9). A small bridge is proposed to cross the gully (green line; pink line indicates proposed trail alignment). Photograph by Rowan Sapsford, 22 May 2024.



Plate A3.33 – Proposed zig-zag trail alignment on slope within curled-leaved inaka/bristle tussock shrubland and rockland (Vegetation and Habitat Type 8; Section 9; pink line indicates proposed trail alignment). 22 May 2024.



Plate A3.34 – General landscape of stabilised mid-holocene lahar material in the mid part of Section 9 of the proposed trail with curled-leaved inaka/bristle tussock-red tussock shrubland and rockland (Vegetation and Habitat Type 8). 22 May 2024.



Plate A3.35 – Proposed trail alignment in the mid part of Section 9 of the proposed trail with curled-leaved inaka/bristle tussock-red tussock shrubland and rockland (Vegetation and Habitat Type 8) (pink line indicates proposed trail alignment; star indicates approximate location where the photograph in Plate A3.36, below, was taken from). Photograph by Rowan Sapsford, 22 May 2024.



Plate A3.36 – Proposed trail alignment in the mid part of Section 9 of the proposed trail with curled-leaved inaka/bristle tussock-red tussock shrubland and rockland (Vegetation and Habitat Type 8) (pink line indicates proposed trail alignment; photograph was taken from the location indicated by a star in Plate A3.35, above). Photograph by Rowan Sapsford, 22 May 2024.

9. Wire rush-tangle fern-red tussock-bog pine rushland and fernland



Plate A3.37 – A large individual shrub of bog pine within wire rush-tangle fern-red tussock-bog pine rushland and fernland (Vegetation and Habitat Type 9; Section 9). 22 May 2024.



Plate A3.38 – Wire rush-tangle fern-red tussock-bog pine rushland and fernland (Vegetation and Habitat Type 9; Section 9) (blue line indicates proposed trail alignment prior to May 2024 site visit; pink line indicates revised trail alignment based on site visit). Photograph by Rowan Sapsford, 22 May 2024.

10. Red tussock-mixed shrubland



Plate A3.39 – Low-stature shrubs of bog pine (centre and left foreground) amongst red tussock-mixed shrubland (Vegetation and Habitat Type 10; Section 9). Mangawhero River is on left side of photograph and mountain beech krummholz scrub is present in background (pink line indicates proposed trail alignment). 22 May 2024.



Plate A3.40 – A slip face above the Mangawhero River within red tussock-mixed shrubland (Vegetation and Habitat Type 10; Section 9, pink line indicates proposed trail alignment). 22 May 2024.



Plate A3.41 – Red tussock-mixed shrubland (Vegetation and Habitat Type 10; Section 9) between the upper part of the Mangawhero River and the Massey Hut (pink line indicates proposed trail alignment). In the distant part of this photograph, there is an area of curled-leaved inaka-bristle tussock-woolly moss gravelfield (Vegetation and Habitat Type 11). 22 May 2024.

11. Curled-leaved inaka-bristle tussock-woolly moss gravelfield



Plate A3.42 – Curled-leaved inaka-bristle tussock-woolly moss gravelfield (Vegetation and Habitat Type 11, Section 9) near a waterfall in the upper part of the Mangawhero River (pink line indicates proposed trail alignment). 22 May 2024.

12. Existing carpark

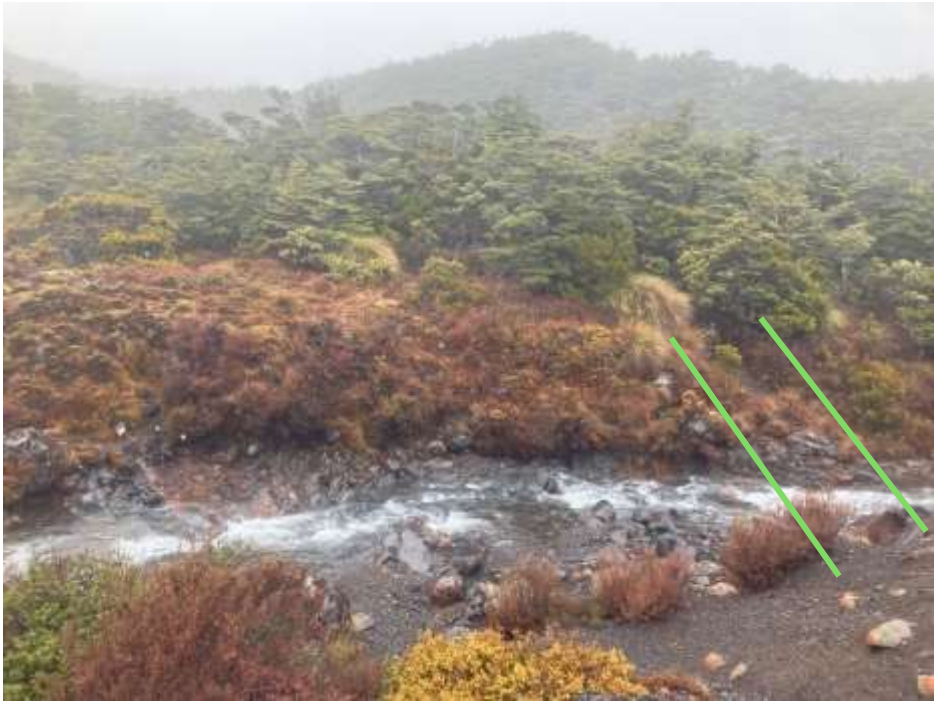


Plate A3.43 – Proposed location of Bridge 9.1B over the Mangawhero River (indicated by green lines). Proposed bridge abutment on the northern side of river (foreground) is at the existing carpark for Mangawhero Falls. Curled-leaved inaka/bristle tussock shrubland and rockland (Vegetation and Habitat Type 8) is present on the southern side of the river (Section 9), with mountain beech forest in the background. 22 May 2024.

Appendix 4

Ngā Haerenga New Zealand Cycle Trails design specifications for **off-road** trails

2.2.2 Grade 2 (Easy)



Description: Some gentle climbs, smooth trail. Suitable for confident beginner riders, the trail is predictable with no surprises. Social component with riders able to ride side by side at times, but possibly large sections of single trail.

Gradient: 0–6% for at least 90% of trail; between 6–8.8% for steeper slopes up to 100m long, and between 8.8–10.5% for steeper slopes up to 10m long. If the track is designed and promoted to be ridden predominantly in one direction, then the downhills can be steeper (up to 14%). Sealed trails can be steeper (same as the equivalent Grade of on-road trail; see Table 4).

Width: Between 0.9m and 1.5m for single trail and minimum 2.2m for double trail sections with adequate clearances. Horizontal clearances as in Appendix 3B, Section B2.

Vertical clearance: Minimum vertical clearance of 2.2m to overhead hazards. A 2.0m vertical clearance may be used for discrete overhead hazards, such as tree branches or existing structures.

Radius of turn: 4m minimum with at least 5m desirable to outside of turn.

Surface: Compacted/stabilised base course, under a maximum top course aggregate of maximum AP 30mm. The surface should be smooth and easy to ride in all weather conditions.

Watercourses: Watercourses bridged, except for fords with less than 100mm of water in normal flow, which can be easily ridden. Surface should be as smooth as adjacent trail.
Bridge width: Recommended bridge width at least 1.5m, minimum width of 1.0m with handrail/barrier to fall. The approach should be the same width as the structure for 10 metres.

Obstacles: Some rocks/roots/ruts that can either be avoided, or are less than 50mm high. No stiles. Cattle stops should be minimum 1.2m wide.

Length: 4 to 5 hours/day (30 to 50km/day).

Barriers/guard rails: Areas such as bluffs or bridges where a fall would result in death or serious harm require handrails. The 'Fall heights' sections in Appendices 3A to 3E (*Design information for contractors*) have a calculation process for confirming whether barriers are required – 'Decision framework for determining fall treatment'.

2.2.3 Grade 3 (Intermediate)



Description: Narrow trail, there will be some hills to climb, obstacles may be encountered on the trail, and there may be exposure on the edge of the trail.

Gradient: 0–8.8% for at least 90% of trail; between 8.8–12.3% for steeper slopes up to 100m long, and a maximum of 17.5% for steeper slopes up to 10m long. If the track is designed and promoted to be ridden predominantly in one direction, then the downhills can be steeper (up to 19.5%). Sealed trails can be steeper (same as the equivalent Grade of on-road trail; see Table 4).

Width: 0.9m for 90% of the trail, 0.6m minimum with adequate clearances. Horizontal clearances as in Appendix 3C, Section C2.

Vertical clearance: Minimum vertical clearance of 2.2m to overhead hazards. A 2.0m vertical clearance may be used for discrete overhead hazards, such as tree branches or existing structures.

Radius of turn: 2.5m minimum, with at least 4m desirable to outside of turn.

Surface: Generally firm, but may have some short muddy or loose sections.

Watercourses: Watercourses bridged, except for fords with less than 200mm of water in normal flow, which can be easily ridden.

Bridge width: Recommended at least 1.0m; minimum 0.75m deck if the width at handlebar height is 1.2m. If there are no handrails, then minimum width of 1m for structures less than 0.5m high.

Obstacles: Occasional rocks/roots and ruts may be up to 100mm high/deep and may be unavoidable.

Length: 4 to 6 hours/day (30 to 50km/day for an intermediate cyclist).

Barriers/guard rails: Areas such as bluffs or bridges where a fall would result in death require handrails. Areas where a fall would likely result in serious harm require either handrails or sight rails or a warning sign, depending on the nature of the drop-off and likelihood of a fall. The 'Fall heights' sections in Appendices 3A to 3E (*Design information for contractors*) have a calculation process for confirming whether barriers are required – 'Decision framework for determining fall treatment'.

Source: Ngā Haerenga New Zealand Cycle Trails (2024).

Call Free 0508 WILDNZ
Ph +64 7 343 9017
Fax +64 7 349018
ecology@wildlands.co.nz

99 Sala Street
PO Box 7137, Te Ngae
Rotorua 3042, New Zealand

Regional Offices located in Auckland; Christchurch;
Dunedin; Hamilton; Invercargill; Queenstown; Tauranga;
Wānaka; Wellington; Whakatāne; Whangārei.

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Appendix 9. Landscape Assessment

Te Ara Mangawhero Trail Pt.II.

Landscape Assessment.

Isthmus.

October 2024



Client Name:	**Ngā Waihua o Paerangi Trust**
Project Name:	**Te Ara Mangawhero Trail Pt.II**
Document Name:	**Landscape Assessment**
Document Status:	**Final**
Date:	**October 2024**
IGL Reference:	**5009 / C2**
Author:	**Simon Button**
QA:	**Lisa Rimmer**

Isthmus Group Limited
Level 6
246 Queen Street
Auckland

Tel: 09 309 9442

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Appendix B – Landscape Related Policies.
Appendix C – Graphic Attachments *(refer separate document)*

Introduction

1 Ngā Waihua o Paerangi Trust is seeking Department of Conservation (DOC) and Regional Council permissions for a proposed walking and cycling, shared use trail on the southern face of Mount Ruapehu to act as an extension to the Mountains to Sea Great Ride.

2 Isthmus Group Ltd (IGL) has been engaged by Ngā Waihua o Paerangi Trust to provide landscape design advice and undertake an assessment of the natural character, landscape and visual amenity effects arising from the proposed trail.

3 The purpose of this report is to undertake an evaluation of the existing natural character, landscape and visual amenity values of the area (including those values associated with the Tongariro National Park Outstanding Natural Landscape and UNESCO World Heritage Site status) and to assess the effects of the proposal on those values. The proposal is also reviewed in relation to relevant statutory documents.

4 This report has been prepared to support the application for the following permissions:

- Concession from the DOC for the development and management of a shared use trail
- Works approval from DOC for physical works to construct a shared use trail
- Resource consent from the Manawatū - Whanganui Regional Council, Horizons - for the development of bridges and land disturbance associated with trail development.

Methodology

5 The following methodology has been used to assess the natural character, landscape and visual amenity values of the site and the Project's potential effects on those values:

- A desktop review of the site area including a review of relevant documents and statutory provisions;
- A site visit (undertaken on 22 and 23 May 2024) which included walking the proposed trail alignment and visiting public locations where the alignment could be viewed. Photographs were taken during the site visit, included within Appendix C – Graphic Attachments;

- A description of the existing landscape context of the Project and the surrounding area. The description includes reference to the existing land uses of the site, including historical, ecological and cultural associations[1];

- An assessment of the natural character values[2] of the wetlands and river margins, in close proximity to the alignment. A 7-point scale is used to summarise these baseline values;

- An analysis of the landscape character and values of the site and of the surrounding area;

- An analysis of the visibility of the Project from the surrounding landscape and the viewing audience types;

- An assessment of the potential natural character effects of the Project for identified wetlands and river margins;

- An assessment of the potential landscape effects of the Project on the site and the wider context; and

- An assessment of the potential visual amenity effects of the Project considering views along the trail, adjacent public roads and from the wider context.

6 An assessment of effects on natural character, landscape values and visual amenity is included within this report, referring to a rating scale for the level of effect. These assessments include definitions for natural character and landscape.

7 A seven-point scale (below) is used to achieve a level of standardisation, to summarise the level of effect[3]. Descriptors are used alongside, and in preference to numbers, to reduce the likelihood of using 'scores' in a formulaic way without considering context.

8 Comparisons of how value ratings assigned in accordance with Te Tangi a te Manu – Aotearoa New Zealand Landscape Assessment Guidelines relate to the RMA terminology of 'less than minor', 'minor' and 'more than minor' are provided on the following page.

1 As informed by district and regional council plans and the assessments provided by other disciplines – Heritage and Ecology Assessment and the Cultural Impact Information provided by Ngāti Rangi (included in the AEE).

2 Natural character matters addressed relate to Section 6a) of the Resource Management Act only. Effects on natural features and processes, that contribute to values on other parts of the trail, are addressed under landscape effects. Baseline natural character values are assigned a rating on a 7 point scale from very low to very high.

3 The scale is symmetrical around 'moderate'. The scale is based on the recommended NZILA Best Practice Guide and is consistent with the Te Tangi a te Manu: Aotearoa New Zealand Landscape Assessment Guidelines'.

Effect Rating	Very Low	Low	Moderate – low	Moderate	Moderate – high	High	Very high
RMA terminology	*Less than Minor*		*Minor*	*More than Minor*			
						Significant	

9 It should be noted that a change in a landscape does not in itself mean that a proposal will result in an adverse effect on the values of that landscape:

> *"Change itself is not an effect: landscapes change constantly. It is the implications of change for a landscape's values that is the effect."*[4]

10 The nature of effects can be **Adverse** (negative) or **Beneficial** (positive). An assessment of effects combines both value ratings (Very Low – Very High) and nature of effects (Adverse, Positive) with the description identifying components of the project from which these arise.

- An adverse effect relates to an activity which results in a reduction in natural character, landscape and / or visual amenity values; in this circumstance the RMA terminology of 'less than minor', 'minor' and 'more than minor' is applied.

- A positive effect relates to an activity which enhances natural character, landscape and / or visual amenity values through restoration and / or provision of positive elements or features.

11 Where a proposal will result in a change, but that change will have no effect on the characteristics that underpin natural character, landscape or visual amenity values , a nature of effect rating of '**Nil**' will be provided.

12 The assessment methodology is based on **Te Tangi A Te Manu Aotearoa New Zealand Landscape Assessment Guidelines** Tuia Pito Ora New Zealand Institute of Landscape Architects, July 2022.

13 The methodology section above sets out a series of 'steps' that have been taken to assess the relevant natural character, landscape and visual effects of the proposal on the receiving environment. The list is provided for completeness to set out the key matters that have been taken into consideration. The detailed description of the work undertaken is contained under the relevant headings throughout the report.

[4] Refer 6.03 - Te Tangi a te Manu: Aotearoa New Zealand Landscape Assessment Guidelines'

Description of the existing environment and landscape values.

14 The author has undertaken a site visit to the proposed trail alignment and the surrounding area and has taken photographs at various locations. These are included within **Appendix C – Graphic Attachments** and provide a visual representation of the site and its context.

Mount Ruapehu and Tongariro National Park – Broadscale Context

15 The proposed trail alignment is on the southern face of Mount Ruapehu, north of Ohakune. Phase 2 of the project starts at Rimu Hill (the end of the consented Stage 1 section of Te Ara Mangawhero) and ends at Massey Flat (Massey Hut).

16 Mount Ruapehu is a dominant feature within the landscape, rising to 2,797m above sea level (asl)[5]. It is the tallest of the three mountains within Tongariro National Park (Ruapehu, Tongariro and Ngāuruhoe) and is the highest mountain in the north island of Aotearoa. Mount Ruapehu and the broader Tongariro National Park ONFL have significant landscape values including those connected to whakapapa, creation narratives and ongoing association for mana whenua and other iwi (with Ngāti Rangi and Uenuku holding mana whenua over the part of the Park where the proposed trail would be built).

17 Tongariro Park is the oldest National Park in Aotearoa and encompasses over 78,500 hectares of protected land. The park is recognised as an Outstanding Natural Feature and Landscape (ONFL) and is also a dual UNESCO World Heritage Site recognised for both cultural and natural values.

[5] Approximately 2,000m higher than the wider plateau.

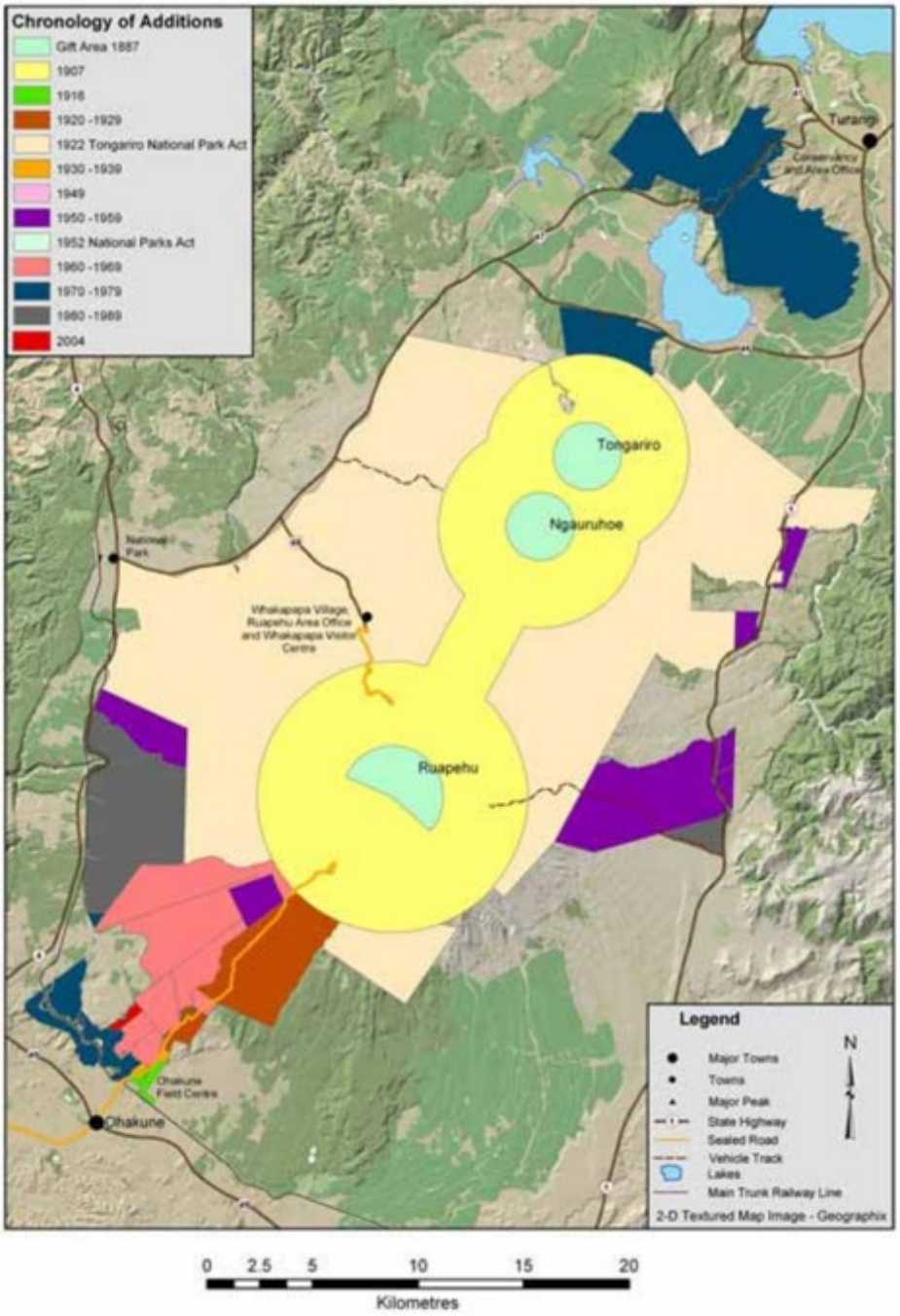


Figure 1: Tongariro National Park Gift Area and Additions (Source: Tongariro National Park Management Plan)

18 Mount Ruapehu began erupting at least 250,000 years ago. It is a stratovolcano / composite volcano made up of alternating layers of ash and lava flow. The summit (tihi) of Ruapehu consists of three craters and includes the currently active vent beneath the crater lake of South Crater.[6] The summit also includes eight named glaciers (the only glaciers on the north island of Aotearoa), which in combination with the intricate network of gullies and lahar

6 When full to overflowing, the crater lake contains 8-10 million cubic metres of acid waters.

paths on the upper slopes of the mountain form the origins of multiple rivers, streams and tributaries which flow down Ruapehu's slopes.

19 Tongariro National Park's ONFL qualities and characteristics are listed in the Horizon's One Plan as:

> *"(i) Visual and scenic characteristics, particularly the park's visual prominence in the Region and the contrast of the Rangipo desert with adjacent landscapes*
>
> *(ii) Geological features including the Rangataua Lava Flow*
>
> *(iii) Recreational values, particularly tramping and snow sports*
>
> *(iv) Scientific value, particularly the volcanic landscape*
>
> *(v) Ecological value, particularly the mountainous ecology and the extensive tussock grasslands and wetlands supporting rare indigenous flora*
>
> *(vi) Importance to tangata whenua"*

20 Almost identical values are listed in the Ruapehu District Plan: *"(1) Visual and scenic characteristics, particularly its visual prominence, (2) Recreational values, (3) Scientific value, particularly the volcanic landscape, (4) Ecological value, particularly the mountainous ecology and the extensive tussock, grasslands and wetlands supporting rare indigenous flora, and (5) Cultural values and importance to tangata whenua."*

21 Along with the significant and well documented associations for iwi, these values are derived from key physical-natural science, perceptual and shared and recognised components of this landscape, as are also relevant to this assessment. In summary:

Vegetation, Topography, Hydrology & Experiential Qualities

22 The alpine[7] sections of Mount Ruapehu (generally above 1,500m asl, but in areas as low as 1,250m asl[8] and up to the permanent snowline) are characterised by exposed rockfaces, gullies / channels, solidified lahar deposits (lahar fields) and gravel fields. Due to the harsh climate of the alpine zone (with great variance in temperature, wind and aridity), vegetation is generally sparse, featuring herb fields, tussock and some alpine shrubs. The alpine zone is therefore exposed and highly visible within the wider landscape.

---

7 The alpine sections are defined as the area between the upper limit of trees and the lower limit of permanent snow.

8 As measured on Google Earth.

23 Below the treeline (the point at which the alpine zone begins), the south-western face of Mount Ruapehu is characterised by Beech Forest (generally in altitudes between 950m asl to 1,500m asl). The Beech Forest includes dense vegetation and canopy coverage, which restricts views to the wider landscape. The beech forest transitions to Podocarp Forest which extends to Ohakune at the base of Mount Ruapehu.

24 An indicative section and diagram illustrating the vegetation types and altitude of Mount Ruapehu is included as Figure 2 below.

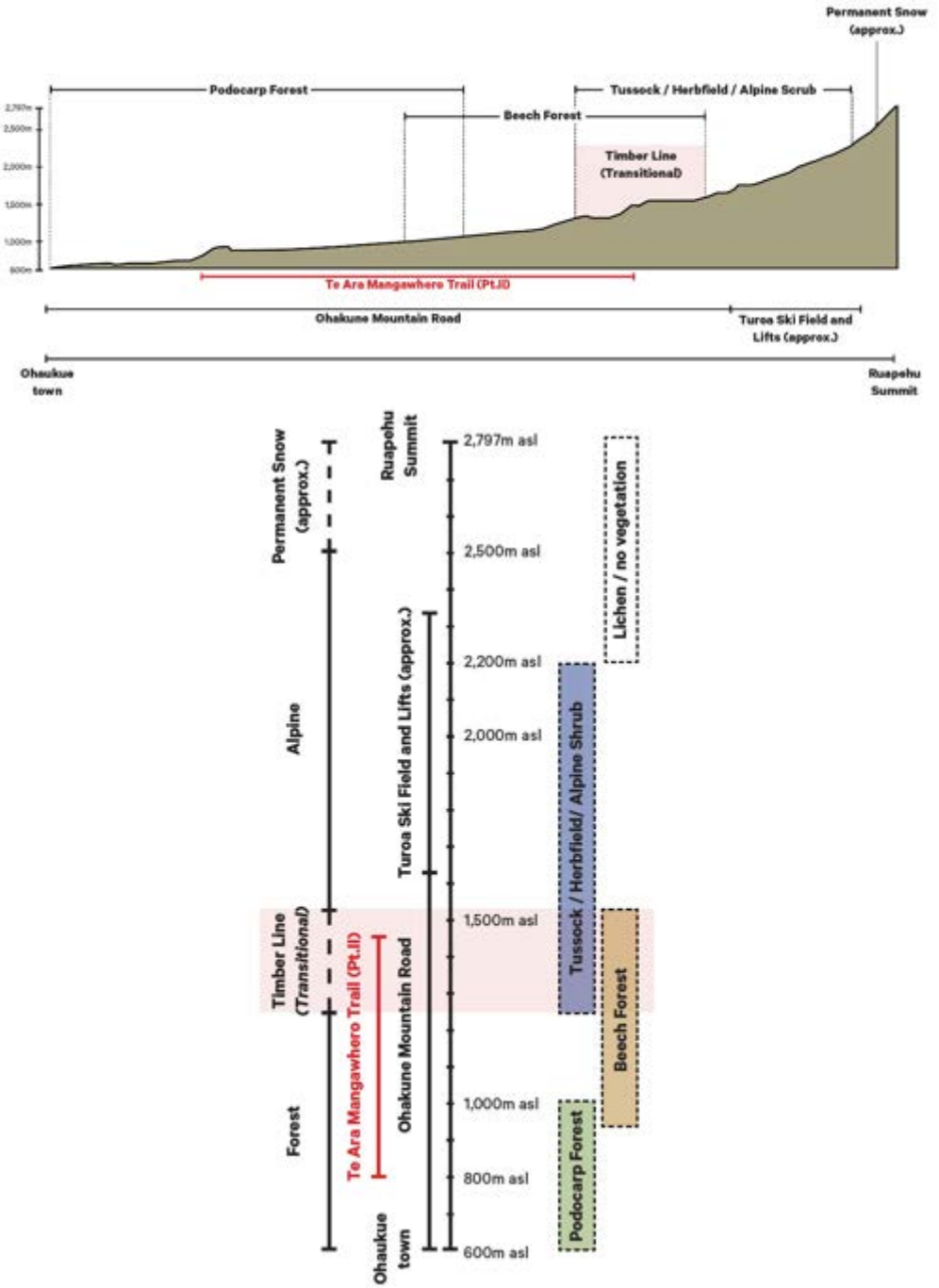


Figure 2: Vegetation and altitude section and analysis

25 Landscape character transitions through distinct zones from the base of Mount Ruapehu to the summit. At lower altitudes along the base of the mountain there is, typically, dense indigenous Podocarp Forest, creating an enclosed and sheltered environment. With increased elevation, the vegetation transitions to Beech Forest, reducing in height and cover. Above the timber line, vegetation is generally characterised by tussock, low shrubs and hardy lichens and moss. The landscape character is open and exposed with more varied daily weather and temperatures, due to altitude related atmospheric conditions and lack of cover. Paired with these distinct landscape character zones there are varied habitats featuring rare and threatened species:

> *"Rangataua Forest is a 10,000-ha forest located on the southern slopes of Mount Ruapehu. It contains a high number of nationally ranked, high-priority threatened species and ecosystems, including the North Island's largest mistletoe population and the largest known population of short-tailed bats in Aotearoa New Zealand. There are also populations of North Island brown kiwi and kākā, as well as endangered wetland orchids."* [9]

26 The upper slopes and summit of Mount Ruapehu is the origin for multiple rivers, streams and tributaries which radiate out from the mountain. Of particular relevance to this project, the Mangawhero River is located on the south-western face of Ruapehu and runs broadly parallel to the Ohakune Mountain Road. The river corridor is generally rocky and shallow on the upper slopes and alpine areas of Ruapehu, becoming increasingly vegetated and at time gullied and incised as it flows through the forested areas.

27 The proposed Te Ara Mangawhero Tail (part II) alignment is located within the forested areas (Podocarp and Beech Forest) and alpine areas of Ruapehu, and includes four crossing points over the Mangawhero River (three within the alpine area and one within the Podocarp Forest). The alignment also includes multiple smaller bridging points over gullies, channels and tributaries which feed into the Mangawhero River.

28 The Assessment of Ecological Effects (Wildlands, September 2024) identifies that, as a whole, the area has exceptional ecological value, with a high diversity of vegetation communities created through volcanic processes (specifically lahars).

29 The project area includes multiple wetland areas (including forest wetland, tussock wetland, seepage wetlands, bogs and fens) which are generally unmodified (with little to no human presence) and are dominated by

[9] Refer 'Walks in and around Tongariro National Park' brochure.
Walks in and around Tongariro National Park (doc.govt.nz)

indigenous species. Wetland areas are present across the trail alignment, in both forested and alpine areas.

30 Ecological values are identified as being High within the Podocarp and beech forest (particularly notable at wetlands and river margins); and Very High within the higher altitude areas (alpine areas), particularly in the alpine tussock shrublands and gravel fields, solidified lahar deposits, river margins and wetlands.

31 Overall, and as informed by desktop study, fieldwork, the ecology assessment and the consideration of both physical and perceptual matters (refer to the Statutory Guidance and Assessment of Effects section below), the baseline natural character values associated with the river crossings margins and wetland areas are generally assessed as being Very High (with some areas having High natural character values).

Recreation and existing infrastructure

32 The southern slopes of Mount Ruapehu and the surrounding National Park include a variety of recreational activities including skiing, tramping, mountain biking, rock climbing, snow caving, photography and hunting.

33 Tūroa Ski Field is located on the southern slopes of Mount Ruapehu, approximately 1.5km north of the proposed trail alignment. The Ohakune Mountain Road, which is located alongside the proposed trail, provides access to the ski field from Ohakune town. The ski field includes numerous built structures including entrance buildings, a café, toilets and ski lifts. The ski field parking area is located at approximately 1,630m asl (the highest point on the proposed trail is approximately 1,460m asl), with the ski lifts spanning between approximately 1,750m asl and 2,050m asl. The ski field is located within the alpine environment and is visible from the base of Mount Ruapehu, along sections of the Ohakune Mountain Road, from the northernmost sections of the proposed trail alignment, and other locations in the wider landscape (subject to favourable atmospheric / visibility conditions).

34 The southern face of Mount Ruapehu includes a number of popular tramping tracks and huts including the 'Round the Mountain Track' (RMT) which traverses the mid and upper slopes of Ruapehu and Ngāuruhoe. The RMT is an approximate 66km circuit tramp which typically takes 4 – 6 days to complete. The track includes 6 huts and has multiple boardwalks and bridges constructed in a variety of materials. The current RMT alignment includes an approximate 3.4km length along the Ohakune Mountain Road to the south of the Tūroa Ski Field.

35 The Old Blyth Track is an approximate 5.5km 'tramping track' that connects the RMT to the north-east to the Ohakune Mountain Road to the south-west,

running broadly parallel to the mountain road. The Old Blyth Track is a historic route constructed in 1910 as a mule track to move materials up the mountain to construct huts. The track includes well preserved examples of horizontally placed logs (corduroy) which were used to improve the muddy conditions of the track.

36 The Ohakune Mountain Road is a sealed road, approximately 16km long, between Ohakune and the Tūroa Ski Field. The road was constructed during the 1950s and 1960s using material quarried[10] from the eastern side of the Mangawhero River (east of the proposed trail alignment). The road includes three structures along its length, including Massey Hut, and smaller buildings likely associated with ensuring road safety and snow-tyre fitting. The road includes multiple passing / pull-over areas and provides parking for the aforementioned tracks, including the Mangawhero Falls short walk[11] and viewing area which the proposed trail alignment connects to.

37 Mangawhero Falls is an approximate 28-metre waterfall and is a filming location in the Lord of the Rings: The Two Towers (featuring as Gollum's Pool and Ithilien).

38 The proposed trail alignment and its broader landscape context are illustrated within **Appendix C Graphic Attachments.**

Description of the Project

39 Phase two of the Te Ara Mangawhero is a 12.2km shared use (biking and walking) trail from Massey Flat on the Ohakune Mountain Road to Rimu Hill on the lower slopes of Ruapehu Maunga. The proposed trail will form the start of the Mountains to Sea Great Ride.

40 Phase One of the trail is currently under construction and links Ohakune town to Rimu Hill.

41 The trail is to be developed and maintained by the Ngā Waihua o Paerangi Trust. The Trust will be supported by New Zealand Cycle Trail (NZCT) and approved Master Trail Builders, Dodge Construction.

42 The trail is a shared use; to be used by people on off road bikes and on foot. It will be a dual direction trail. Most of the trail will be built to NZCT Grade 3 standard, with a width of between 0.9m and 1.5m and a gradient of 3-5 degrees.

[10] Refer Panorama 2 and Viewpoint 13 within the Graphic Attachments.

[11] Refer Panorama 3 within the Graphic Attachments.

43 The trail will be surfaced with a natural compacted gravel finish, as other trails in the area. There will also be several bridges over the Mangawhero River and its tributaries, the longest of which will be 24m. Some sections of the trail (approximately 1.5km total) will require the use of Fibreglass Reinforced Polymer (FRP) board walks. This path type is proposed where the trail crosses permanently wet or rocky areas including ecologically sensitive sites, to reduce the physical impact of the trail.

44 The proposed trail will include wayfinding and information boards (designed to be in keeping with the existing typology of signage in the National Park), and will require barriers (galvanised) at intersections with existing trails, and squeezes at the intersection of Ohakune Mountain Road, to ensure the safety of trail users. Refer to Appendix A for a more detailed description of design approach, for the trail alignment, types and their sequence, as used to inform this assessment.

45 For descriptive and assessment purposes, the proposed trail has been broken down into five sections as set out in table 1 (and as illustrated on **Figure 5, Appendix C – Graphic Attachments**). Please note that the section numbering represents a continuation of Phase one of the trail.

Table 1 Te Ara Mangawhero Phase 2 Sections

Section	Length	Description
Section 5 Rimu Hill to Old Blyth Track	3.2km	A section of new trail through previously undisturbed indigenous forest. The trail also crosses the Ohakune Mountain Road. Section 5 finishes at the start of the existing Old Blyth Trail adjacent to the road. Structures required are limited to the 24m long bridge over the Mangawhero River and five sections of FRP boardwalk (approx. 66m in total).
Section 6 Old Blyth Track	4.5km	This section is an upgrade of part of the existing Old Blyth Track, set within indigenous forest. The historic track is eroded and difficult to use over much of its extent). Extensive upgrades are required to the existing trail to bring it up to Grade and include the addition of numerous sections of FRP boardwalks (approx. 182 m in total) and extensive measures to improve drainage conditions. Existing sections of the trail will also be resurfaced with compacted gravel and, in some areas, widened to achieve a minimum 0.9m width. The trail will be realigned in two places, where the existing alignment is unstable. A wharepaku (toilet) is proposed at the start of this section (set back and not visible from the road). This section has heritage values and extensive areas of wooden 'corduroy' that dates

Section	Length	Description
		to when the trail was originally constructed in 1910. Sections of this corduroy will be preserved.
Section 7 Old Blyth Track to Waitonga Falls Track	1.1km	This is a new section of trail connecting the Old Blyth Track to the Waitonga Falls / Round the Mountain Track. The trail is to be constructed through previously undisturbed indigenous forest and will include four bridges (8 to 15m) and two sections of FRP boardwalk (approx. 35m in total).
Section 8 Waitonga Falls Track to Mangawhero Falls	1.5km	This new section of the trail is within an alpine environment and a mix of alpine beech forest and grass / shrublands. The trail will be on undisturbed land except for an area near the highest point of this section that will use the existing Mangawhero Falls look out trail. There will be a number of sections of FRP boardwalk (approx. 463m in total) and a 20m suspension bridge over the Mangawhero River. The shared path will form part of the Round the Mountain Trail which currently uses the Ohakune Mountain Road at this point, providing an alternative safer route to trail users (removing cyclists and walkers from the road).
Section 9 Mangawhero Falls to Massey Flat	1.9km	A new section of trail set within an alpine and previously undisturbed environment predominantly over open areas of grassland, featuring historic lava flows and lahar fields. This section will also form a new part of the Round the Mountain Trail. There are numerous sections of FRP boardwalk on this part of the trail (approx. 826m in total) which is in response to sensitive nature and harsh climactic conditions of the environment here. There will also be two bridges over the Mangawhero River just above the Mangawhero Falls carpark. The top part of the trail terminates at Massey Flat.

46 In summary, while there are sections of the proposed trail that are already in used as a track, and have been modified by earthworks, vegetation clearance (Blyth Track) and feature lookout structures, or are closer to public roads and less remote, the landscape values of the site are in keeping with, and contribute to, the overall ONFL status of the Tongariro National Park.

Alignment changes and construction methodology

47 The proposed trail alignment has been extensively 'ground-truthed'[12] and has undergone a detailed design process to give as much surety as possible to its proposed location and alignment; however, due to the complexity of the

[12] To check its feasibility, viability and confirm the alignment when considering aspects such as the avoidance of any key / notable ecological or landscape features (eg, wetlands, key vegetation, ridgelines etc).

landscape setting and type of project proposed, this assessment allows for minor deviations from the alignment which may be required during the construction stage (accounting for instances such as change in the condition of the existing environment[13], constructability issues[14], or any inaccuracies in topographical data relating to ground level below canopy etc). A suite of **Landscape Recommendations, Design and Management Principles** are included as **Appendix A** to this assessment, which provide clarity on the landscape principles and approach to design taken for the trail alignment and its main components (trail types and their sequencing, signage, barriers etc) . Should any minor deviations or changes in trail type be required, as a result of more detailed survey and investigation, the same principles will be applied to ensure that effects are appropriately avoided, remedied or mitigated.

48 A construction methodology also accompanies this application. Construction works will be completed over a 2- year timeframe. Much of the trail alignment is readily accessible, with materials proposed to be delivered by truck along the mountain road, and taken to the alignment by power barrows / quad bikes; however, where the trail becomes more remote (as distance from the road increases), materials will be lifted in by helicopter and temporarily placed where natural openings in the canopy occur. Construction of the trail will consist of hand tools and a mini excavator, minimising the construction footprint of the proposal (with trail construction within wetland areas restricted to hand tools to avoid ground compaction).

49 The proposal is outlined in full within the Assessment of Environmental Effects (AEE) prepared by Roam Consulting and the proposed trail alignment is illustrated within Appendix C – Graphic Attachments.

Statutory context

50 This section of the report summarises the provisions most relevant to natural character, landscape and visual amenity matters; with a full list of relevant policies included within **Appendix B** to this Assessment. Other relevant planning matters are addressed in the AEE, prepared by Roam Consulting.

51 As the proposed route alignment is located wholly within the Tongariro National Park and Conservation Area, no resource consent is required with Ruapehu District Council for landuse activities. Where parts of the Ruapehu District Plan have been discussed, these are in relation to the Tongariro National Park Outstanding Natural Landscape values, with the purpose of informing the assessment of natural character, landscape and visual amenity effects.

[13] Eg should a slip occur

[14] Eg, during construction, ground conditions are not as expected

Resource Management Act 1991

52 With regard to Part 2 of the RMA, the relevant provisions are within section 6: Matters of National Importance and section 7: Other Matters.

Section 6

"In achieving the purpose of this Act, all persons exercising functions and powers under it, in relation to managing the use, development, and protection of natural and physical resources, shall recognise and provide for the following matters of national importance:"

- *s6(a) - the preservation of the natural character of the coastal environment (including the coastal marine area), wetlands, and lakes and rivers and their margins, and the protection of them from inappropriate subdivision, use, and development*
- *s6(b) - the protection of outstanding natural features and landscapes from inappropriate subdivision, use, and development*

Section 7

"In achieving the purpose of this Act, all persons exercising functions and powers under it, in relation to managing the use, development, and protection of natural and physical resources, shall have particular regard to:"

- *s7(c) - The maintenance and enhancement of amenity values.*
- *s7(f) - Maintenance and enhancement of the quality of the environment.*

Horizons One Plan – Regional Policy Statement

53 The Regional Policy Statement provides consideration of natural character (NATC section of the Policy Statement). Objectives and Policies are summarised below (with complete wording provided within **Appendix B – Landscape Related Policy**):

- *Objective 1 - Outstanding natural features and landscapes and the natural character of wetlands, rivers and their margins are protected from inappropriate development.*
- *Objective 2 - Adverse effects on the natural character of wetlands, rivers and their margins are avoided in areas with outstanding natural character.*
- *Objective 3 – Promote the rehabilitation of natural character of wetlands, rivers and their margins.*

- *Policy NATC-P1 (1) – Preservation of the natural character of wetlands, rivers and their margins.*
- *Policy NATC-P1 (2) – Restoration and rehabilitation of natural character.*
- *Policy NATC-P1 (3) – Natural characteristics to be considered.*
- *Policy NATC-P2 (2) – Development in relation to natural character effects is considered appropriate if it is compatible with existing levels of modification, has a functional need to be in that location, is of an appropriate form, scale and design, will not significantly disrupt natural processes and will provide for the rehabilitation and restoration of natural character.*
- *Policy NATC-P3 (1) - Providing for public access.*

54 The Regional Policy Statement also provides consideration of Natural Character in combination with Natural Features and Landscapes (NFL section of the Policy Statement: Natural Features and Landscapes, and Natural Character). Objectives and Policies are summarised below (with complete wording provided **within Appendix B – Landscape Related Policy**):

- *Objective 1 - Outstanding natural features and landscapes and the natural character of wetlands, rivers and their margins are protected from inappropriate development.*
- *Objective 2 - Adverse effects on the natural character of wetlands, rivers and their margins are avoided in areas with outstanding natural character.*
- *Objective 3 – Promote the rehabilitation of natural character of wetlands, rivers and their margins.*
- *Policy NFL-P1 (1) – Avoid significant adverse cumulative effects on Outstanding Natural Features and Landscapes.*
- *Policy NFL-P1 (2) – Avoid adverse effects as far as reasonable practicable on Outstanding Natural Features and Landscapes.*

55 Tongariro National Park ONFL is listed in Table 48 as a Regionally Outstanding Natural Feature and Landscape. The assessment criteria (Table 8) by which to assess effects on the ONFL is provided below:

Table 2: ONFL Assessment Criteria (Table 8 of the Regional Policy Statement)

Assessment factor	Scope
1. Natural science factors	These factors relate to the geological, ecological, topographical and natural process components of the natural feature or landscape: 1. Representative: the combination of natural components that form the feature or landscape strongly typifies the character of an area. 2. Research and education: all or parts of the feature or landscape are important for natural science research and education 3. Rarity: the feature or landscape is unique or rare within the district or Region, and few comparable examples exist. 4. Ecosystem functioning: the presence of healthy ecosystems is clearly evident in the feature or landscape
2. Aesthetic values	The aesthetic values of a feature or landscape may be associated with: 1. Coherence: the patterns of land* cover and land* use are largely in harmony with the underlying natural pattern of landform and there are no, or few, discordant elements of land* cover or land* use. 2. Vividness: the feature or landscape is visually striking, widely recognised within the local and wider community, and may be regarded as iconic. 3. Naturalness: the feature or landscape appears largely unmodified by human activity and the patterns of landform and land* cover are an expression of natural processes and intact healthy ecosystems. 4. Memorability: the natural feature or landscape makes such an impact on the senses that it becomes unforgettable.
3. Expressiveness (legibility)	The feature or landscape clearly shows the formative natural processes or historic influences that led to its existing character
4. Transient values	The consistent and noticeable occurrence of transient natural events, such as daily or seasonal changes in weather, vegetation or wildlife movement, contributes to the character of the feature or landscape.
5. Shared and recognised values	The feature or landscape is widely known and is highly valued for its contribution to local identity within its immediate and wider community
6. Cultural and spiritual values for tangata whenua^	Māori values inherent in the feature or landscape add to the feature or landscape being recognised as a special place.
7. Historic Heritage values	Knowledge of historic events that occurred in and around the feature or landscape is widely held and substantially influences and adds to the value the community attaches to the natural feature or landscape. Heritage features, sites* or structures* that are present and add to the enjoyment and understanding of the feature or landscape.

Ruapehu District Plan

56 As above, the proposed route alignment is located within the Tongariro National Park and Conservation Area. As such, no resource consent is required with Ruapehu District Council.

57 The below summary of the Ruapehu District Plan is in relation to the relevant objectives and policies of the Tongariro National Park Outstanding Natural Landscape, which have been used to inform the assessment of effects on the ONFL values. Objectives and Policies are summarised below (with complete wording provided within **Appendix B – Landscape Related Policy**):

- *Objective NL.2.2.1 (a): Protection of Outstanding Natural Features and Landscapes from inappropriate development.*
- *Objective NL.2.2.1 (a): Protection of Outstanding Natural Features and Landscapes from inappropriate development; including avoiding adverse effects of values specified in Policy NL 2.2.2(c) and avoiding significant adverse cumulative effects.*
- *Policy NL2.2.2 (c): To protect the below specified values of Tongariro National Park (particularly the volcanoes):*
    - *Visual and scenic characteristics, particularly its visual prominence.*
    - *Recreational values.*
    - *Scientific value, particularly the volcanic landscape.*
    - *Ecological value, particularly the mountainous ecology and the extensive tussock grasslands and wetlands supporting rare indigenous flora.*
    - *Cultural values and importance to tangata whenua.*

Tongariro National Park Management Plan

58 The Tongariro National Park Management Plan states at 2.4.5 (**emphasis** added):

> *"The **scenic and landscape values** of Tongariro were a significant reason for its gazettal as New Zealand's first national park in 1887. The **peaks of Tongariro, Ngauruhoe and Ruapehu dominate the landscape** from all*

directions as they rise from the central North Island plateau. They have many moods depending on the season, the weather, and the extent of any volcanic activity. These scenic values have contributed to the adoption of the park as a World Heritage site.

***The park is very accessible**. It is surrounded by a network of state highways and has three roads that ascend above 1700 metres. Many of the visitors to the park are drawn by the scenic attractions of a drive or a short walk where they can experience a snow-covered mountain, an active volcano, a desert or a magnificent podocarp forest."*

59 When discussing recreational use, the management plan states at 2.4.7 (**emphasis** added):

*"The objective of management is to facilitate public benefit, use and enjoyment of the park by **providing for a variety of low-impact recreational activities**, where this is consistent with the primary objective of **protecting the natural character of the park**."*

60 The Management plan includes a section on Landscape (at 4.1.3 of the plan). Objectives and Policies are summarised below (with complete wording provided within **Appendix B – Landscape Related Policy**):

- *Objective a) To retain the natural landscape.*
- *Objective b) To restore landscape values.*
- *Objective c) Avoid impacts on landscape values.*
- *Policy 1) Avoid impacts on landscape values.*
- *Policy 2) Design of infrastructure to blend into the environment.*
- *Policy 3) Removal or redundant infrastructure.*
- *Policy 4) Avoidance of adverse impact of earthworks on watercourses.*

Assessment of effects

61 The following section assesses the Project's effects on the natural character, landscape and visual amenity values of the site and the wider landscape setting. The specific effects considered are:

a) ***Natural Character*** *effects*

i. *Effects on the natural character of wetlands*

ii. *Effects on the natural character of the Mangawhero River and its margins*

b) ***Landscape*** *effects:*

i. *Overall effects on landscape*

ii. *Effects on landscape values associated with Tongariro National Park ONFL and World Heritage Site*

c) ***Visual Amenity*** *effects:*

i. *Effects on public views within the immediate, localised and wider setting of the site; including:*

a) Views from crossing points (where the trail alignment crosses an existing road or track)

b) Views from Ohakune Mountain Road

c) Views from the wider setting (Ohakune settlement)

d) ***Construction*** *Effects*

e) ***Cumulative*** *Effects*

62 Considering the specific characteristics of the site which contribute to these wider values, there are key aspects of the project which will influence the nature and extent of adverse effects:

- Vegetation removal and required earthworks, as influenced by the alignment, required path standards (width) and the sequencing of path types. The project shaping and ground truthing related to these aspects is described within the project description.

- Measures that retain existing patterns of hydrology, including for wetland areas and in the design for river crossings.

- The design detail of individual trail types and bridges, including such matters of scale, colour and materials used and their make-up, number of components and their connections as well as the transitions between trail types. These details will influence both the overall fit of the trail within the

wider landscape and, at a finer grain, the physical and visual 'footprint' and its dominance; as is relevant to natural character, landscape and visual amenity effects.

63 Design for each of the main trail types has been considered as part of the project shaping to reduce effects with measures considered for (as included in the Construction Management Plan):

- Typical gravel trail (edging, gravel source, typical width)
- FRP (numbers of sections, overall length, width, maximum height above ground, piling, dominance of deck/sub structure, railing requirements, colour)
- Bridges (total number, range of length, typical design – width, railing, sub structure, colour).

Natural Character Effects

64 The proposed trail alignment crosses several wetland areas and requires four bridges over the Mangawhero River. Under s6(a) of the RMA this makes the consideration of natural character matters relevant to this assessment.

65 Te Tangi a te Manu Aotearoa New Zealand Landscape Assessment Guidelines includes an interpretation of natural character:

> *'Natural character is the distinct combination of an area's natural characteristics and qualities, including degree of naturalness.'*[15]

66 Naturalness is a quantitative attribute-a condition-related to the degree of modification of an area. Naturalness is one attribute of natural character.

67 The characteristics and qualities that contribute to natural character include physical natural elements and processes and how these are perceived and experienced; how dominant the human or structures or activities are in contrast to the areas natural aspects.

68 Combined with a description of natural character, a 7 point scale (from very low to very high) can be used to summarise baseline natural character values.

69 Policy NATC-P1(3) of the Horizons One Plan determines that natural character includes the following matters. These assessment criteria are consistent with the those outlined within the New Zealand Coastal Policy Statement 2010 (NZCPS), as have been adopted in this assessment.

[15] Refer Chapter 9 Natural Character, Paragraph 9.4, Te Tangi A Te Manu Aotearoa New Zealand Landscape Assessment Guidelines.

a) natural elements, processes and patterns;

b) biophysical, ecological, geological and geomorphological aspects;

c) natural landforms such as headlands, peninsulas, cliffs, dunes, wetlands, reefs, freshwater springs and surf breaks;

d) the natural movement of water and sediment;

e) the natural darkness of the night sky;

f) places or areas that are wild or scenic;

g) a range of natural character from pristine to modified; and

h) experiential attributes, including the sounds and smell of the sea; and their context or setting.

70 The below tables provide assessments against the natural character criteria outlined within Policy NATC-P1(3) of the Horizons One Plan for wetland areas and the Mangawhero River crossings independently.

Wetlands

71 The proposed trail alignment crosses multiple wetland areas (including forest wetland, tussock wetland, seepage wetlands, bogs and fens). These are generally unmodified (with little to no human presence) and are dominated by indigenous species. These areas are located, in both forested and alpine environments. Given their remote setting and physical characteristics, and as informed by the ecology assessment, site work and desktop study, they have a Very High degree of natural character.

72 Measures used to avoid and minimise adverse natural character effects for wetland areas include:

- Trail alignment changes made to avoid crossing wetland areas where possible
- Where works within a wetland are unavoidable, the trail has been aligned to the edge of the wetland area and will be constructed in raised FRP boardwalks that minimise any ground disturbance or impact on underlying vegetation and on patterns of hydrology. Machinery will be kept off the wetland, tracking over the permanent or, in some locations, temporary boardwalk, to avoid damage.
- Construction methods will be restricted to hand tools only within wetland areas (with machines tracking over the boardwalk only), ensuring there is no compaction through use of machinery

73 The below assessment in Table 3 considers all wetland areas in combination.

Table 3: Natural Character Assessment (Wetlands) – Horizons One Plan Criteria

Policy NATC-P1(3) Criteria	Natural Character Assessment
a. Natural elements, processes and patterns;	The wetland areas have very high natural character values with intact natural elements, processes and patterns. The wetland areas are unmodified with little to no human presence, dominated by indigenous vegetation. The proposed raised boardwalks have been designed to minimise effects on existing vegetation and the processes and patterns of the wetland areas, with boardwalks located around the edge of wetland areas where possible and raised above the wetland (supported by piles) to minimise vegetation removal, earthworks and any impact on hydrology patterns. Overall, the boardwalks will introduce new built structures into unmodified wetland environments, however their design and siting will ensure that adverse effects are minimised and are localised to the boardwalk corridor, with the broader natural elements, processes and patterns are unchanged. Overall, the proposal will result no more than **Low** adverse effects on the natural elements, process and patterns of the wetlands.
b. Biophysical, ecological, geological and geomorphological aspects;	The proposed boardwalk alignments within the wetland areas have been carefully considered and tested to minimise disturbance and reduce any biophysical, ecological, geomorphological effects. The use of raised boardwalks will minimise vegetation loss and protect tree roots, and will enable the free flowing of water to ensure that the underlying geological and geomorphological and hydrology systems remain unaffected. As outlined within the Assessment of Ecological Effects (Wildlands, October 2024), with appropriate management, all potential ecological effects across the trail alignment can be avoided or reduced to minor or less than minor. Overall, the proposal will result in localised **Low** adverse effects on the biophysical, ecological and geomorphological aspects of the wetland.
c. Natural landforms such as headlands, peninsulas, cliffs, dunes, wetlands, reefs, freshwater springs and surf breaks;	The overall natural landform and topography of the wetlands will be retained. Minimal and localised earthworks will be required to install the boardwalk piles, however, all other earthworks (eg cut and fill) and regrading will be avoided. Adverse effects on natural landform will be, at most, **Very Low**.
d. The natural movement of water and sediment;	The proposed raised boardwalk will be supported by piles to reduce the extent of earthworks and avoid the need to 'dig in' a gravel track (avoiding creating cut 'channels' within the wetland environment). The use of raised

	boardwalks in wetland areas will enable water to continue to flow unimpeded throughout the wetland areas. Effects on the natural movement of water and sediment in the wetland areas will be **Nil,** post construction.
e. The natural darkness of the night sky;	The proposal will not include any lighting and the natural darkness of the night sky will remain unaffected. Effects on the natural darkness of the night sky will therefore be **Nil**.
f. Places or areas that are wild or scenic;	Due to the lack of modification and human presence, the wetland areas across the alignment are assessed as being wild and scenic. Whilst the proposed trail will introduce a new built feature into these locations, trails are not out of keeping or unexpected within this environment and will not detract from the wild or scenic qualities and characteristics of the setting of the wetlands. The proposed boardwalks will allow these scenic and wild experiential qualities to be appreciated whilst maintaining their natural characteristics. Overall, the proposed trail will result in **Nil** effect where the wetlands are avoided and **Low** adverse effect on the wild or scenic qualities of the wetland areas where boardwalks are required.
g. A range of natural character from pristine to modified; and	The proposed wetland areas across the trail alignment are reflective of the remote, wild and scenic setting of the broader landscape environment. The wetlands are pristine, with no (or little) modification or human presence. The proposed trail will introduce a degree of modification into these environments; however the design and siting of the boardwalks have been carefully considered to avoid or minimise effects (which are limited to the footprint of the boardwalk), ensuring that the broader natural characteristics of the wetland areas will remain unchanged. Overall, the proposal will result in localised adverse effects of no more than **Low** on the pristine natural character of the wetlands where board walks are required, with the broader natural characteristics of wetlands in the area, and those avoided unchanged.
h. Experiential attributes, including the sounds and smell of the sea; and their context or setting.	The proposed boardwalks will result in positive experiential effects, providing access to remote wetland environments which were previously inaccessible; and allowing these areas to be experienced and appreciated. The boardwalks will be a singular track within these environments (i.e, will not be visible from outside of the wetland) and will provide access to these areas to allow them to be appreciated. Overall, the proposed trail will result in **Low** positive effects on experiential attributes.

74 Overall, the proposed trail will result in **no more than Low** adverse effects on the natural character of wetlands along the alignment. The proposed trail design, alignment and management methods (refer Appendix A to this

assessment) ensure that adverse effects are avoided or minimised to be no more than minor.

Mangawhero River Crossings

75 The proposed trail alignment includes four crossings over the Mangawhero River corridor. Crossings are located at the following locations:

- *Trail section 5 – 24m suspension bridge within Podocarp Forest*
- *Trail section 7 – 15m suspension bridge within Beech Forest (north of the Round the Mountain Track)*
- *Trail section 8 – 18m single span bridge adjacent to the Mangawhero Falls Car Park (at the location of a former, now dismantled crossing point).*
- *Trail section 9 – 20m suspension bridge within alpine shrubland, adjacent to Ohakune Mountain Road*

76 Whilst sections of the Mangawhero River are in close proximity to the Ohakune Mountain Road, the river corridor is generally unmodified. The proposed river crossing at section 8 of the trail is located on a former (dilapidated) crossing point, with concrete foundations still present, however, the area has regenerated over time, due to limited public access / disturbance, such that these elements are less dominant.

77 Two of the crossings are within forested environments, and two are located within the alpine environment. Overall, the river and the crossing locations at sections 5 and 7 of the trail have a Very High degree of natural character. The crossing locations within sections 8 and 9 of the trail have a High degree of natural character (due to their more immediate proximity to the Ohakune Mountain Road corridor which detracts from experiential factors of natural character).

78 Measures used to avoid and minimise adverse natural character effects for the reiver crossings include (refer also to Appendix A for a more detailed description of design approach):

- Trail alignment changes made to minimise crossing numbers where possible.
- Where crossings are required, the crossing location and alignment has been selected to minimise vegetation removal and minimise earthworks (i.e, ensuring riverbanks are a comparable height).
- Bridge typology has been selected to ensure that bridges are single span / suspension bridges, avoiding the need for works or structures within the riverbed.

Table 4: Natural Character Assessment (Mangawhero River Crossings)

Policy NATC-P1(3) Criteria	Natural Character Assessment
a. Natural elements, processes and patterns;	The bridges have been designed and located to minimise vegetation removal and avoid the need for any cut / fill earthworks, ensuring that the natural elements of the river margins will remain intact. The proposed bridges will not alter the processes or patterns of the riverbed or the natural flow of water. Overall, the proposed bridges will result in **Very Low** adverse effects on the natural elements, process and patterns of the Mangawhero River.
b. Biophysical, ecological, geological and geomorphological aspects;	The proposed bridge locations and alignments have been carefully considered and tested to minimise disturbance and reduce any biophysical, ecological, geomorphological effects on the river margins. The location of the boardwalks have been selected to minimise vegetation loss and any earthworks will be highly localised to the foundations (avoiding the need for any cut / fill works to manage grade or height difference between banks). The bridges will be single span / suspension bridges, avoiding any effect on the river bed or aquatic ecology. As outlined within the Assessment of Ecological Effects (Wildlands, October 2024), with appropriate management, all potential ecological effects across the trail alignment can be avoided or reduced to minor or less than minor. Overall, the proposal will result in localised effects of **Very Low** adverse effects on the biophysical, ecological and geomorphological aspects of the Mangawhero River.
c. Natural landforms such as headlands, peninsulas, cliffs, dunes, wetlands, reefs, freshwater springs and surf breaks;	The natural landforms of the riverbed will remain unchanged; however the river margins will require localised earthworks to implement the bridge foundations. Earthworks will be restricted to the foundation footings at the entrance to the bridges and any suspension wires (located further from the river corridor). The bridges will work with the underlying topography and contours of the natural landforms, with the crossing locations having been selected to ensure that earthworks is not required to 'level' the opposing river margins (i.e locations have been selected where the bridge will be at grade without any cut / fill earthworks). Overall, the proposal will result in **Low** adverse effects on the natural landforms of the Mangawhero River margins. Effects will be highly localised, limited to the footprint of the bridge foundations.
d. The natural movement of water and sediment;	The proposed bridge designs have been developed to ensure that no footings or support beams (during construction or operation) will be required within the riverbed. Works are limited to the river margins only, and

	there will therefore be **Nil** effects on the natural movement of water and sediment.
e. The natural darkness of the night sky;	The proposal will not include any lighting and the natural darkness of the night sky will remain unaffected. Effects on the natural darkness of the night sky will therefore be **Nil**.
f. Places or areas that are wild or scenic;	The river crossings at sections 5 and 7 of the trail are remote and largely unmodified, having wild and scenic values. In contrast, the river crossings at sections 8 and 9 of the trail are located in close proximity to Ohakune Mountain Road which decreases the sense of wilderness, however they are still located in a highly scenic environment. Whilst the bridges will introduce a new built feature into these locations, they have been designed to be visually recessive (in terms of bulk, scale, colour and materiality) are will not be out of keeping or unexpected within this environment. The proposed boardwalks will allow the scenic and wild experiential qualities of the river corridor to be appreciated whilst maintaining the natural characteristics. Overall, the proposed trail will result in **Very Low** adverse effect on the wild or scenic qualities of the river corridor and **Low** adverse effects at the specific crossing location.
g. A range of natural character from pristine to modified; and	Within Tongariro National Park, the Mangawhero River generally has High - Very High natural character values, dependant on its distance from the Ohakune Mountain Road corridor and associated structures and parking areas. The proposed bridges will introduce a degree of modification into these environments; however the design and siting of the bridges avoids or minimises effects as far as practicable, and will ensure that the broader natural characteristics of the river and its margins will remain unchanged. Overall, the proposal will result in localised effects of no more than **Low** on the natural character values of the river corridor, with the broader natural characteristics and qualities unchanged.
h. Experiential attributes, including the sounds and smell of the sea; and their context or setting.	The proposed bridges have been designed to be visually recessive (through appropriate bridge typology design, materiality, location and colouring), however, in sections 7, 8 and 9 of the trail, the bridges will be visible from Ohakune Road in combination with the river. Whilst visible, the bridges will not detract from the experiential qualities of the river, with bridging structures being expected elements within this environment, and other experiential factors (such as the sound of the moving water) remaining unchanged. For users of the trail, the proposal will result in positive experiential effects, providing access across the river and

	views along the corridor; allowing these areas to be experienced and appreciated. Overall, the proposed trail will result in **Very Low** positive effects on experiential attributes.

79 Overall, the proposed bridges will result in **no more than Low** adverse effects on the natural character of the river and its margins. The bridge designs, alignment and management methods (refer Appendix A to this assessment) will ensure that adverse effects are avoided or minimised to be no more than minor.

Landscape Effects

80 The methodology for assessing the effects of an activity or development on landscape values requires a four-stage process:

i. Definition of 'landscape';
ii. Analysis of landscape characteristics that contribute to values;
iii. Overall synthesis (or appraisal) of landscape values; and
iv. Assessment of effects of an activity or change on landscape values and the characteristics.

'While landscape draws strands from diverse sources (natural sciences, humanities, cultural perspectives), it is perceived and experienced as a unified phenomenon. It is an integrated whole. It is more than a summary of data – the whole is greater than the sum of the parts.

The current professional practice of conceptualising 'landscape' as the overlap of its physical, associative, and perceptual dimensions'[16]

81 The three overlapping dimensions of landscape include:

- **Physical** aspects (its geomorphology, ecological communities and processes) of the site;
- **Perceptual** aspects (the vividness and memorability of the landscape features); and,
- **Associative** aspects, including such meanings as the historical connections of the site.

82 The landscape character on the slopes of Mount Ruapehu transition through distinct altitudinal zones with marked changes in vegetation typology, as

[16] Te Tangi a te Manu: Aotearoa New Zealand Landscape Assessment Guidelines, Paragraphs 4.21 – 4.22

elevation rises. The lower slopes of Ruapehu are generally characterised by dense indigenous vegetation creating an enclosed and sheltered environment. At higher altitudes, the vegetation thins, reducing in height and cover. Above the timber line, landcover is generally characterised by tussock, lower shrubs and hardy herbaceous plants, establishing a more exposed and open character which is subject to rapid changes in weather, atmospheric condition and temperatures.

83 The wider National Park area provides a variety of recreational activities including skiing, tramping, mountain biking, rock climbing, snow caving, photography and hunting. Tracks, trails and bridges / crossings are frequent and expected features of this landscape (and within National Parks in general), providing movement through, and enjoyment of, the natural environment.

84 When considering the projects potential effects on the **physical** aspects of this landscape, the proposed trail alignment has used existing tracks (including the Old Blyth Track and the Mangawhero Falls viewpoint track[17]) where possible, to minimise disturbance to unmodified landforms and vegetation. However, approximately 7.7km[18] of the trail is through previously undisturbed forest or alpine environments. Areas of new trail and the widening of the Blyth track, to Grade 2 standard width, will require earthworks and indigenous vegetation removal. These effects have been minimised by refining the alignment and the use of boardwalks in some locations. Furthermore, the proposed trail alignment has been developed to avoid the clearance of larger indigenous trees (larger than 15cm diameter at breast height) and any threatened or at risk plants.

85 The majority of the proposed trail will be constructed as a natural compacted gravel finish, similar to other trails in the area. This (typical) approach to trail construction will result in localised physical effects. Earthworks will be required to 'dig in' the track – achieving a flush finish with adjacent contours, and clearance of vegetation to provide access along the alignment with the footprint of these works limited to the Grade 3 standard – 0.9m width typically. This tight footprint construction methodology has been used to develop Stage 1 of the trail and many others in the wider park area.

86 Boardwalk structures (FRP) will be used for approximately 1.5km (combined) length of the trail. This trail type will be used to actively manage grade in areas where there is a steep rise or fall in topography (avoiding the need for large scale cut / fill earthworks), and within locations which are wet, ecologically sensitive or rocky (i.e where a compacted gravel tail could not feasibly be

[17] During the site visit and ground-truthing of the trail alignment, multiple unmapped poled routes were also observed, assumed to be former (now disused) hunting tracks. Where possible, the trail has been aligned to these tracks to avoid having parallel trails.

[18] Approximately 4.5km of the trail is along the Old Blyth Track and approximately 35m is along the Mangawhero Falls viewpoint track.

constructed). Boardwalk structures will be used along sections of the Old Blyth Track to preserve and allow views of the historic corduroy trail; with some of these sections partially overlapping (slightly offset) the existing trail alignment. The physical effects of boardwalk structures will be localised, limited to the piling footprint (supporting a raised boardwalk) and the clearance of vegetation to provide access along the alignment. Boardwalk structures are used in other parts of the National Park which are typically constructed from treated timber, which has the risk of leaching into waterways which has been avoided with the use of FRP.

87 Other structures along the proposed trail are limited to bridges over the Mangawhero River and its tributaries, and the siting of a wharepaku midway along the trail (near the southern end of the Old Blyth Track). The wharepaku has been located in a natural opening within the Podocarp Forest to minimise the extent of vegetation removal. All bridging structures will be single span / suspension bridges to avoid the need for supporting posts / columns within gullies / the Mangawhero River; generally minimising physical effects.

88 Overall, the proposed trail alignment has sought to minimise physical effects through the route selection and type of materials / structures used. Where earthworks and vegetation clearance are required to construct the trail, they will be localised and limited to the trail footprint / corridor. Overall, the proposed trail will result in **Low Moderate adverse** effects on the physical landscape aspects.

89 When considering **perceptual** aspects, the distinct altitudinal zones and transition in landscape character on the southern slopes of Mount Ruapehu has a strong sense of memorability, coherence, geomorphic legibility and contributes to the aesthetic qualities of this environment. There is a strong sense of remoteness and wilderness, along the alignment which is only reduced in some locations by Ohakune Mountain Road and the occasional sound of passing vehicles (with remoteness and wilderness being strongest as distance from the road increases). On the mid and upper slopes of Ruapehu, the presence of buildings along the mountain road and structures associated with Tūroa Ski Field also detract from the overall sense of remoteness and wilderness.

90 In contrast, the existing tracks on the southern slopes of Mount Ruapehu do not detract from these perceptual qualities. Whilst the tracks include built structures (such as boardwalks and bridging points) and require clearings in vegetation to allow for access through the landscape, they are generally visually discrete and are expected components within the wider National Park. They provide for the appreciation of this environment and enhance perceptual values, in keeping with the overall Management Plan.

91 Whilst the project will establish a new trail, boardwalks, bridging structures and requires some earthworks and vegetation removal, the proposed trail alignment will not detract from the overall perceptual aspects of Mount Ruapehu. The new track will provide access to remote areas within the forest and alpine areas which were previously inaccessible, providing an immersive 'near wilderness' experience. The track will maintain the memorability, coherence, geomorphic legibility and aesthetic qualities of this environment, whilst allowing this landscape to be appreciated by users of the trail. Overall, the proposal will result in **Low Moderate positive** effects on perceptual landscape aspects.

92 When considering **associative** aspects, the proposed trail will not detract from the identity, sense of place or shared and recognised values of Mount Ruapehu. Tracks are commonplace and expected features within this environment (and within National Parks generally) which have contributed to the community use and enjoyment of this landscape. The proposal will be consistent with this associative value and will enhance the user experience, accessibility and enjoyment of this environment.

93 Approximately 4.5km of the proposed trail alignment is along the Old Blyth Track. The Old Blyth Track is a historic route constructed in 1910 as a mule track to move materials up the mountain to construct huts. The track includes well preserved examples of corduroy which were used to improve the muddy conditions of the track. An Archaeological Evaluation and Impact Assessment[19] accompanies this application, which includes recommendations to preserve and enhance the historical values of the Old Blyth Track, however, as an overview, the proposed trail alignment will preserve the more degraded examples of corduroy below the new trail alignment[20], and showcases more intact and exemplar areas of corduroy by retaining them in situ alongside the proposed trail. Furthermore, interpretive signage will be introduced along the trail to provide for educational opportunities and highlight the historical associations and attributes of the trail.

94 Mount Ruapehu and the wider Tongariro National Park holds immense cultural significance to local Māori, with Ngāti Rangi and Uenuku holding mana whenua over the part of the Park where the proposed trail would be built. A cultural statement has been prepared, as included in the AEE, outlines the proactive involvement of Ngāti Rangi throughout the Te Ara Mangawhero project. Ngāti Rangi will be responsible for the construction and kaitiakitanga of ongoing management and maintenance of the trail, and the cultural statement concludes that Ngāti Rangi are satisfied that any cultural impacts have either been mitigated or can be managed.

19 Authored by Neville A Ritchie, Ph.D, July 2024.

20 This approach is considered most appropriate, as it prevents the timber corduroy from further degrading, and retains it within its original location and alignment.

95 The trail creates new opportunities for the control of pest plants and pest animals to complement existing conservation management in the local area. There are also opportunities to enhance the recovery of indigenous vegetation within previously disturbed areas. The aim is to build a trail that is well integrated into the environment, where adverse effects have been minimised through alignment, trail type design and sequencing to enhance the mouri of the area.[21] Overall, the proposed trail will result in, at least, **Moderate positive** effects on associative landscape aspects.

96 When considering the combined physical, perceptual and associative aspects, the proposed trail will result in **Low positive** effects on landscape values, for the following reasons:

- Physical effects are localised to the immediate trail footprint along the corridor and have been minimised through alignment, trail design and sequencing.
- Proposed bridging points over the Mangawhero River and its tributaries have been designed to be single span / suspension bridges, to avoid the need for supporting columns or earthworks within the river or gullies.
- Trails are commonplace and expected features within this landscape (and within National Parks more generally). The proposed trail will not appear out of place or unexpected within this environment.
- The trail will provide access to remote areas of the forest and alpine environments of Ruapehu, allowing this landscape to be appreciated by users of the trail and enhancing perceptual values.
- The proposed trail will provide for the preservation of the Old Blyth Track and will include interpretive signage to create educational opportunities and highlight historical attributes of the track.
- The trail will create new opportunities for pest control (animal and plant) and provide opportunity to enhance the recovery of indigenous vegetation.

Tongariro National Park Outstanding Natural Landscape

97 Tongariro National Park is identified as an Outstanding Natural Landscape and dual UNESCO World Heritage Site recognised for both cultural and natural values. The National Park is listed as a Regionally Outstanding Natural Feature and Landscape within the Horizons One Plan Regional Policy Statement (RPS)

[21] Refer to Cultural Impact Information, included in the AEE.

and is subject to the ONFL assessment criteria outlined within Table 8 of the RPS.

98 An assessment of the Table 8 criteria is provided below:

Table 3: Assessment against ONFL Criteria (Table 8 of the Regional Policy Statement)

Assessment factor	Comments
Natural science factors	The proposed trail will not detract from the combination of natural components that are representative of the National Park. The trail alignment will provide access to previously inaccessible forest and alpine environments and will include opportunities for education and environmental management. The scientific value of the volcanic setting will remain unaffected by the trail. The proposed alignment will be partly located within the alpine zone (mid slopes of Ruapehu) and will cross historic lahar fields. The trail will not detract from these features (having a highly localised physical footprint), and will enhance the experiential aspects of these features, supported by information boards. Potential ecological effects of the construction and subsequent use of the proposed trail can be reduced and mitigated (with reference to the Assessment of Ecological Effects) through the use of good techniques and trail management. These effects will be localised, and the broader ecological function and setting of the National Park will remain consistent. Overall, the proposed trail alignment has been sensitively designed to avoid or mitigate any effects on the geological, topographical, ecological and dynamic components of the landscape.
Aesthetic values	The proposed trail will not detract from the coherence or aesthetic values of this landscape. A sensitive approach to the design of the alignment has been taken to minimise effects on the underlaying natural patterns of landform, with earthworks localised and minimal in extent (eg, the approach to design has resulted in ramped boardwalks being used to avoid the need for cut / fill where the alignment crosses challenging topography). The vividness and visual dominance of the volcanic forms will be unaffected by the proposed development. Where parts of the trail will be visible (eg, at crossing points or from the upper sections of the Ohakune Mountain Road), the trail will be visually recessive and discrete. It will not appear out of place or unexpected within this environment. The trail will introduce additional built features into the landscape (including boardwalks and bridging points), however, these have been sensitively designed to not detract from the overall naturalness of the National Park and will be seen as being in keeping with the existing landscape character of the area.

	The characteristics of the wider landscape that contribute to memorability will remain unchanged; and the proposed trail will provide opportunity for additional off -road, immersive experiential connections .
Expressiveness (legibility)	The legibility of Tongariro National Park ONFL and the formative processes leading to it result from the scientific volcanic processes (which remain evident), which have resulted in a visually dominant landscape feature and collection of volcanic forms. The proposed trail will not detract from the expressiveness of the volcanic forms. The trail is predominantly located below the canopy (with a highly restricted visual catchment) and within localised gullies in the alpine zone, further minimising its visibility, ensuring it is a discrete component of this landscape.
Transient values	Transient values associated with this landscape include the seasonal changes (climactic, temperature and weather i.e snow topped), and transitional landscape characteristics associated with the rise in elevation / altitude on the southern slopes of Ruapehu (with changes in vegetation typology, openness, exposure to elements). The proposed trail will not detract from these values; rather it will allow the transient characteristics to be better appreciated, providing a shared use path which spans forest and alpine zones. The track has been designed to withstand the changes in climactic conditions (both across the alignment and between seasons), with the transient values of this environment also contributing to the specified FRP boardwalk material, which is more durable within extreme weather conditions.
Shared and recognised values	The National Park is a fundamental component of the local identity with strong shared and recognised values. These values are enhanced through sensitive design of trails allowing community / public access to the National Park. The proposed trail will provide additional access to this landscape and will include additional facilities (such as wharepaku and information boards) which will enhance the shared and recognised values of this environment.
Cultural and spiritual values for tangata whenua	Mount Ruapehu and the wider Tongariro National Park hold immense cultural significance to local Māori, with Ngāti Rangi and Uenuku holding mana whenua over the part of the Park where the proposed trail would be built. A cultural statement has been prepared, as included in the AEE, which outlines the proactive involvement of Ngāti Rangi throughout the Te Ara Mangawhero project. Ngāti Rangi will be responsible for the construction and kaitiakitanga of ongoing management and maintenance of the trail, and the cultural statement concludes that Ngāti Rangi are satisfied that any cultural impacts have either been mitigated or can be managed.

Historic Heritage values	Due to the type of development proposed, its scale and location, the broader heritage values associated with Tongariro National Park will remain unaffected. An Archaeological Evaluation and Impact Assessment[22] accompanies this application which evaluates the impact on and condition of surviving historic features, particularly the Old Blyth track. Prior to the establishment of the Ohakune Mountain Road, the Old Blyth track was one of three main routes for accessing the snowfields or for climbing Mt Ruapehu. The track is notable for the amount of surviving corduroying, and its importance to the community. The Archaeological Evaluation and Impact Assessment provides recommendations to ensure that the historical heritage values of the track are maintained, with the proposed development protecting degraded sections of the historic route and showcasing more exemplar sections of corduroy.

99 In addition to the above assessment against the criteria listed within Table 8 of the Regional Policy Statement, the Ruapehu District Plan identifies a list of values which are to be protected from inappropriate subdivision, use and development within Tongariro National Park (particularly the volcanoes) (identified within Policy NL2.2.2 (c) (viii).

- When considering **visual and scenic characteristics (particularly visual prominence)**, the proposed trail will not detract from the overall scenic qualities of the National Park. The trail will be discrete and visually recessive, predominantly located below the canopy, and, where it is in more exposed alpine environments, avoids ridgelines. The trail will not detract from the visual prominence and scale of the volcanic forms within the National Park.

- When considering **recreational values**, the proposal will enhance recreational opportunities within the National Park, providing access to previously inaccessible forest and alpine environments.

- The proposed trail will not detract from the **scientific value** of the volcanic landscape. The trail will traverse some distinctive volcanic geological features (such as lahar fields), however the physical effects of the trail will be localised and the proposal will provide access to this area, enhancing the appreciation this volcanic landscape.

- The application is supported by an Assessment of Ecological Effects which identifies that potential ecological effects of the construction and

[22] Authored by Neville A Ritchie, Ph.D, July 2024.

subsequent use of the proposed trail, can be reduced to minor or less than minor through the use of good techniques and trail management.

- **Cultural** Impact Information (included in the AEE) also supports this application which concludes that Ngāti Rangi are satisfied that any cultural impacts have either been mitigated or can be managed.

100 Overall, and with reference to Section 6b) of the RMA, the proposed trail will be appropriate and protect the values and contributing characteristic and qualities of the Tongariro National Park Outstanding Natural Landscape.

Visual Amenity

101 The author undertook a site visit on 22 and 23 May 2024 with viewpoints taken from the proposed trail alignment and from the immediate and localised setting. Viewpoint photographs are included within **Appendix C – Graphic Attachments** and provide visual illustrations of the setting and context of the site.

102 The proposed trail is visually discrete, predominantly located below the timberline within a densely vegetated setting. The only parts of the trail that will be visible (from outside of the trail alignment itself) are those sections that are above the timberline (within the alpine environment) or where the trail is located within close proximity to either Ohakune Mountain Road or other trails on Mount Ruapehu.

103 The potential viewing audiences are limited to public viewpoints within the immediate, localised and wider setting of the site; including:

a) Views from crossing points with existing trails for walkers

b) Views from Ohakune Mountain Road for motorists and cyclists

c) Views from the wider setting (Ohakune settlement) for motorists, cyclists and pedestrians

Views from crossing points with existing trails

104 The proposed Te Ara Mangawhero Trail (pt.II) alignment crosses three existing tracks on the southern slopes of Mount Ruapehu:

- The proposed trail alignment is along an approximate 4.5km length of the **Old Blyth Track** and will require a 'Y junction' / crossing where the proposed alignment deviates from the existing track (at the start of

Section 7 of the trail). Refer **Viewpoint 21** – Appendix C, Graphic Attachments.

- The proposed trail alignment will cross the Round the Mountain Trail, resulting in a typical 'X crossing'. Refer Viewpoint 18 – Appendix C, Graphic Attachments.
- The proposed trail alignment is along an approximate 35m section of the Mangawhero Falls Track and will result in a 'Y junction' where it deviates from the existing track alignment. Refer Viewpoint 16 - Appendix C, Graphic Attachments[23].

105 Bike barriers are proposed at the Round the Mountain Trail and Old Blyth Track crossing points[24] to ensure safety for both people on foot and bikes at these locations and to restrict access to people on bikes. The bike barriers will likely be galvanised steel and will be approximately waist height. The proposed crossings will also include additional signage (wayfinding).

106 On the **Old Blyth Track**, the deviation (Y crossing), gate and signage will be located within densely vegetated setting and will not be visually distinguishable beyond the immediate setting of the crossing. Where visible, the crossing will not appear out of place (with crossings being expected components along trails) and will be seen in passing as the users move along the trail.

107 The **Round the Mountain Trail** crossing will include two barriers on the existing track alignment (i.e, not on the proposed Te Ara Mangawhero Trail alignment). The rationale for the location of these barriers is to deter people on bikes (in combination with signage) from using the Round the Mountain Trail (which is for walkers only). The proposed gates will be visible along an approximate 90m straight length of the Round the Mountain Trail. Once the trail bends, the gates and signage will not be visible, screened by vegetation.

108 The **Mangawhero Falls Track** crossing is located within the timber line, which is broadly characterised by alpine shrubs interspersed with pockets of beech forest. This crossing does not include a barrier and will be more visually discrete, only being visible from a short section of the Mangawhero Falls Track. It will not be visible from Ohakune Mountain Road.

109 Overall, the proposed crossing locations will result in no more than **Very Low** adverse effects on the visual amenity of existing trail users. The crossings and their associated infrastructure (barriers and signage) will only be discernible at close proximity, and where visible, they will not be seen as out of place or unexpected within this environment. Whilst visible, the crossings will provide

23 Viewpoint 16 is taken in the general proximity of the crossing, and illustrates the vegetation typewithin this area.

24 A bike gate is also proposed at the Mangawhero Falls Trail location, however not where the Te Ara Mangawhero Trail deviates from the existing track. Gates are proposed at the existing car park area, which is assessed in views from Ohakune Mountain Road.

a positive secondary purpose by providing wayfinding markers which allow people on foot to orientate themselves within a densely vegetated and enclosed landscape.

Views from Ohakune Mountain Road

110 The proposed Mangawhero Trail alignment is broadly parallel to the Ohakune Road Corridor; however, due to its vegetative and topographical siting and distance from the road, only short sections of the trail will be visible from the road, including:

- Where the trail crosses Ohakune Mountain Road (section 5 of the trail). Refer **Viewpoint 27** - Appendix C, Graphic Attachments.
- A proposed (approx.) 20m bridge over the Mangawhero River (section 8 of the trail). Refer **Viewpoint 20** - Appendix C, Graphic Attachments.
- Where the trail crosses the Mangawhero Falls car park, including a proposed (approx.) 15m bridge over the Mangawhero River. Refer **Panorama 03** and **Viewpoint 15** - Appendix C, Graphic Attachments.
- Where the trail is within close proximity to Ohakune Mountain Road, approximately 200m uphill of the Mangawhero Falls car park. Refer **Panorama 02** - Appendix C, Graphic Attachments.
- Where the proposed trail traverses a localised hill to the north of Massey Hut, visible from motorists travelling south along Ohakune Mountain Road from Tūroa Ski Field. Refer **Panorama 01** - Appendix A, Graphic Attachments.

111 The proposed trail crossing (refer **Viewpoint 27**) will require the limited clearing of vegetation, and introduction of barriers and signage which will be visible in passing from the road corridor. The introduction of this infrastructure will not appear out of place or unexpected within this environment, with existing trail crossings along the road corridor.

112 The proposed approx. 20m bridge across the Mangawhero River (refer **Viewpoint 20**) will be visible through a break in vegetation along the road corridor, at distance (approx. 175m) and at an oblique angle. The bridge will be visually recessive, seen against a vegetated backdrop and will be difficult to distinguish. The bridge will be visible along an approximate 40m length of road and will be seen in passing.

113 The proposed trail will cross the Mangawhero Falls car park and will include a bridge over the Mangawhero River (refer **Panorama 03** and **Viewpoint 15**) and bike ramp at the entrance to the Mangawhero Falls Walk. These components will be visible along an approximate 150m length of Ohakune Mountain Road and from the Falls car park. They will introduce additional built elements into

this setting, seen within the context of the existing parking area, signage, trail access and road barriers. Whilst visible, they will not detract from the key landscape values and characteristics of this landscape (with views of the Ruapehu summit remaining dominant and unimpeded) and will not appear out of place or unexpected within this environment. Furthermore, the proposal is for a ridged span[25] bridge which is positioned on a former (historic) crossing point[26], and will be seen against a vegetated backdrop.

114 A short section of the proposed trail alignment will be visible from an approximate 130m length of road, approximately 200m uphill (north) of the Mangawhero Falls car park, where the alignment is within a gully, traversing the Mangawhero River. Passing views of the trail will be filtered by established vegetation along the road corridor, and where visible, the trail will be seen low down in the landscape and against a vegetated backdrop.

115 The northern section of the proposed trail alignment (north and east of Massey Hut) will be visible from sections of Ohakune Mountain Road between Massey Hut and the Tūroa Ski Field. In this location, the trail will be constructed in FRP boardwalk which will require minimal earthworks or alteration to the underlying landform (eg, avoiding the need for cut /fill to 'dig in' a trail); however, the boardwalk will introduce a new visible built structure into this environment. The boardwalk will climb from the lower slopes of the gulley to the Massey Hut plateau. It will be visible by motorists travelling south (downhill) along Ohakune Mountain Road, seen as a linear feature along the gully-face. The recommendations in this assessment include specifying a colour for the FRP boardwalk which will assist in visually integrating the structure into this environment.

116 Overall, the proposed trail will result in no more than **Low** adverse effects on the visual amenity of users of Ohakune Mountain Road. The majority of the trail will not be visible from the road, however five sections / components of the trail will be visible. The trail has been designed to be visually discrete and will not be seen as out of place or unexpected within this environment. Where glimpsed views of road crossings or bridges are available, they will not detract from the landscape values or characteristics of the view, however where larger sections of the trail are visible (notably proximate to Massey Hut), the trail will be a more visually distinguishable feature. Whilst visible, the proposed trail will not appear out of place or unexpected within this environment.

[25] A rigid span bridge is typically more visually recessive and sits lower in the landscape, in contrast to suspension bridges which typically include 'towers' at either end to support suspension cables and anchors.

[26] Concrete foundations were observed during the site visit which supported a historic bridge at this location. The bridge has since been removed, with only the foundations remaining in place.

Views from Ohakune settlement

117 The majority of the proposed trail alignment is located below the canopy of podocarp and beech forest on the lower and mid slopes of Mount Ruapehu. These parts of the trail are enclosed and have a highly localised visual catchment. They will not be visible from the wider landscape setting.

118 The upper section of the proposed trail alignment is located within the alpine environment, which is more exposed, with views from the trail alignment to the broader landscape setting to the south.

119 Ohakune settlement (centre) is located approximately 14km to the south of the alpine section of the proposed trail alignment (refer **Viewpoint 1** - Appendix C, Graphic Attachments. At this distance (and under favourable atmospheric conditions) the proposed trail will barely discernible. The following approaches have been adopted to ensure that the trail is visually recessive:

- The design of the trail, including the use of FRP boardwalk to minimise earthworks, and use of more visually recessive rigid span bridges.
- The colouring and materiality, notably of the FRP boardwalk areas where colours have been recommended to ensure visual integration.
- The location of the trail alignment, which broadly follows the river corridor and gullies, i.e, avoiding move visually prominent ridgelines.

120 Overall, the proposed trail alignment will result in no more than **Very Low** adverse effects on the visual amenity from the wider landscape setting (including Ohakune settlement). The trail will be visually recessive, and where visible (under ideal atmospheric conditions) the trail will not be seen as out of place or unexpected within this environment.

Construction Effects

121 The construction of the proposed trail is anticipated to occur over a maximum of 2 years. Construction equipment will consist of hand tools and a mini excavator and will largely be confined to the footprint of the trail (with the exception of any laydown areas). Within wetland areas, only hand tools will be used (with machinery tracking over the constructed boardwalk only) to ensure ground compaction is avoided. Any vegetation required to be removed for the trail alignment will be retained on the forest floor to provide ecological habitat.

122 The proposed construction works will require the infrequent delivery of materials (bags of gravel, FRP panels and materials for bridges etc). Where possible these materials will be delivered by truck along Ohakune Mountain Road, however where the trail is more remote, helicopter drops will be used.

Where possible, laydown areas will be positioned in natural openings in the canopy and will be discretely located (e.g. located within the forested areas, not along the roadside).

123 Due to the scale of machinery and approach to construction, the proposed works will have the same level of visibility as the proposed operational trail, with construction works visible in passing along sections of Ohakune Mountain Road and visible from crossing points with existing trails (albeit more noticeable than an operational trail).

124 The majority of the construction works will be contained by vegetation, set back from the road and trail crossing points. Where visible, construction activity will be temporary, and seen as construction progresses along the trail (e.g, whilst the overall construction may take up to two years, it may only take 2 - 3 days to construct a trail crossing including signage and barriers before construction extends into the forest and is contained by vegetation).

125 Overall, the proposed approach to construction has developed to ensure that landscape values are maintained. Construction works will be temporary in duration and will generally be contained by existing vegetation. Where visible, construction activity will occur over a short timeframe as the works progress along the trail alignment. Overall, the proposed construction works will result in no more than **Low** adverse effects, consistent with the level of visual amenity effect for the operational trail.

Cumulative Effects

126 Cumulative effects are the effects of a proposal in combination with those of previous [or consented] developments. Cumulative effects come into play in circumstances where an additional effect takes a landscape beyond a 'tipping point' - which would normally require a benchmark against which the effects are to be measured. Such benchmarks might include the character envisaged in the district plan or the 'capacity' of a landscape to accommodate development before compromising its landscape values (its valued attributes).[27]

127 Consideration of cumulative effects are required in relation to avoiding adverse cumulative effects on natural character (NATC Objective 2 of the Regional Policy Statement) and avoiding significant adverse cumulative effects on Outstanding Natural Features and Landscape (NFL Objective 2 of the Regional Policy Statement and Objective NL.2.2.1(a) of the Ruapehu District Plan).

[27] Refer 6.46 – 6.48 - Te Tangi a te Manu: Aotearoa New Zealand Landscape Assessment Guidelines'

128 The proposed Te Ara Mangawhero Trail is the second stage of a proposed extension of the Mountains to Sea Great Ride. Stage 1 of the trail is currently under construction on the lower slopes of Mount Ruapehu. The first stage of the trail in combination with the existing tracks (Round the Mountain Track, Blyth Track etc) inform the consented and existing environment of the second stage of the trail.

129 Whilst there is a greater concentration of development (buildings, Ohakune Mountain Road and existing trails etc) on the southern side of Mount Ruapehu, overall, the trail network remains sparse. There is limited visibility between existing trails, and they are generally difficult to discern beyond the immediate setting (with the exception of occasional crossing points on the Ohakune Mountain Road).

130 The proposed trail will be visually recessive and will not be visible in combination with existing trails within the area (except where they cross). Sequentially, additional trail entrances will be visible along the Ohakune Mountain Road, however these will not appear out of place, with trails being expected within national parks. The scale of the Mount Ruapehu landscape has sufficient capacity to accommodate the proposed trail without giving rise to adverse effects on the values of the Outstanding Natural Landscape.

131 The proposed trail will cross areas of wetland and sections of the Mangawhero River. The proposed design of the trail has been developed to avoid and / or mitigate effects on natural character, reducing any earthworks in wetland areas, using single span bridges over the river and minimising any vegetation clearance. The proposed trail will not detract from the natural character of the wetlands and streams on the southern slopes of Mount Ruapehu, and will not result in cumulative effects.

132 Overall, the southern slopes of Mount Ruapehu has capacity to accommodate a new trail of this type and sensitive design, with Outstanding Natural Landscape and Natural Character values being maintained. The proposal will not represent a ‘tipping point’, and cumulative effects have been avoided.

Conclusions

133 Ngā Waihua o Paerangi Trust is seeking Department of Conservation (DoC) and Regional Council permissions for a proposed walking and cycling, shared use trail on the southern face of Mount Ruapehu to act as an extension to the Mountains to Sea Great Ride.

134 The proposal is for the upper section (Pt.II) of the trail between Ohakune and Massey Hut. Pt.I of the trail is currently under construction.

135 Mount Ruapehu and the broader Tongariro National Park ONFL have significant landscape and ecological values including those connected to whakapapa, creation narratives and ongoing association for mana whenua and other iwi

136 The Project has been assessed against the natural character, landscape character and visual amenity values of the site, and will result in:

- No more than Low adverse effects on the natural character of wetlands along the alignment.
- No more than Low adverse effects on the natural character of the Mangawhero River margins.
- Low positive effects on the landscape values.
- Effects on the Tongariro National Park Outstanding Natural Landscape values are appropriate.
- No more than Low adverse effects on visual amenity.
- No more than Low adverse construction effects.
- The project will not result in cumulative effects.

137 The proposed alignment has been developed to avoid and minimise adverse effects. The National Park is well suited for the proposal trail and any natural character, landscape or visual amenity effects arising from the proposal on the receiving environment are appropriate.

Isthmus

October 2024

Appendix A.
Landscape Recommendations, Design and Management Principles.

The following landscape recommendations, design and management principles have been applied to the proposed trail alignment to ensure that effects are appropriately avoided, remedied or mitigated. This list of recommendations and principles have been used as a 'baseline' of design assumptions to inform the Landscape Assessment and are to be applied should any deviations occur from the proposed alignment. Recommendations and design principles are outlined under the relevant categories below:

Trail Alignment

- The proposed trail alignment has been developed to achieve a relatively consistent and accessible grade (Grade 3, with some sections at Grade 2) for shared walking and cycling access on the lower and mid slopes of Mount Ruapehu.
- The proposed trail follows a similar alignment to the Ohakune Mountain Road corridor, and where practical, is aligned with existing tracks (Old Blyth Track and Mangawhero Falls Track). In these locations, the proposed trail is primarily 'in place of' the existing track, avoiding having parallel tracks / alignments. An exception to this principle is where intact and exemplar areas of corduroy along the Old Blyth Track are to be showcased alongside the proposed trail alignment (refer recommendations included within the Archaeological Evaluation and Impact Assessment, Neville A Ritchie, Ph.D, July 2024).
- Where possible, the proposed trail alignment is set back from (whilst remaining broadly parallel to) the Ohakune Mountain Road corridor, ensuring that there are only limited sections of intervisibility between the road and proposed trail.
- Within the alpine section of the alignment, the trail broadly follows the Mangawhero River corridor, located within a gully which is largely screened from view (i.e, avoiding ridgelines where possible). This approach to the proposed alignment assists in visually integrating the trail from both localised and distant views.
- The trail alignment takes the 'path of least resistance', minimising the extent of physical works (eg, earthworks and vegetation removal) and avoiding wetland areas where possible
- Within wetlands, the trail alignment is along the edge of the wetland area, avoiding crossing wetlands where possible and minimising any physical works in these locations.
- Proposed bridges over the Mangawhero River and its tributaries have been located to minimise vegetation removal where possible and ensure that structures do not require any physical works within the watercourse (eg, using single span bridges). Where relevant, crossing points are located at the site of former / historic crossings (notably adjacent to the Mangawhero Falls Track car park).
- The proposed trail has been extensively 'ground-truthed' by the project team (including by cultural, ecological, landscape, heritage, civils and planning experts) to ensure that the trail alignment is appropriate from each disciplines' perspective.

Earthworks

- The trail alignment and change between trail typology (boardwalk, compacted gravel, bridging locations etc) has been designed to minimise earthworks where possible. I.e, the first approach to the alignment is to avoid steep areas, however where this is not possible, boardwalk structures are specified to 'actively manage grade', minimising the need for extensive cut and fill earthworks.
- Some areas of cut and fill earthworks will be required to 'dig in' the compacted gravel track. The proposal will re-use cut and fill on site across the balance of the trail alignment.
- Staked timber edging is to be used on the compacted gravel trail sections to avoid any slope chase in areas of steeper landform.

Vegetation

- The proposed trail has been aligned to minimise the removal of existing vegetation, and avoid larger trees (over 15cm diameter at breast height), and any rare or threatened species.
- Where vegetation is to be removed to facilitate the trail, the felled specimens / removed branches will placed alongside the trail (within the bush) to provide ecological habitat.
- Where the trail alignment is across areas of tuff / low shrubs, this layer will be removed and, where possible, transferred and re-established outside of the trail alignment.

Boardwalks

- Fiber reinforced Plastic (FRP) Boardwalks have been selected for use in the following areas of the trail alignment:
    - Where grade is to be actively managed, avoiding the need for expansive cut / fill earthworks. (i.e, raised boardwalks can sit above undulations or achieve a gradual rise, avoiding the need for cut / fill earthworks to meet grade).
    - Where the trail is through areas of wetland (or wet areas, not classified as wetland), with boardwalks having a smaller footprint and minimising effects on hydrological processes, wetland vegetation and habitat.
    - Where the trail is along rocky areas, or areas of exposed rockface which is not suitable to be left in its current state (eg due to safety reasons). Within these locations, other trail types (such as compacted gravel) could not feasibly be constructed.
    - Where the trail is along the Old Blyth Track, with sections of FRP Boardwalk used to preserve and allow for views of the historic corduroy trail.
- FRP Boardwalks are manufactured in rectangular panels and will require cutting to accommodate bends in the trail. It is assumed that the cutting of boardwalk panels will be done on site (during construction) to ensure accuracy with subtle bends and any retained tree / vegetation stems (which may be integrated into the edge of the boardwalk). Where possible, panels are to be cut within the trail's construction footprint to avoid clearing any vegetation beyond the trail alignment. Any cutting of FRP products should be undertaken within a contained environment (eg, transportable water pool) and, or, use vacuum attachments on cutting tools to prevent any microplastic leaking.

- Where required, any handrails / balustrades along the boardwalk are to be constructed in timber and be of a natural (unpainted) finish.
- FRP Boardwalks are to be coloured dark grey to ensure that they are visually recessive in the landscape. This colour has been recommended as it is visually comparable to the existing areas of exposed rock within the alpine environment and will ensure that where visible, the boardwalk will be visually discrete. Any exposed metal posts to support the boardwalk structure are to be painted to be consistent with the colour of the FRP Boardwalk.

Construction

- Where possible, construction works is to be undertaken within the footprint of the trail alignment, minimising the extent of vegetation clearance.
- Storage of construction materials (and any required machinery) is to be set back from public viewpoints (i.e, not located along Ohakune Mountain Road and not located at crossings with existing trails). Where possible, material storage / lay down areas are to be located within forested areas and within natural openings within the canopy, ensuring that it is visually discrete and minimises vegetation removal.

Infrastructure and Structures

- The proposed trail alignment includes multiple bridging structures over the Mangawhero River and its tributaries. Bridges have been designed to be 'single span', avoiding the need for support posts within the riverbed or base of the tributary.
- A wharepaku (toilet) is proposed at the entrance onto the Old Blyth Track from Ohakune Mountain Road. The wharepaku has been located within a natural opening within the forest to minimise vegetation clearance and is set-back from the road to reduce its visibility and minimise its likely usage by passing motorists.
- Wayfinding and interpretation boards are proposed along the trail (at the locations indicated on the Phase Two Construction Trail Section plans, Cheal). Wayfinding and interpretation boards have been located at relevant points along the trail (e.g., crossings, and where proximate to culturally, historically or ecologically notable features) and are to be designed to be in keeping with the existing signage typology (colour, font, size etc) within the National Park.
- Barriers are required along the trail at crossing points with Ohakune Mountain Road and existing trails. Barriers will require foundations outside of the trail footprint (i.e, they will be 'grounded' immediately adjacent to the edge of the track / boardwalk). Where possible, barriers are to be located to minimise vegetation disturbance and are to be set back from crossings to minimise their visibility.

This document should be read in combination with the Cultural Impact Information (included in the AEE), and the Ecological and Heritage Assessment which include additional recommendations relevant to their disciplines.

Appendix B.
Landscape Related Policies.

Horizons One Plan – Regional Policy Statement

The Regional Policy Statement provides consideration of Natural Character (NATC section of the Policy Statement). Objectives and Policies include (**emphasis** added):

- Objective 1: *The **characteristics and values** of:*

  *a. the Region's **outstanding natural features and landscapes**, including those identified in RPS-SCHED7, and*

  *b. the **natural character** of the coastal environment*, **wetlands***, **rivers*** and lakes* **and their margins** are protected from inappropriate subdivision*, use and development.*

- Objective 2: ***Adverse effects***, including cumulative adverse effects*, on the **natural character** of the coastal environment*, **wetlands***, **rivers*** and lakes* **and their margins**, are:*

  *a. **avoided in areas with outstanding natural character**, and*

  b. avoided where they would significantly diminish the attributes and qualities of areas that have high natural character, and

  c. avoided, remedied or mitigated in other areas.

- Objective 3: ***Promote the rehabilitation or restoration of the natural character** of the coastal environment*, **wetlands***, **rivers*** and lakes* **and their margins**.*

  Policy NATC-P1: Natural character

- (*1) The **natural character** of the coastal environment, **wetlands***, **rivers*** and lakes* **and their margins** must be **preserved** and these areas must be protected from inappropriate subdivision*, use and development.*

- *(2) **The natural character of these areas must be restored and rehabilitated where this is appropriate and practicable**.*

- *(3) Natural character of these areas may include such attributes and characteristics as:*

  a. Natural elements, processes and patterns,

  b. Biophysical, ecological, geological, geomorphological and morphological aspects,

c. Natural landforms such as headlands, peninsulas, cliffs, dunes, wetlands, reefs, freshwater* springs and surf breaks,*

d. The natural movement of water and sediment including hydrological and fluvial processes,*

e. The natural darkness of the night sky,

f. Places or areas that are wild and scenic,

g. A range of natural character from pristine to modified, and

h. Experiential attributes, including the sounds and smell of the sea; and their content or setting.

Policy NATC-P2: Managing natural character

In relation to the natural character of:

- *(1) the component of the coastal environment* which is not coastal marine area^ (CMA), and*
- *(2) **wetlands**, **rivers** and lakes* **and their margins** subdivision*, use or development must generally (but without limitation) **be considered appropriate if it**:*
- *(3) is **compatible with the existing level of modification** to the environment*,*
- *(4) has a **functional need** to be located in or near the component of the coastal environment* which is not coastal marine area^ (CMA), wetland*, river* or lake* and no reasonably practicable alterindigenous locations exist,*
- *(5) is of an **appropriate form**, **scale** and **design** to be compatible with the existing landforms, geological features and vegetation,*
- *(6) will not, by itself or in combination with effects* of other activities, significantly disrupt natural processes or existing ecosystems, and*
- *(7) will provide for the **restoration and rehabilitation of natural character** where that is appropriate and practicable.*

Policy NATC-P3: Public access to and along rivers* and lakes* and their Margins

- *(1) Activities within or near **rivers** and lakes* must be established and operated in a manner which readily **provides for public access**. Public access may be restricted only where necessary for safety, cultural or conservation purposes, or to ensure a level of security appropriate for activities authorised by a resource consent^.*

- *(2) Public access for recreational purposes must recognise the need to protect rare habitats*, threatened habitats* and at-risk habitats*.*

The Regional Policy Statement provides consideration of Natural Character in combination with Natural Features and Landscapes (NFL section of the Policy Statement: Natural Features and Landscapes, and Natural Character). Objectives and Policies include (**emphasis** added):

- Objective 1: *The **characteristics and values** of:*

  *a. the Region's **outstanding natural features and landscapes**, including those identified in RPS-SCHED7, and*

  *b. the **natural character** of the coastal environment*, **wetlands***, rivers* and **lakes***and **their margins** are **protected** from inappropriate subdivision*, use and development.*

- Objective 2: ***Adverse effects***, including cumulative adverse effects*, on the **natural character** of the coastal environment*, **wetlands***, **rivers*** and lakes* and **their margins**, are:*

  *a. **avoided in areas with outstanding natural character**, and*

  b. avoided where they would significantly diminish the attributes and qualities of areas that have high natural character, and

  c. avoided, remedied or mitigated in other areas.

- Objective 3: ***Promote the rehabilitation or restoration of the natural character** of the coastal environment*, **wetlands***, **rivers*** and lakes* **and their margins**.*

  Policy NFL-P1: Regionally outstanding natural features and landscapes
  *The natural features and landscapes listed in RPS-SCHED7 Table 48 must be recognised as **regionally outstanding** and must be spatially defined in the review and development of district plans. All subdivision*, use and development directly affecting these areas must be managed in a manner which:*

- *(1) **avoids significant adverse cumulative effects*** on the **characteristics and values** of those outstanding natural features and landscapes, and*

- *(2) except as required under (1), **avoids adverse effects* as far as reasonably practicable** and, where avoidance is not reasonably practicable, **remedies or mitigates adverse effects*** on the characteristics and values of those outstanding natural features and landscapes.*

  NFL-P2: Assessing outstanding natural features and landscapes

The Regional Council and Territorial Authorities must take into account but not be limited to the criteria in Table 8 when:*

- *(1) identifying outstanding natural features and landscapes, and consider whether the natural feature or landscape is conspicuous, eminent, remarkable or otherwise outstanding, and*
- *(2) considering adding to, deleting from, or otherwise altering, redefining or modifying the list of outstanding natural features or landscapes listed in Table 48 of RPS-SCHED7, or*
- *(3) considering the inclusion of outstanding natural features or landscapes into any district plan^, or*
- *(4) establishing the relevant values to be considered when assessing effects* of an activity on:*

  a. outstanding natural features and landscapes listed in Table 48 of RPS-SCHED7, or

  b. any other outstanding natural feature or landscape.

Ruapehu District Plan

The below consideration of the Ruapehu District Plan is in relation to the relevant objectives and policies of the Tongariro National Park Outstanding Natural Landscape, which have been used to inform the assessment on the ONFL values. Objectives and Policies include (**emphasis** added):

- Objective NL.2.2.1 (a): *The **protection** of the **values** of identified areas of **outstanding natural features and landscapes** from inappropriate subdivision, use and development.*
- Policy NL2.2.2 (a): *To **protect outstanding natural features and landscapes** from inappropriate subdivision, use and development. In determining inappropriate subdivision, use and development the following will be taken into account - the degree to which the activity:*

  *(i) **Would adversely affect the values specified in Policy NL 2.2.2(c).***

  (ii) Is necessary to provide for the social or economic wellbeing of communities, or to provide essential utilities, infrastructure or services to the public; and

  (iii) Has functional, technical and operational constraints which require it to be located and designed in the manner proposed; and

  *(iv) **Avoids** any **significant adverse cumulative effects** on the characteristics and values of those outstanding natural features and landscapes.While ensuring that, in all cases, any modification of the features or landscapes is consistent with the purpose of the Act.*
- Policy NL2.2.2 (c*): To **protect**, from inappropriate subdivision, use and development, the **specified values** associated with the following outstanding natural features or landscapes:*

(viii) ***Tongariro National Park*** *(particularly the volcanoes) and specifically its:*

(1) ***Visual and scenic characteristics****, particularly its* ***visual prominence****.*

(2) ***Recreational values****.*

(3) ***Scientific value****, particularly the volcanic landscape.*

(4) ***Ecological value****, particularly the mountainous ecology and the extensive tussock grasslands and wetlands supporting rare indigenous flora.*

(5) ***Cultural values*** *and importance to tangata whenua.*

Tongariro National Park Management Plan

The Management plan includes a section on Landscape (at 4.1.3 of the plan). Objectives and Policies include (**emphasis** added):

- *Objective a) To* ***retain the natural landscape*** *of Tongariro National Park in perpetuity.*
- *Objective b) To* ***restore landscape values*** *where adverse effects of development or exotic plants have not caused irreversible consequences.*
- *Objective c) To ensure that infrastructure is designed and located to* ***avoid impacts on landscape values****.*
- *Policy 1) Facilities should be designed and sited to* ***avoid impacts on landscape values****.*
- *Policy 2) Design of infrastructure should ensure that it will* ***blend into the environment****, reducing the impact of facilities on the landscape.*
- *Policy 3) Where infrastructure is redundant it will be removed.*
- *Policy 4) Any earthworks carried out should not exacerbate natural erosive processes or have adverse impacts on watercourses.*
- *Policy 5) Any disturbance of vegetated landscapes in an approved works programme will be accompanied, as a condition of approval, by a restoration and planting plan.*
- *Policy 6) Landscape assessments and design will be undertaken by appropriately qualified specialists.*

Appendix C.
Graphic Attachments.

(refer separate document)

Te Ara Mangawhero Trail (Pt II.)
Landscape Assessment.
Appendix C - Graphic Attachments.

October 2024
—

Isthmus.



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People.
Culture.

Isthmus.

Document record

Issue	Revision	Author	QA	Date
Draft	A	SF/SB	SB	01.10.2024
Final Draft	B	SF/SB	SB	31.10.2024

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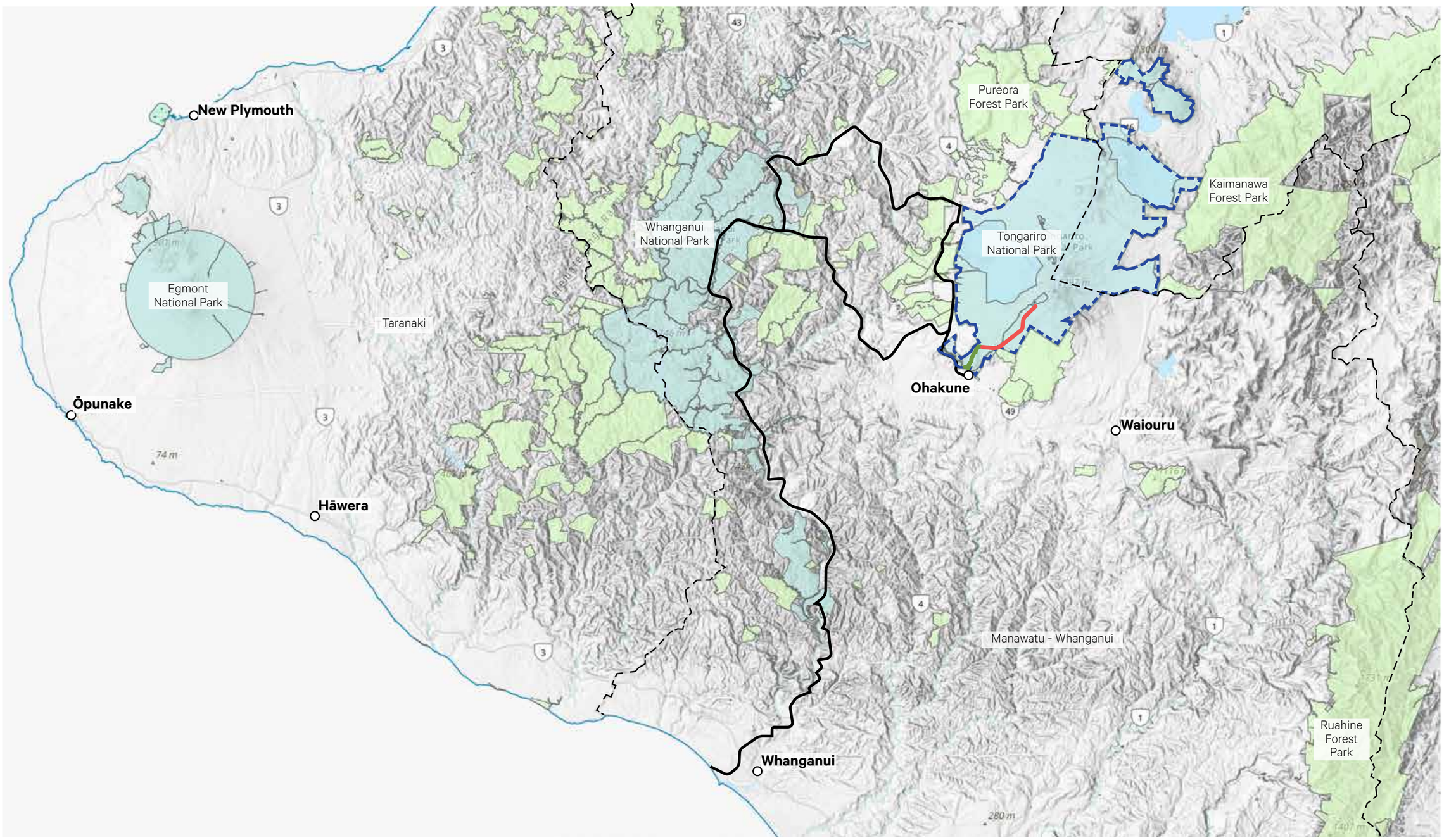


Figure 01 - Regional Context

N

0m 750km 150km 375km

1:750,000 @ A3

- Te Ara Mangawhero Trail (Part II.) proposed alignment
- Te Ara Mangawhero Trail (Part I.) alignment (under construction)
- UNESCO WHS / Tongariro National Park Boundary
- Conservation Areas
- National Parks
- Mountain to Sea Great Ride (indicative alignment)
- Regional Boundaries

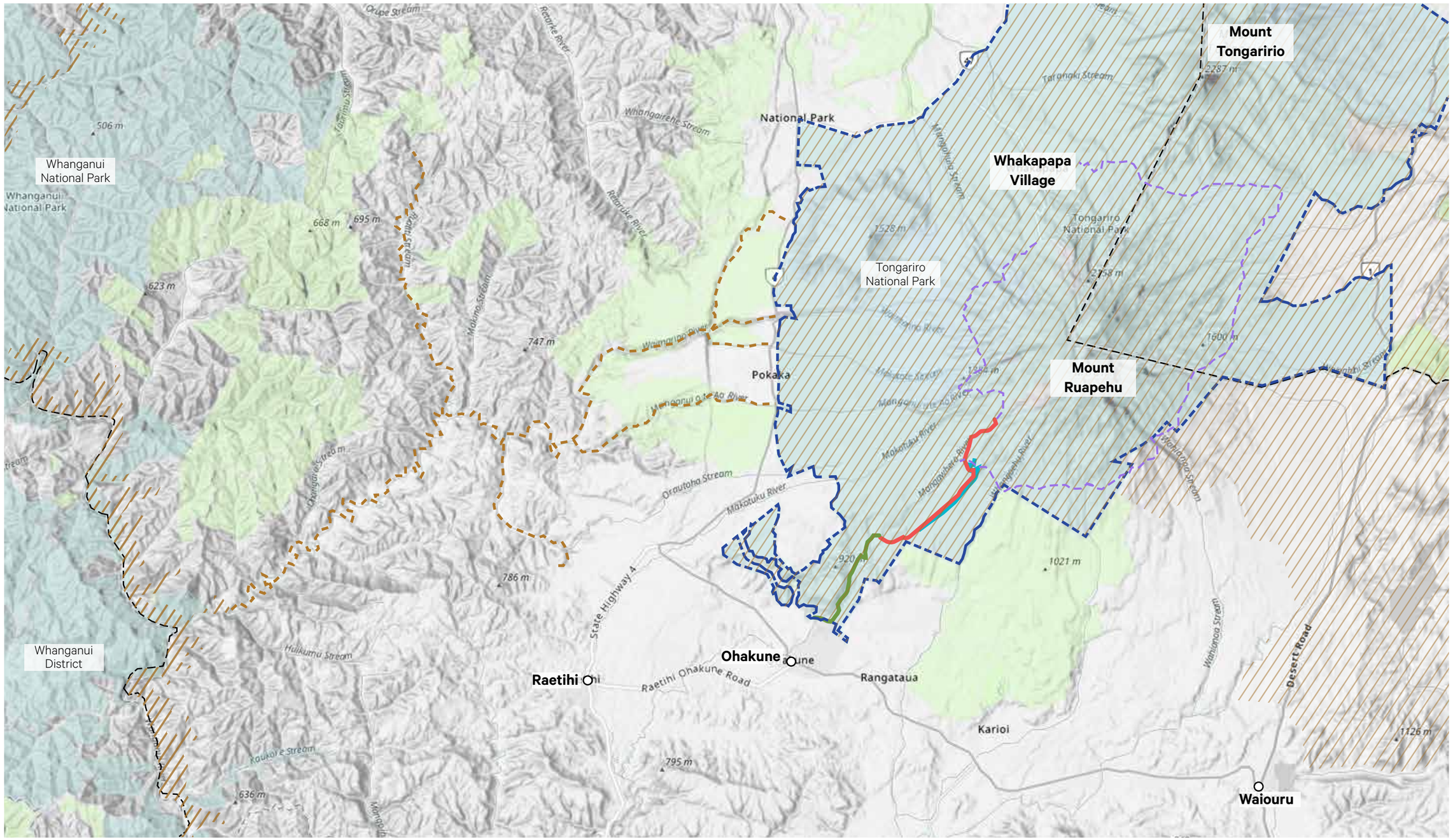


Figure 02 - National Park Context

N

0m 2.5km 5km 12.5km

1:250,000 @ A3

- Te Ara Mangawhero Trail (Part II.) proposed alignment
- Te Ara Mangawhero Trail (Part I.) alignment (under construction)
- Around the Mountain Track
- Old Blyth Track (mostly along alignment of proposed trail)
- Regional Boundary
- UNESCO WHS / Tongariro National Park Boundary
- ONFL Boundary (Ruapehu District)
- Conservation Areas
- National Parks

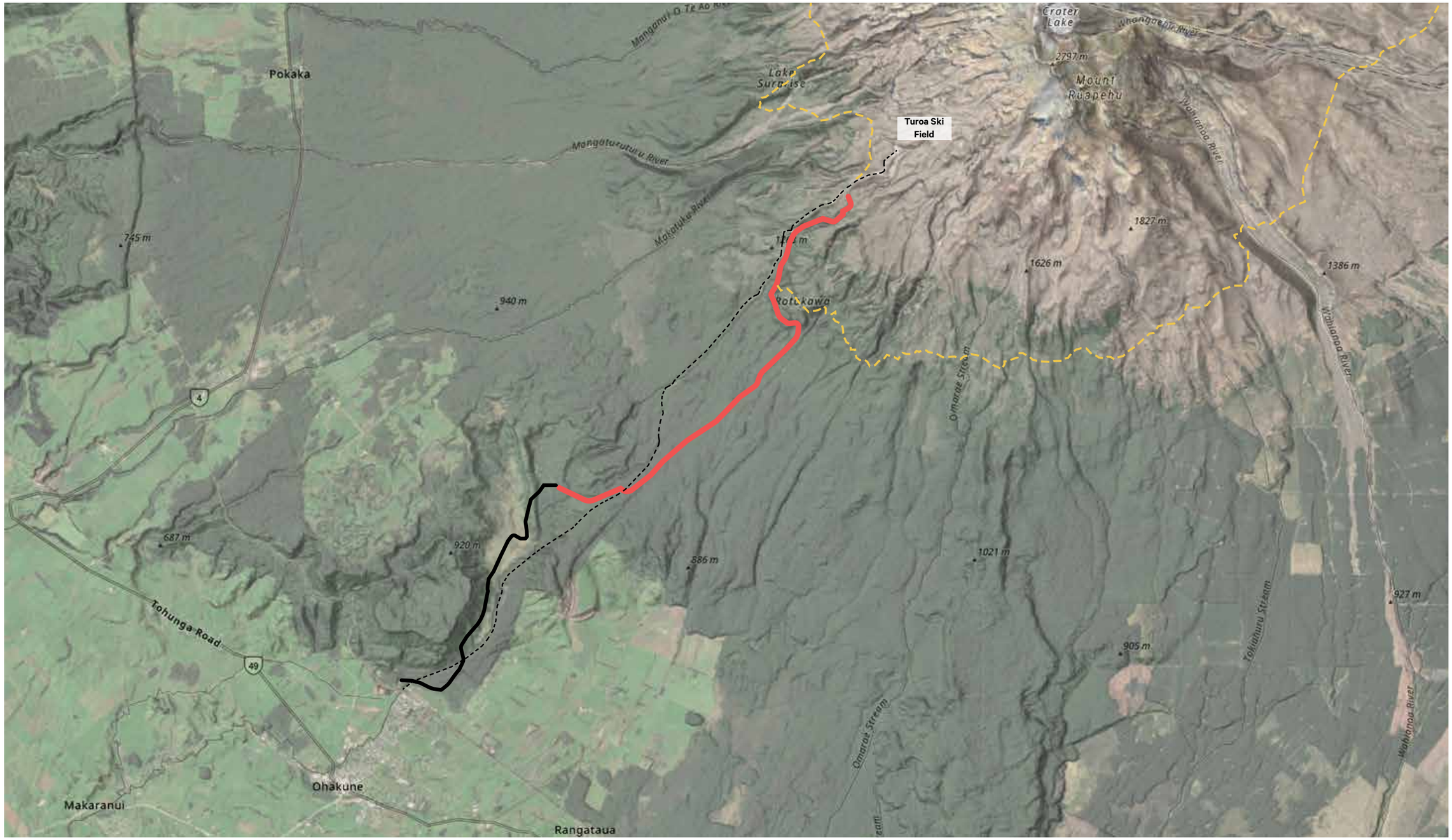


Figure 03- Site Context

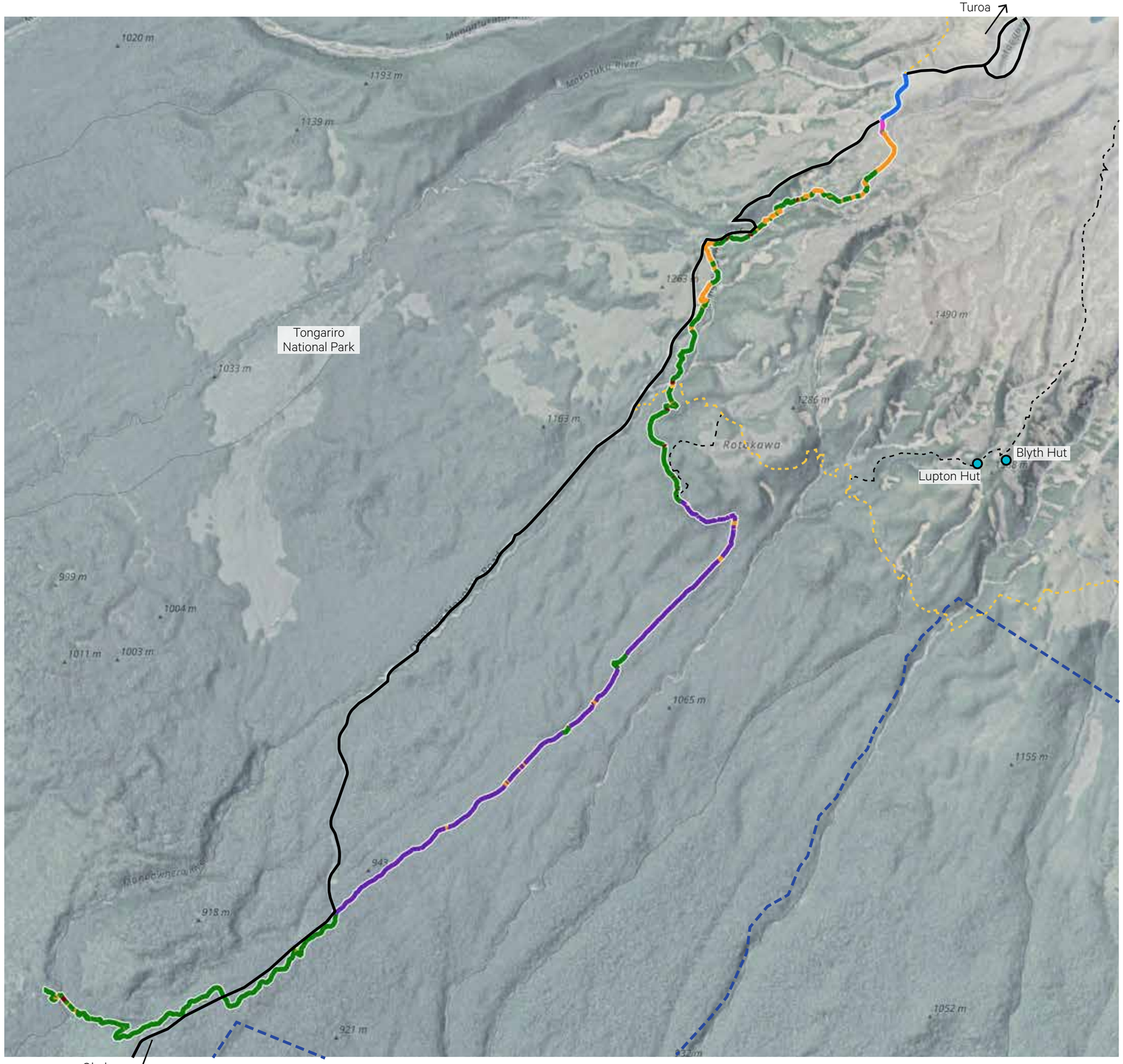
N

0m 1km 2km 5km

1:100,000 @ A3

- Te Ara Mangawhero Trail (Part II.) proposed alignment
- Te Ara Mangawhero Trail (Part I.) alignment (under construction)
- Around the Mountain Track
- Ohakune Mountain Road

Figure 04- Trail Typology



Legend

- Existing Blyth Track (to be upgraded)
- Proposed Trail Bridge
- Proposed Trail FRP Boardwalk
- Proposed Trail Compacted Gravel
- Connection to Round the Mountain Track (road)
- Existing 4WD Track
- UNESCO WHS / National Park / ONFL Boundary
- Ohakune Mountain Road
- Around the Mountain Track
- Other Hiking Tracks
- Hut

0m 250m 500m 1,500m

N

1:35,000 @ A3

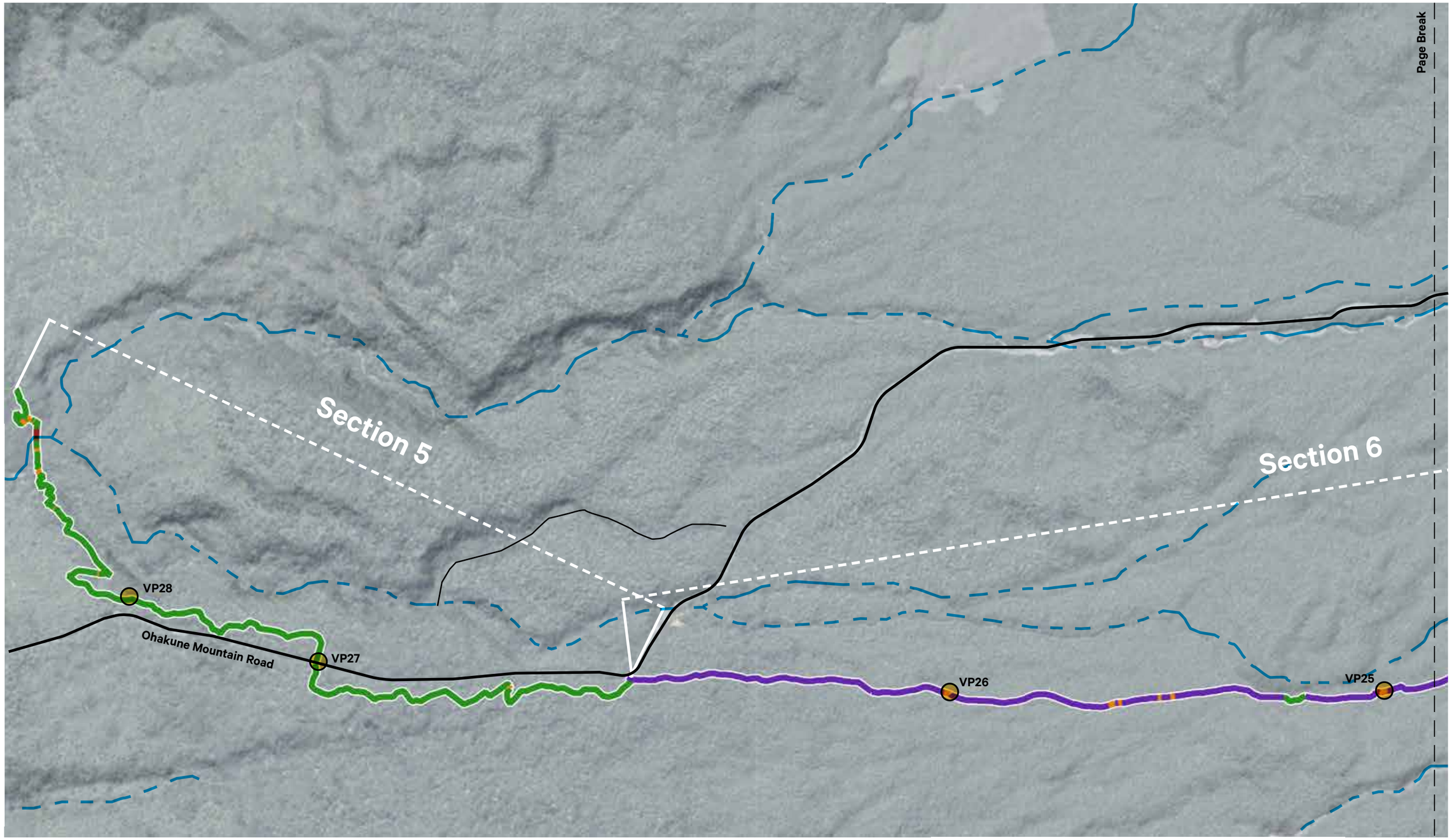


Figure 05- Trail Alignment & Viewpoint Locations

0m 125m 250m 750m

1:15,000 @ A3

Page Break

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Section 8

Section 7

Ohakune Mountain Road

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VP13
VP14
PANO 2
VP16
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VP9
VP11 & 12
VP6, 7 & 8
VP4
VP5
VP3
VP2
PANO 1
VP20
VP18
VP19
VP21
VP22
VP23
VP24

VP1
Ohakune
N

Legend

- Existing Blyth Track (to be upgraded)
- Proposed Trail Bridge
- Proposed Trail FRP Boardwalk
- Proposed Trail Compacted Gravel
- Connection to Round the Mountain Track (road)
- Existing 4WD Track
- Ohakune Mountain Road
- Around the Mountain Track
- Watercourse / River corridors (indicative)
- Panorama Locations
- Viewpoint Locations

Panorama 01

View from Ohakune Mountain Road (north of Massey Hut) looking south



Original Photo SB | 50mm | DSLR Nikon D800 | 23 May 2024
Reading distance for correct scale: 400mm
Field of View Approximately 110˚ horizontal (across 2 x A3 pages) & 34˚ vertical

Panorama 02

View from Ohakune Mountain Road (mid way along the track alignment) looking north. Quarry face visible.



Original Photo SB | 50mm | DSLR Nikon D800 | 23 May 2024
Reading distance for correct scale: 400mm
Field of View Approximately 110˚ horizontal (across 2 x A3 pages) & 34˚ vertical

Panorama 03

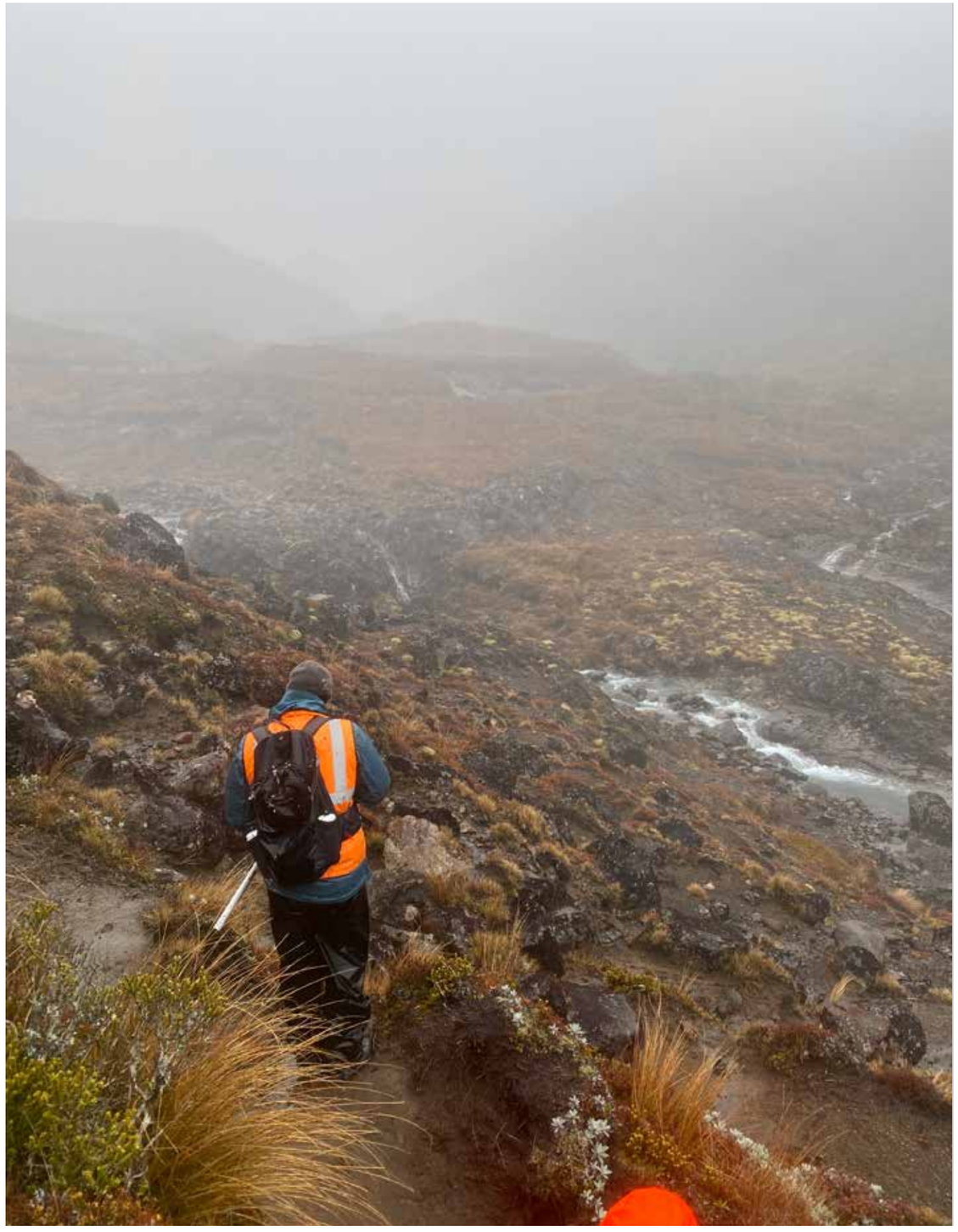
View from Ohakune Mountain Road towards the Mangawhero Falls parking area



Original Photo SB | 50mm | DSLR Nikon D800 | 23 May 2024
Reading distance for correct scale: 400mm
Field of View Approximately 110˚ horizontal (across 2 x A3 pages) & 34˚ vertical

Viewpoint 01

View from Goldfinch Road, Ohakune



Viewpoint 2
View east of Blythe Hut within the Alipine Zone illustrating tussock and rock outcrops



Viewpoint 3
View looking north within Alpine Zone illustrating tussock and existing trail markers (now disused)



Viewpoint 4
View looking north within Alpine Zone illustrating tussock / shrub and existing trail markers (now disused)



Viewpoint 5
View looking north within Alpine Zone illustrating tussock and alpine shrub.



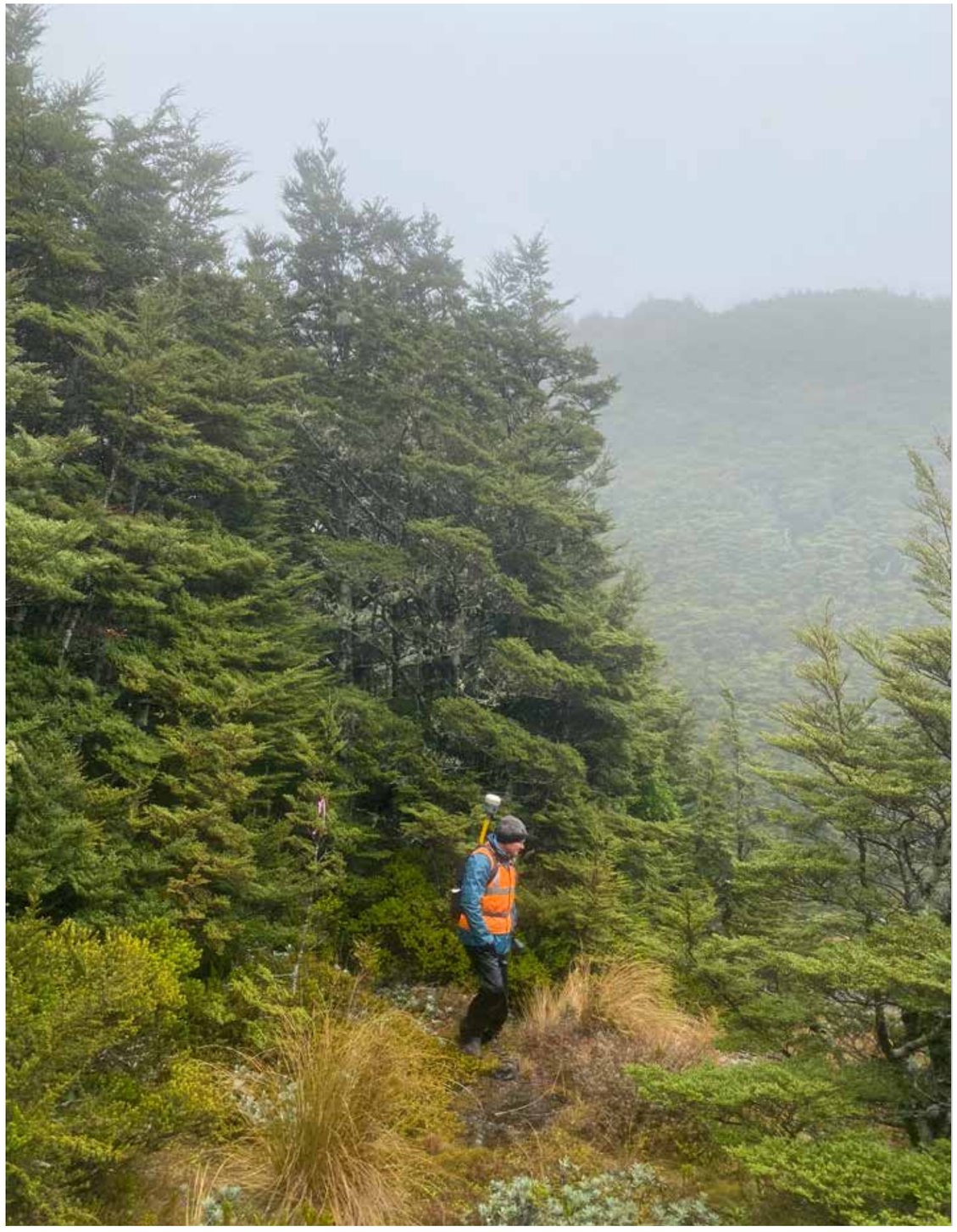
Viewpoint 6
View illustrating crossing location on tributary into the Mangawhero River



Viewpoint 7
View illustrating rocky outcrop in Alpine Zone



Viewpoint 8
View in Alpine Zone illustrating rocky outcrops - likely historic lahar field.



Viewpoint 9
View illustrating transitional timber line, with pockets of beech forest.



Viewpoint 10
View illustrating alignment of trail through pocket of beach forest within Alpine Zone.



Viewpoint 11
View illustrating trail alignment traversing Mangawhero River



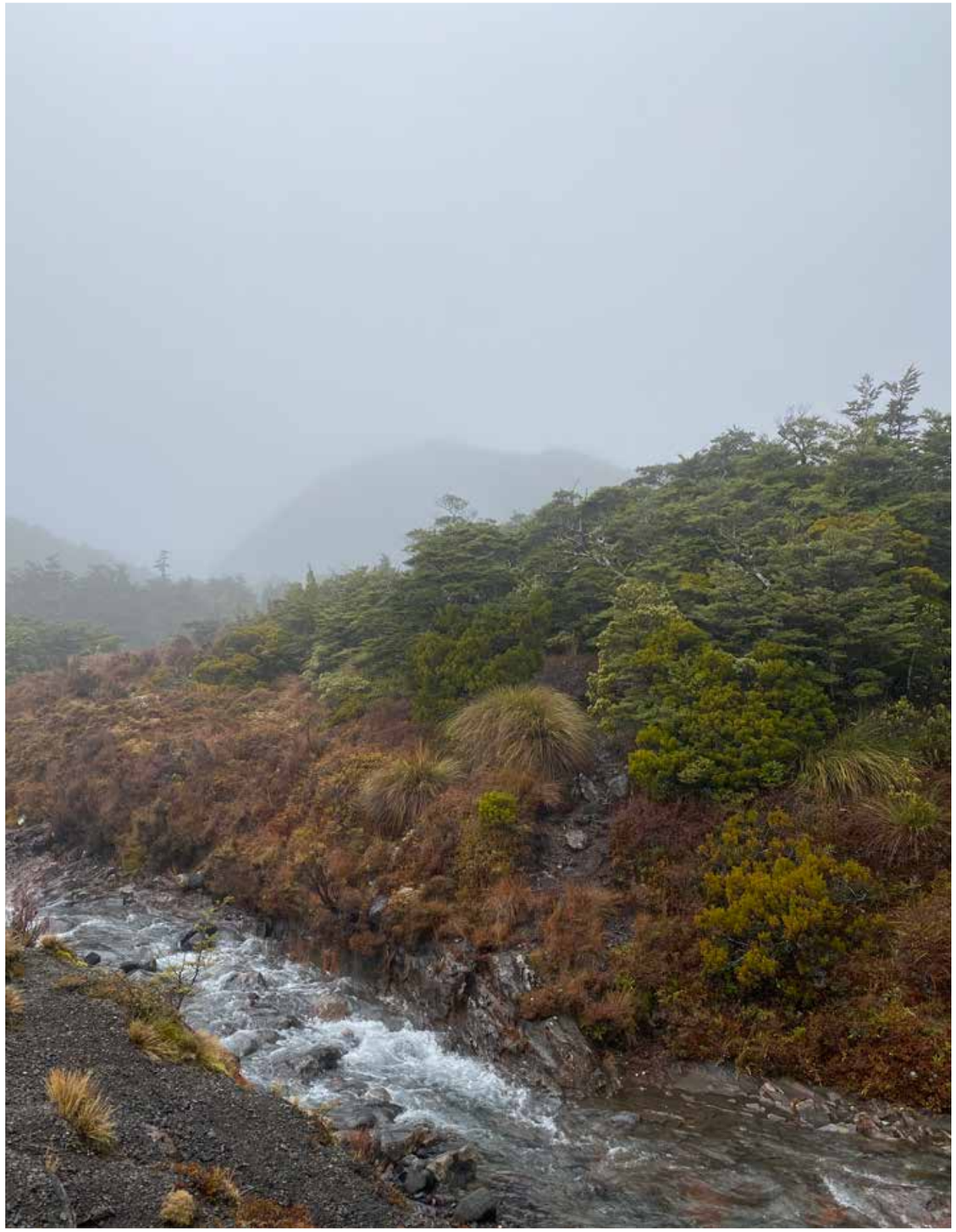
Viewpoint 12
View illustrating trail alignment traversing Mangawhero River



Viewpoint 13
View from Ohakune Mountain Road illustrating quarry face. Trail alignment is between the road and quarry.



Viewpoint 14
View illustrating crossing on Mangawhero River



Viewpoint 15
View illustrating crossing on Mangawhero River adjacent to car park for Mangawhero Falls.



Viewpoint 16
View illustrating transitional timber line with shrub and beech forest.



Viewpoint 17
View illustrating re-entering beech forest with trail alignment.



Viewpoint 18
View illustrating crossing between trail alignment and Round the Mountain Track.



Viewpoint 19
View illustrating Mangawhero River crossing, north of the Round the Mountain Track.



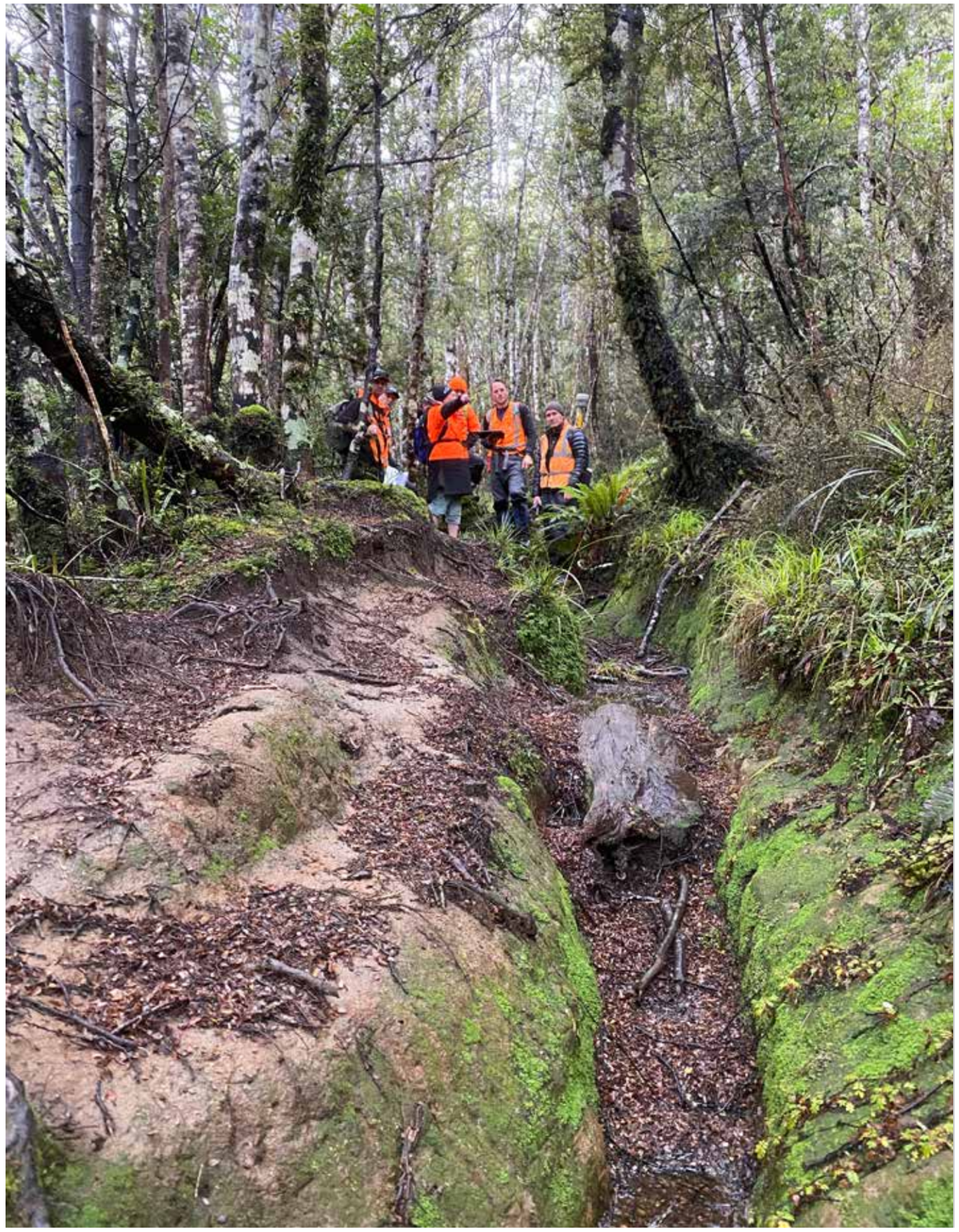
Viewpoint 20
View from Ohakune Mountain Road illustrating crossing above waterfall (shown in VP19)



Viewpoint 21
View illustraing crossing between trail alignment and Old Blythe Track.



Viewpoint 22
View illustrating intact section of corduroy trail on Blythe Track.



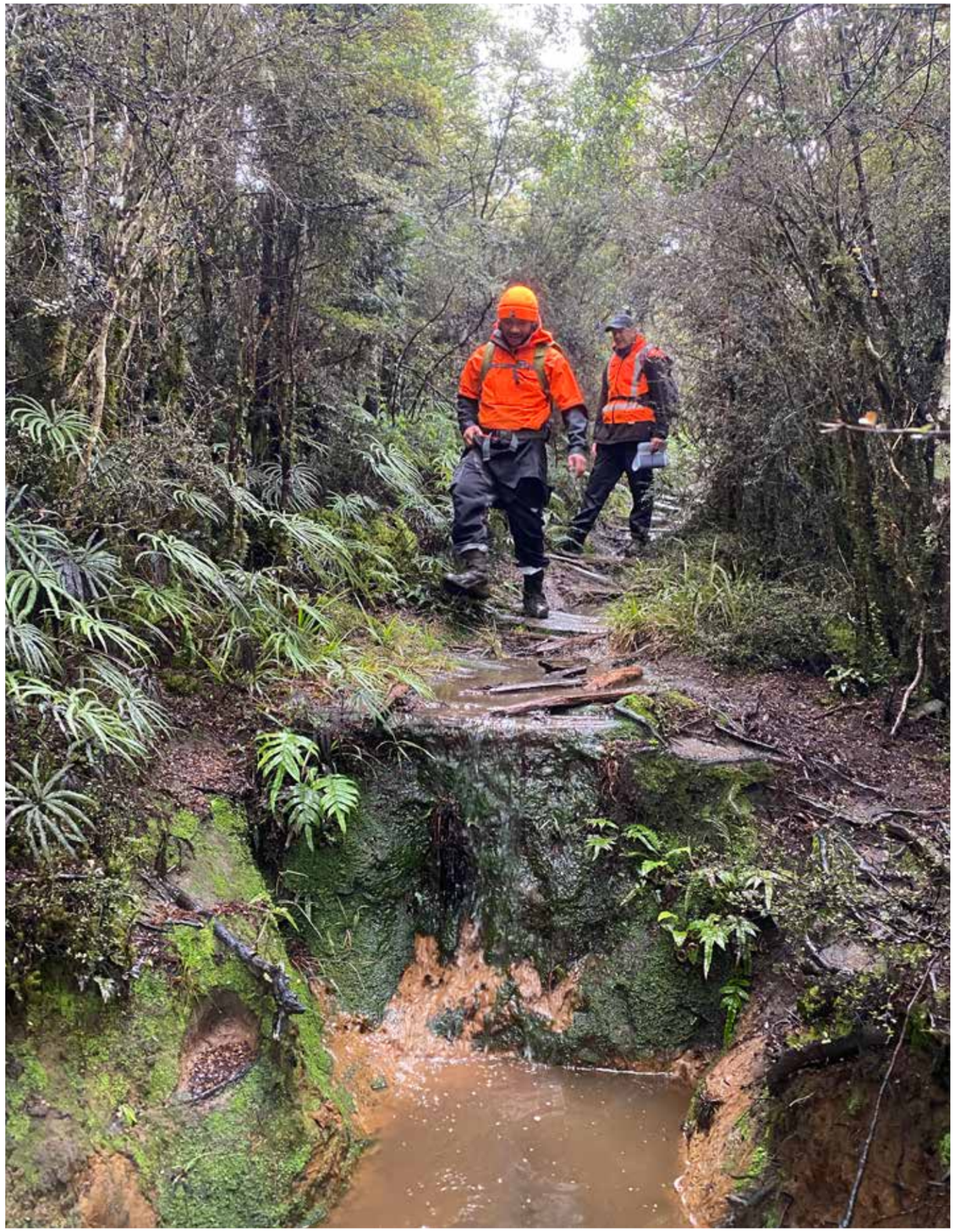
Viewpoint 23
View illustrating washed out sections along Blythe Track



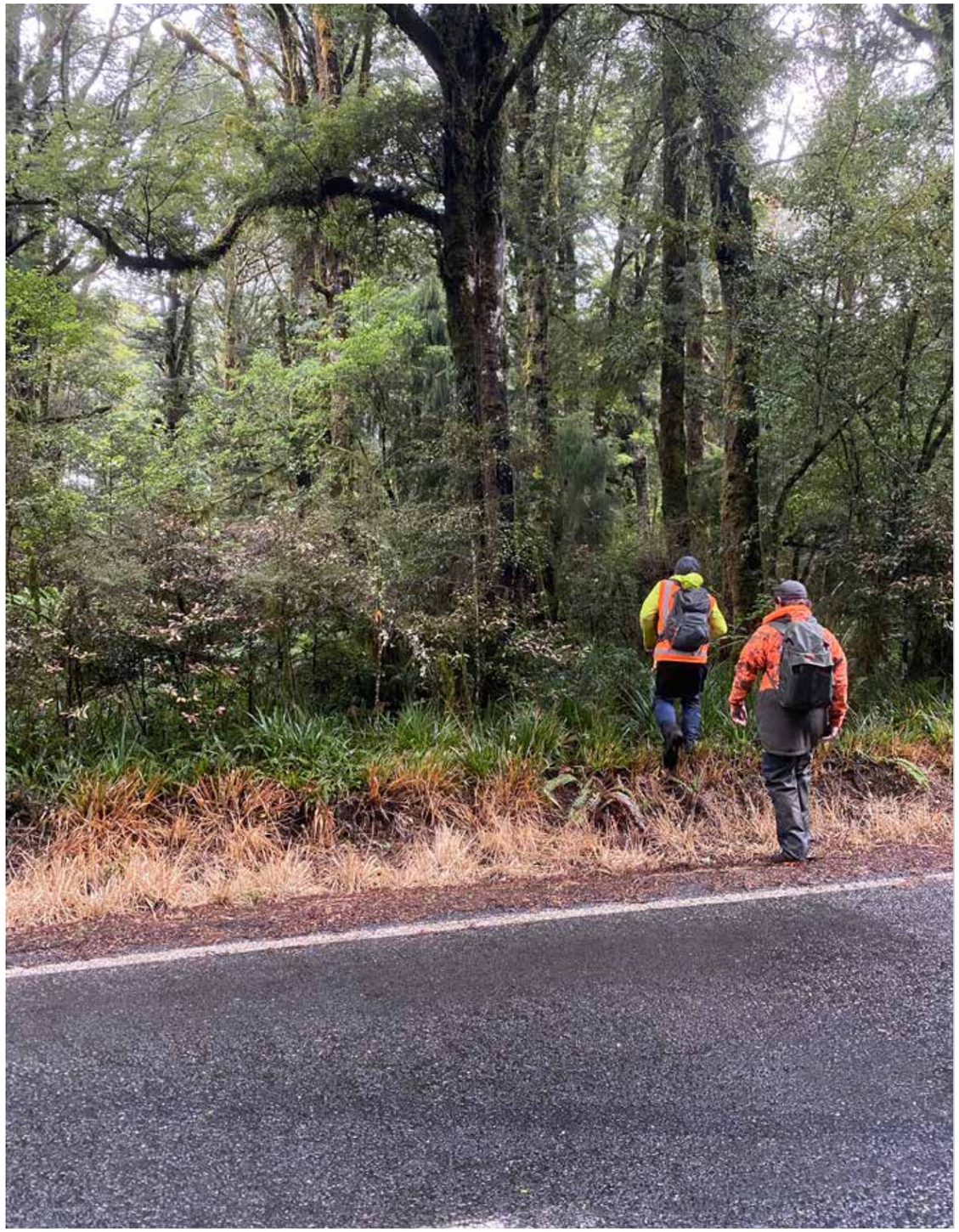
Viewpoint 24
View illustrating waterlogged sections of corduroy on Blythe Track.



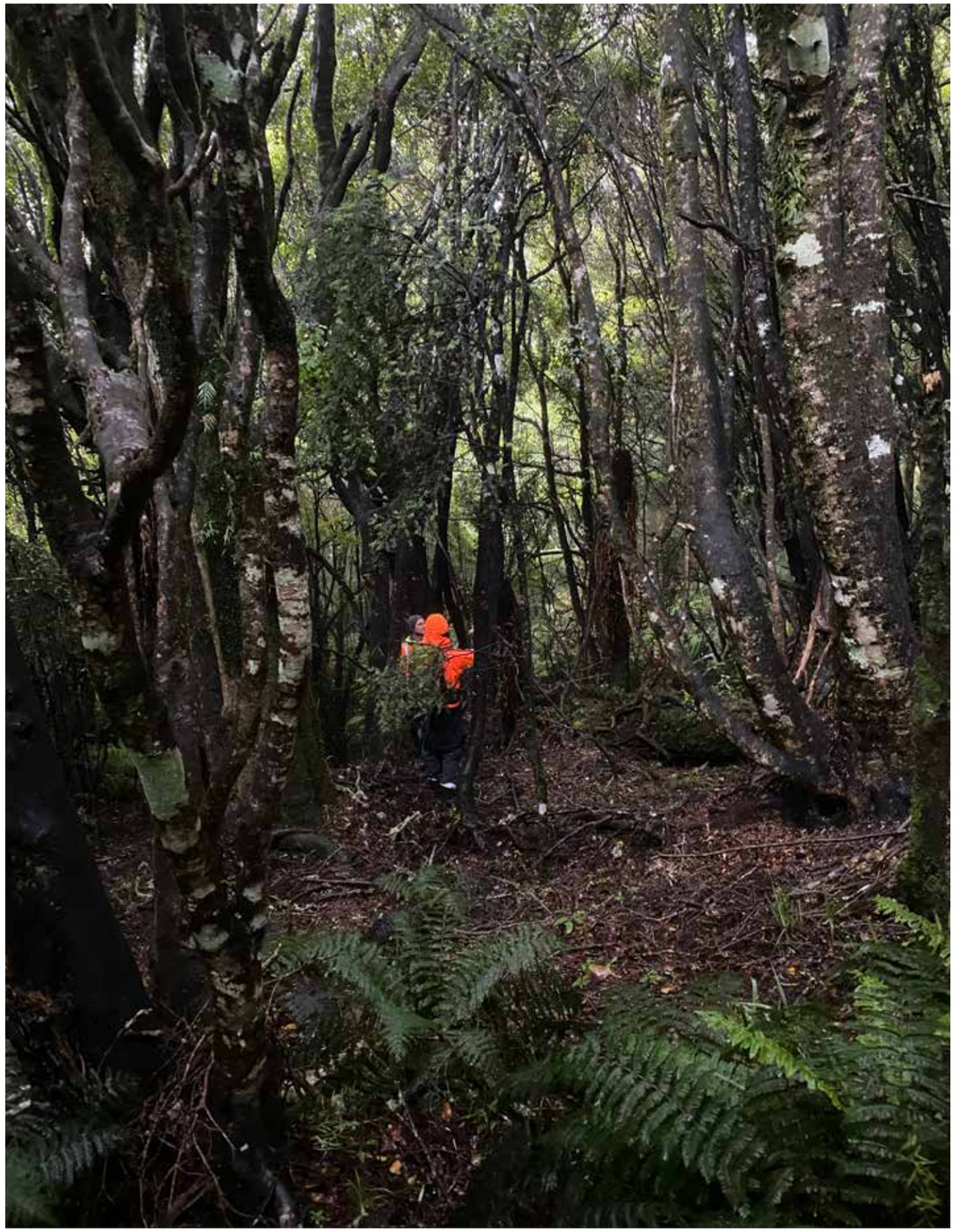
Viewpoint 25
View illustrating waterlogged sections of corduroy on Blythe Track.



Viewpoint 26
View illustrating washed out sections along Blythe Track



Viewpoint 27
View illustrating crossing location with Ohakune Mountain Road



Viewpoint 28
View illustrating trail alignment within podocarp forest, west of crossing with Ohakune Mountain Road

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Tāmaki Makaurau
Auckland
Level 6
246 Queen St
Central City
PO Box 90 366
Victoria Street West

+64 9 309 9442

Te Whanganui-a-Tara
Wellington

Level 1
191 Cuba Street
PO Box 24116
Wellington

+64 4 499 9832

Ōtautahi
Christchurch
10A Mollett Street
Mataī Common
Central City
PO Box 1153
Chistchurch 8011

+64 27 55 33 495

Appendix 10. Heritage Assessments

Archaeological Evaluation and Impact Assessment Te Ara Mangawhero (TAM) Trail

particularly in connection with planned modifications to the Old Blyth track

Commissioned by Nga Waihua O Paerangi Trust and Rowan Sapsford (Roam Consulting)

Neville A Ritchie, Ph.D.

July 2024



A view of Ruapehu from the Round the Mountain Trail about 400m south of its intersection with the top end of the present Blyth Track. Photo N Ritchie June 11, 2024

Executive Summary

Roam Consulting on behalf of Nga Waihaua O Paerangi Trust (Ngati Rangi) is currently preparing applications for the following permissions for a proposed shared use trail (to be known as Te Ara Mangawhero), on the southern slopes of Mt Ruapehu:

- Concession application to the Department of Conservation (DOC) for the development and management of a shared use trail
- Works approval from DOC or physical works to construct a shared use trail
- Resource consent application to the Manawatu Whanganui Regional Council for the development of bridges and land disturbance associated with trail development.

The applicant is Ngāti Rangi. The proposed trail will be an extension to the Mountains to Sea great ride. More specifically, the proposed TAM trail will extend from a point c500m below the Turoa skifield carpark to the outskirts of Ohakune. The Ohakune Mountain Road which provides access to the skifield will also provide access and egress points to Te Ara Mangawhero.

The Te Ara Mangawhero proposal involves a major upgrade of the historic Blyth track which is addressed in this report.

The historical research and field inspection discussed in this report found no historic features protected under the Heritage New Zealand Pouhere Taonga Act (2014) but the remaining portion of the original Blyth track is a significant historic feature in its own right. Sections of it should be retained

Acknowledgements

Thanks to Merrilyn George, author of “Ohakune: Opening to a New World” (1990); Karen Grimwade, author of “The Ohakune Mountain Road: Yard By Yard” (2010); and Alan Whale, who was involved in the construction of the Ohakune Mountain Rd and walked the Blyth track many times in its heyday for useful insights about the Blyth track, and Paul Mahoney for helpful comments on the draft.

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Fig. 5 Another view of Blyth's hut in the mid 1940s 19

Fig 6 Conscientious Objector Merv Bergeson's hut in 1949 20

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Commission

This report was commissioned by Rowan Sapsford (Roam Consulting, Taupo) on behalf of Ngā Waihua o Paerangi (Ngāti Rangi), the applicant.

The purpose of the report and the associated fieldwork was to evaluate the impact on and condition of surviving historic features, particularly the Old Blyth track which will be incorporated into Te Ara Mangawhero and considerably modified in the process.

There are no recorded Māori sites in the vicinity of the proposed Te Ara Mangawhero shared use track.

Introduction

The Te Ara Mangawhero shared use track will commence near the present Massey University Alpine Club (MUAC) hut located beside the Ohakune Mountain Rd at a point about 500m down the road from Turoa skifield parking area (Massey Flat). The first 5km involves new trail construction from the MUAC hut, then down and across montane tussock-land, thence along the Mangawhero Stream, past the 22m Mangawhero Falls until it intersects with the Round Mountain Trail (RTM). This new track development will greatly enhance the RTM because RTM users will no longer have to walk up or down about 5km of the Ohakune Mountain Rd to get back onto the RTM.

From the RTM, the existing Blyth Track is 6.2km long (from its lower end on the Ohakune Mountain Road) to where it joins the RTM). Of this 5.3km is to be upgraded for the proposed trail and the top 900m, largely through a perched wetland, will be left untouched and for walking only.

The bottom third of the TAM will follow the Bennett and Punch tramway, which was constructed on part of the lower section of the Ohakune (Blyth track). The original track commenced at Ohakune east of the Ohakune station, not where the OMR leaves Ohakune.

This assessment was undertaken by Dr Neville Ritchie, an experienced heritage archaeologist, accompanied by Paul Mahoney, a DOC heritage specialist), and Rowan Sapsford (Roam Consulting) in the field. Before the fieldwork was undertaken, meetings were arranged with three local identities to further knowledge and understanding of the heritage of the Blyth track, the Bennett and Punch logging tramway and the Ohakune Mountain Road the history of which are intertwined in many ways. The interviewees were Merrilyn George, author of “Ohakune: Opening to a New World” (1990); Karen Grimwade,

author of “The Ohakune Mountain Road: Yard By Yard” (2010); and Alan Whale, who was involved in the construction of the Ohakune Mountain Rd and walked the Blyth track many times in its heyday.

A former member of the Tongariro Natural History Society, Dave Wilton, put me on to a useful unpublished report viz, “Memories of Ohakune Track in the 1940s” by Ashley Cunningham. I managed to track down a copy through Interloan. According to the author, only four copies of the report were produced. The report might more appropriately have been titled ‘Memories of Climbing Mt Ruapehu via the Ohakune Track’ because the focus is definitely on climbing the maunga and using the former Blyth hut as the base camp. Nonetheless, it is a valuable firsthand account of the important role of the Ohakune (Blyth) track in its heyday. His memories and valuable insights about the Blyth track in the 1940s (i.e. after the Joe Blyth era) are reproduced later in this report.

Statutory Requirements

There are two main pieces of legislation in New Zealand that control work affecting archaeological sites. These are the *Heritage New Zealand Pouhere Taonga* Act 2014 (HNZPTA) and the *Resource* Management Act 1991 (RMA)

Heritage New Zealand administers the HNZPTA. It contains a consent (authority) process for any work affecting archaeological sites, where an archaeological site is defined as:

Any place in New Zealand, including any building or structure (or part of a building or structure), that -

1. Was associated with human activity that occurred before 1900 or is the site of the wreck of any vessel where the wreck occurred before 1900; and
2. Provides or may provide, through investigation by archaeological methods, evidence relating to the history of New Zealand; and
3. Includes a site for which a declaration is made under section 43 (1)

Any person who intends carrying out work that may modify or destroy an archaeological site, must first obtain an authority from Heritage New Zealand. The process applies to sites on land of all tenure including public, private and designated land. The HNZPTA contains penalties for unauthorised site damage or destruction.

The archaeological authority process applies to all archaeological sites, regardless of whether:

- The site is recorded in the NZ Archaeological Association Site Recording Scheme or included in the Heritage New Zealand List.
- Or, the site only becomes known about as a result of ground disturbance, and/ or
- The activity is permitted under a district or regional plan, or a resource or building consent has been granted

Heritage New Zealand also maintains the New Zealand Heritage List/ Rarangi Korero of Historic Places, Historic Areas, Wahi Tupuna, Wahi Tapu and Wahi Tapu Areas. The List can include archaeological sites. Its purpose is to inform members of the public about such places.

The RMA requires City, District and Regional Councils to manage the use, development, and protection of natural and physical resources in a way that provides for the wellbeing of today's communities while safeguarding the options of future generations. The protection of historic heritage from inappropriate subdivision, use, and development is identified as a matter of national importance (section 6f).

Historic heritage is defined as those natural and physical resources that contribute to an understanding and appreciation of New Zealand's history and cultures, derived from archaeological, architectural, cultural, historic, scientific, or technological qualities.

Historic heritage includes:

- historic sites, structures, places, and areas
- archaeological sites;
- sites of significance to Maori, including wahi tapu;
- surroundings associated with the natural and physical resources (RMA section 2). These categories are not mutually exclusive; some archaeological sites may include above ground structures or may also be places that are of significance to Maori.

Methodology

The assessment involved both desktop research as well as a field inspection.

The field inspection was undertaken on June 11th 2024, by archaeologist Neville Ritchie accompanied by DOC Heritage specialist Paul Mahoney and Rowan Sapsford (ROAM Consulting).

The principal sources utilised for the desktop research included local histories and other published and archival resources, aerial photography (Retrolens) , local authority heritage lists, and NZAA Site Recording Scheme (ArchSite).

This report is focused on the evaluation and utilisation of historic infrastructure that it is proposed to incorporate into the Te Ara Mangawhero (TAM) shared track proposal. The TAM proposal going from top to bottom involves three discrete areas. The first part of the track from the vicinity of the Massey University Alpine Club hut (about 500m below the Turoa skifield), consists of new track through open montane tussock country down to where it will intersect with the Round the Mountain track below the bushline. The next section will incorporate about 80% of the existing (Old) Blyth track much of which is corduroyed. The lowest section, from Rimu Hill, will utilise part of the abandoned Bennett and Punch logging tramway down to the outskirts of Ohakune. It has been the subject of a separate assessment (Mahoney 2021).

This report principally focuses on the intermediate section, the surviving portion (the central one third) of the (Old) Blyth track.

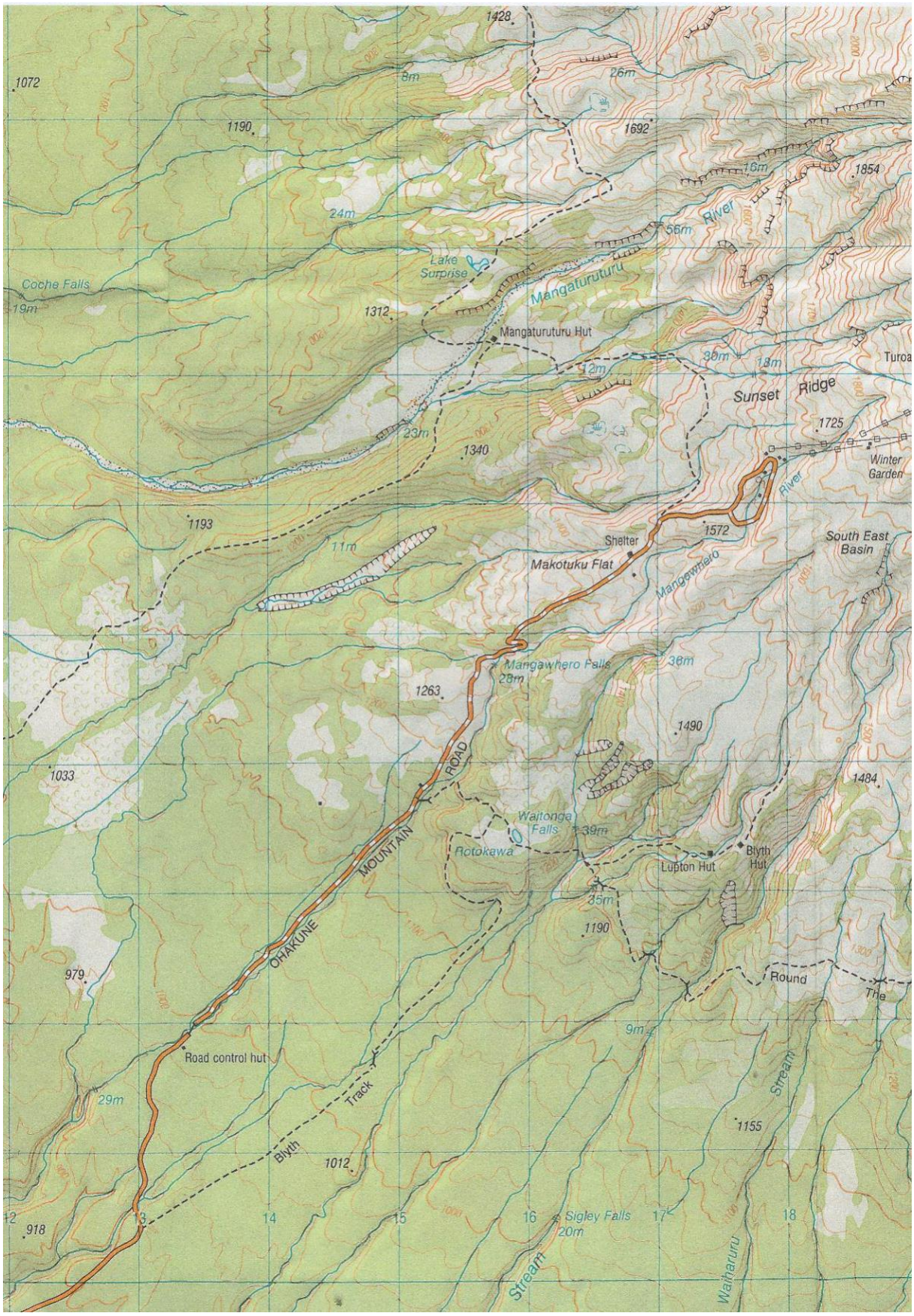


Fig. 1 The route of the present Blyth track can be seen extending from grid line 130 to where it connects with the Round The Mountain track near Rotokawa.
Ohakune NZMS Sheet S20 1:50,000

Physical Environment or Setting

The original Ohakune (Blyth) track and the Ohakune Mountain Rd extend from Ohakune, up or adjacent to the Mangawhero stream valley out onto the open montane tussock on the lower southwestern slopes of Mt Ruapehu, a distance of about 17km from Ohakune. The skifield carpark is at 1600m asl, whereas the now demolished Ohakune Mountain cottage hut (the old Blyth hut) was just above the bushline at c1490m asl and 9 miles (14.5km) from Ohakune.

Rising nearly one thousand metres, the Ohakune Mountain Road is one of the most picturesque drives in the country, taking in lowland forest, alpine beech forest, then through windswept alpine shrublands with magnificent views of the surrounding countryside and Mt Ruapehu. Starting at 600 metres above sea level at the Ohakune Junction, the 17-kilometre road passes through podocarp/broadleaf forest originally dominated by lofty rimu and matai trees while mountain cabbage trees (toii) with silvery under-sided leaves dot the roadside.

Higher up, red, silver and black beech take over, with stunted and gnarled specimens interspersed with mountain cedar (kaikawaka) and mountain beech. At Makotuku Flat the trees succumb to the altitude and are replaced by alpine shrubs such as olearia with its thick, glossy leaves and the woolly mountain daisy amongst red tussock. Above the ski field carparks (1620m), even the hardy mountain herbs are subdued, sheltering as tiny communities of cushion plants and mosses among the boulders.

Along the way there are numerous points of interest. The Mangawhero Campground is on the left 1.5km up the road. Further up the road, the start of the steep winding section on Rimu Hill (3.5km mark) is marked with impressive rimu trees. Next on the right at 7.4km is the start of Blyth Track and further on is the Waitonga Falls walking track (part of the Round the Mountain Track). Two kilometres further are the spectacular Mangawhero Falls (a short walk from the road) and past the hairpin corner is the Makotuku Flat with the only club lodge on the Turoa side of the mountain – the Massey University Alpine Club Hut.

A little way further on the left is the track to Lake Surprise and the Round the Mountain Track heading west and around a few more corners the top of the road and the Turoa Ski Field is reached.[1]

[1] https://www.ruapehu.info/do/ohakune-mountain-road.

The vegetation in the surviving section of the Blyth track is dominated by mountain beech species except for the 500m or so below the Round the Mountain track (i.e. the top end of the surviving Blyth track) which is occupied by an extensive open perched wetland.

Historical Background

Ohakune was founded in 1895 on the Waimarino block, which the government acquired in 1887. Like Raetihi, it was accessed via the Whanganui River and a dray road from Pipiriki until the railway arrived in 1908 and made it a rival to the older settlement.[2] Besides Ohakune, the communities of Horopito, and Rangataua formed on the south side of Ruapehu with a mixed economic base of railways, sawmilling, and farming (because of excellent soil). They preceded the communities to the north by 20 years. Sawmilling led to National Park growing from 1924 and Erua from 1934. From the outset these communities were also interested in developing mountain recreation/tourism and they vied to have the best route to the summit. Blyth track is Ohakune's contribution to this rivalry, and it won the day for Ohakune.

The following is a summary of the events that led to the construction of the Ohakune Mountain Track (later renamed Blyth track), and ultimately the Ohakune Mountain Road, both intended to provide access to the lower slopes of Mt Ruapehu for recreation, initially in the case of the track for climbing to the summit and alpine walking, while the aspirations of the Ohakune Mountain Road builders was to help facilitate the development of a commercial skifield and create a new economic opportunity for Ohakune following the logging era.

After 'the Gift' of the mountain peaks by Ngati Tuwharetoa chief Te Heuheu in 1897, the Park was gazetted in 1907. The first Park Board, appreciating that the new North Island Main Trunk Railway (NIMT) would greatly increase development pressure in the area and especially encourage logging, commissioned a botanical survey by renowned botanist Leonard Cockayne which was published in 1909. He was particularly concerned about protecting the forests on the south and west spurs of Ruapehu which were they opened to logging and the consequent denudation would detract greatly from the scenic values of the Park and 'the value of the important farmlands along the Main Trunk line". The Scenery Preservation Board (established in 1907) and the Tongariro National Park Act (1922) reinforced progress in enlarging and consolidating the Park. Over a period of half a century the Board acquired land and undertook land swaps, firstly to create reserves and gradually merge them to create the southern part of the Park as it stands now.[3]

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[2] https://teara.govt.nz/en/1966/ohakune

[3] George 1990, p245; Grimwade 2010, p.8

During 1908 groups in Ohakune and Rangataua, 5km east of Ohakune, sought Government funds to build tracks to the summit. They were told there was no funding available. At the same time, a report by Mr E. Phillips-Turner, a Lands Dept official, favoured a route from Waimarino (now National Park). But neither Ohakune nor Rangataua was taking no for an answer. By 1909 the Rangataua group had created a good 14km bridle track through the forest to a point above the bushline and E.H. Snow established a camp for tourists at the head of the Rangataua route. He charged fees for guiding and camping and hired horses. His service operated from 1908 until 1918 .[4]

The inaugural meeting of the Ohakune Alpine Club (OAC) was held in Ohakune on 3rd March 1910. Their main purpose was to open a track through the bush from Ohakune to the slopes of Ruapehu for recreation, sightseeing and climbing. More specific aims developed later- building mountain huts and providing guiding services. T.A. (Joe) Blyth and H. Girdlestone (a surveyor) either volunteered or were employed to define a route for the Ohakune track (later renamed Blyth track). The Club let a contract for £19 to Reid Bros to clear a 1.2m wide track from the railway station for 11.2km, and soon after paid them another £6 for another 4.8km. Tents were donated to create a camp just inside the bush line. The Club set a toll of 1/- for track users and an annual sub of 10/6d.[5]

Joe Blyth's wife died in 1915 at the age of 35. Joe found solace in the mountain, in maintaining the track and taking visitors to the heights. In 1920 OAC let a contract to William Salt to build Ohakune Mountain Cottage Hut (aka Mangawhero hut). Joe Blyth and several others helped in the construction of the hut in several work stints through 1921-22. The hut had three rooms and 22 bunks. During this period a horse paddock and shed were added.[6]

The entire route of Ohakune track is marked on a PWD map drawn in 1925 (see Fig. 2). Given the track had been in existence for c15 years prior to the plan being made, it is not certain why it was felt necessary to produce the plan, but it was probably because of issues to do with land ownership. It is a remarkable record. It shows several sections of the track (particularly in the mid-section known today as Byth's track) had been corduroyed by that date.[7] Scaling from the plan reveals no less than 2.4km had been corduroyed. Corduroying involves cutting

[4] George, M. 1990, p245

[5] George, M. 1990, p246

[6] George, M. 1990, p.247, Grimwade, K. 2010, p.52

[7] Plan of Ohakune Track from Ohakune Junction to Ohakune Mountain Hut by S. Fairjhall 28/6/1926 Plan No.18121

and laying timber slabs across a track (or road) to provide traction and stability in wet, swampy and slippery areas. On the Blyth track the corduroying was made by felling and splitting kaikawaka (mountain cedar) which formerly grew abundantly along the route. Much of it is still in evidence today. Through the 1920s and 1930s the Park Board provided some funding for maintenance of the Ohakune (Blyth) track. Most of the Park funds went towards corduroying.[8] With 2.4km of corduroying and 10 corduroys per metre, that means no less than 240,000 individual pieces of kaikawaka were used to create the corduroyed sections, and that's assuming there is only a single layer of corduroy

From 1922, up until his death in 1940, Joe Blyth, who was the headmaster of Ohakune School, started taking groups of visitors and school children to the hut, the supplies being carried by his pack horses - Polly and Betty. Joe spent so much time on the mountain that the track and the hut became synonymous with his name.[9] The hut and the track were maintained by toll fees and an occasional grant from the Tongariro National Park Board.

Starting in 1934 Joe Blyth began to build the pole line across the western face of the mountain. The 2.7m silver pine (manoao) poles were packed in by his horses, each horse carrying 6 poles, 3 on each side. To facilitate the packing in of supplies and the poles, the track had to be widened to six feet (2 metres) and all the cut material hidden off to the sides. This work was done by an army of volunteers including Joe Blyth and his sons.[10]

During 1934-35 a road was built to Hussey's farm (where Mangawhero camping ground is now) via Gamman's tramline using 'Scheme 5' funding.

[8] Grimwade, K. 2010, p10

[9] George, M. 1990, p248

[10] George 1990, p246, p249

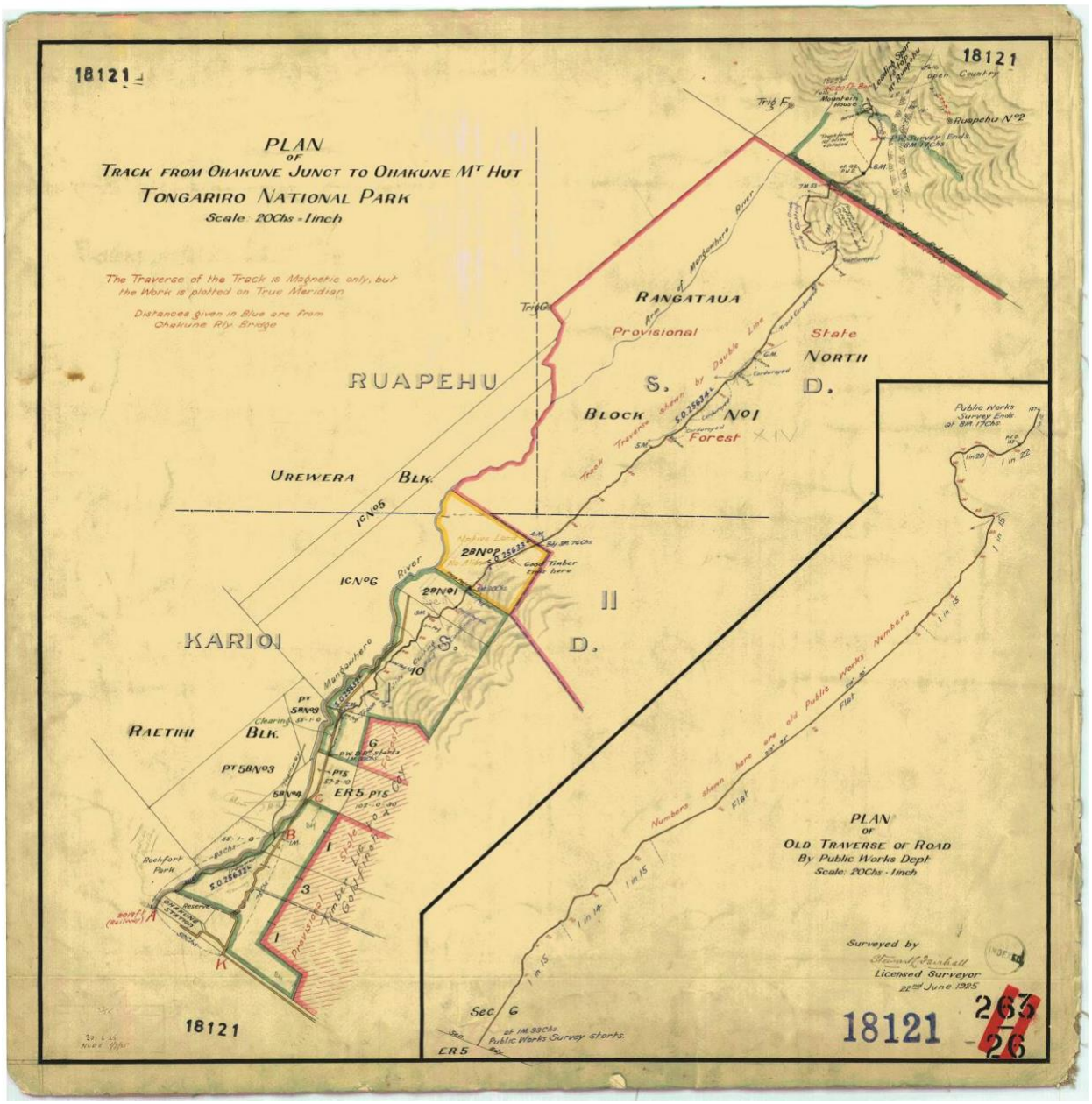


Fig. 3 PWD plan of the Ohakune (Blyth) track. Plan No. 18121. Fairhall, Stewart 28th June 1925. A notable feature of the plan is that it shows several long sections of corduroy in place by that date. Scaled off the map they amount to c2.4km. The plan also shows the one time mile posts along the route.

In 1940 Joe Blyth died and without his energy, drive and regular trips, both the hut and track began to deteriorate probably compounded because there were more important things to do during the war years than climb the maunga. Later the Park Board changed the name of the Ohakune track to Blyth track in honour of the contribution of Joe Blyth.[11]

[11] Grimwade, K. 2010, p10

Memories of the Ohakune (Blyth) Track in the 1940s

In 1943, 14 year old Ohakune-based Ashley Cunningham persuaded his stepfather Owen Buckingham to take him up to Blyth hut via the Ohakune track. They found three men were staying in the hut including the well-known Joe Blyth. Blyth told Cunningham the weather would clear by the following day and offered to loan them his ice axe. The next day he and his stepfather climbed Mt Ruapehu The friendliness, knowledge and confidence of the three men impressed the 14 year old and mountains became a dominant interest in his life. Between 1943 and 1949 he made 28 trips up the Ohakune track to the hut and beyond.[12] Later he became a NZ Forest Service botanist and was a keen observer. The following is a précised version of his memories specifically of the Ohakune Track proceeding from Ohakune up to Blyth hut.[13]

"Although the remaining section is now called Blyth track, in the 1940s it was more commonly known as the Ohakune Track. The track was initially cut about 1908, and during the next few years was opened up by members of the Ohakune Ruapehu Alpine Club, one of whom was Thomas Arthur Blyth, affectionately known as Joey (or Joe). When his wife died in 1915, Joey took solace in working on the track, steadily developing and improving it until 1940, helped by his son Jack".

"In the 1940s, the first mile or so was up the narrow and heavily pot-holed road leading to Hussey's farm. On the eastern side of the road, just before it crossed a bridge over the Mangawhero, there was a small clearing in the bush where one could park a car (or in my case leave a bicycle). From here it was only a few yards walk to Bennett and Punch's logging tramway which one followed for a further mile before it turned westward to cross the Mangawhero [this part of the B & P tramway was built c1936 on part of the original Ohakune track]. After crossing the Mangawhero one entered the podocarp forest on the track proper".

"Today the roadside clearing, and the old tramway are well overgrown. Most of the tramway section of the track has been replaced by the Ohakune Mountain Road, but south of the Mangawhero Road bridge the alignment can still be traced, and some of the old sleepers seen" (i.e. in 1988).

[12] Cunningham 1988, p.7

[13] Cunningham 1988 pp.3-4

"Before the tramway crossed the Mangawhero it passed through a fire-induced clearing, at the end of which one entered the forest. Today (1988) this clearing is still recognisable, but largely as second growth forest"

"The next two or three miles lay through dense podocarp/beech forest. The track here has largely been replaced by the Ohakune Mountain Road. Shortly after leaving the tramway, the track briefly worked its way along the steep hillsides above the Mangawhero River, where it was benched and well drained, with little bridges over the side streams. Further on it rose up gently sloping flats, where it was wider (about 2m) with some muddy patches. After the 5 mile peg, which was about 700m up the track, beyond where the sealed road now parts from the Blyth track, the podocarps were left behind and one entered a more stunted beech/totara/kaikawaka forest. There were many muddy sections here, and the track was often corduroyed, some of which remains today. The marker pegs indicating each mile of the track were of great interest to travellers as it was a long walk to Blyth hut. [In the 1940s] There was no 6 mile peg; we always judged the stream crossing at 1030m elevation to be that distance. Of course, there were no footbridges here in the 1940s. Up to this point today's forest has encroached on the track, so it presently seems rather more narrow than it was 40 years ago [i.e. in the 1940s]. Beyond the stream, however, the forest growth is rather sluggish, and the track here is very much as it was in the 1940s. The 7 mile peg was still visible in 1989 but the figure was almost illegible. Much of the corduroy on this section of the track probably dates back to the 1920s and 1930s, because very little of such work was done in the 1940s".

"Beyond the 7 Mile peg the benched track rose round the hill at a steady grade. Small log bridges spanned the streams, but these have collapsed and been replaced by more modern structures. The predominantly mountain beech has changed little in the intervening years"

"In the 1940s there was no track going past the Rotokawa tarn, which because of the swampy ground, was seldom visited. The track passed to the west of this small plateau, through open and eroded mountain scrubland, and then crossed a mountain beech slope, which had been slashed by a debris avalanche during the heavy rainfalls in 1941, which carried away about 50m of the track. Forty years later (in the 1980s) there are still no plants growing on the main surface of this slip".

"Beyond this patch of forest, and its slip, the track emerged onto tussock and scrub. At this point we sometimes left our packs and walked across to the Waitonga Stream and down to the falls. There was no track, but the going was

easy. The section of the track from the slip to the (old Blyth) hut site is now disused, and slowly becoming overgrown with snow totara. The final steep and gullied section was always the worst part of the track. At the top of the hill, just before arriving at the hut, was the horse paddock. In the 1940s there was a makeshift fence here, with posts pf local wood, and one or two strands of wire. Horses were seldom used on the track at that time (the 1940s). The paddock was a remnant of the 1920s and 30s when both pack and riding horses were more commonly used".

Regarding Blyth hut, Cunningham recalled in the 1940s- The hut was then called Blyth Hut or Ohakune Mountain Hut, but in earlier days it had variously been called Mangawhero Hut or Ohakune Mountain Cottage. It was built in 1921 by Willam Salt assisted by Bill Mead and Joey Blyth. It was an 'L' shaped building of three rooms with a verandah in the sheller of the angle. There were 22 bunks, and the two large rooms each had an open fireplace, It was well constructed with sound flooring and walls lined with dressed T & G rimu. The roof and exterior walls were of corrugated iron. Cutlery, crockery and cooking utensils were provided, and the hut was unlocked and freely available to the public".[14].

[14] Cunningham 1988 p.5

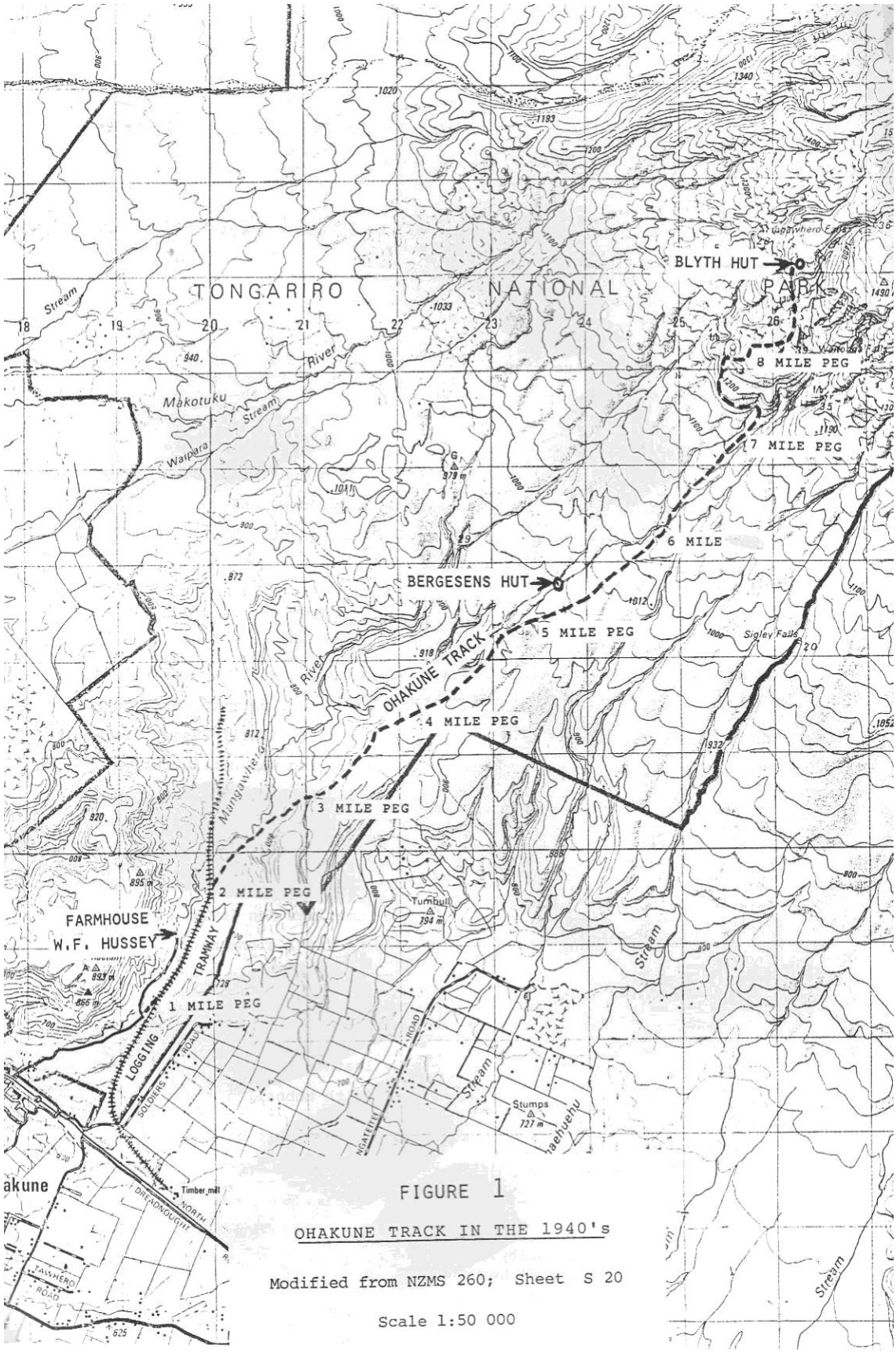


Fig. 3 Map reproduced from Cunningham 1988 showing the Ohakune (Blyth) track including the lower section on which part of the Bennett and Punch tramway was later built; the mile posts on the track, and the positions of Blyth's and Bergeson's huts. W F Hussey's farmhouse (now Mangawhero camping ground) is also marked.



Fig 4 Blyth's hut in the mid-1940s. [15]



Fig. 5 A stylish woman outside Blyth's hut in the md 1940s.[16]

During WW2, Les Bergeson and his nephew Mervyn, both conscientious objectors, evaded conscription by hiding in the bush above Ohakune. They were captured and

[15] Cunningham 1988 Fig. 6 facing p.6

[16] Cunningham 1988 Fig. 5 facing p.6

imprisoned in 1944. In recent years both of their hut sites have been located, one is only 700m from the lower end of Blyth track.[17]

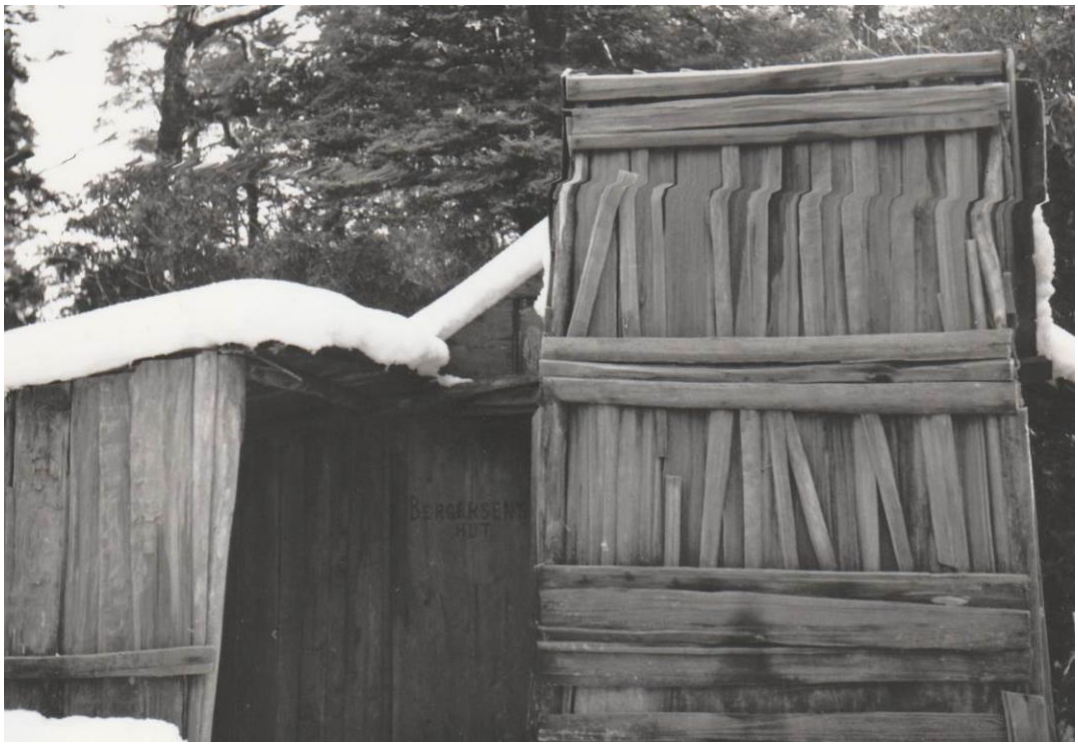


Fig. 6 Conscientious objector Merv Bergeson's refuge hut near the Blyth track in 1949 [18]

The decline of the local timber industry provided impetus to the Councl to advocate for a road further up the slopes. In 1945 a MOW report was commissioned and seven years later the Ohakune Mountain Road Association (OMRA) was formed and began regular working bees on the road formation, initially using horse and cart and later trucks, tractors and bulldozers. Where boggy conditions were encountered, they laid mill slabs (waste offcuts from the local timber mills) and gravelled over them. In 1958 the MOW agreed to supervise the road construction.[19]

In 1960 the first Park Ranger moved into the old Hussey family homestead at what became the Mangawhero campsite (1.5km from Ohakune). Before becoming a farm, it had been logged by Gamman's.[20]

By 1956 the construction of the Ohakune Mountain Road (OMR) reached the point where it diverts from the Blyth track, at the 7.4km mark from Ohakune. Because the OMR followed the route of the Ohakune Mountain track to this point, the lower third of the old track has been lost to the road.[21] This was a major decision point during the road's construction. Many of the volunteers thought the ridge the Blyth track was built on above this point was too swampy to facilitate road construction. Others favoured

[17] Wilton. D. 2012.

[18] Cunningham 1988 Fig.2 facing p.4

[19] Grimwade, K. 2010, p52

[20] Grimwade, K. 2010, p54

[21] Grimwade, K. 2010, p52

going up a narrow ridge to the west which was well drained by the Mangawhero Stream on the eastern side and an unnamed tributary on the western side (later named Reid's Creek). A bit of clandestine bulldozer work by some members of the OMRA settled the debate (A. Whales pers. comm June 2024). The road swung to the left and a hard rocky base which was difficult to bulldoze but solved some of the drainage issues. The next obstacle was crossing Reid's Creek. Here, in 1958, the Army assisted in building the Reid's Creek bridge as a public relations and training exercise.[22] The crossing of Mangawhero Stream at the 9km mark proved much easier to achieve using a surplus highway bridge. Then it was relatively easy going until the vicinity of the area now known as the grader shed. Here the ashy-mud (pug) had to be laboriously scraped off, mill slab corduroy laid down, then metal laid on top. This enabled the road to reach the metal pit above the Mangawhero Falls (13km mark). The ready supply of metal greatly facilitated the road construction. In 1967 the road reached its current end (at the 17km mark), where eventually the Turoa skifield was established.[23]

Timeline of the Ohakune (Blyth) Track and Ohakune Mountain Road

1905: Ohakune becomes a base for railway construction. Some of the workers are interested in climbing Mt Ruapehu in their leisure time. It is likely that various routes are explored and compared. They find it difficult forcing a path through the thick forest and alpine scrub.

1907 Cockayne report commissioned. Foresaw the need for a road up Ruapehu after the completion of the NIMT.[24]

1908 The railway opens for regular traffic. Passenger trains from Auckland to Wellington operate three days a week and some of the passengers are tourists. Some business people in Ohakune, represented by the Chamber of Commerce, are interested in the potential for mountain tourism. It is likely that by this time the favoured route (the eventual Ohakune track) has been identified and marked.

1908 Rangataua and Ohakune groups sought Govt funds to build tracks to the summit of Ruapehu. Declined.

1909 Mr E Phillips-Turner, a Lands Department official, is escorted up the Ohakune Track route, and is not impressed by the boggy conditions, which leads to him to report in favour of the government investing in mountain access via Whakapapa. [25]

1910 Inaugural meeting of The Ohakune Ruapehu Alpine Club. Committee member T.A. (Joe) Blyth and H Girdlestone (surveyor) are asked or volunteer to define the route of what became the Ohakune Track (later renamed Blyth track). The

[22] Grimwade, K. 2010, p30

[23] Grimwade, K. 2010 pp.24-42

[24] George 1990, p.245

[25] George 1990.p.245

club promptly lets a tender for £19 to Reid Brothers to clear a 1.2m wide track from the railway station for 11.2km, and soon after another 4.8km for a further £6. This was for clearance rather than track formation. Tents were donated to create a camp.[26] The Reid Brothers track follows the route blazed by Blyth and Girdlestone. The route is notable in that they stayed to the east of the Mangawhero Stream to avoid major bridges, and in the surviving central section of the track today, the Blyth/Girdlestone route was more or less the shortest direct line up the swampy ridge to get above the bushline. From the outset little or no consideration seems to have been given to dealing with runoff running down and eroding the track. In this regard the track was little different from the many muddy bush tracks in forested areas of NZ. They were the means to get from A to B and NZ trampers just put up with the conditions Until recent years 'muddy tracks were part and parcel of tramping n NZ bush. Public guided tours commence. The Club set a toll of 1/- for track users.

1914-1918 The War, followed by the Influenza epidemic, sees track construction and use interrupted. There is no evidence of provision for packhorses up to this time, but some users may have rode private horses or even bicycles up all or parts of the track.

1915 Joe Blyth's wife Jane died at the age of 35. Joe found solace in the mountain and taking visitors to the heights.[27]

1920 March. A contract is let to William Salt to build Ohakune Mountain Hut (3 rooms and 22 bunks).

1921-1922 Salt appears to have enlisted or accepted an offer of help from Joe Blyth and several others to build the hut over several work stints. During this period a horse paddock and shed were built near the hut.[28] The materials for the hut were presumably hauled in using packhorses necessitating work to upgrade the 1.2m wide walking track to a 2.0m wide packhorse track. It is likely damage inflicted by horses (both riding and pack horses) churning up the poorly drained soils in turn triggered the need to lay extensive sections of corduroy on the track, starting at the worst locations. The horses (and to a lesser extent walkers) and runoff taking the route of least resistance- running down the track resulted in the track becoming progressively entrenched in many places compounding the drainage problem and the increasingly poor state of the track to this day

1922-1940 Joe Blyth started taking groups of visitors and school children to the hut, the supplies being carried by his horses Polly and Betty. Joe spent so much time on the Mountain that the Ohakune Mountain track became known as Blyth track. During this period, the track was widened and upgraded by an army of volunteers including Joe Blyth and his sons.[29]

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[26] Ibid. pp. 245-247

[27] Ibid. p.247

[28] George 1990, p.248

[29] Ibid. p.246

1924 G A Gamman's bush tramway opens from their Ohakune sawmill up the Mangawhero. Once the tramway is established, people bypass the first section of Blyth track and walk along the tramway to where it intersects with the track.

1925 Jun 22. PWD Plan 18121 is a survey plan of the entire route of the Ohakune Track from Ohakune to the Ohakune Mountain hut. (a total length of just under 9 miles). The plan shows several corduroyed sections totalling c2.4km are in place by that date as well as mile marker pegs, the horse paddock and Mountain House. "Through the 1920s and 1930s the Park Board offered some financial assistance, mostly spent on corduroying' [30]

1934 Joe Blyth built the pole line across the western face of the mountain. The 2.7m silver pine poles were packed in by his horses, each carrying 6 poles, 3 on each side.[31]

1934 Discussion about building a road up the mountain .G A Gamman's bush tramway closes. A one-mile section of its route is later used for the mountain road.

1936 Bennett & Punch bush tramway opens from their Ohakune sawmill up the Mangawhero. It crosses Blyth Track near the 2-mile mark. The lower part of the B & P tramway appears to follow the route of Gamman's 1924 tramway. The B & P tramway closed in 1957 as work was underway on the mountain road.

1938 Work on what later became the first section of the Mountain Road commences using Council workers. 2km is completed in 1939 to Hussey's farm. The road follows Gamman's bush tramway route, which may or may not be the same as Blyth track. (Gamman's tramway bridge over the Mangawhero would have given access to the farm.).

1939 Another War intervenes. It is likely the Ohakune Track and the Hut see less use during the war.

1940 Feb. Joe Blyth dies. Without his energy, enthusiasm and regular trips with visitors, both the hut and the track begin to deteriorate. The track is later renamed Blyth Track and the hut is renamed Blyth Hut.

1940s Ashley Cunningham walked Byth track 28 times in the 1940s and in his "Memories of Ohakune Track in the 1940s" he recalled the full route of the track from the outskirts of Ohakune to Blyth hut. Some key points. He noted "that horses were seldom used on the track by the 1940s" and he considered "the worst part of the track" was the final steep gullied section below the hut. In the mid-section (the existing Blyth track) he noted the track has having "some muddy patches or sections and the track was often corduroyed" and (presumably with the demise of horse usage") below the 6 Mile peg "the forest had encroached on the track so it presently seems rather narrow compared with

[30] Grimwade 2010: p.10, Fairhall 1925

[31] George 1990 p.249

how it was 40 years ago" Interestingly, he does not mention the entrenched nature of the track, presumably a result of horse trampling and runoff undermining the corduroying, He just seems to have accepted that the boggy condition of the track in many places was more or less the norm for bush tracks in NZ forest. He also makes no mention of wholesale erosion. The swampy ridge was a wet environment but was stable; the only slip prone areas being along the banks of the Mangawhero. which were subject to erosion with every freshet.

1948 The decline of the timber industry gives impetus to Council to create a road to the higher slopes.[32]

1950 Ministry of Works report on proposed Ohakune Mountain Road.[33]

1952 Nov. A joint deputation of the Borough Council and Chamber of Commerce presents a mountain road proposal to Tongariro National Park Board, which gives approval. The Ohakune Mountain Road Association (OMRA) is formed and regular working bees on the road formation commence, initially using horse and cart, later bulldozers, tractors and trucks. They aim to build 1.6km each year. The section between Hussey's farm and Reid Creek follows the line of Blyth's track effectively destroying any vestiges of the lower section of the track.

1955 Nov 23. The OMRA Annual Report states that '(road formation) construction has reached Reid's Creek at five and a half miles.' The surface metalling is some distance behind. Sometime later OMRA make the significant decision not to follow Blyth Track any further.

1956 The OMR reaches the point where the OMR diverts from the line of Blyth's track 7.4km.[34] Most of the original Blyth track to this point has been lost to the road. or the Bennet & Punch logging tramway.

1957 Bennett & Punch bush tramway closes. In 2024, part of the tramway route is being redeveloped as part of the TAM trail.

1958 Reid's Creek bridge is built by the NZ Army. It takes three years (until late 1955) to form the road to Reid's Creek and another three years to 1958 just to get across it. All this to avoid following the swampy section of Blyth track. Use of Blyth Track and hut continue in the 1950s: Allan Whale recalled a school trip up the mountain in 1958.

1958 MOW agrees to supervise construction of the OMR.[35]

1960 The first park ranger moves into the old Hussey homestead at the Mangawhero campsite, 1.5km mark.[36]

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[32] Grimwade 2010, p.52

[33] Grimwade.2010, p.52

[34] Grimwade 2010, p.52

[35] Grimwade 2010, p.52

[36] Grimwade 2010, p.52

1963 Mar 02. Ohakune Mountain Road officially opened to Mangawhero Falls, the 13 km mark. For some the job is done.[37]

1967 The road reaches the current end where the Turoa skifield was established.[38] This date likely marks the beginning of the end for Blyth track and the hut. Visitors could now drive up the mountain, climb to the summit, and return to Ohakune all in one day.

1975 Blyth hut is burned down by Park staff after being replaced by a new Blyth hut at a lower elevation. The upper section of Blyth track, above the 'Round the Mountain' track falls into total disuse, becomes progressively overgrown and effectively lost. Only hard core trampers or those interested in the history of Blyth track continue to use the surviving middle section of the route,

By c2000 with the focus on the RTM track, DOC progressively reduces maintenance work on Blyth track leading to its present poor state- virtually an entrenched corduroyed drain masquerading as a tramping track but remarkably still reflecting its raison d'etre as a key route to access Mt Ruapehu.

[37] Grimwade 2010, p.52

[38] Grimwade 2010, p.52

Previous Archaeological Work

Most of the archaeological site recording in the Tongariro National Park has been done on a voluntary basis by members of the Tongariro Natural History Society (now Project Tongariro). Only one site has been recorded in the vicinity of the proposed TAM trail- viz. the location of two hut sites (S20/34) built and used by conscription evaders during WW2. Known sites in the general area that are presently not recorded include the Blyth track, the Bennett and Punch tramway, the Gamman (Ohakune) tramway and incline and some early (but not pre-1900) huts and hut sites.

Research Results

The primary purpose of this assessment was to examine the route of the Blyth track particularly the still accessible middle section from where it can be accessed from the OMR at the 7.2km mark from Ohakune, to its top end where it intersects the Round the Mountain (RTM) track. The former section above the RTM track that led to the Old Blyth Hut has not been maintained for over 30 years and is now overgrown and the route effectively lost. Similarly, much of the bottom third of the original track has been obliterated because the OMR was built on top of it.

The existing central section of Blyth Trail is 6.2km long (from the OMR access point up to the RTM track). Of this, 5.3km is to be used/upgraded for the proposed trail and the top 900m will be left untouched and left for walking only. The top 900m which is through a perched wetland will be bypassed by an approximately equivalent length section of new trail through the bush to the west of the wetland. This will not only prevent damage to the wetland, but it will also greatly facilitate construction.

Archaeological and Other Values

One of the purposes of this archaeological assessment was to ascertain if there is any evidence now of pre-1900 human activity (archaeological sites) in and around the proposed TAM route, which would trigger the need to apply for an authority to modify the site(s) from Heritage New Zealand. None are known or found.

The Blyth track and the Bennett and Punch tram route are presently unrecorded archaeological sites. However, they are not protected archaeological sites because they postdate 1900. The main protection afforded to these sites now is that they are within Tongariro National Park and come under the protective provisions of the National Parks Act.

Sites	Value	Assessment
Blyth track	Rarity/uniqueness	By far the most extensive surviving corduroying on any track in NZ.
	Contextual value	Its context is in relation to the desire by local communities to provide access to and create recreational opportunities on 'their maunga'-Mt Ruapehu
	Information potential	The surviving corduroying reflects how it was cut and laid in huge quantities and at considerable expense in money and labour
	Engineering significance	A great example of an engineered track from the horse era that was progressively improved.
	Amenity values	The track still provides walking access on an historic route between the OMR and the RTM track and ultimately if one desires the summit of Mt Ruapehu
	Cultural Associations	The Ohakune track and the Ohakune Mountain Road are two of the largest, long term and enduring community construction projects ever undertaken in NZ.

Assessment of Effects: Conclusions and Recommendations

The Ohakune/Blyth track, a community initiative, was an important route in its day providing access for recreation to the upper slopes of Mt Ruapehu, a role it fulfilled until the completion of the Ohakune Mountain Road, greatly reduced its usage. However, that does not negate its historic and technological values. The proposed Te Ara Mangawhero (TAM) construction will have substantial effects on the Blyth track (and the Bennett and Punch tramway) as they are now but there are several mitigating factors and long-term beneficial outcomes inherent in the establishment of the TAM.

Blyth track - present condition

The present condition of the Blyth track, as is evident in Figures 7 to 30, varies from good to virtually walking in an entrenched wooden-bottomed (corduroyed) stream with numerous awkward 'step-downs' where the water has scoured out deep holes. Large sections of the track are entrenched and boggy with no or inadequate side drainage so that run-off literally runs down the track especially in the lower 3km. A possible benefit of this situation is that damage to the corduroy seems roughly inversely proportional to the level of wetness of the corduroying. Where the timbers are continually wet it appears to have helped preserve them. Treated pine boards have been positioned across wetter parts of the track in several places presumably to divert water. While they have undoubtedly trapped silt, in most places they are not diverting water off the track at all, it either flows round the ends or over the top of the boards. From the open wetland at the top, down through the beech forest, and with many intact sections of corduroying along the route, Blyth track certainly has scenic, photogenic, historic, engineering and amenity values, but overall. the track as it stands is not up to accepted track standards and with limited funding for maintenance or decisions made to spend funding elsewhere, it is likely to deteriorate further in future. Comments in Cunningham's memoirs indicate that some of the original corduroying was gone by the 1940s.[39]

Development of the Te Ara Mangawhero would see over 80% of the present Blyth track modified to create a shared use route. As presently planned, two main techniques will be used to upgrade the track- building up the surface with metal with a curved cap and sub surface drainage so that runoff is channelled off to the sides and not down the track, and building elevated Fibreglass

[39] Cunningham 1988, p.3

Reinforced Polymer (FRP) boardwalks over many of the corduroyed and water-damaged sections. FRP panels are perforated which will make the underlying corduroying more visible compared to timber-decked boardwalks.

Blyth Track – Assessment

Throughout the alpine areas of New Zealand, especially in the more mountainous South Island, would be climbers and local people created walking and pack tracks to provide access to the lower slopes of peaks they wanted to climb. While most of these tracks were informal, the route of some were chosen by experienced surveyors or persons who understood the impact of runoff on tracks and routed them to mitigate water problems and avoid naturally boggy ground. In the North Island alpine climbing was focused on Mt Ruapehu and Mt Taranaki. Before the construction of the OMR, the 1910 Ohakune (Blyth) track was one of three main routes for accessing the snowfields or for climbing Mt Ruapehu. The track is especially notable for the amount of surviving corduroying, and (along with the later OMR) were important community projects.

A comparative analysis has revealed that Blyth track is the premier historic corduroyed pack track and walking track in New Zealand but because of the deficiencies outlined above the route is in poor condition now and can be expected to get worse in future.

The key feature is the extensive corduroying which gives the track its special character. Given its historic significance, it is desirable that a good portion of the better sections are retained.

Recommendations with regard to the TAM track build in the Blyth track section

1. Where there are good sections of relatively flat corduroying build the TAM to one side of the corduroying by metaling or boardwalk construction and let runoff continue to run down the corduroying as at present which seems to be both preserving the timber and keeping it free of vegetation growth. These should not be a few token short sections but some good long photogenic and representative sections each minimally c100m in length. These sections should be identified prior to the trail being developed and inspected by a suitably qualified and experienced archeologist. They will retain the historic character of the upgraded track,

and users will be able to see and appreciate long sections of the corduroying more or less as they were laid.

2. Build the proposed FRP boardwalks over the sections of corduroying where there are changes of elevations and scoured holes. The corduroying will be 'preserved' under the boardwalks and users will see sections of it either by looking through the boardwalks or sticking out to the sides.

3. A film and photographic record should be made of the Blyth track as it exists now as a record and for future story-telling.

4. As noted not far off the lower end of the Blyth track is the site of a conscription evaders hut. The collapsed remains of the hut don't warrant creating a side track to it but an interpretation panel beside the TAM telling the story about conscientious objectors would be another point of visitor interest on the TAM.

The Bennett and Punch tramway

The B & P tramway is not the main focus of this report but nonetheless it is an integral part of the TAM and will extend from the Blyth track section down to Ohakune. Work has already started on the Bennet and Punch tramway section (see Figures 25 to 30) and gives a good indication of what both the gravelled and boardwalk sections of the TAM will look like.

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Maps & Plans

Plan of Track from Ohakune Junction to Ohakune Mt Hut, Tongariro National Park. Public Works Dept 22/6/1925 Plan 18121

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Photographs of the Proposed Upper Section of the Te Ara Mangawhero

All photos by N Ritchie June 2024



Te Ara Mangawhero (TAM) will commence to the left of the Massey University Alpine Club (MUAC) hut



The area immediately below the MUAC hut through which the TAM will traverse. The original Blyth hut was over the ridge to the left.



Mangawhero Stream above the Mangawhero Falls



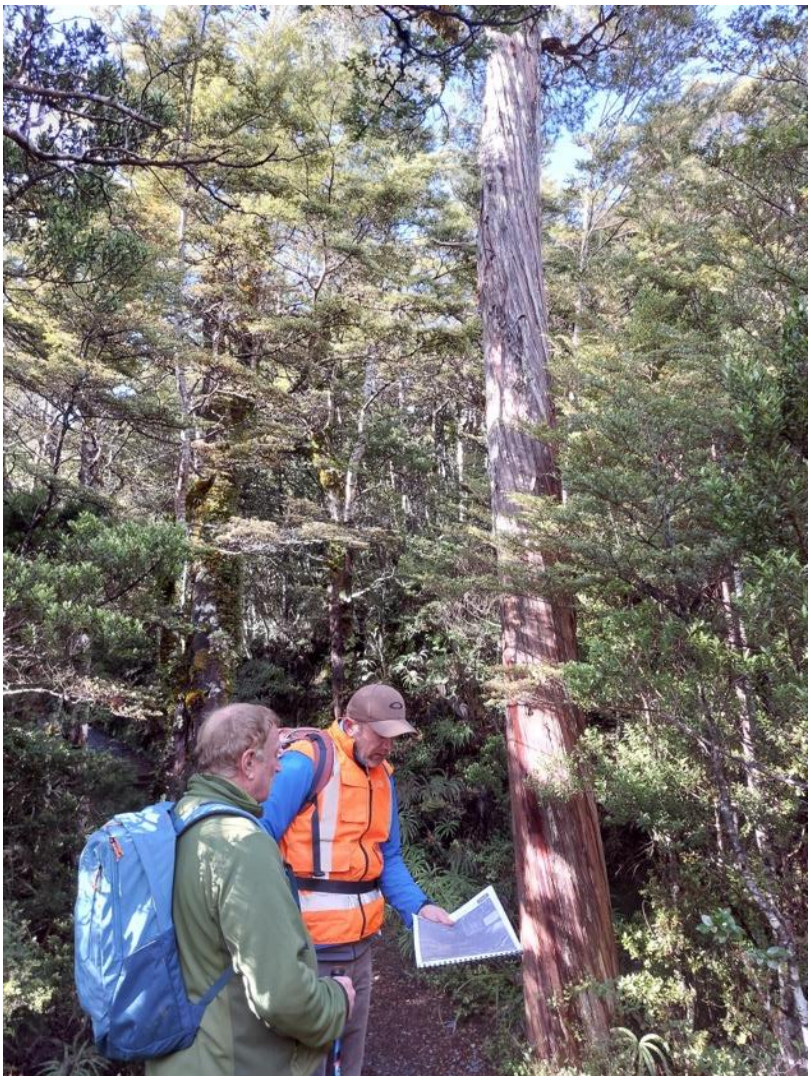
A concrete retaining wall for a footbridge at the location depicted in the previous photo



Gollum’s Pool (Lord of the Rings filming site) above Mangawhero Falls



The 22m high Mangawhero Falls



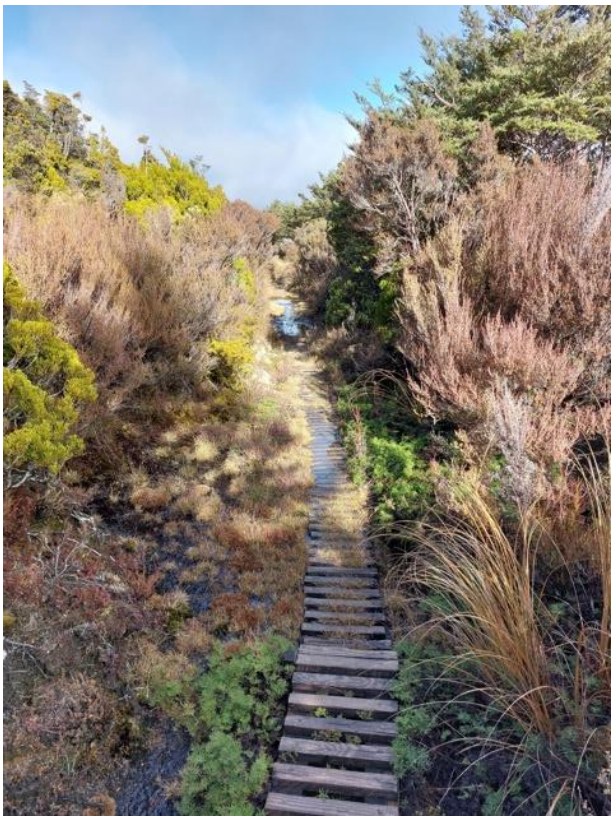
The point where the TAM will intersect the Round the Mountain Track is marked by a kaikawaka (mountain cedar)- the species which was used for corduroying on the Blyth track

Photographs of The Blyth Track from top to bottom June 2024



Sign posts at the Round The Mountain/Blyth Track intersection c1km east of Ohakune Mountain Rd.





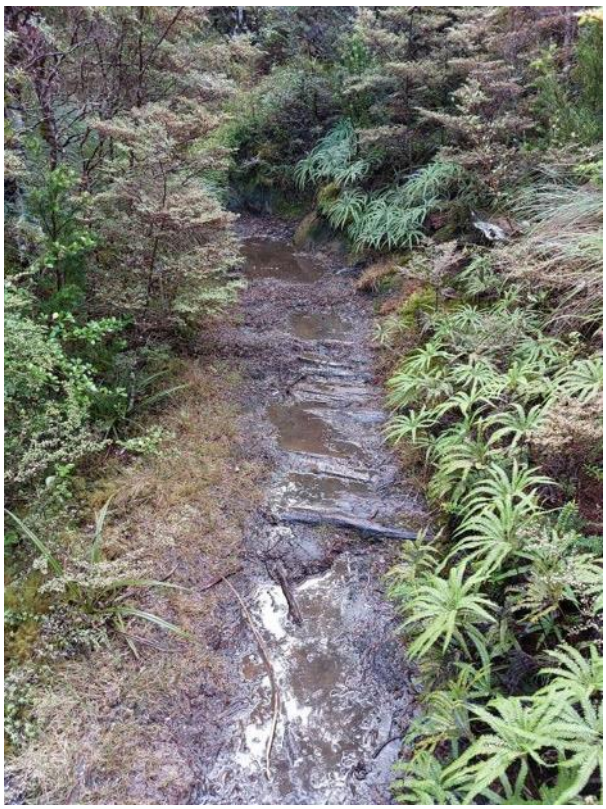
Boardwalks through the perched wetland in the upper 1km of Blyth track



Another view of the wetland through which the first km of Blyth track traverses coming down from the RTM track. The trench-like feature to the left of the flooded boardwalk is almost certainly Blyth's original track.



Two views of the upper part of Blyth track after leaving the wetland. This wetland area and the areas depicted above will be bypassed by the TAM and not effected.



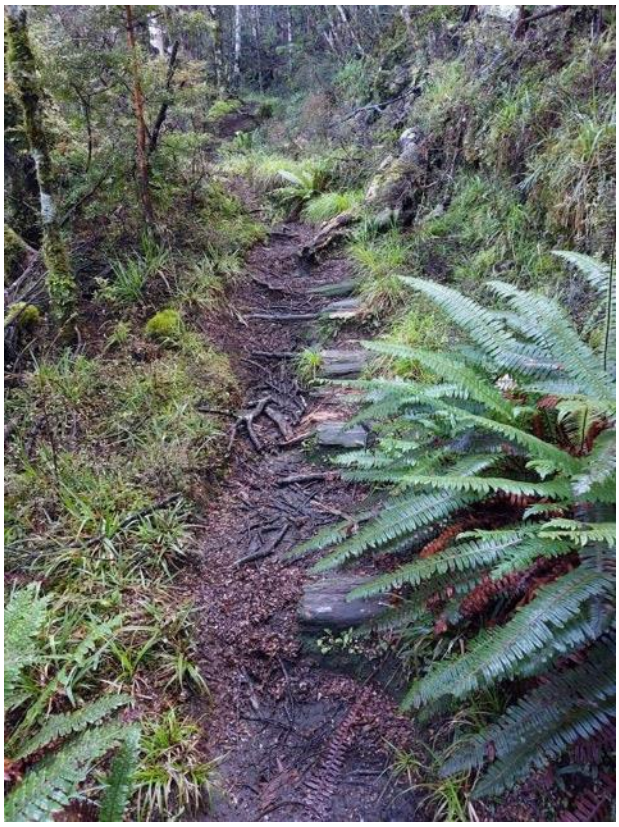
This short length of corduroying is above the bypass and will not be affected



The pink flagging tape on the tree marks the point where the new bypass from the RTM will connect with the Blyth track on the right.



An example of erosion and roots creating an obstacle on the track



A damaged section of corduroying c2km down the Blyth track. The condition and extent of the corduroying is much better on the lower half of the track.



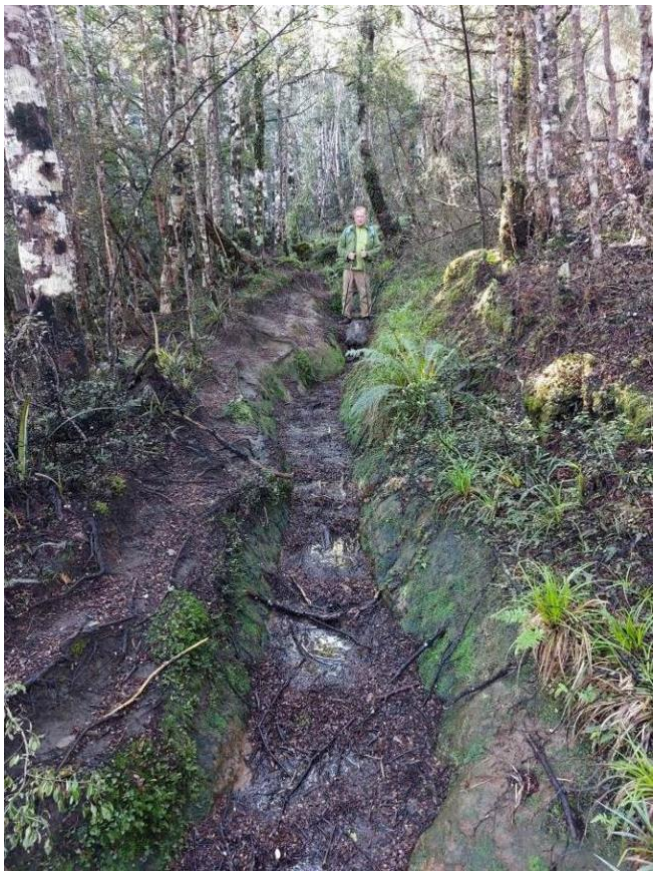
A section of corduroying on the Blyth track (upper section) which should be left unmodified by building the TAM beside it.



To the left of the footbridge, there is a log beam which supported a bridge on the Blyth track. Its days are numbered but it should be left in-situ during the TAM build.



One of many boards (usually placed at right angles across the track) but many of them including this one pond water rather than allowing it to drain



A typical section of which there are many where the original Blyth track is now quite entrenched. Where there is little or no corduroying, the TAM could traverse these sections on boardwalks or preferably be built on the higher ground on either side leaving the original Blyth track largely unmodified.



In some sections the corduroying now forms a series of 'steps' but the original corduroyed route is well defined. Ideally the TAM should be built to one side of these sections.



The same section as above looking down the track. The entrenching nature of many sections has resulted in a constant flow of water down parts of the track





The entrenched nature and often virtually non-existent side drainage along the track now. Building the TAM to one side of the original track should be seriously addressed leaving the original trail to serve as a drain as it does now.



Large sections of the present Blyth track and its corduroying are virtually continuously underwater. In some places the corduroying is completely underwater



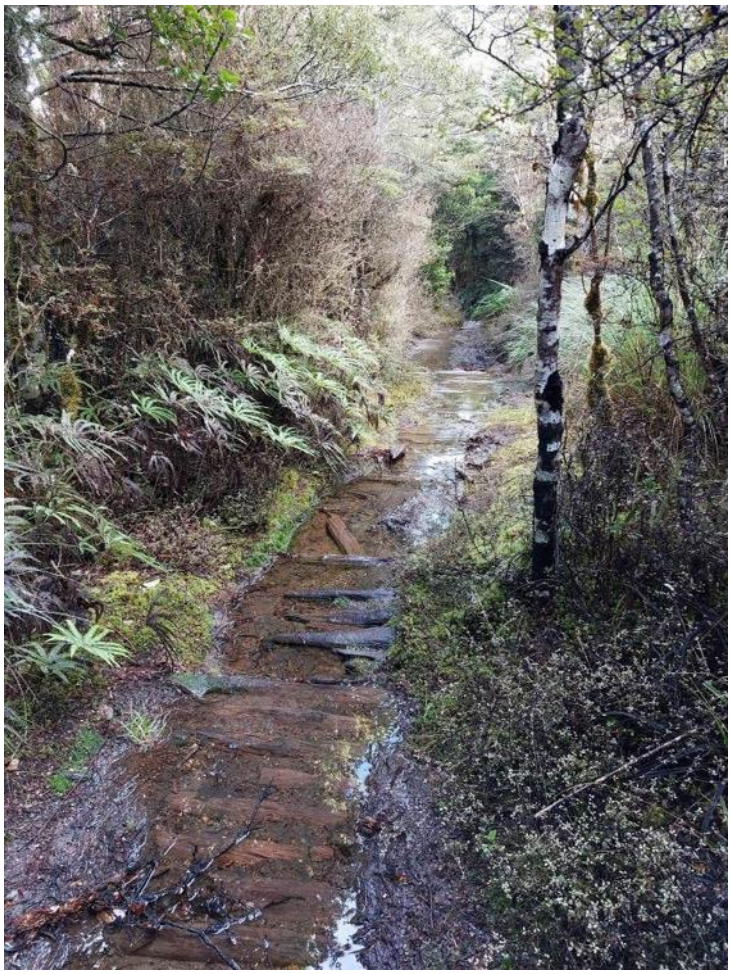
One of many sections of the original Blyth track which can and should be retained simply by building the TAM to one side



In places only every 5th or 6th section of corduroying is visible, the rest is underwater.



One of many long corduroyed sections in the lower half of the track. The corduroy timbers are c1.2m long and there are approximately 10 to each metre of corduroyed track. Corduroying the track was a major job done (and probably re-done) over many years.



A drier section of corduroying above the Mangawhero Stream bridge



A section with no corduroying about 800m from the bottom of the track



At both ends of the Blyth track there are narrow sections of floating ‘modern’ boardwalk. Because of their short width, it’s easier to walk on the original kaikawaka corduroying.



The bottom end of Blyth track from the small carpark beside Ohakune Mountain Rd

Some images of the Bennett and Punch Tramway which will form the lower portion of the TAM . They give an idea of the width of the TAM (2m) and what it will like as a shared track.



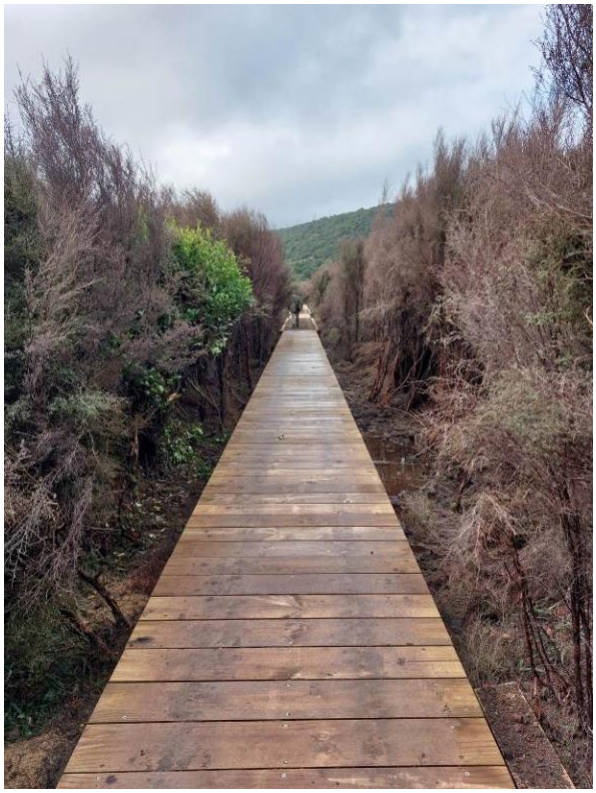
A completed 2m wide section of the TAM through the forest below the Mangawhero camping area



Newly completed bridge across Mangawhero Stream. It is built on the original concrete piers which supported the Bennett and Punch tramway.



The TAM faithfully follows the line of the Bennett and Punch tramway across reverting farmland in the lower valley.



One of the new 2m wide boardwalks on the tramway section



Faithfully following the route of Bennett and Punch tramway by exposing the sleepers ahead of the trail build.

Appendix 11. Te Ara Mangawhero Te Waiū-o-Te-Ika

Te Ara Mangawhero Te Waiū-o-Te-Ika information

Te Waiū-o-Te-Ika Ngāti Rangi maintains a strong and connected relationship with our freshwater, fostered through our whakapapa connections with the landscape we have resided in from time immemorial. Mouri is the lifeblood that exists in all things; it is the fundamental element that brings health and wellbeing to all facets of life. Mouri is the element that flows through us and returns life repeatedly in a perpetual cycle. As tangata tiaki, it is the responsibility of Ngāti Rangi to advocate, protect, and enhance the mouri of waterways that flow through our rohe.

Te Waiū-o-Te-Ika is a legal framework for the Whangaehu River catchment from Te Wai ā moe to the sea, incorporating its tributaries and all its physical (including mineral) and metaphysical elements, as an indivisible and living whole. The framework focuses on recognising, promoting, and protecting the health and wellbeing of the awa, and the intrinsic relationship of Ngā Iwi o Te Waiū-o-Te-Ika with the awa and our responsibility to care for, protect and use the awa in accordance with our kawa, tikanga, and ritenga.

Te Waiū-o-Te-Ika framework is inclusive and recognises and promotes the mana of all Iwi with connections and interests in the Whangaehu River catchment, putting the mana of Te Waiū-o-Te-Ika at the centre. Much of the framework provides collectively for Ngā Iwi o Te Waiū-o-Te-Ika, and not just Ngāti Rangi. Ngā Iwi o Te Waiū-o-Te-Ika have a collective connection and interest in the health and wellbeing of the awa and will work together to restore the mouri and the health and wellbeing of the awa and its people.

The waterways flowing through the proposed phase one areas of Te Ara Mangawhero originate on Ruapehu and form the Mangawhero River. The Mangawhero River is an important freshwater tributary of the Whangaehu River. Consequently, the proposed areas for trail establishment are encompassed within the framework of Te Waiū-o-Te-Ika. The Ngāti Rangi Claims Settlement Act 2019 provides statutory recognition of Te Waiū-o-TeIka as a living and indivisible whole from Te Wai ā-moe to the sea and through a set of intrinsic values firmly based in our kawa and tikanga, Te Mana Tupua and Ngā Toka Tupua. These intrinsic values reflect expectations of underpinning cultural foundations for increasing the health and wellbeing of the catchment.

Concerning this application, the settlement Act requires that any persons exercising or performing a function, power, or duty (decision-makers) under:

- The Conservation Act 1987 and National Parks Act 1980 (amongst other Acts) must recognise and provide for Te Mana Tupua and Ngā Toka Tupua.

- The Resource Management Act 1991 (amongst other Acts) must have particular regard to Te Mana Tupua and Ngā Toka Tupua.

Te Waiū-o-Te-Ika in its fullest sense is still being implemented. It is noted that Ngā Wai Tōtā, the co-governance entity for Te Waiū-o-Te-Ika is yet to be established.

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The proposed trail development will result in a variety of outcomes, including:

- The trail will traverse and showcase a wide range of ecologically and culturally significant forest and river margin habitats on the lower slopes of Ruapehu. Enabling recreational access will create connection, health and wellbeing benefits, and enable greater environmental and conservation outcomes.
- As tangata tiaki, Ngā Waihua o Paerangi Trust and Pae Whakahaumaru will establish, manage and maintain the trail which will enhance connection, care and reciprocity for the location while providing employment and growth opportunities for local people.
- The aim is to build a sustainable trail that has minimal impact, resists erosion through proper design, and blends with the environment. The route has been designed to maximise the use of previously disturbed sites/areas on the Blyth Track.
- The upper portions of the Trail traverse through sensitive sub-alpine vegetation. This includes locally rare red tussock inaka and red pine ecosystems, alpine wetlands and a lahar pathway close to the Mangawhero stream. In these areas care has been taken to divert the trail around the wetlands where possible. Where the trail has to traverse sensitive wetlands, it will be laid with reinforced polymer boardwalks. Raised boardwalks are commonly used in Australia have been found to prevent erosion and to protect biodiversity. Reinforced polymer boards blend in with the environment, and have fewer maintenance requirements than treated timber boardwalks.
- We plan to monitor the effectiveness of the board walks in preserving biodiversity through seasonal monitoring, likely involving a graduate student thesis. . To respect the sensitive nature of the natural landscape the trail construction methodology is based around the wellbeing of the taiao.
- The trail requires the placement of eleven new bridges across the Mangawhero River. Pae Whakahaumaru along with a qualified master trail builder who will use sensitive construction techniques along with erosion and sediment control will avoid any adverse effects on the waterway including aquatic flora and fauna at each location. Therefore, while we recognise the placement of bridges affects the essence of waterways, disruption of the mouri of each waterway will be minimised as much as possible.
- New opportunities for the control of pest plants and pest animals to complement existing conservation management in the local area will result from the establishment of the trail. In specific locations, there are also opportunities to enhance the recovery of indigenous vegetation within previously disturbed areas. These ecological improvements will result in enhanced mouri of the area.
- Although interpretation has not been developed yet, it is important to note that this is a key element of the proposed trail. Interpretation will not only add to the trail experience but will also provide an opportunity for important natural, cultural and

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historical korero associated with the land and the trail to be told. Increased knowledge will enable connection with the area to be developed and inspiration to be drawn.

- Business cases have demonstrated that the proposed trails will benefit the Ruapehu District's economy. The establishment of the proposed trail will result in renewed and enhanced connection and kaitiakitanga, which benefits health and wellbeing – physically, spiritually, culturally, and economically.

Placing the taiao at the forefront of decision-making minimises the degradation of mouri of the waterways and enables improvements in the ecology and mouri of the surrounding areas. The combined effect is raised individual and community inspiration, sustenance, prosperity, and growth now and for future generations.

Holistically speaking, as the mouri of the taiao and mana of individuals and communities will be enhanced, the mana of Te Waiū-o-Te-Ika will be uplifted. The outcomes of the development of the proposed areas of Te Ara Mangawhero entwine as an integrated management approach to uphold the intrinsic values that represent the essence of Te Waiū-o-Te-Ika, therefore giving effect to Te Mana Tupua and Ngā Toka Tupua.

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Appendix 12. Construction Management Plan

TRAIL CONSTRUCTION PROTOCOL

FOR THE

TE ARA MANGAWHERO WALKING AND CYCLING TRAIL

PHASE 2 TRAIL DEVELOPMENT

30 October 2024



ROAM

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1 INTRODUCTION

This document sets out the general conditions and monitoring requirements for design and works associated with the construction of Phase 2 of the proposed Te Ara Mangawhero (TAM) dual use walking and cycling trail. Te Ara Mangawhero will be an extension of the Mountains to Sea – Ngā Ara Tūhono – and the government's Ngā Haerenga New Zealand Cycle Trails project.

Phase 2 is a 12.18 km shared use, dual direction trail that will traverse the lower slopes of Mt Ruapehu adjacent to the upper section of the Ohakune Mountain Road. As well as forming the start of the Mountains to Sea Great Ride, the trail will be a new part of the Round the Mountain (RTM) track and remove the existing 3km section of road from that multiday walking experience.

The proposed trail is intended to meet the criteria for Trail Grade 3 (will include sections of Grade 2), as per the New Zealand Cycle Trail Design Guide (2024) and standards for off-road cycle tracks on land managed by the Department of Conservation (DOC 2020). These criteria include details on maximum uphill gradient and trail width.

The average width of the completed trail will be 0.9 metres, extending to 1.5 metres where terrain permits to allow for easy passing and shared use. The maximum width of the construction alignment, including batters, will be 2.0 metres.

Boardwalks will be used in sections of sensitive terrain, such as wetlands, unconsolidated volcanic soilfields, or dense areas of tree roots. Boardwalks will also be used to provide switch-backs trails in areas of steep terrain (such as Section 9). In addition, boardwalks will be used along parts of Section 6 - Blyth Track where there is severe erosion and/or a desire to retain visibility of the historic 'corduroy' (logs placed horizontally across the track surface).

The trail will have an all-weather compacted gravel and boardwalked surface.

1.1 Dodge Contracting

Dodge Contracting is a construction and trail development company based in Hawkes Bay. They are led by Tim Dodge who is a New Zealand Cycle Trails (NZCT) recognised Master Trail Builder. Tim will be managing the overall construction process of the proposed trail. Matt Dodge will be the construction manager and will be on the ground on a daily basis doing the mahi and managing the construction team.

Dodge Contracting have extensive trail development experience within the area, including assisting with the development of the Old Coach Road trail. Matt and Tim are currently building Phase One of the Te Ara Mangawhero Trail with Ngā Waihua o Paerangi Trust.

Dodge Contracting has a good working relationship with the Trust and are guided in their work by the Trust's taiao management team and wider collective of kaimahi who have been leading taiao management on Ruapehu since 1992.

All projects are undertaken under a third party audited Health and Safety Plan relevant to the activity to be undertaken.

2 DESCRIPTION OF THE SITE

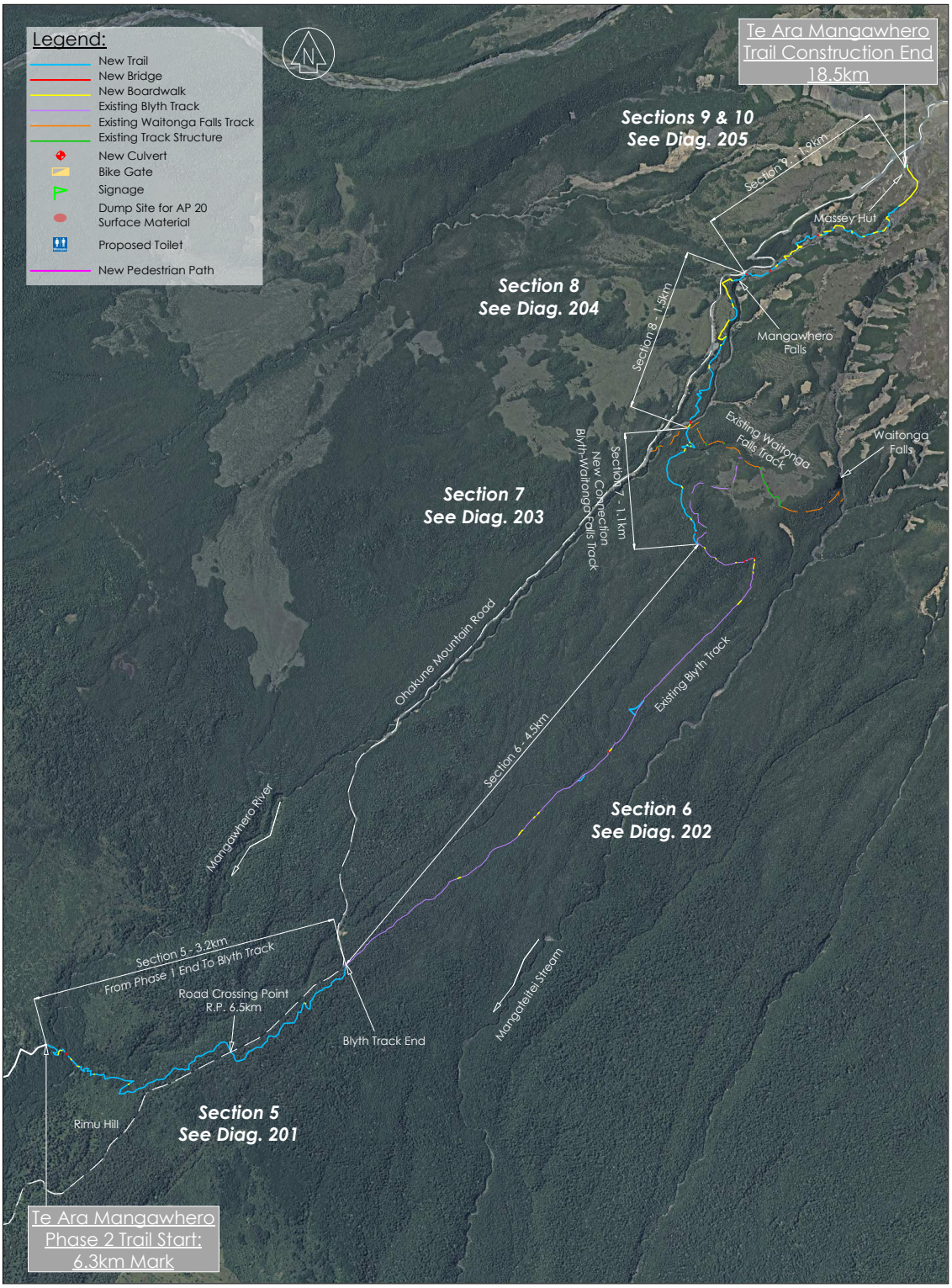


Figure 1 Proposed Trail Alignment

The route of the trail is shown in Figure 1. For more detailed maps showing the specific trail sections please see Appendix 1. The proposed trail alignment is on the southern face of Mount Ruapehu, north of Ohakune. Phase 2 of the project starts at Rimu Hill (the end of the consented Stage 1 section of Te Ara Mangawhero) and ends at Massey Flat (Massey Hut).

The proposed Te Ara Mangawhero Tail (part II) alignment is located within the forested areas (Podocarp and Beech Forest) and alpine areas of Ruapehu, and includes four crossing points over the Mangawhero River (three within the alpine area and one within the Podocarp Forest). The alignment also includes multiple smaller bridging points over gullies, channels and tributaries which feed into the Mangawhero River.

The majority of the trail is to be located within Tongariro National Park, however parts will be within the Ohakune Mountain Road (OMR) Road Reserve.

3 TRAIL DESIGN

The proposed trail has been designed to predominantly meet the Ngā Haerenga New Zealand Cycle Trails Grade 2 specifications. Parts of the upper sections of the trail will be Grade 3 due to trail gradient and the steeper and more sensitive nature of the terrain. Grade 2 could be achieved physically in these places, but with a greater impact on the conservation values at place.

The proposed trail with be a NZCT Great Ride and a trail on Public Conservation Land (PCL). The following guidelines and standards are therefore relevant for the design of the trail and associated structures:

- SNZ HB 8630:2004 New Zealand Handbook Tracks and Outdoor Visitor Structures – for structures,
- DOC Cycle Track Service Standards -October 2020
- Ngā Haerenga New Zealand Cycle Trails Design Guide – Sixth Edition – July 2024.

As the trail is to be established on Public Conservation Land (PCL), the design of the trail and associated structures will need to be in accordance with these standards.

The trail will generally comply with the standards for a Day Visitor – Walking Track for Cyclists/Mountain-Bikers and Pedestrians and NZCT Grade 2 and 3 standards.

All signs are to be in accordance with the Department of Conservation's Outdoor Sign Manual with the addition of thematic design elements to incorporate the specific Mountains to Sea identity, the trail's identity, and the design requirements of Ngā Haerenga New Zealand Cycle Trails.

The key elements of these standards and general elements of sustainable trail design are set out below and in Appendix 1. Trail design and routing has been guided by the following key standards:

Table 1 NZCT Trail Grades

	Grade 2 (Easy)	Grade 3 (Intermediate)
Description	Some gentle climbs, smooth trail. Suitable for confident beginner riders, the trail is predictable with no surprises. Social component with riders able to ride side by side at times, but possibly large sections of single trail.	Narrow trail, there will be some hills to climb, obstacles may be encountered on the trail, and there may be exposure on the edge of the trail.
Gradient	0–6% for at least 90% of trail; between 6–8.8% for steeper slopes up to 100m long, and between 8.8–10.5% for steeper slopes up to 10m long.	0–8.8% for at least 90% of trail; between 8.8–12.3% for steeper slopes up to 100m long, and a maximum of 17.5% for steeper slopes up to 10m long
Width	Between 0.9m and 1.5m for single trail (with adequate horizontal clearance to drops or banks/trees)	0.9m for 90% of the trail, 0.6m minimum (with adequate horizontal clearance to drops or banks/trees)

	Grade 2 (Easy)	Grade 3 (Intermediate)
Turn Radius	4m minimum with at least 5m desirable to outside of turn.	2.5m minimum, with at least 4m desirable to outside of turn.
Surface	Compacted top-course aggregate of maximum AP30 mm	Generally firm, but may have some short muddy or loose sections.

Table 2 Length of Proposed Trail Sections

Section	Length
Section 5 – Mangawhero to Blyth Track	3,227m
Section 6 – Existing Blyth Track	4,449m
Section 7 – Blyth Track to Waitonga Falls (RTM) Track	1,100m
Section 8 – RTM to Mangawhero Falls	1,486m
Section 9 – Mangawhero Falls to Massey Flat	1,919m
	12,181m

4 TRAIL SETOUT

A detailed trail set out process has taken place to identify the route of the proposed trail. This has included route assessments by trail builders, engineers, ecologists, landscape experts, iwi representatives and archaeologists.

In June 2024 a two day hikoi took place to review the trail corridor. Those experts referred to above were present on this hikoi and the trail route has been revised and redesigned on the basis of the advice received. Surveyors were also present who captured the results of the korero that took place. The objective of the hikoi was to identify and record a sustainable trail route that would reflect and respect the important cultural, ecological, visual and historic values at place.

The resulting trail was marked on site using flagging tape, and was electronically surveyed and mapped. The maps identify the proposed location of the trail (new and existing), boardwalks, signs, bridges and other structures. These maps were reviewed by the subject experts and revised. They were then provided to DOC staff for review.

The final proposed route was used to inform ecological, visual and archaeological assessments. More detailed structure designs, and geotechnical and hydrological assessments were also developed.

Detailed trail set out will occur in an incremental manner where the trail alignment will be inspected and confirmed prior to physical works occurring.

The route and design of the trail has been driven by the important values at place, the local and global recognition of Maunga Ruapehu, and its enduring and significant relationship with ngā uri o Ngāti Rangi.

The finalised route of the trail is shown in Figure 1. For more detailed maps showing the specific sections please see Appendix 1. A detailed breakdown of works is set out in Appendix 2.

The proposed trail is 12,181m in length. The breakdown of new and existing trail and structures is set out in Table 3 Trail Breakdownbelow.

Table 3 Trail Breakdown

Feature	Length	%
Existing Trail	4,004m	33%
New Trail	6,466m	53%
New Boardwalks	1,572m	13%
New Bridges	139m	1%

The existing trail is Section 5 on the Old Blyth Track. This is a 4,449m length of trail which includes considerable boardwalks and surface repairs to bring the trail up to grade. There also two deviations (238m) from the existing route to avoid an area of significant erosion and where the river is undercutting the trail.

5 TRAIL GRADE

The proposed trail has been designed to be a NZCT Grade 3 Trail. A Grade 2 trail was not possible in this location due to the associated environmental impact that would result from a trail with that foot print, i.e. a less steep trail would require a greater length of trail and more associated disturbance.

Table 4 Key Trail Elements and Grade

Element	Trail Grade	Specification	Notes
Trail Gradient	3	<8.8% for 90% of length 8.8-12.3% for <100m in length 12.3-17.5% for <10m in length	Section 9 and 8 largely marked at 8.8% (5 deg) Blyth Track ~7% (4deg)
Turning radius	3	2.5m min, 4.0-5.0m to outside of turn	7 corners in section 8 and 9 the rest are within Grade 2 Standards.
Trail Surface	2	Compacted gravel	
Track width	2	0.9 - 1.5m	Phase 1 is largely 1.5m. 1.5m width is required for side by side / machine access
Structure width (internal clear space)	2	1.5 - 2.5m (1.0 with fall barrier)	Phase 1 is a mix of 1.2m and 1.5m. 1.5m required for side-by-side / excavator access. FRP cost increases by ~$80/m when wider than 1.2m ($126/m to $207/m)
Structure gradient	All	NZCT - 0-5% recommended, <9% HB 8630 - 12.5% (1 in 8) for structures subject to icing	Phase 1 structures sit around 10-11%. Phase 2 structures planned to be 12.5%
Passing bays	All	Every 50m, 5m long x 2.5m wide (total inc. adjacent structure width)	

Element	Trail Grade	Specification	Notes
Barriers / hand rails (use NZCT decision framework B7)	2	1.2m high, flared at 17.5-27% Type A - bridges adjacent to road access Type B - all other bridges & boardwalks	Phase 1 is a mix of Type B (verticals @ 200mm spacing) and C (horizontal boards at max 0.5m spacing)
Sight rails	2	As per barriers	

The trail will be a steep (trail gradients are generally at the upper end of grade specs) Grade 3 trail with approximately seven Grade 3 corners on the upper sections of the trail. The balance of the trail elements, width and surface especially, will be Grade 2. The outcome of these factors will mean that the trail will be steep for beginners but technically an easy trail to ride.

6 EARTHWORKS AND TRAIL CONSTRUCTION

6.1 Construction Management

There will be two to three teams working on trail construction at any one time.

Each team will consist of four trail builders. One of these four will be a digger driver and one will be a team leader. The teams will be overseen by Matt Dodge the Contract Manager.

The project manager will manage the overall project and oversee the nature and quality of the work undertaken. During construction of the trail, the project manager and / or their delegate will undertake regular site visits to ensure the trail crew understand and are complying with the conditions set out in this report.

The project manager will be Jake Saathof from Cheal Consultants. Jake is a qualified and experienced civil engineer and project manager.

The project manager will be the key liaison between DOC and Horizons.

Additionally, a number of subcontractors including but not limited to helicopter operators, bridge builders, transport providers and structure construction contractors may be on-site from time to time. They will be operating under Dodge Construction as the principal contract holder. All subcontractors will be managed by the project manager.

In addition to hand held tools, the following machinery will be used for the development of the trail:

- 2 x 1.8 tonne diggers
- 2 x power barrows / tractors (1.5m)
- 2 x side by sides
- 1 x quad

All trail crew will be working under a third party audited health and safety plan and will go through an ecological and cultural induction prior to commencing work.

The quality of the trail build will be overseen by Tim Dodge who is a New Zealand Cycle Trails accredited Master Trail Builder.

6.2 Trail Construction Overview

The trail construction methodology is driven by the wellbeing of the ngahere (forest) and taiao (environment). The overriding intention of the construction methodology is for minimal disturbance of the environment to ensure the protection of the important ecological, historical and cultural values at site. The construction methodology has been developed to be cognisant of these values. It has also been developed to ensure long term resilience in the face of the current and future climate on the upper Maunga.

The methodology is also focused on the development of a trail that meets the relevant DOC and NZCT standards (refer Section 3 of this report). Importantly, the resulting trail surface will be resilient to erosion and will reduce ongoing maintenance issues.

6.3 Construction Principles

The aim is to build a sustainable trail that has minimal impact, resists erosion through proper design, and blends with the environment.

The following are the key principles of trail development that will be always applied:

1. The extent of works should be physically marked with stakes and/or flagging tape prior to any vegetation removal and earthworks to ensure that only the minimum area required for the trails is cleared. No areas beyond this boundary should be used during construction, e.g. as temporary storage areas for equipment or for disposal of fill.
2. No mature trees will be removed in the construction of the trail and, wherever possible, the trail will go around any trees with a height greater than 2m.
3. Felling of large indigenous trees (>15 centimetres dbh) will be avoided. Specifically, large podocarps (including rimu, miro, mataī, Hall's tōtara) and beech trees should be retained and protected from damage.
4. Trimming of large trees, particularly podocarps, will be avoided or kept to the minimum where absolutely required to form the trail corridor.
5. All vegetation clearance is to be undertaken by hand (this includes the use of hand held machinery such as chainsaws etc). This will ensure vegetation clearance is minimised, enable felled branches to be placed into the surrounding area, and any fauna such as lizards to be moved into the vegetation in the surrounding area.
6. Vegetative material that is cleared will be scattered along the trail margins, where suitable, avoiding the formation of large piles of debris.
7. If required, logs or branches can be cut into manageable sized sections suitable for spreading out along the trail margins, but they should not be mulched.
8. Physical contact with trees (large branches, and trunks in particular) will be avoided when construction materials are being transported, and during construction. All equipment and machinery used during construction will be moved with care.
9. Where trail construction is constrained by an abundance of large surface roots, the trail will generally be realigned to avoid the roots. In places where large lateral roots might extend into the footprint of the trail, a spade will be used to dig holes to assess the diameter of the roots. For roots that are larger than five centimetres , the trail will either be realigned, or fill should be placed over the roots (only a small proportion of the root system), or a section of boardwalk should be used.
10. In the event that roots greater than five centimetres in diameter are to be severed, no tree will have multiple large roots removed. All roots greater than three centimetres in diameter that are cut will be cleanly severed using a handsaw.
11. The initial trail construction width and area disturbed in the course of construction will be wider than the final ongoing maintained trail width, which is to be a minimum of 1.5m to 2m depending on the section and characteristics of the site.

12. A small percentage of the trail will be built across slopes. In these sections, in order to manager water, an outward sloping trail is preferable over a crowned or inward sloping surface which could require an inside drain and use of culverts. This is to assist any water to run across the trail and not down the trail, with minimal ongoing maintenance needs.
13. On flat country the trail surface is to be crowned with surface slope to each side of about 4%. This will avoid a trenched/dished trail surface developing with use within a short timeframe.
14. Rolling grade dips will be constructed at suitable locations to divert water off the trail and into the surrounding vegetation.
15. Fill (if not used on the trail) will be compacted at an angle similar to the surrounding slope and replanted with saved vegetation (e.g., small ferns, ground covers) and/or covered with saved humus layer material and surface litter to minimise any erosion and reduce visual impact.
16. There is no requirement for large scale earthworks in the construction of the trail. There will be a need for sediment control at all bridge sites. This will use silt fencing, coir logs or similar to reduce the movement of silt.

6.3.1 Corridor Preparation

The alignment of the trail has been surveyed and marked with flagging tape. Tall vegetation within the trail corridor will be cleared by hand, cut up as necessary and placed to the side of the trail to break down. As noted in Section 6.3.3 below, an assessment of the Old Blyth Track will be undertaken by the Master Trail Builder, an archaeologist and ecologist to identify those areas of corduroy to be preserved.

6.3.2 New Trail Development

Trail construction will be undertaken using a small 1.8T digger that will clear the trail line to form a trail width of 2m. Organic matter (tuff layer) will be removed and a benched trail will be constructed. Excess spoil will be kept within the trail corridor and used to maintain a cut and fill balance along the trail. Where the trail is within a wet area but not planned to be boardwalked, bidim cloth will be placed on the formed trail line.

The trail will then be metalled and compacted.

Metal will be trucked or flown in then deposited along the trail corridor and transported to the work site using power barrows.

6.3.3 Old Blyth Track

Section 5 follows the alignment of the Old Blyth Track. This track is a historic feature that was used as a means to access the upper mountain prior to the development of the Ohakune Mountain Road. Long sections of the trail are built on the ‘fall line’ which means the natural flow of water is down the trail. This has resulted in parts of the trail becoming heavily eroded. To address this issue, lengths of native timber were placed across the trail when it was being constructed to protect the trail surface. This timber, referred to as corduroy, was locally sourced native timber. There are still long sections of exposed and intact corduroy.

There are also long sections where the corduroy has ‘blown out’ and the trail corridor has become

heavily eroded and will need to be completely rebuilt to bring the trail up to grade. The trail surface has not been actively maintained for many years and has subsequently degraded.

A careful and considered approach has been proposed for rebuilding the Old Blyth Track. This involves corduroy protection, the use of boardwalks, and trail deviations (x2) from the existing corridor.

Recommendation 1 of the archaeological report (page 30) requires the following:

Where there are good sections of relatively flat corduroying build the TAM to one side of the corduroying by metaling or boardwalk construction and let runoff continue to run down the corduroying as at present which seems to be both preserving the timber and keeping it free of vegetation growth. These should not be a few token short sections but some good long photogenic and representative sections each minimally c100m in length. These sections should be identified prior to the trail being developed and inspected by a suitably qualified and experienced archaeologist. They will retain the historic character of the upgraded track, and users will be able to see and appreciate long sections of the corduroying more or less as they were laid.

Prior to works starting on Section 6, the Trail Crew, an ecologist and an archaeologist will walk the length of Section 6 and identify and tape those representative sections referred to.

The two proposed deviations (6.12 and 6.17) will be developed as per the process set out in 6.3.2. Board walking will be developed as per the process set out in 6.3.4.

Where the existing trail is in good condition, the trail will be widened to between 1.8m and 2m depending on the nature of the environment and surfaced. This will include those sections of corduroy which are to be buried. For those sections, gravel will be placed directly on the corduroy and compacted. Where possible, the ends of the corduroy will be left exposed to retain visibility of these trail features.

For those wet areas that are not suitable to boardwalk, the trail surface will be built up higher than the surrounding area to facilitate drainage. This will include a thick gravel layer with subsurface drainage put in place to divert the water off the trail as soon as possible. The resulting trail will be more resilient to the effects of water but still maintain the trail on the existing corridor.

6.3.4 Trail development above the Alpine Areas (Sections 8 and 9)

Trail development above the treeline will be similar to the wider route. Diggers and power barrows will only operate in the formed corridor and no spoil will be deposited outside of it. Machinery will traverse the corridor using boardwalks where they are present so as to preserve the vegetation underneath. For sections of boardwalk greater than 1m in height the digger will traverse a temporary scaffold so that it is off the ground but still able to pile holes. This approach will protect the important vegetation and habitat in these areas.

Silt fences will be used when developing the trail adjacent to wetland areas. Metal will be flown in and deposited on formed trail or areas of bare ground adjacent to the trail only. Geotextile will be used beneath metal stockpiles to protect underlaying vegetation.

6.4 Trail Drainage and Water Control

Water management is key to ensuring the development of a sustainable trail. The design of the trail has a strong focus on protecting the surface from the effects of water to create a resilient trail surface

and reduce ongoing maintenance. The use of boardwalks and bridges has been prioritised for wet areas along with the installation of subsurface drainage to remove water from the trail as soon as possible.

The trail will be sloped outwards at 4% to encourage any runoff to flow across the trail. Where run off is likely to occur, shallow swales will be placed across the trail at regular intervals to let the water cross the trail. The finished slopes will be at an angle similar to the existing natural slopes which will result in water being shed from the trail but not concentrated so that it scours the area below the trail.

Further, the following minimum trail construction standards will be used:

1. Reverse grade or rolling grade dips will be used as the main water control method on the trail and, wherever possible, this will be done at least every 10 metres (Figure 2)
2. Boardwalks will be used for any parts of the trail which are permanently or intermittently wet (i.e. ephemeral gullies).
3. Side drains, if used, shall be no less than 250 millimeters in width and 200 millimeters in depth.
4. Side drains shall be discharged using out-slope trail formation techniques and armed with local rock, if possible, with culvert pipes used as a last resort.
5. When the trail gradient is consistently up to 1 in 6 (16.7%), drainage will occur every 10-15 metres of trail.

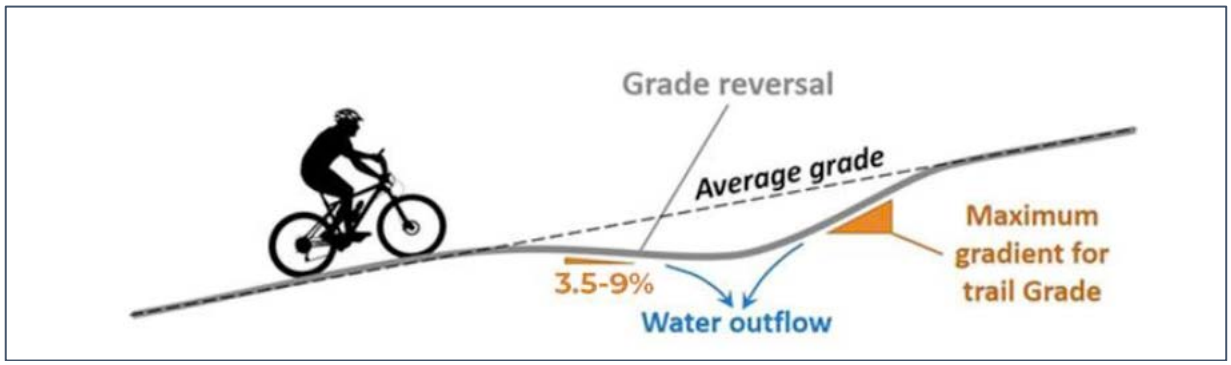


Figure 2 Grade Reversals

6.5 Materials Brought onto Site

Helicopter-drop locations will be used to deliver supplies to the construction front. These will be at set locations along the route. For sections 5, 6 and 7 existing clearings or gaps in the forest canopy will be used for helicopter-drop locations.

If access is within one kilometre of road access or staging points, tracked low ground pressure dumpers will be used to transport material to site.

If material for trail construction is required to be brought from outside of the Park, it will come from the following sources:

1. AP65– Scoria Pit, Taura Metal Supplies Ltd, Ohakune
2. AP20 – Berrys Pit, Tohunga Junction, Ohakune

7 STRUCTURES

The project will include the development of bridges, boardwalks, barriers, toilets and signs.

Designs for all proposed structures can be found in Appendix 5 and Appendix 6.

Ongoing maintenance requirements for the bridges will include 2-yearly checks by qualified civil engineer inspectors and 6-yearly checks by an appropriately qualified bridge engineer.

All structures are required to have an engineering design and approval to Department of Conservation standards. This includes all bridges, handrails, and boardwalks. Ownership of all structures will be with the Trust and any building or resource consents will be in the name of the Trust.

Data on all structures on Public Conservation Land will be maintained in the Trust's and the Department of Conservation's asset management systems to ensure ongoing management in the public interest, but they will be recorded as '*owned and maintained by iwi*' and as such will not incur capital charge, depreciation and ongoing maintenance costs for the Department.

7.1 Boardwalks

1,572 meters of boardwalks are proposed to be developed as part of this trail. The use of boardwalks (rather than a natural surfaced trail) has been prioritised in the following locations:

- In wet areas or areas likely to be subject to inundation by water.
- Within close proximity to wetlands.
- Over or adjacent to areas of high ecological value such as alpine or wetland vegetation.
- In areas of rock or loose material where significant earthworks or physical works would be required to create an 'in grade' trail surface.
- Where the excavation of a trail could lead to slope destabilisation.
- Where climatic effects, such as the effects of frost heave or heavy rainfall, are likely to lead to significant adverse maintenance impacts and/or off site effects.

Boardwalks are proposed to be constructed using a Fiberglass Reinforced Polymer (FRP) decking. FRP is proposed to be used (instead of more conventional wooden boardwalking) for the following reasons:

- Reduced physical impact on the land where the boardwalking is proposed.
- Lower impacts on vegetation underneath the boardwalk due to increased light.
- Visually less intrusive as it can be coloured to suit the environment.
- More visually permeable so features (such as OBT corduroy) can be visible.
- Has a non-slip surface which reduces the need to apply an additional slip resistant treatment (plastic or rubber netting).
- More resilient to the effects of snow and ice – proven use in alpine areas such as Kosciuszko National Park in Australia.
- Is lighter, so faster and easier to install which reduces offsite development effects and requires less helicopter trips etc. to transport to site.
- Longer lifespan (20 years +) so cheaper to maintain and less physical works required over its lifespan.

The FRP panels will be flown onto the site in bundles. They will be installed by hand onto wooden/steel substructure. The FRP panels are clipped onto the joists. The width of the panels will be 1.8m which will be the standard width of the boardwalks.

The piles will be driven into the ground using the onsite digger Or concreted into augered pile holes. In areas of rock, piles will be bolted into rock and/or bolted onto concrete bearers poured onsite on top of rock. For sections of boardwalk greater than 1m in height the digger will traverse a temporary scaffold so that it is off the ground but still able to pile holes. This approach will protect the important vegetation and habitat in these areas.

For longer curved boardwalks, some of the panels will require cutting to achieve the desired angle. All cutting will be done within the trail corridor on drop sheets. Cutting tools will also have vacuum attachments to ensure there is no residue left in the environment.

7.2 Bridge Development

This CMP covers the development of the bridges and boardwalks listed in Appendix 2.

The location of these bridges is shown on the Plans in Appendix 1

Proposed bridge designs can be found in Appendix 5 and Appendix 6 with the locations of bridges shown in Appendix 1.

Geotechnical and Hydrological assessments have been undertaken for each of the bridge sites to demonstrate that they will be sound and not impacted by flood events. These assessments can be found in Appendix 7 and 8.

All bridges will be constructed as follows:

1. All bridges will span over the waterways to avoid contamination.
2. Clearance of vegetation at bridge construction sites is to be kept to a minimum. All construction of structures under the safe lifting capacity of helicopters will be completed off-site. Some structures will need to be manufactured in components and assembled on-site to fit within safe helicopter lifting capacity limits.
3. Balustrades on bridge sides will be 1200mm high, suitable for off-tarmac cyclists.
4. Width and deck capacity of all structures are to be built to a standard that meets loading for a 1.8 Tonne digger and maintenance machinery.
5. Building consent will be obtained from Ruapehu District Council for all bridges over 1 metre high.

Most of these structures will be constructed on wooden piled abutments. Excavation of the abutments will be done using a small (1.8 Tonne) digger on site or hand dug. Any excess spoil from this excavation will be used as fill for the bridge approaches, compacted and metalled when the trail is surfaced.

Prior to these holes being excavated a silt fence will be constructed between the holes and the waterway. Silt fences will be ‘dug in’ to a depth of 200mm and constructed as per the guidelines

contained in the 'Erosion and Sediment Control Guide for Disturbing Activities in the Wellington Region, dated February 2021' ('the Wellington guidelines').

The holes for the **piles** will be excavated using an auger attached to a 1.8 Tonne digger. Any excess spoil from this excavation will be used as fill in the trail corridor, compacted and metalled when the trail is surfaced. The amount of spoil is anticipated to be like that of a large fence post with most of the foundation designs have a 600mm diameter pile hole.

Construction of the bigger bridges (5.8.B, 8.3.B, 9.1.B and 9.3.B) will require concrete abutments. The erosion and sediment controls to be used in the development of these bridges are set out in the construction management plan submitted with the resource consent application.

Figure 3 shows the basic design of the bridges to be developed. The red line is the approximate position (between the foundations and the waterway) of the silt fences.

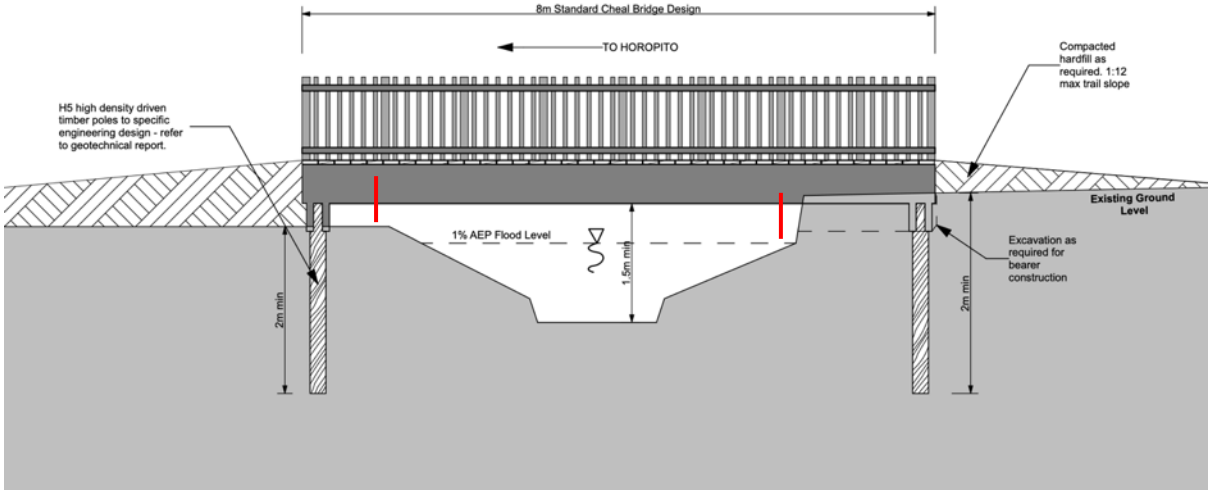


Figure 3 Location of silt fence for bridge development

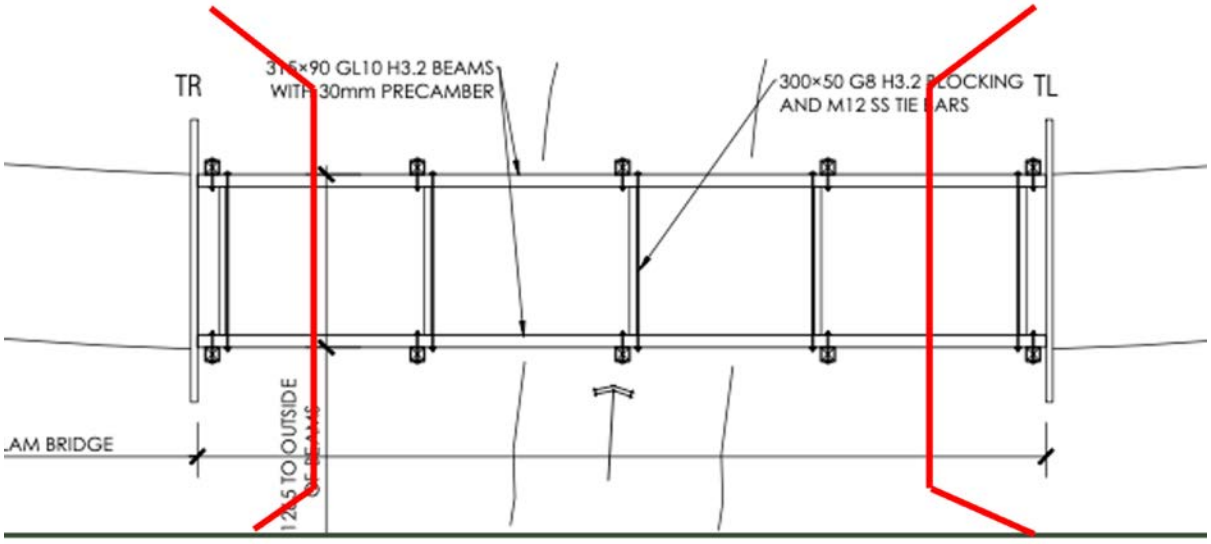


Figure 4 Plan View: Location of silt fence for bridge development

The silt fence will be removed once the spoil has been removed, the piles are secure in the ground and all earthworks within 20m of the waterway have been completed.

There will be no commencement of works associated with the major bridges (greater than 15m in length) until at least four (4) days of dry weather[1] has been forecast by the New Zealand Meteorological Service (MetService) for the water body's catchment.

In the event of any un-forecasted heavy rain, work will cease, and any uncompacted loose material will be moved to a location where it will not be washed into the waterway. Any construction materials and equipment will be kept in safe and elevated locations away from flood-prone areas, including any overland flow paths.

7.3 Barriers

Two types of barriers are to be used to exclude the wrong type of users from sections of the trails. The locations of these barriers are shown on the maps in Appendix 1.

Squeeze barriers will be used at locations where the trail is accessible from the road. Squeeze barriers allow access by walkers and cyclists but exclude motorbikes and larger vehicles. Gates (locked) will be located next to the squeezes to allow access to the trail by machinery for trail maintenance etc.

Bike barriers will be placed on the RTM track where it intersects with the shared use trail. These barriers allow easy access for walkers but not for those on bikes.

7.4 Toilets

One toilet is proposed to be developed within the Road Reserve at the bottom of the Old Blyth Track. Its location is shown in Appendix 1. The toilet will be vaulted so there will be no associated discharge of waste to the surrounding environment. The toilet will be regularly maintained, with waste removed from the site by truck and disposed of in the Ohakune wastewater system.

One toilet is also proposed to be developed adjacent to Massey Hut for use by trail users.

7.5 Signs

Wayfinding and safety signage will be installed along the route of the trail as part of the build process.

Safety signage will be installed at road crossings and wayfinding signs at intersections. A trail head sign will also be placed at Massey Flat with key safety and route-finding information about the trail.

In addition, distance markers will be placed along the track at km intervals.

Signs will be developed as per the Mountains to Sea Signage Guidelines which can be viewed here: https://www.dropbox.com/s/844ekmpk2og84n1/M2SNZ%20Signage%20Guidelines_0520.pdf?dl=0

[1] Dry weather is defined as sunny, partially cloudy or overcast but does not include light or heavy precipitation.

8 EROSION AND SEDIMENT CONTROL

All works will be undertaken in accordance with this Construction Management Plan. As it relates to erosion and sediment control, this plan has been guided by the specific principles and practices appropriate for the activity as contained within the document titled 'Erosion and Sediment Control Guide for Disturbing Activities in the Wellington Region, dated February 2021'. Additional specific principles, procedures and practices are set out below.

- Waterways are shown on the detailed drawings in Appendix 1. All waterways will either be bridged or boardwalked. There will be no culverts put in place. There are no anticipated points of discharge associated with the proposed development.
- There will be no soil disturbance within 20m of any waterway sites when there are forecasted or heavy rainfall events.
- Sediment control measures will be limited to the use of silt fences at bridge sites and for works within 20m of a waterway or 10m of a wetland.
- Given the extent and nature of the works proposed, it is anticipated that the silt fences adjacent to streams will be adequate to protect these streams from the impacts of extreme rainfall events. The amount of loose sediment on site at any one time will not be significant.
- The nature of the earth disturbance and associated sediment control for bridge development is set out in Section 7.2.
- Any exposed cuts or batters will be covered in sterile straw to promote revegetation[2]. Where possible, these areas will be replanted using vegetation taken from within the trail corridor.

Sediment control measures associated with bridge development are shown in Figure 3 and Figure 4.

There will be no commencement of works over the bed of the Mangawhero River and other waterways until there is at least four (4) days of settled weather forecast by the New Zealand Meteorological Service (MetService) for the water body's catchment.

In the event of any un-forecasted heavy rain, work will cease, and any uncompacted loose material will be moved to a location where it will not be washed into the waterway. Any construction materials and equipment will be kept in safe and elevated locations away from flood-prone areas, including any overland flow paths.

8.1 Flood Contingency Plan

A flood contingency plan is required to be developed for the construction of the bridges along the route of the proposed trail.

Given the scale of the proposed bridge development, there is not likely to be a risk posed to neighbouring properties. All development is to be undertaken outside of the riverbed and above a 100-year flood water level. Once the foundations of the bridges are in, the soffit, decking and balustrades of the bridges can be constructed within 1 – 2 days.

[2] This was a technique used successfully on the recent upgrade of the adjacent Ohakune Mountain Road

9 ECOLOGICAL EFFECTS

The trail will be developed in a manner consistent with the recommendations contained in Section 11 of the Assessment of Ecological Effects for a Proposed Shared Use Trail on the Lower Slopes of Mount Ruapehu – Contract Report 5405i October 2024

Specifically this will be the considerations set out in sections 11.2 to 11.7 of Wildlands 2024.

Developing the trail with due regard to the matters listed in these sections will reduce the magnitude of adverse effects associated with the development of the trail can be avoided or reduced to minor or less than minor.

10 ACCIDENTAL DISCOVERY PROTOCOL

The proposed route of the trail is away from any known wāhi tapu sites. It is possible that unknown wāhi tapu sites could be discovered during the construction of the trail.

Staff working on the trail will be trained to identify any potential wāhi tapu sites. If they find or suspect a wāhi tapu site, they will stop work immediately and follow Ngāti Rangi policy and inform appropriate iwi leaders and the Department of Conservation. If any human bones are found the Police will also be contacted.

11 HAZARDOUS MATERIALS

Refilling of machinery or plant will be restricted to designated areas away from water courses or bodies of water, and all fuel storage containers will be double bunded with anti-spill nozzles to reduce potential for spills on-site.

All machinery or plant will be serviced off-site, and before transportation will be steam cleaned to prevent transfer of pathogens, weed sources and soils.

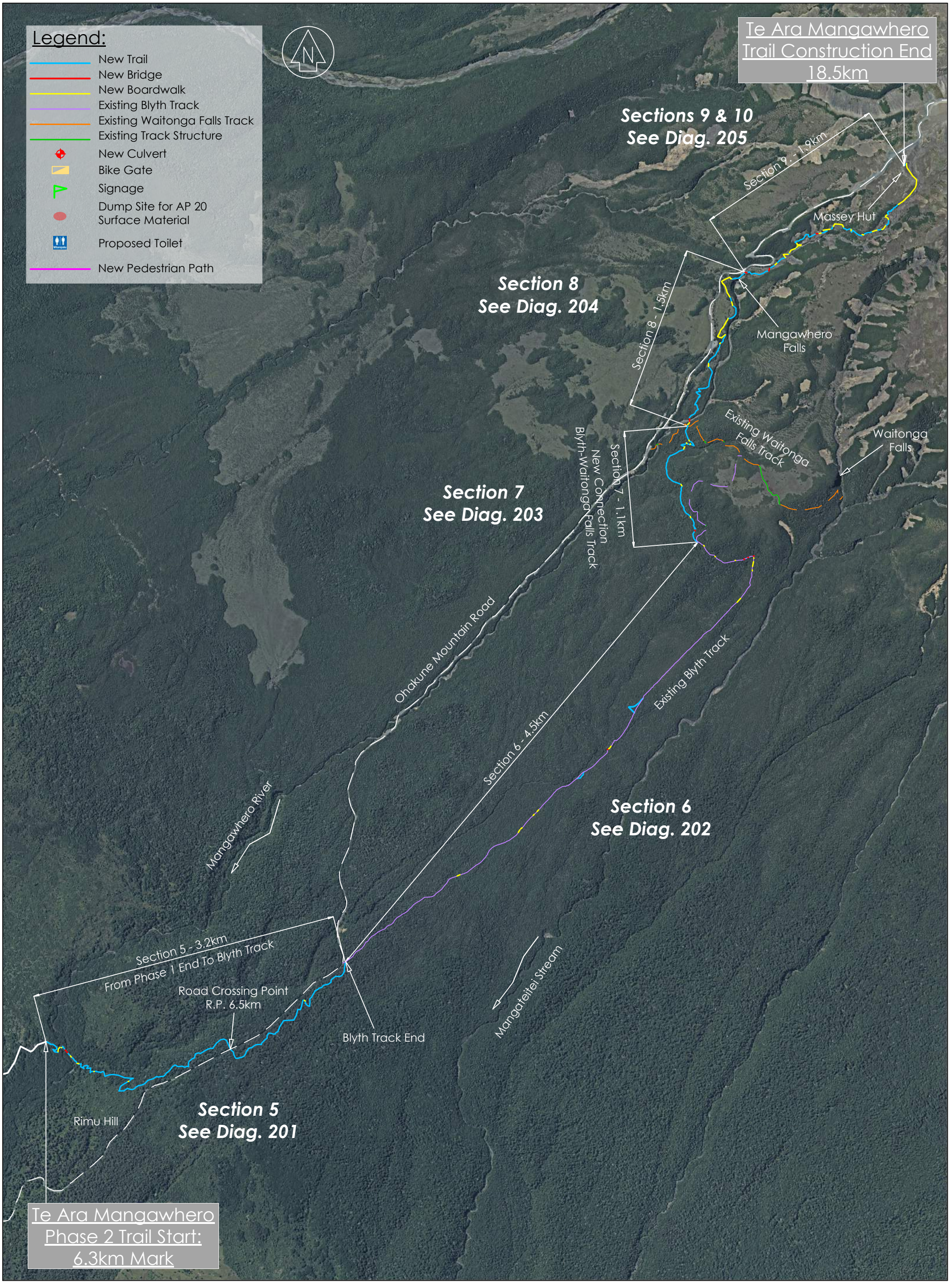
Daily site meetings/briefings and training will identify risks and potential issues to ensure all potential effects are minimised and contained within the construction zone. Spill kits will be on-site for quick response to any unforeseen accidents.

12 PERMISSIONS

All parts of the Te Ara Mangawhero will be built and maintained in accordance with relevant permission (concession, works approval and resource consent) documents that are obtained in order to develop the trail.

All conditions that form part of those permissions will be complied with in the development of the trail and associated structures.

Appendix 1. Te Ara Mangawhero Phase 2 Maps



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Rev	Date	Amendment	By	Chk	App
A	12/08/24	First Issue	AJW	DS	DS

Project Title
Ngā Waihua o Paerangi Trust
Te Ara Mangawhero Trail

Drawing Title
Phase Two Construction Trail Sections Overview

Surveyed	D.Sherrit	Sept-Nov 23	DS
Designed	C.J.Olmi	01/12/23	CJO
Drawn	A.White	12/08/24	AJW
Checked	D.Sherrit	12/08/24	DS
Approved	D.Sherrit	12/08/24	DS

Status **INFORMATION**

Scale A3 1:22500 | A3

Drawing Number 210700-200 | Rev A

Legend:

- New Pedestrian Path
- New Trail
- New Bridge
- New Boardwalk
- Existing Blyth Track
- Existing Waitonga Falls Track
- Existing Track Structure
- New Culvert
- Bike Gate
- Signage
- Dump Site for AP 20
- Surface Material
- Proposed Toilet

Section 9
Diag. 205

Section 8
Diag. 204

Section 7
Diag. 203

Section 6
Diag. 202

Section 5
Diag. 201

Waitonga Falls

Road

Mountain

Mangawhero River

Ohakune

Mangateitei Stream

A

B

Locality Plan

Scale 1:50000

Section 5/6 Transition

POWER

Existing Blyth Track Carpark

Turoa Ski Field Power Cable (Ground)

Wharepaku

5.20.W
Boardwalk
8m

5.21

Ohakune Mountain Road

5.18
Ohakune Mountain Road
R.P. 6.5km existing sealed road
New 2 x 300Ø culverts in existing table drains

5.19

225m min. Sight Distance

5.17

250m min. Sight Distance

Turoa Ski Field Power Cable (Ground)

Diag. 201 B

Phase 1
Last Segment
(4.4)

5.4.W
Boardwalk
11m

5.8.B
Mangawhero Bridge
24m

5.5

5.3

5.6.W
Boardwalk
3m

5.7

5.1

5.10.W
Boardwalk
10m

5.9

5.12.W
Boardwalk
12m

5.11

5.2.W
Boardwalk
14m

5.13

5.15

5.17

5.14.W
Boardwalk
3m

5.16.W
Boardwalk
5m
(Tree roots)

Mangawhero River

Rimu Hill

Ohakune Mountain Road

Phase 2
Trail Construction Start:
6.3km Mark

Diag. 201 A

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Rev	Date	Amendment	By	Chk	App
A	12/08/24	First Issue	AJW	DS	DS

Project Title
Ngā Waihua o Paerangi Trust
Te Ara Mangawhero Trail

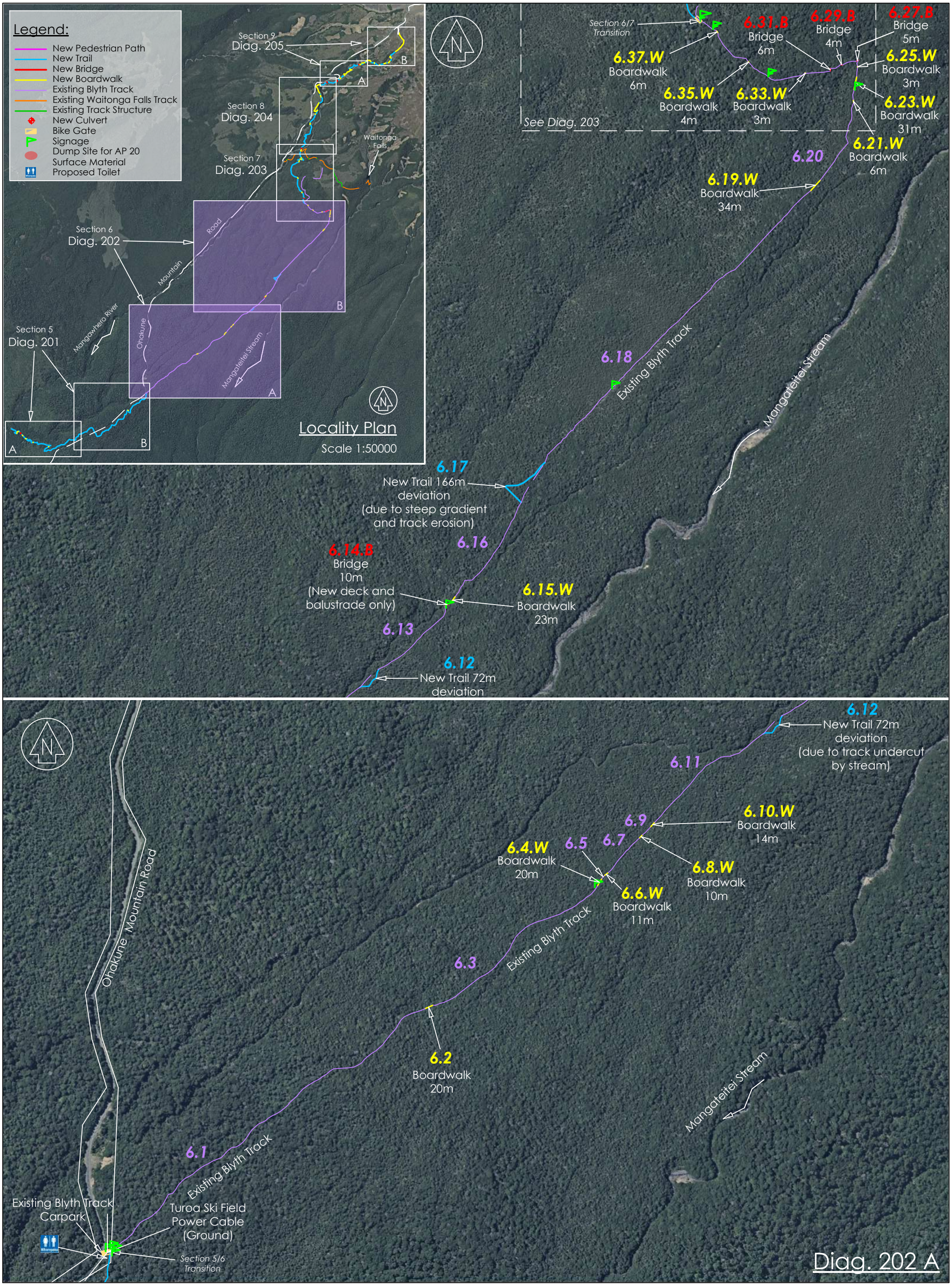
Drawing Title
Phase Two Construction
Trail Section Detail

Surveyed	D.Sherrit	Sept-Nov 23	DS
Designed	C.J.Olmi	01/12/23	CJO
Drawn	A.White	12/08/24	AJW
Checked	D.Sherrit	12/08/24	DS
Approved	D.Sherrit	12/08/24	DS

Status **INFORMATION**

Scale A3 1:4000 | A3

Drawing Number 210700-201 | Rev A



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Rev	Date	Amendment	By	Chk	App
A	12/08/24	First Issue	AJW	DS	DS

Project Title
Ngā Waihua o Paerangi Trust
Te Ara Mangawhero Trail

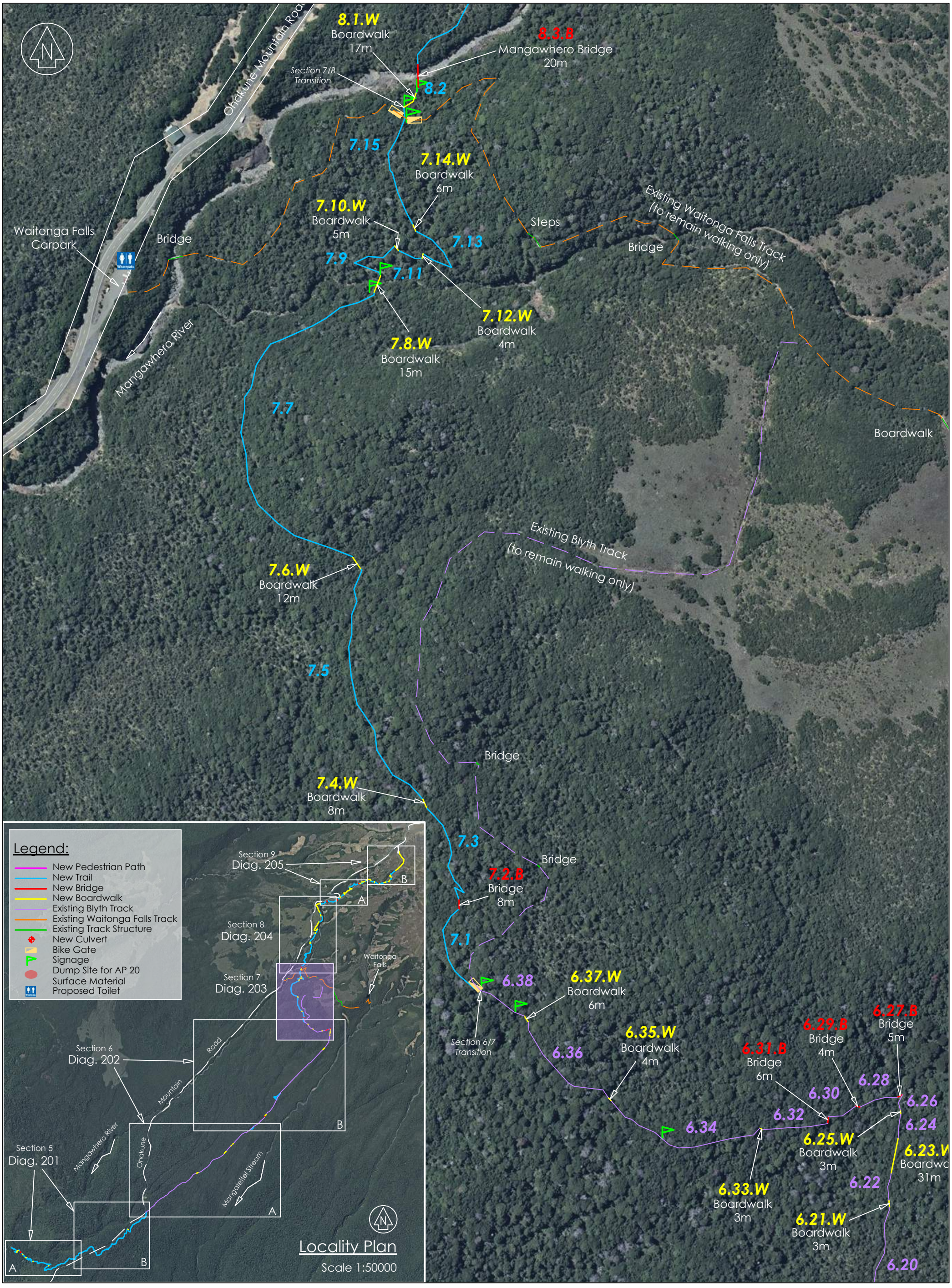
Drawing Title
Phase Two Construction
Trail Section Detail

Surveyed	D.Sherrit	Sept-Nov 23	DS
Designed	C.J.Olmi	01/12/23	CJO
Drawn	A.White	12/08/24	AJW
Checked	D.Sherrit	12/08/24	DS
Approved	D.Sherrit	12/08/24	DS

Status **INFORMATION**

Scale A3 1:8000 | A3

Drawing Number 210700-202 | Rev A



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Rev	Date	Amendment	By	Chk	App
A	12/08/24	First Issue	AJW	DS	DS

Project Title
Ngā Waihua o Paerangi Trust
Te Ara Mangawhero Trail

Drawing Title
Phase Two Construction
Trail Section Detail

Surveyed	D.Sherrit	Sept-Nov 23	DS
Designed	C.J.Olmi	01/12/23	CJO
Drawn	A.White	12/08/24	AJW
Checked	D.Sherrit	12/08/24	DS
Approved	D.Sherrit	12/08/24	DS

Status INFORMATION

Scale A3 1:3000 | A3

Drawing Number 210700-203 | Rev A

Legend:

- New Pedestrian Path
- New Trail
- New Bridge
- New Boardwalk
- Existing Blyth Track
- Existing Waitonga Falls Track
- Existing Track Structure
- New Culvert
- Bike Gate
- Signage
- Dump Site for AP 20
- Surface Material
- Proposed Toilet

Section 9
Diag. 205

Section 8
Diag. 204

Section 7
Diag. 203

Section 6
Diag. 202

Section 5
Diag. 201

Waitonga Falls

Road

Mountain

Ohakune

Mangawhero River

Mangateitei Stream

A

B

Locality Plan

Scale 1:50000

Section 8/9 Transition

Existing steps to be ramped

8.15

9.2

9.1.B
Mangawhero Bridge
14m

8.14.W
Boardwalk
195m

Mangawhero Falls

8.13

8.12.W
Boardwalk
25m

8.11

8.10.W
Boardwalk
174m

Barrier
15m

8.9.W
Elevated Boardwalk
and Barrier
25m

8.8

8.7.W
Boardwalk
7m

8.6

Mangawhero River

Ohakune Mountain Road

8.5.W
Boardwalk
20m

8.4

8.1.W
Boardwalk
17m

8.3.B
Mangawhero Bridge
20m

Section 7/8 Transition

8.2

Existing Waitonga Falls Track

7.15

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Rev	Date	Amendment	By	Chk	App
A	12/08/24	First Issue	AJW	DS	DS

Project Title
Ngā Waihua o Paerangi Trust
Te Ara Mangawhero Trail

Drawing Title
Phase Two Construction
Trail Section Detail

Surveyed	D.Sherrit	Sept-Nov 23	DS
Designed	C.J.Olmi	01/12/23	CJO
Drawn	A.White	12/08/24	AJW
Checked	D.Sherrit	12/08/24	DS
Approved	D.Sherrit	12/08/24	DS

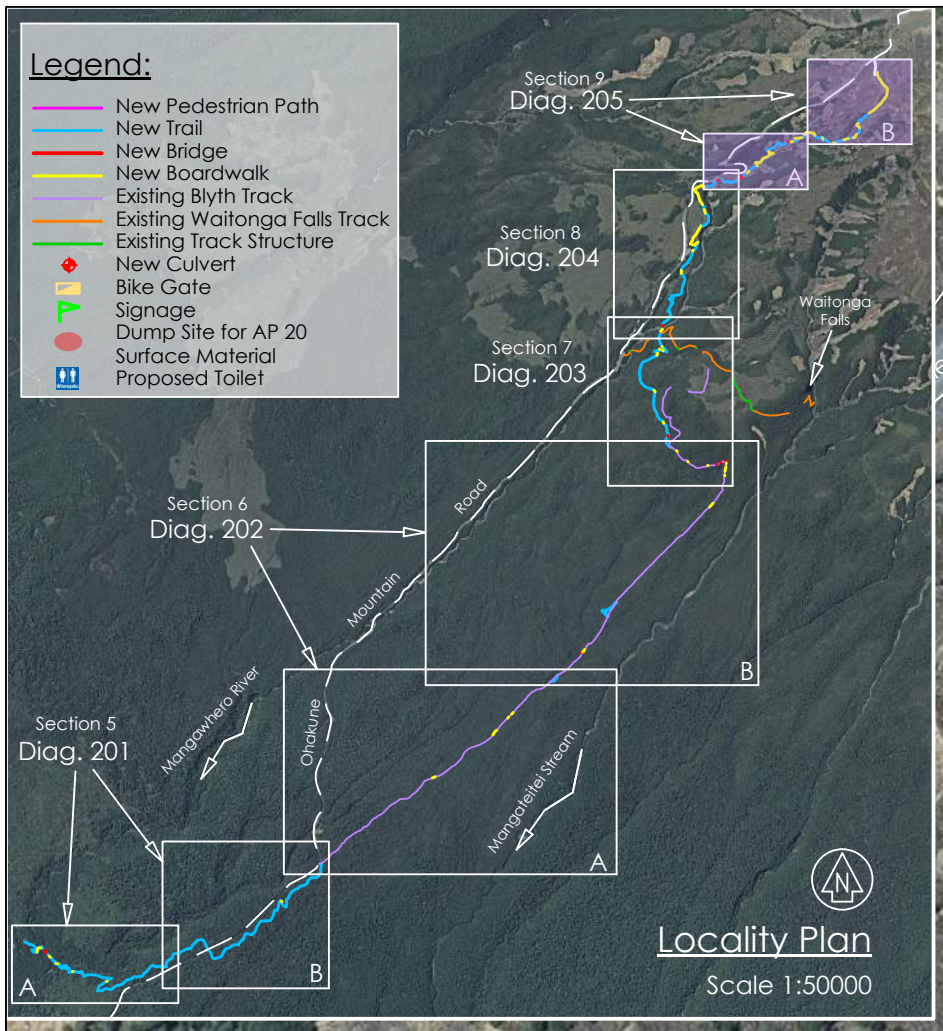
Status **INFORMATION**

Scale A3 1:3000 | A3

Drawing Number 210700-204 | Rev A

Legend:

- New Pedestrian Path
- New Trail
- New Bridge
- New Boardwalk
- Existing Blyth Track
- Existing Waitonga Falls Track
- Existing Track Structure
- New Culvert
- Bike Gate
- Signage
- Dump Site for AP 20
- Surface Material
- Proposed Toilet



Locality Plan

Scale 1:50000

Existing access road (gravel)

Phase 2
Trail Construction End:
18.5km

Massey Hut

Barriered Boardwalk 340m

Mangawhero River

9.32 9.31.W 9.30 9.29.W Boardwalk 46m 9.28 9.27.W Boardwalk 36m 9.26 9.25.W Boardwalk 30m 9.24 9.23.W Boardwalk 12m 9.22 9.21.W Boardwalk 10m 9.20 9.19.W Boardwalk 85m

Diag. 205 B

9.18 9.15.W Boardwalk 13m 9.13.B Bridge 14m 9.16 9.14 9.12 9.17.W Barriered Boardwalk 46m

Ohakune Mountain Road

9.11.W Barriered Boardwalk 85m 9.10 9.9.W 50m Boardwalk with 30m Barrier 9.8 9.7.W Boardwalk 57m 9.6 9.5.W Boardwalk 16m 9.4 9.3.B Bridge 18m 9.2 8.15 9.1.B Mangawhero Bridge 14m

Section 8/9 Transition

Diag. 205 A

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Rev	Date	Amendment	By	Chk	App
A	12/08/24	First Issue	AJW	DS	DS

Project Title
Ngā Waihua o Paerangi Trust
Te Ara Mangawhero Trail

Drawing Title
Phase Two Construction
Trail Section Detail

Surveyed	D.Sherrit	Sept-Nov 23	DS
Designed	C.J.Olmi	01/12/23	CJO
Drawn	A.White	12/08/24	AJW
Checked	D.Sherrit	12/08/24	DS
Approved	D.Sherrit	12/08/24	DS

Status **INFORMATION**

Scale A3 1:2500 | A3

Drawing Number 210700-205 | Rev A



Trail Section Details

Section	Segment	Name	Length (m)	Start Chainage (m)	End Chainage (m)	Description
5	5.1	New Trail	171	6358	6529	
	5.2.W	Boardwalk	14	6529	6543	New
	5.3	New Trail	7	6543	6550	
	5.4.W	Boardwalk	11	6550	6561	New
	5.5	New Trail	10	6561	6571	
	5.6.W	Boardwalk	3	6571	6574	New
	5.7	New Trail	53	6574	6627	
	5.8.B	Bridge	24	6627	6651	New over Mangawhero River
	5.9	New Trail	28	6651	6679	
	5.10.W	Boardwalk	10	6679	6689	New
	5.11	New Trail	60	6689	6749	
	5.12.W	Boardwalk	12	6749	6761	New
	5.13	New Trail	221	6761	6982	
	5.14.W	Boardwalk	3	6982	6985	New
	5.15	New Trail	326	6985	7311	
	5.16.W	Boardwalk	5	7311	7316	New
	5.17	New Trail	1022	7316	8338	
	5.18	New Trail	9	8338	8347	Ohakune Mountain Road intersection
	5.19	New Trail	756	8347	9103	
	5.20.W	Boardwalk	8	9103	9111	New
	5.21	New Trail	474	9111	9585	
6	6.1	Existing formed trail	973	9585	10558	Existing Blyth Track
	6.2	Boardwalk	20	10558	10578	New
	6.3	Existing formed trail	486	10578	11064	Existing Blyth Track
	6.4.W	Boardwalk	20	11064	11084	New
	6.5	Existing formed trail	9	11084	11093	Existing Blyth Track
	6.6.W	Boardwalk	11	11093	11104	New
	6.7	Existing formed trail	108	11104	11212	Existing Blyth Track
	6.8.W	Boardwalk	10	11212	11222	New
	6.9	Existing formed trail	27	11222	11249	Existing Blyth Track
	6.10.W	Boardwalk	14	11249	11263	New
	6.11	Existing formed trail	333	11263	11596	Existing Blyth Track
	6.12	New Trail	72	11596	11668	Deviation
	6.13	Existing formed trail	220	11668	11888	Existing Blyth Track
	6.14.B	Bridge	10	11888	11898	New Deck Only
	6.15.W	Boardwalk	23	11898	11921	New
	6.16	Existing formed trail	277	11921	12198	Existing Blyth Track
	6.17	New Trail	166	12198	12364	Deviation
	6.18	Existing formed trail	890	12364	13254	Existing Blyth Track
	6.19.W	Boardwalk	34	13254	13288	New
	6.2	Existing formed trail	207	13288	13495	Existing Blyth Track
	6.21.W	Boardwalk	3	13495	13498	New
	6.22	Existing formed trail	24	13498	13522	Existing Blyth Track
	6.23.W	Boardwalk	31	13522	13553	New
	6.24	Existing formed trail	22	13553	13575	Existing Blyth Track
	6.25.W	Boardwalk	3	13575	13578	New
	6.26	Existing formed trail	14	13578	13592	Existing Blyth Track
	6.27.B	Bridge	5	13592	13597	New
	6.28	Existing formed trail	34	13597	13631	Existing Blyth Track
	6.29.B	Bridge	4	13631	13635	New
	6.3	Existing formed trail	26	13635	13661	Existing Blyth Track
	6.31.B	Bridge	6	13661	13667	New
	6.32	Existing formed trail	57	13667	13724	Existing Blyth Track
	6.33.W	Boardwalk	3	13724	13727	New
	6.34	Existing formed trail	148	13727	13875	Existing Blyth Track
	6.35.W	Boardwalk	4	13875	13879	New
	6.36	Existing formed trail	104	13879	13983	Existing Blyth Track
	6.37.W	Boardwalk	6	13983	13989	New
	6.38	Existing formed trail	45	13989	14034	Existing Blyth Track
7	7.1	New Trail	90	14034	14124	
	7.2.B	Bridge	8	14124	14132	New
	7.3	New Trail	106	14132	14238	
	7.4.W	Boardwalk	8	14238	14246	New
	7.5	New Trail	227	14246	14473	
	7.6.W	Boardwalk	12	14473	14485	New
	7.7	New Trail	346	14485	14831	
	7.8.B	Bridge	15	14831	14846	New
	7.9	New Trail	67	14846	14913	
	7.10.W	Boardwalk	5	14913	14918	New
	7.11	New Trail	22	14918	14940	
	7.12.W	Boardwalk	4	14940	14944	New
	7.13	New Trail	74	14944	15018	
	7.14.W	Boardwalk	6	15018	15024	New
	7.15	New Trail	110	15024	15134	Intersection with Waitonga Falls Track
8	8.1.W	Boardwalk	17	15134	15151	New
	8.2	New Trail	5	15151	15156	
	8.3.B	Bridge	20	15156	15176	New over Mangawhero River
	8.4	New Trail	509	15176	15685	
	8.5.W	Boardwalk	20	15685	15705	New
	8.6	New Trail	154	15705	15859	
	8.7.W	Boardwalk	7	15859	15866	New
	8.8	New Trail	69	15866	15935	
	8.9.W	Boardwalk	25	15935	15960	New elevated and barriered
	8.10.W	Boardwalk	174	15960	16134	New, 15m barrier
	8.11	New Trail	127	16134	16261	
	8.12.W	Boardwalk	25	16261	16286	New
	8.13	New Trail	34	16286	16320	
	8.14.W	Boardwalk	195	16320	16515	New
	8.15	New Trail	105	16515	16620	
9	9.1.B	Bridge	14	16620	16634	New over Mangawhero River
	9.2	New Trail	158	16634	16792	
	9.3.B	Bridge	19	16792	16811	New over Mangawhero River
	9.4	New Trail	42	16811	16853	
	9.5.W	Boardwalk	16	16853	16869	New
	9.6	New Trail	69	16869	16938	
	9.7.W	Boardwalk	57	16938	16995	New
	9.8	New Trail	13	16995	17008	
	9.9.W	Boardwalk	50	17008	17058	New with 30m barrier
	9.1	New Trail	10	17058	17068	
	9.11.W	Boardwalk	85	17068	17153	New barriered
	9.12	New Trail	191	17153	17344	
	9.13.B	Bridge	14	17344	17358	New
	9.14	New Trail	7	17358	17365	
	9.15.W	Boardwalk	13	17365	17378	New
	9.16	New Trail	70	17378	17448	
	9.17.W	Boardwalk	46	17448	17494	New barriered
	9.18	New Trail	31	17494	17525	
	9.19.W	Boardwalk	85	17525	17610	New
	9.2	New Trail	62	17610	17672	
	9.21.W	Boardwalk	10	17672	17682	New
	9.22	New Trail	105	17682	17787	
	9.23.W	Boardwalk	12	17787	17799	New
	9.24	New Trail	63	17799	17862	
	9.25.W	Boardwalk	30	17862	17892	New
	9.26	New Trail	34	17892	17926	
	9.27.W	Boardwalk	36	17926	17962	New
	9.28	New Trail	51	17962	18013	
	9.29.W	Boardwalk	46	18013	18059	New
	9.3	New Trail	119	18059	18178	
	9.31.W	Boardwalk	340	18178	18518	New barriered
	9.32	New Trail	21	18518	18539	Massey Hut - Trail End 18.5km

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Rev	Date	Amendment	By	Chk	App
A	12/08/24	First Issue	AJW	DS	DS

Project Title

Ngā Waihua o Paerangi Trust
Te Ara Mangawhero Trail

Drawing Title

Phase Two Construction
Engineering Table

Surveyed	D.Sherrit	Sept-Nov 23	DS
Designed	C.J.Olmi	01/12/23	CJO
Drawn	A.White	12/08/24	AJW
Checked	D.Sherrit	12/08/24	DS
Approved	D.Sherrit	12/08/24	DS

Status **INFORMATION**

Scale A3 Not To Scale | A3

Drawing Number 210700-206 | Rev A

Appendix 2. Trail and Structure Schedule

Section	Segment	Name	Length (m)	Start Chainage (m)	End Chainage (m)	Description
5	5.1	New Trail	171	6358	6529	
	5.2.W	Boardwalk	14	6529	6543	New
	5.3	New Trail	7	6543	6550	
	5.4.W	Boardwalk	11	6550	6561	New
	5.5	New Trail	10	6561	6571	
	5.6.W	Boardwalk	3	6571	6574	New
	5.7	New Trail	53	6574	6627	
	5.8.B	Bridge	24	6627	6651	New over Mangawhero River
	5.9	New Trail	28	6651	6679	
	5.10.W	Boardwalk	10	6679	6689	New
	5.11	New Trail	60	6689	6749	
	5.12.W	Boardwalk	12	6749	6761	New
	5.13	New Trail	221	6761	6982	
	5.14.W	Boardwalk	3	6982	6985	New
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	6.6.W	Boardwalk	11	11093	11104	New
	6.7	Existing formed trail	108	11104	11212	Existing Blyth Track
	6.8.W	Boardwalk	10	11212	11222	New
	6.9	Existing formed trail	27	11222	11249	Existing Blyth Track
	6.10.W	Boardwalk	14	11249	11263	New
	6.11	Existing formed trail	333	11263	11596	Existing Blyth Track
	6.12	New Trail	72	11596	11668	Deviation

Section	Segment	Name	Length (m)	Start Chainage (m)	End Chainage (m)	Description
	6.13	Existing formed trail	220	11668	11888	Existing Blyth Track
	6.14.B	Bridge	10	11888	11898	New Deck Only
	6.15.W	Boardwalk	23	11898	11921	New
	6.16	Existing formed trail	277	11921	12198	Existing Blyth Track
	6.17	New Trail	166	12198	12364	Deviation
	6.18	Existing formed trail	890	12364	13254	Existing Blyth Track
	6.19.W	Boardwalk	34	13254	13288	New
	6.2	Existing formed trail	207	13288	13495	Existing Blyth Track
	6.21.W	Boardwalk	3	13495	13498	New
	6.22	Existing formed trail	24	13498	13522	Existing Blyth Track
	6.23.W	Boardwalk	31	13522	13553	New
	6.24	Existing formed trail	22	13553	13575	Existing Blyth Track
	6.25.W	Boardwalk	3	13575	13578	New
	6.26	Existing formed trail	14	13578	13592	Existing Blyth Track
	6.27.B	Bridge	5	13592	13597	New
	6.28	Existing formed trail	34	13597	13631	Existing Blyth Track
	6.29.B	Bridge	4	13631	13635	New
	6.3	Existing formed trail	26	13635	13661	Existing Blyth Track
	6.31.B	Bridge	6	13661	13667	New
	6.32	Existing formed trail	57	13667	13724	Existing Blyth Track
	6.33.W	Boardwalk	3	13724	13727	New
	6.34	Existing formed trail	148	13727	13875	Existing Blyth Track
	6.35.W	Boardwalk	4	13875	13879	New
	6.36	Existing formed trail	104	13879	13983	Existing Blyth Track
	6.37.W	Boardwalk	6	13983	13989	New
	6.38	Existing formed trail	45	13989	14034	Existing Blyth Track
7	7.1	New Trail	90	14034	14124	
	7.2.B	Bridge	8	14124	14132	New
	7.3	New Trail	106	14132	14238	
	7.4.W	Boardwalk	8	14238	14246	New
	7.5	New Trail	227	14246	14473	
	7.6.W	Boardwalk	12	14473	14485	New
	7.7	New Trail	346	14485	14831	
	7.8.B	Bridge	15	14831	14846	New

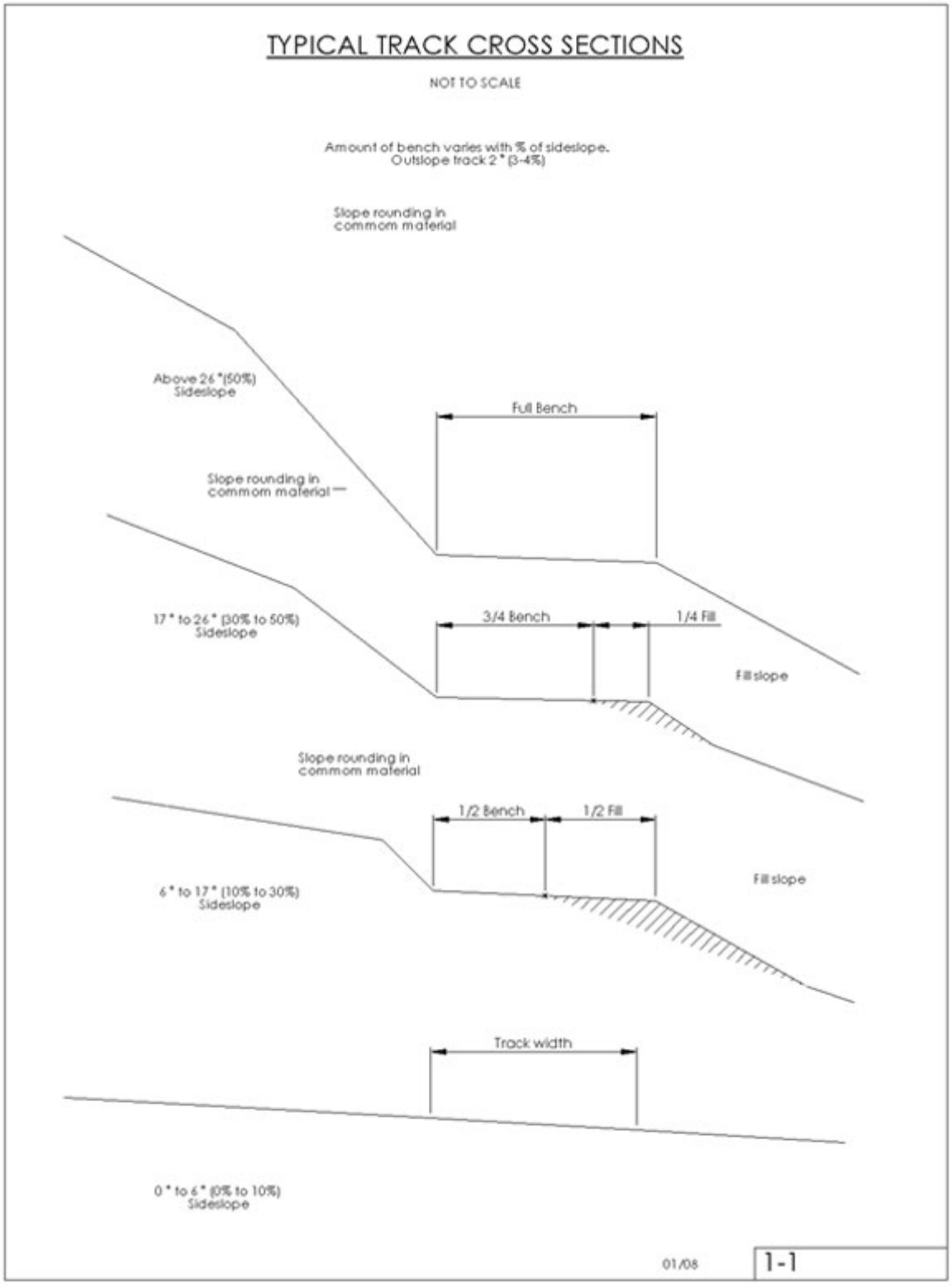
Section	Segment	Name	Length (m)	Start Chainage (m)	End Chainage (m)	Description
	7.9	New Trail	67	14846	14913	
	7.10.W	Boardwalk	5	14913	14918	New
	7.11	New Trail	22	14918	14940	
	7.12.W	Boardwalk	4	14940	14944	New
	7.13	New Trail	74	14944	15018	
	7.14.W	Boardwalk	6	15018	15024	New
	7.15	New Trail	110	15024	15134	Intersection with Waitonga Falls Track
8	8.1.W	Boardwalk	17	15134	15151	New
	8.2	New Trail	5	15151	15156	
	8.3.B	Bridge	20	15156	15176	New over Mangawhero River
	8.4	New Trail	509	15176	15685	
	8.5.W	Boardwalk	20	15685	15705	New
	8.6	New Trail	154	15705	15859	
	8.7.W	Boardwalk	7	15859	15866	New
	8.8	New Trail	69	15866	15935	
	8.9.W	Boardwalk	25	15935	15960	New elevated and barriered
	8.10.W	Boardwalk	174	15960	16134	New, 15m barrier
	8.11	New Trail	127	16134	16261	
	8.12.W	Boardwalk	25	16261	16286	New
	8.13	New Trail	34	16286	16320	
	8.14.W	Boardwalk	195	16320	16515	New
	8.15	New Trail	105	16515	16620	
9	9.1.B	Bridge	14	16620	16634	New over Mangawhero River
	9.2	New Trail	158	16634	16792	
	9.3.B	Bridge	19	16792	16811	New over Mangawhero River
	9.4	New Trail	42	16811	16853	
	9.5.W	Boardwalk	16	16853	16869	New
	9.6	New Trail	69	16869	16938	
	9.7.W	Boardwalk	57	16938	16995	New
	9.8	New Trail	13	16995	17008	
	9.9.W	Boardwalk	50	17008	17058	New with 30m barrier
	9.1	New Trail	10	17058	17068	
	9.11.W	Boardwalk	85	17068	17153	New barriered
	9.12	New Trail	191	17153	17344	
	9.13.B	Bridge	14	17344	17358	New
	9.14	New Trail	7	17358	17365	
	9.15.W	Boardwalk	13	17365	17378	New
	9.16	New Trail	70	17378	17448	
	9.17.W	Boardwalk	46	17448	17494	New barriered

Section	Segment	Name	Length (m)	Start Chainage (m)	End Chainage (m)	Description
	9.18	New Trail	31	17494	17525	
	9.19.W	Boardwalk	85	17525	17610	New
	9.2	New Trail	62	17610	17672	
	9.21.W	Boardwalk	10	17672	17682	New
	9.22	New Trail	105	17682	17787	
	9.23.W	Boardwalk	12	17787	17799	New
	9.24	New Trail	63	17799	17862	
	9.25.W	Boardwalk	30	17862	17892	New
	9.26	New Trail	34	17892	17926	
	9.27.W	Boardwalk	36	17926	17962	New
	9.28	New Trail	51	17962	18013	
	9.29.W	Boardwalk	46	18013	18059	New
	9.3	New Trail	119	18059	18178	
	9.31.W	Boardwalk	340	18178	18518	New barriered
	9.32	New Trail	21	18518	18539	Massey Hut - Trail End 18.5km

Appendix 3. Notes on trail construction near larger trees

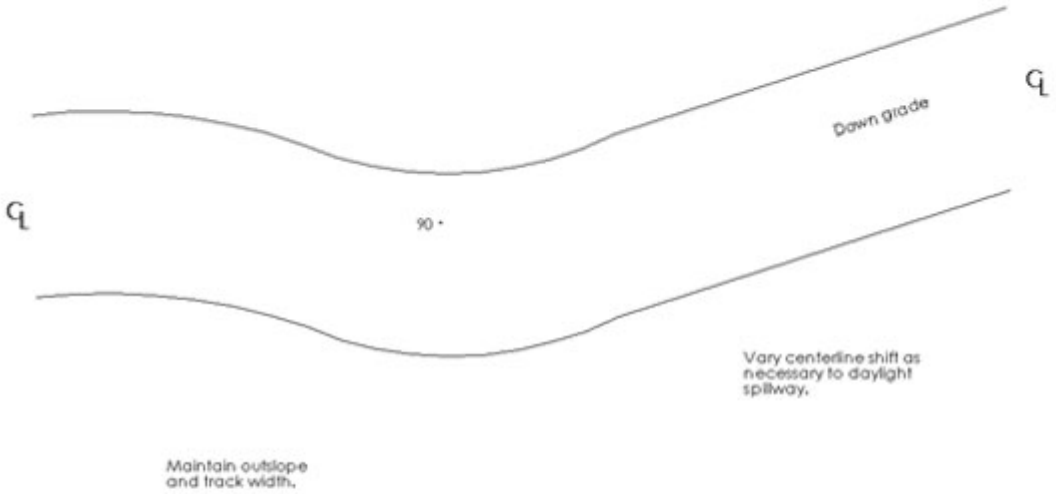
Species	Common Name	Distance within which large surface laterals are likely to be common	Notes on Trail Construction Near Large Trees
Dacrydium cupressinum	Rimu	3 metres	Highly variable surface root length. Large trees in close proximity to trail should be assessed on a case-by- case basis.
Podocarpus laetus	Halls Tōtara	4-6 metres	Separation distance of 4 metres should avoid large surface roots of most trees. Some larger trees may have large surface roots out to 6 metres.
Pectinopitys ferruginea	Miro	4-8 metres	Separation distance of 4 metres should avoid large surface roots for most trees. Some larger trees may have large surface roots to 8 metres.
Prumnopitys taxifolia	Mataī		
Weinmannia Kāmahi racemosa	Kāmahi	2 metres	Trail can probably be as close as 0.5- 1 metre from trees less than 20 cm diameter if no large surface laterals are damaged.

Appendix 4. Trail Construction Drawings



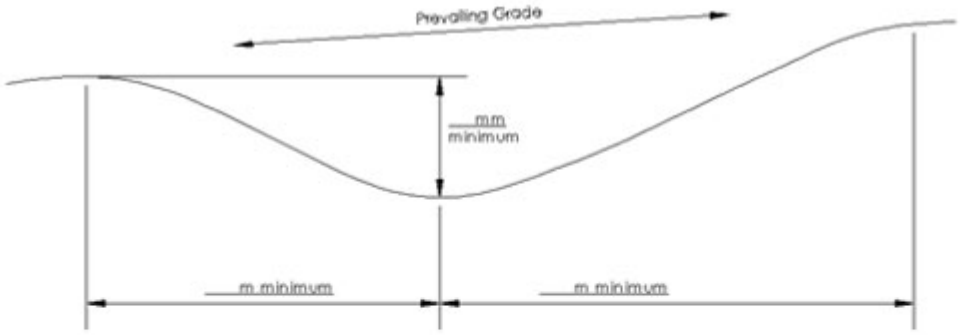
Drainage DIP

NOT TO SCALE



PLAN VIEW

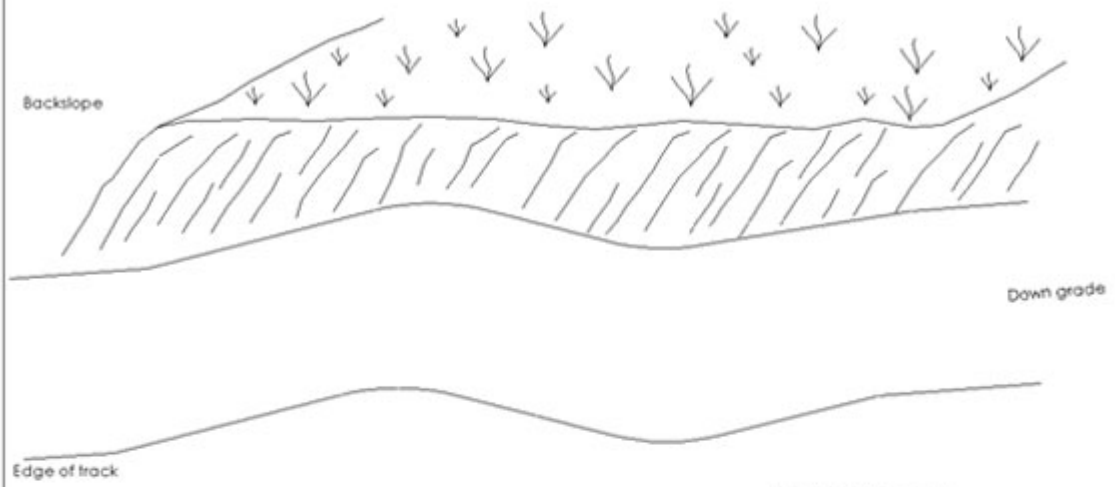
Refer 'Drainage Dip' table for dimensions under Water Management



PROFILE

ROLLING DIP

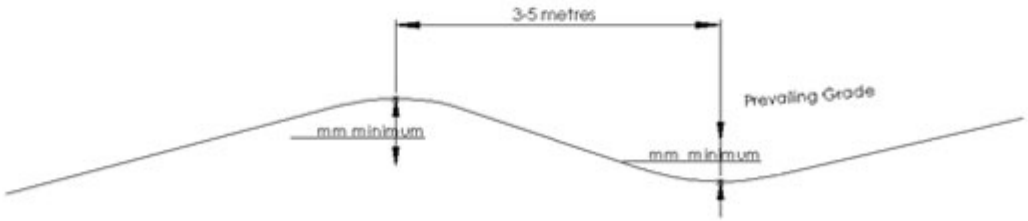
NOT TO SCALE



If spill point of dip is not to daylight, construct lead-off ditch to daylight.

Skew top and bottom of dip *

PLAN VIEW



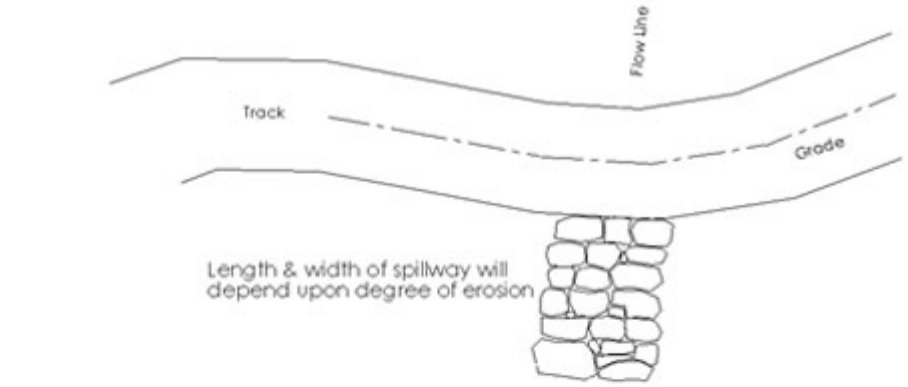
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01/08

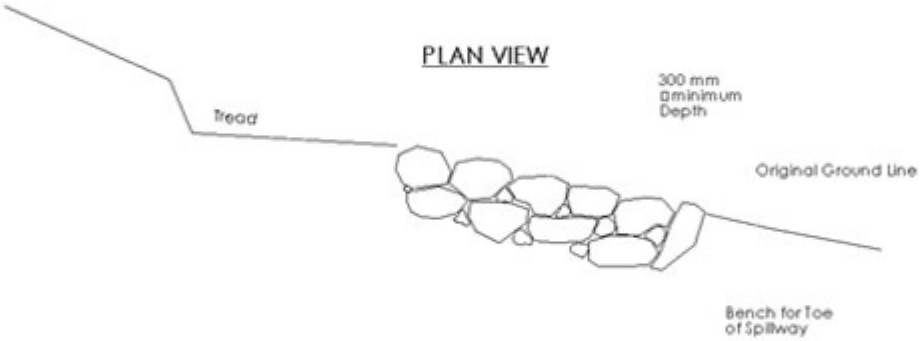
2-2

ROCK SPILLWAY

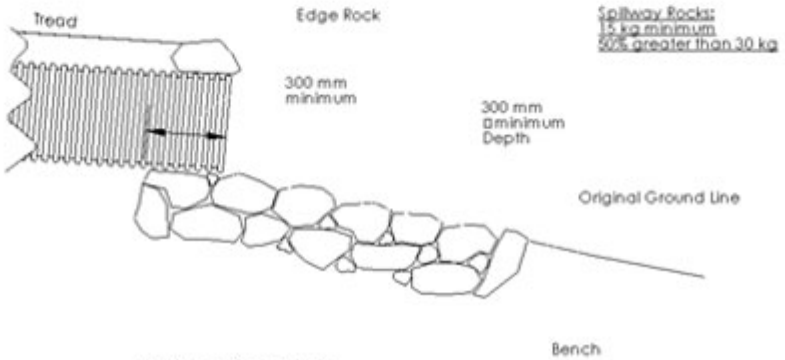
NOT TO SCALE



PLAN VIEW



TYPICAL CROSS SECTION
DRAINAGE DIP OR CROSS DRAINAGE



TYPICAL CULVERT CROSS SECTION

01/08

Appendix 5. Boardwalk and Small Bridge Designs

Bridges 6.27, 6.29, 6.31, 7.2, 9.13 & Boardwalks 9.11, 9.29, 9.31

Te Ara Mangawhero Trail

Drawing List

Number	Name	Rev.
S-100	Locality Plans	A
S-110	Bridge 6.27.B	A
S-111	Bridge 6.27.B	A
S-120	Bridge 6.29.B	A
S-121	Bridge 6.29.B	A
S-130	Bridge 6.31.B	A
S-131	Bridge 6.31.B	A
S-140	Bridge 7.2.B	A
S-141	Bridge 7.2.B	A
S-150	Bridge 9.13.B	A
S-151	Bridge 9.13.B	A
S-200	Boardwalks Site Plan	A
S-210	Boardwalk 9.11.W 3D View	A
S-211	Boardwalk 9.11.W Plan 1	A
S-212	Boardwalk 9.11.W Plan 2	A
S-213	Boardwalk 9.11.W Joists Plan	A
S-214	Boardwalk 9.11.W Bearers & Piles Plan	A
S-215	Boardwalk 9.11.W Sections	A
S-216	Boardwalk 9.11.W Sections	A
S-220	Boardwalk 9.29W 3D View	A
S-221	Boardwalk 9.29W Plan 1 & 2	A
S-222	Boardwalk 9.29W Joist, Bearers & Piles	A
S-223	Boardwalk 9.29W Sections	A
S-230	Boardwalk 9.31W 3D View	A
S-231	Boardwalk 9.31W Plan1	A
S-232	Boardwalk 9.31W Plan 2	A
S-233	Boardwalk 9.31W Plan 1 & 2 Joists	A
S-234	Boardwalk 9.31W Plan 1 & 2 Bearers & Piles	A
S-235	Boardwalk 9.31W Plan 3	A

Drawing List

Number	Name	Rev.
S-236	Boardwalk 9.31W Plan 4	A
S-237	Boardwalk 9.31W Plan 3 & 4 Joists	A
S-238	Boardwalk 9.31W Plan 3 & 4 Bearers & Piles	A
S-239	Boardwalk 9.31W Plans 5 & 6	A
S-240	Boardwalk 9.31W Plans 5 & 6 Joist, Bearers & Piles	A
S-241	Boardwalk 9.31W Plans 7 & 8	A
S-242	Boardwalk 9.31W Plans 7 & 8 Joist, Bearers & Piles	A
S-243	Boardwalk 9.31W Plan 9	A
S-244	Boardwalk 9.31W Plan10	A
S-245	Boardwalk 9.31W Plans 9 & 10 Joists	A
S-246	Boardwalk 9.31W Plans 9 & 10 Bearers & Piles	A
S-247	Boardwalk 9.31W Plans 11 & 12	A
S-248	Boardwalk 9.31W Plans 11 & 12 Joist, Bearers & Piles	A
S-249	Boardwalk 9.31W Sections	A
S-250	Boardwalk 9.31W Sections	A
S-251	Boardwalk 9.31W Sections	A
S-252	Boardwalk 9.31W Sections	A
S-253	Boardwalk 9.31W Sections	A
S-300	Boardwalks Typical details	A
S-301	Boardwalks Typ. Piles Details	A
S-302	Boardwalks Typ. Piles Details	A

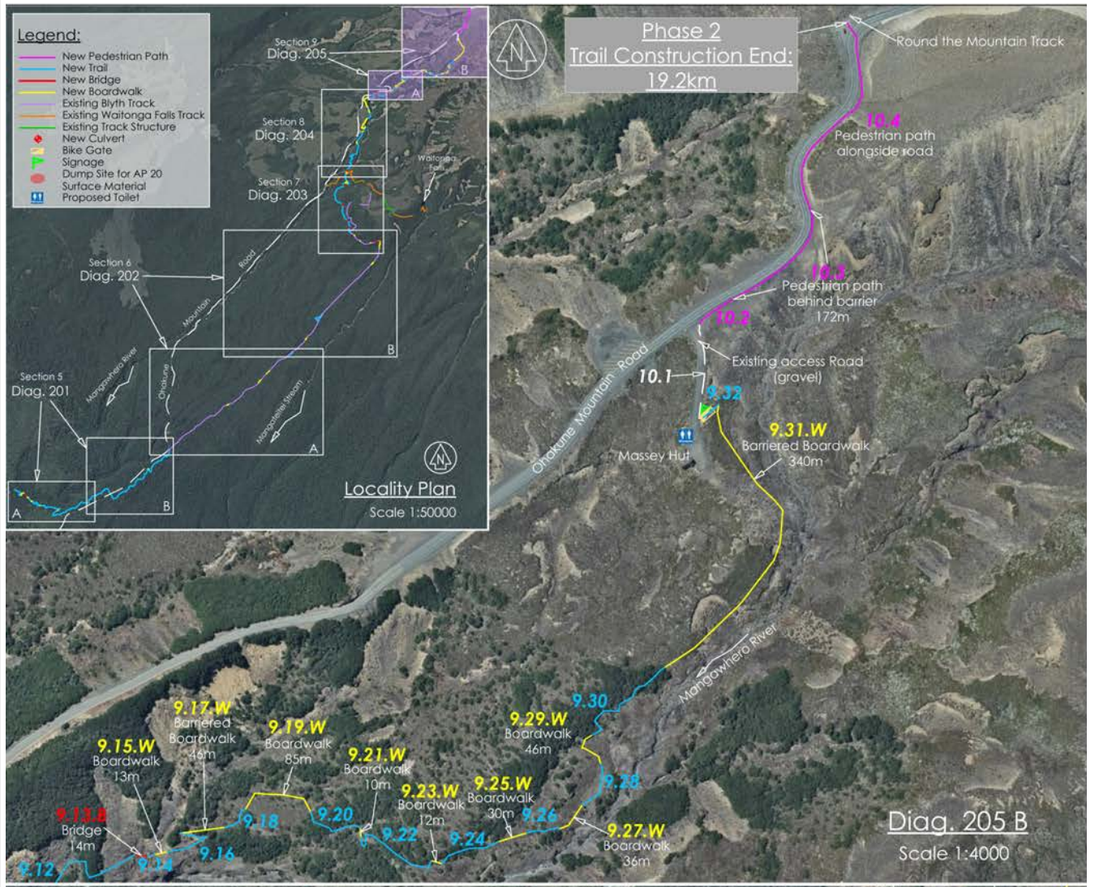
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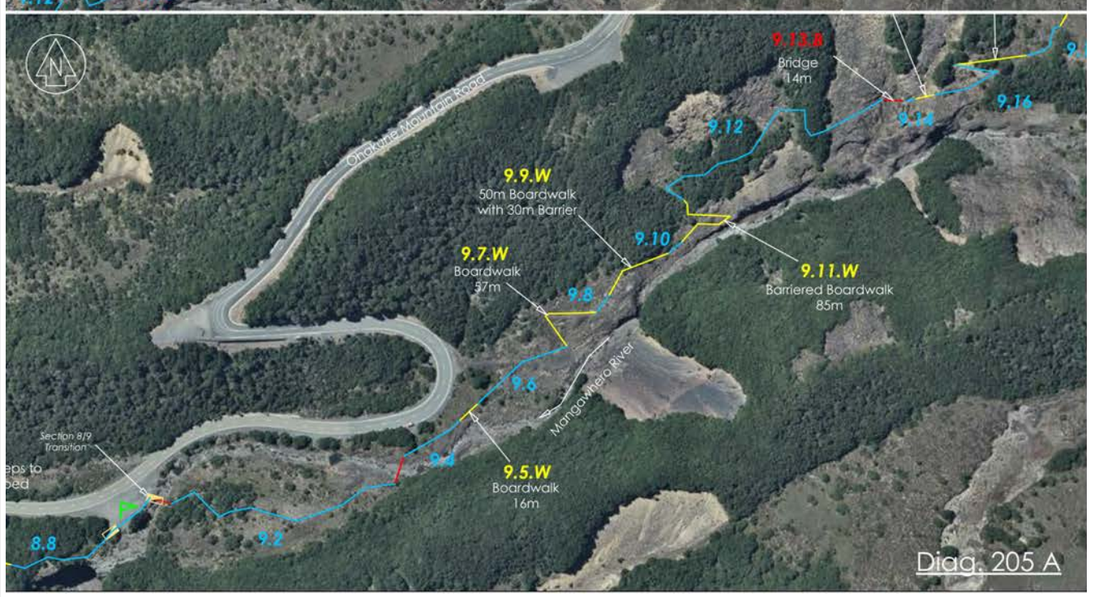
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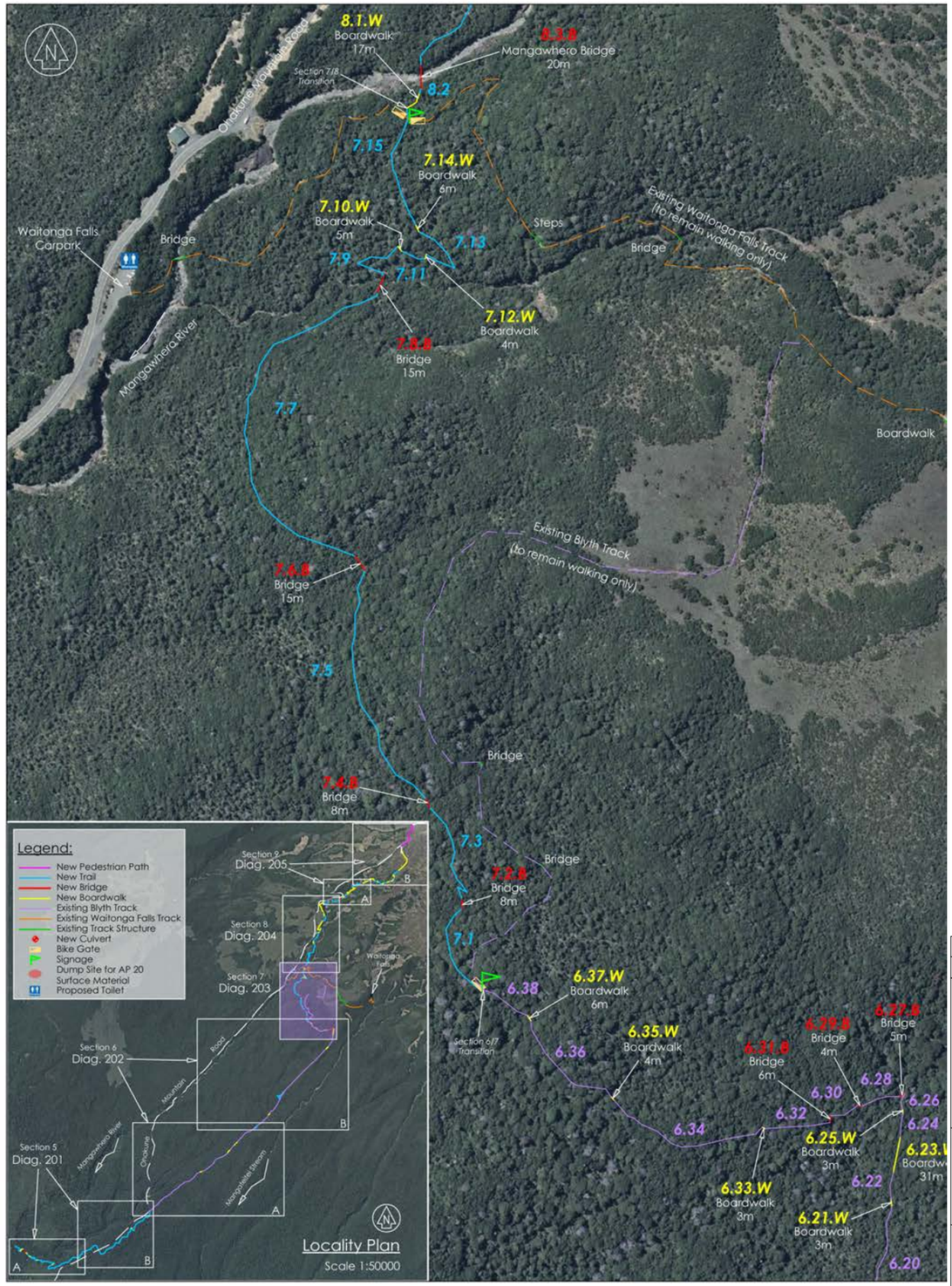
15 Hihitahi Rise Paihia, New Zealand, 0200 W I www.taiao-design.com

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A	JLA	Concept	17.10.24
Rev	**By**	**Amendment**	**Date**

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Bridges 6.27, 6.29, 6.31, 7.2, 9.13 & Boardwalks 9.11, 9.29, 9.31

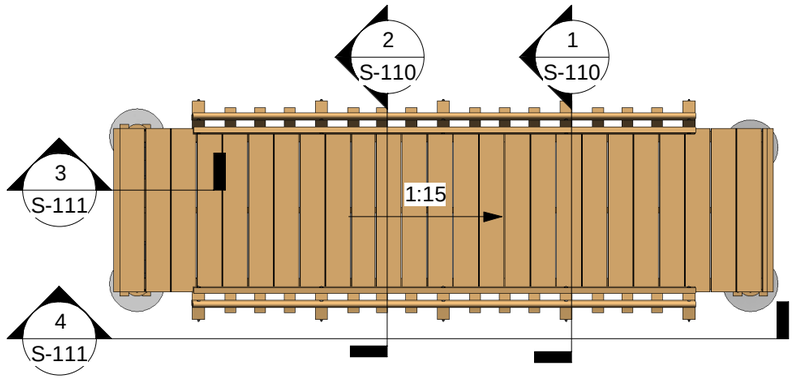
Te Ara Mangawhero Trail

Drawing Name

Locality Plans S-100

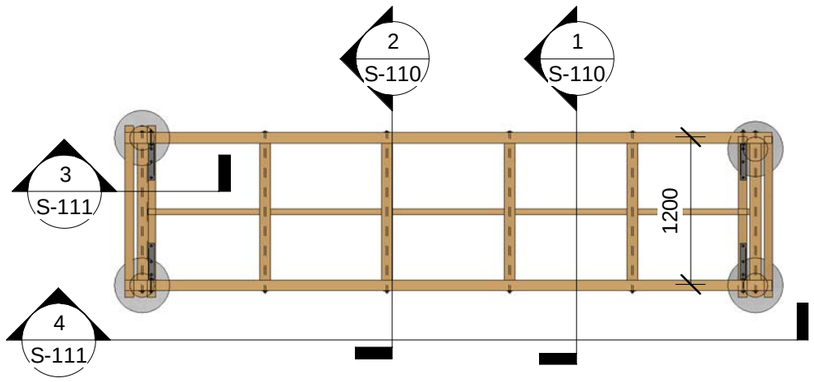
DATE: **07/08/2024**

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JLA	**NW**
SCALE **1 : 3000**	REV. **A**



Floor Plan

1 : 50



Framing Plan

1 : 50

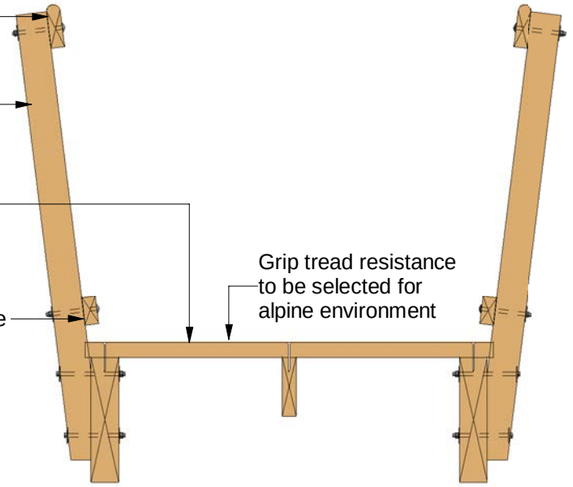


140x45 SG8 H3.2 With rounded top edge. Fixed with 1/M12 SS coach bolt set flush to inside with 50x50x3 SS washer to outside.

100x100 SG8 H4 posts @ 1m centers with 7 degree angle

200 x 50 H5 SG8 Decking with 10-15mm gaps between. Screw to beams using 2 x 125mm long type 17 - 14gauge SS bugle screws each end and to central nog

90x45 SG8 H4 bottom rail, fixed with 1/M12 SS coach bolt set flush to inside with 50x50x3 SS washer to outside



1 / S-110 **Section** 1 : 20

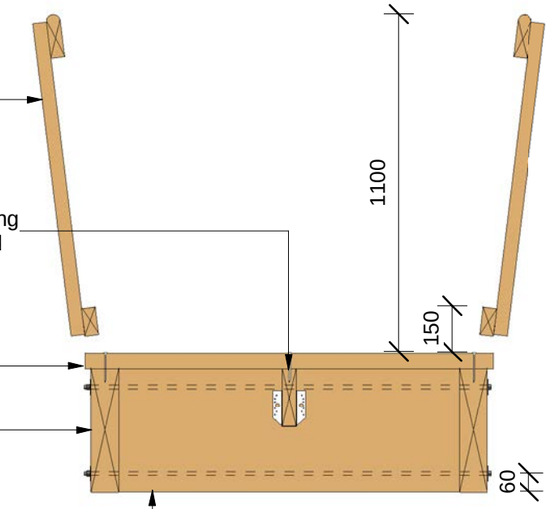
90x45 SG8 H3.2 vertical infill with 150mm (max 200mm) openings between infill fixed top and bottom with 75mm SS 14g type 17 bugle screws and 2 skew SS nails.

190 x 45 H3.2 SG8 blocking on centerline fix each end to glulam blocking using JH 47x120 SS joist hangers fixed to manufacturer pecifications

20mm min overhang typical

405 x 90 GL8 H4 Glulam Bridge Beams

405 x 90 GL8 H4 Glulam blocking at 1m c-c. With 12mm SS tie rods drilled through entire length top and bottom bolted to bridge beams with 50x50x3 SS washers



2 / S-110 **Section** 1 : 20

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A	JLA	Concept	17.10.24

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Te Ara Mangawhero Trail

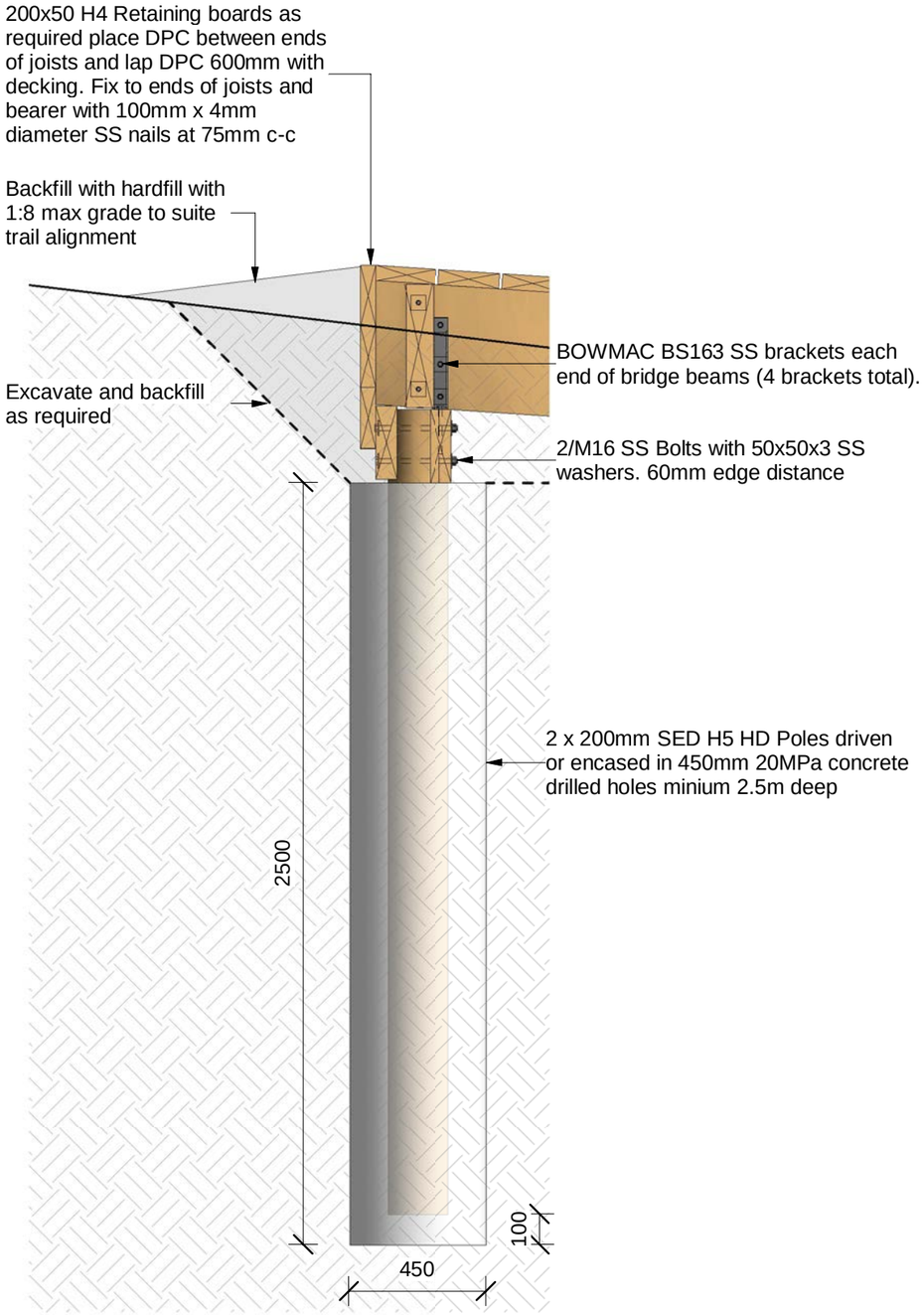
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Bridge 6.27.B
S-110

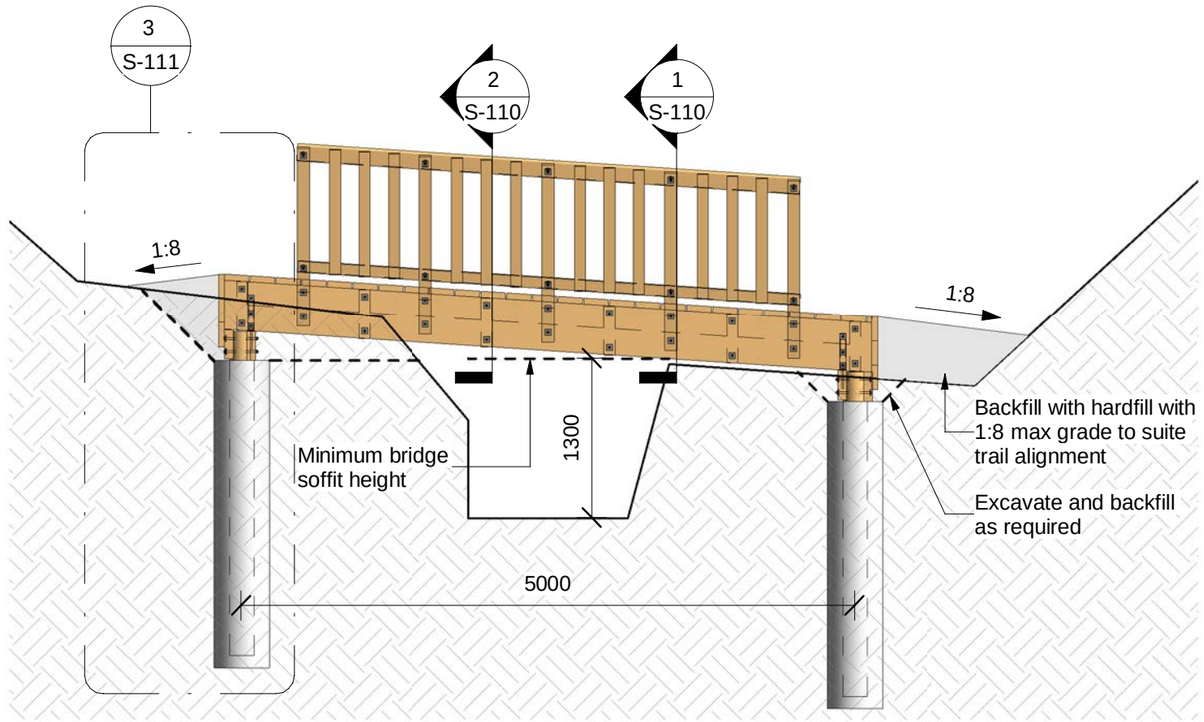
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DRAWN:	CHECKED:
JLA	**NW**

SCALE	REV.
As indicated	**A**



3 / S-110 **Detail** 1 : 20



4 / S-110 **Section** 1 : 50

FLOOD LEVELS PROVIDED BY CHEAL CONSULTANTS

Table 2 - Flood flow hydraulic analysis

Proposed Bridge	Manning's 'n'	Peak flow Depth (m)	Minimum bridge Sofifit Height (m)	Recommended Bridge Span (m)	Arg. Velocity (m/sec)
5.8	0.066	2.0	2.5	34	3.3
6.27	0.070	0.8	1.3	5	2.9
6.29	0.070	0.3	0.8	4	4.4
6.31	0.058	0.2	0.7	6	3.3
7.2	0.058	0.3	0.8	8	1.8
8.3	0.065	1.8	2.3	20	3.3
9.1	0.070	1.3	1.8	14	2.9
9.3	0.070	1.5	2.0	19	2.7

*Height above stream bed, includes 0.5m Freeboard

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Te Ara Mangawhero Trail

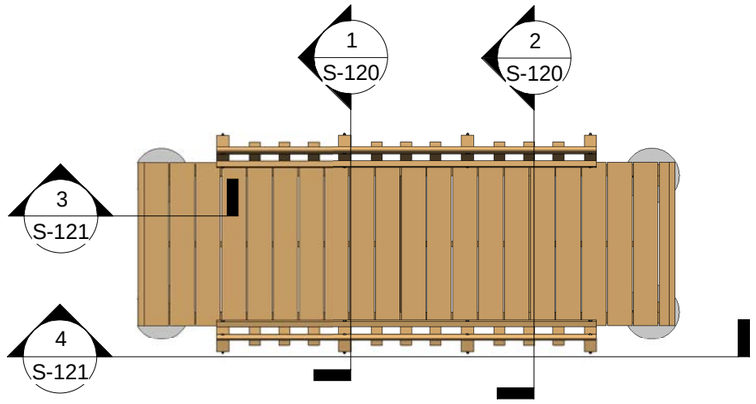
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Bridge 6.27.B S-111

DATE: **07/08/2024**

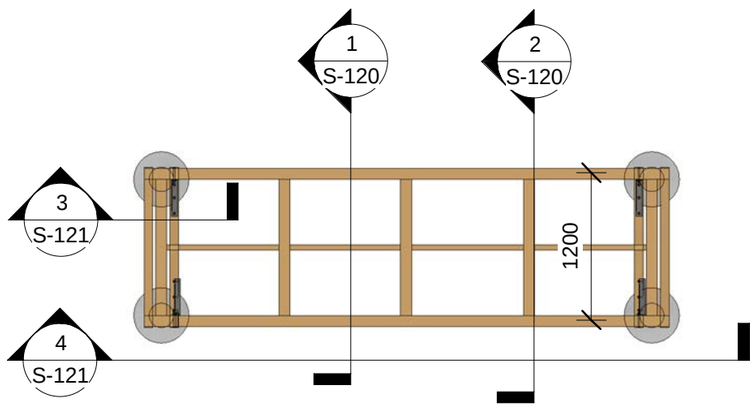
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SCALE	REV.
As indicated	**A**



Floor Plan

1 : 50



Framing Plan

1 : 50

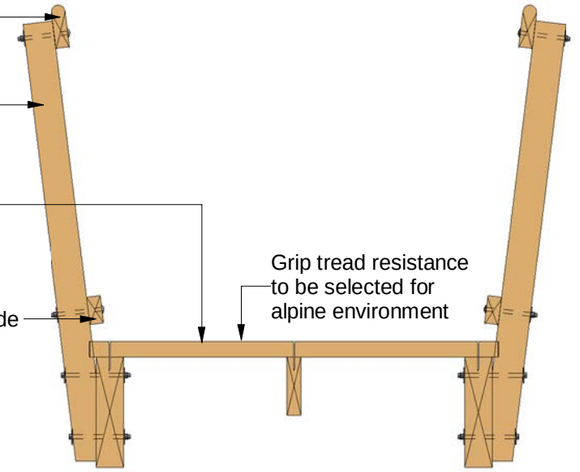


140x45 SG8 H3.2 With rounded top edge. Fixed with 1/M12 SS coach bolt set flush to inside with 50x50x3 SS washer to outside.

100x100 SG8 H4 posts @ 1m centers with 7 degree angle

200 x 50 H5 SG8 Decking with 10-15mm gaps between. Screw to beams using 2 x 125mm long type 17 - 14gauge SS bugle screws each end and to central nog

90x45 SG8 H4 bottom rail, fixed with 1/M12 SS coach bolt set flush to inside with 50x50x3 SS washer to outside



1 S-120 **Section** 1 : 20

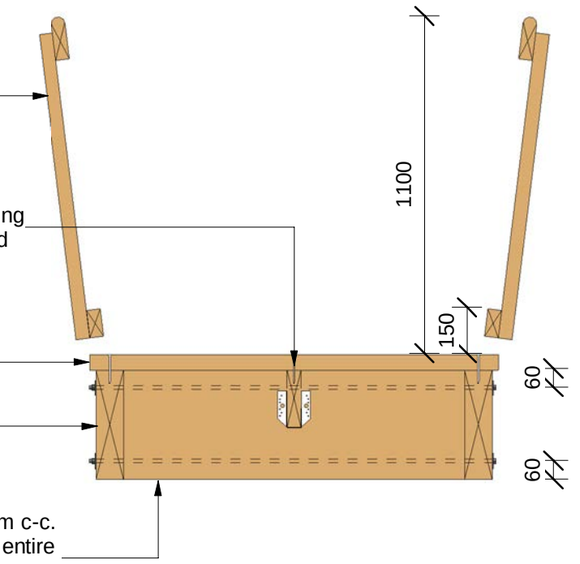
90x45 SG8 H3.2 vertical infill with 150mm (max 200mm) openings between infill fixed top and bottom with 75mm SS 14g type 17 bugle screws and 2 skew SS nails.

190 x 45 H3.2 SG8 blocking on centerline fix each end to glulam blocking using JH 47x120 SS joist hangers fixed to manufacturer pecifications

20mm min overhang typical

360 x 90 GL8 H4 Glulam Bridge Beams

360 x 90 GL8 H4 Glulam blocking at 1m c-c. With 12mm SS tie rods drilled through entire length top and bottom bolted to bridge beams with 50x50x3 SS washers



2 S-120 **Section** 1 : 20

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A	JLA	Concept	17.10.24

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Bridges 6.27, 6.29, 6.31, 7.2, 9.13 & Boardwalks 9.11, 9.29, 9.31

Te Ara Mangawhero Trail

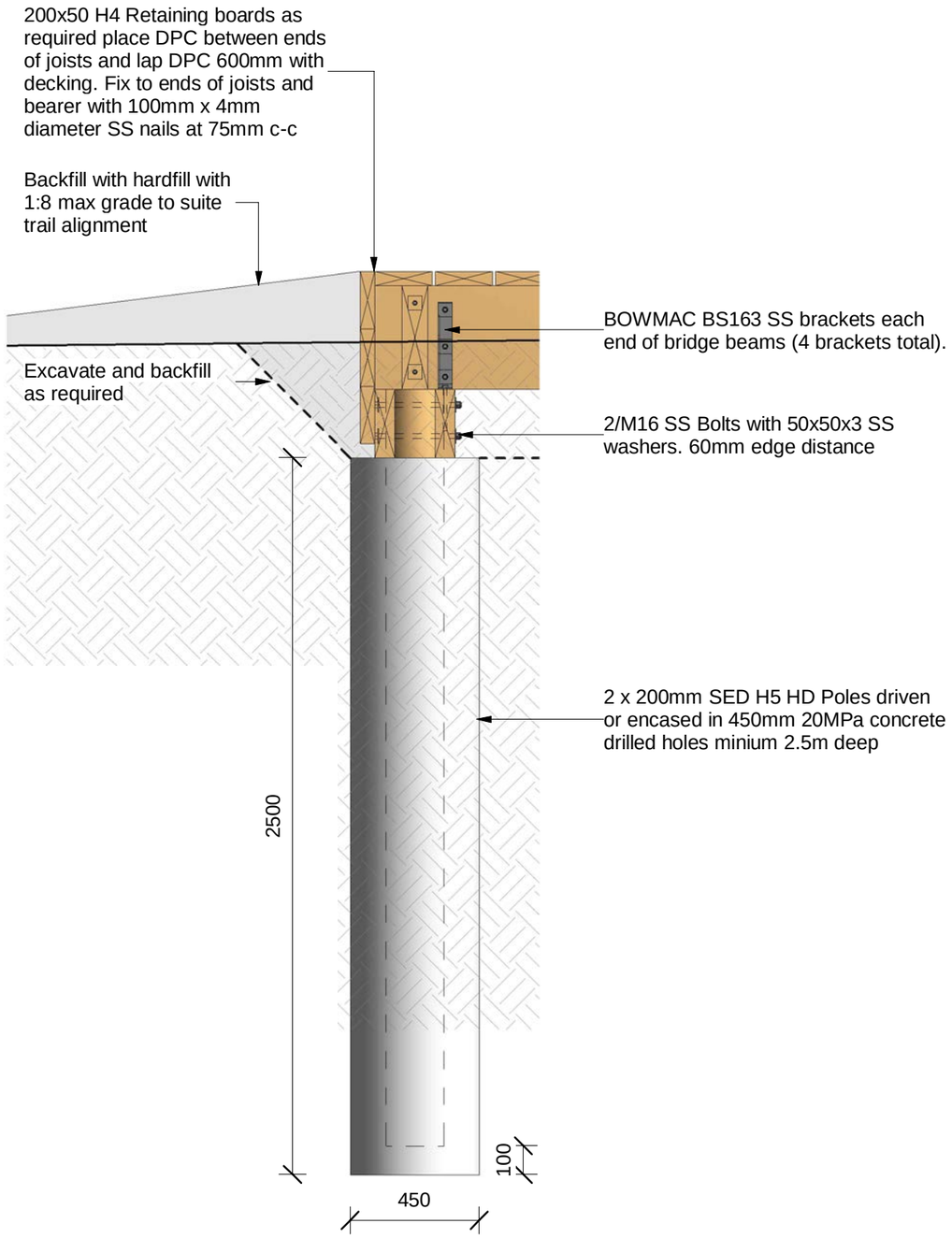
Drawing Name

Bridge 6.29.B
S-120

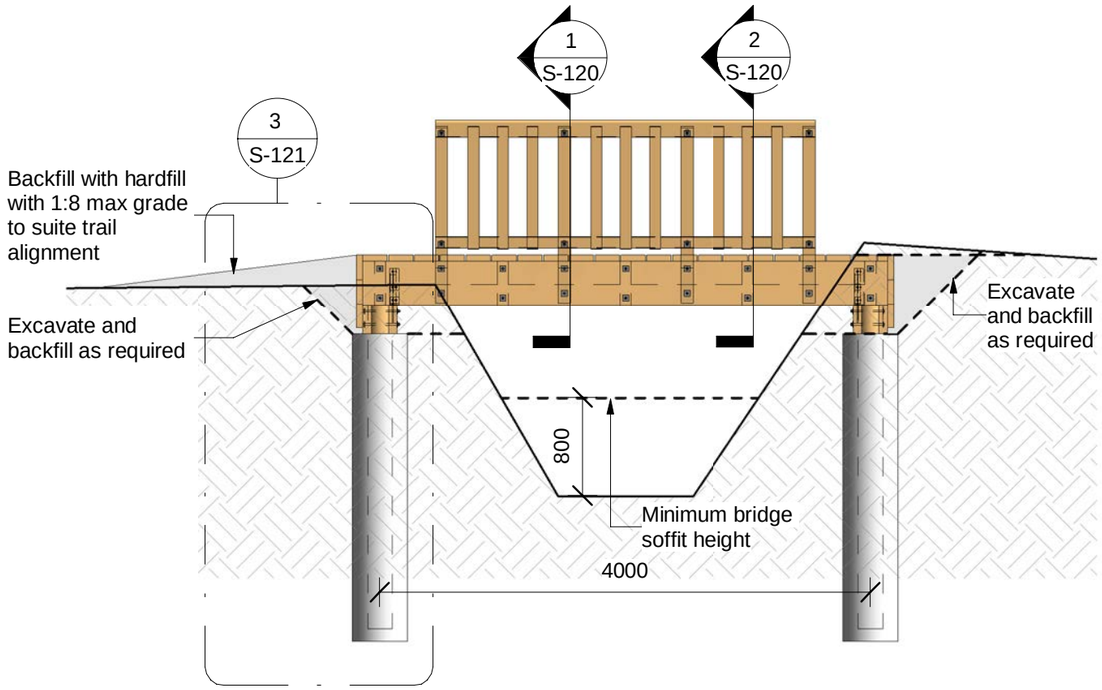
DATE: **07/08/2024**

DRAWN:	CHECKED:
JLA	**NW**

SCALE	REV.
As indicated	**A**



3 S-120 **Detail** 1 : 20



4 S-120 **Section** 1 : 50

FLOOD LEVELS PROVIDED BY CHEAL CONSULTANTS

Table 2 - Flood flow hydraulic analysis

Proposed Bridge	Manning's 'n'	Peak flow Depth (m)	Minimum bridge Sofifit Height (m)	Recommended Bridge Span (m)	Arg. Velocity (m/sec)
5.8	0.066	2.0	2.5	34	3.3
6.27	0.070	0.8	1.3	5	2.9
6.29	0.070	0.3	0.8	4	4.4
6.31	0.058	0.2	0.7	6	3.3
7.2	0.058	0.3	0.8	8	1.8
8.3	0.065	1.8	2.3	20	3.3
9.1	0.070	1.3	1.8	14	2.9
9.3	0.070	1.5	2.0	19	2.7

*Height above stream bed, includes 0.5m Freeboard

Rev	By	Amendment	Date
A	JLA	Concept	17.10.24

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Bridges 6.27, 6.29, 6.31, 7.2, 9.13 & Boardwalks 9.11, 9.29, 9.31

Te Ara Mangawhero Trail

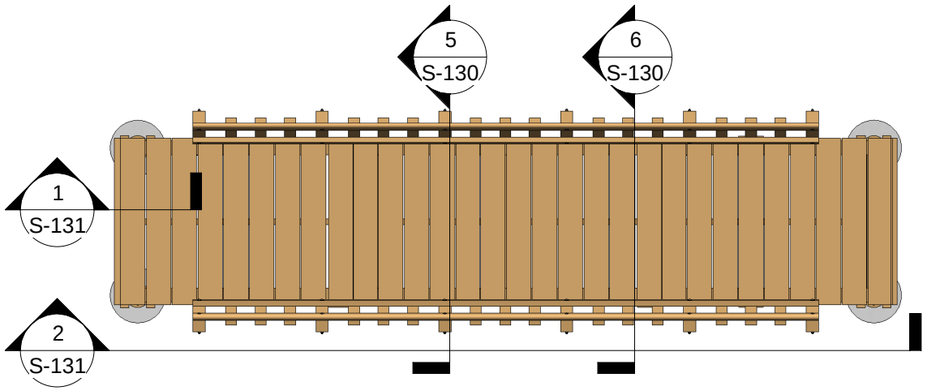
Drawing Name

Bridge 6.29.B S-121

DATE: **07/08/2024**

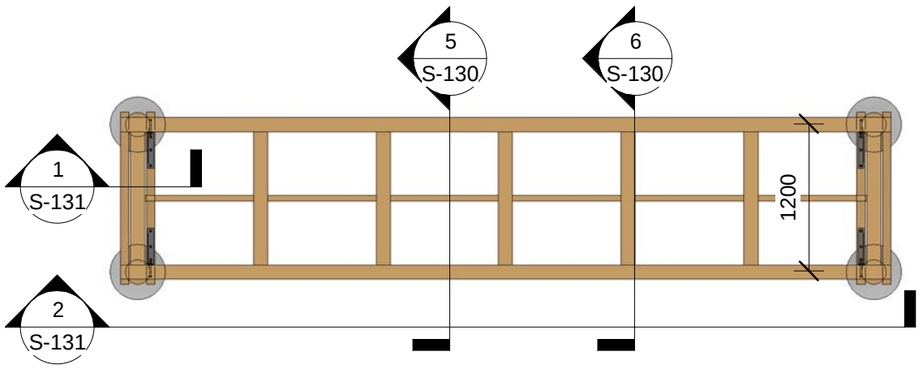
DRAWN: **JLA** | CHECKED: **NW**

SCALE **As indicated** | REV. **A**



Floor Plan

1 : 50



Framing Plan

1 : 50

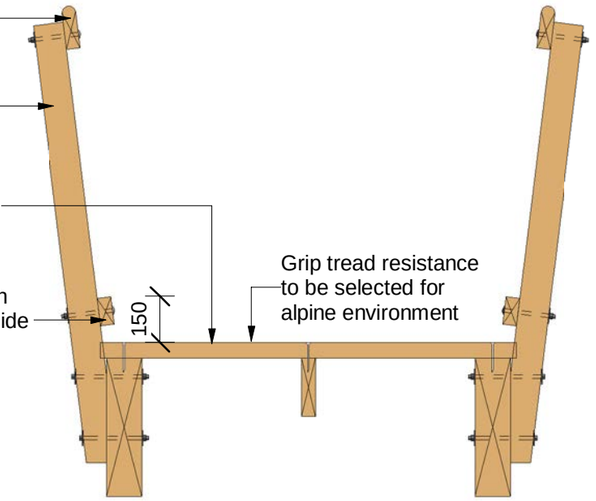


140x45 SG8 H3.2 With rounded top edge. Fixed with 1/M12 SS coach bolt set flush to inside with 50x50x3 SS washer to outside.

100x100 SG8 H4 posts @ 1m centers with 7 degree angle

200 x 50 H5 SG8 Decking with 10-15mm gaps between. Screw to beams using 2 x 125mm long type 17 - 14gauge SS bugle screws each end and to central nog

90x45 SG8 H4 bottom rail, fixed with 1/M12 SS coach bolt set flush to inside with 50x50x3 SS washer to outside



5 / S-130 **Section** 1 : 20

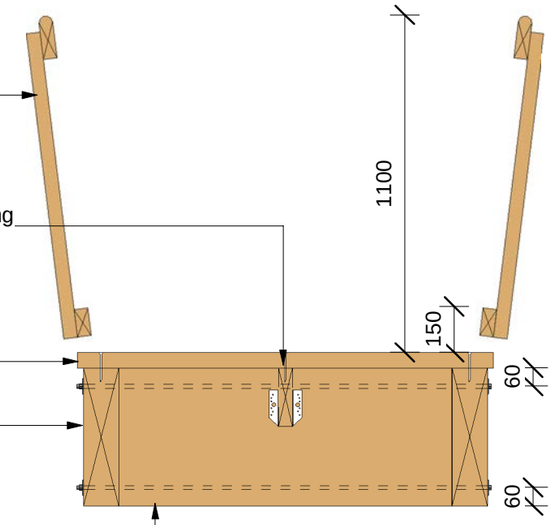
90x45 SG8 H3.2 vertical infill with 150mm (max 200mm) openings between infill fixed top and bottom with 75mm SS 14g type 17 bugle screws and 2 skew SS nails.

190 x 45 H3.2 SG8 blocking on centerline fix each end to glulam blocking using JH 47x120 SS joist hangers fixed to manufacturer pecifications

20mm min overhang typical

450 x 115 GL8 H4 Glulam Bridge Beams

450 x 115 GL8 H4 Glulam blocking at 1m c-c. With 12mm SS tie rods drilled through entire length top and bottom bolted to bridge beams with 50x50x3 SS washers



6 / S-130 **Section** 1 : 20

Schedule

B1	450x115
B2	190x45 H3.2 SG8

Rev	By	Amendment	Date
A	JLA	Concept	17.10.24

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Te Ara Mangawhero Trail

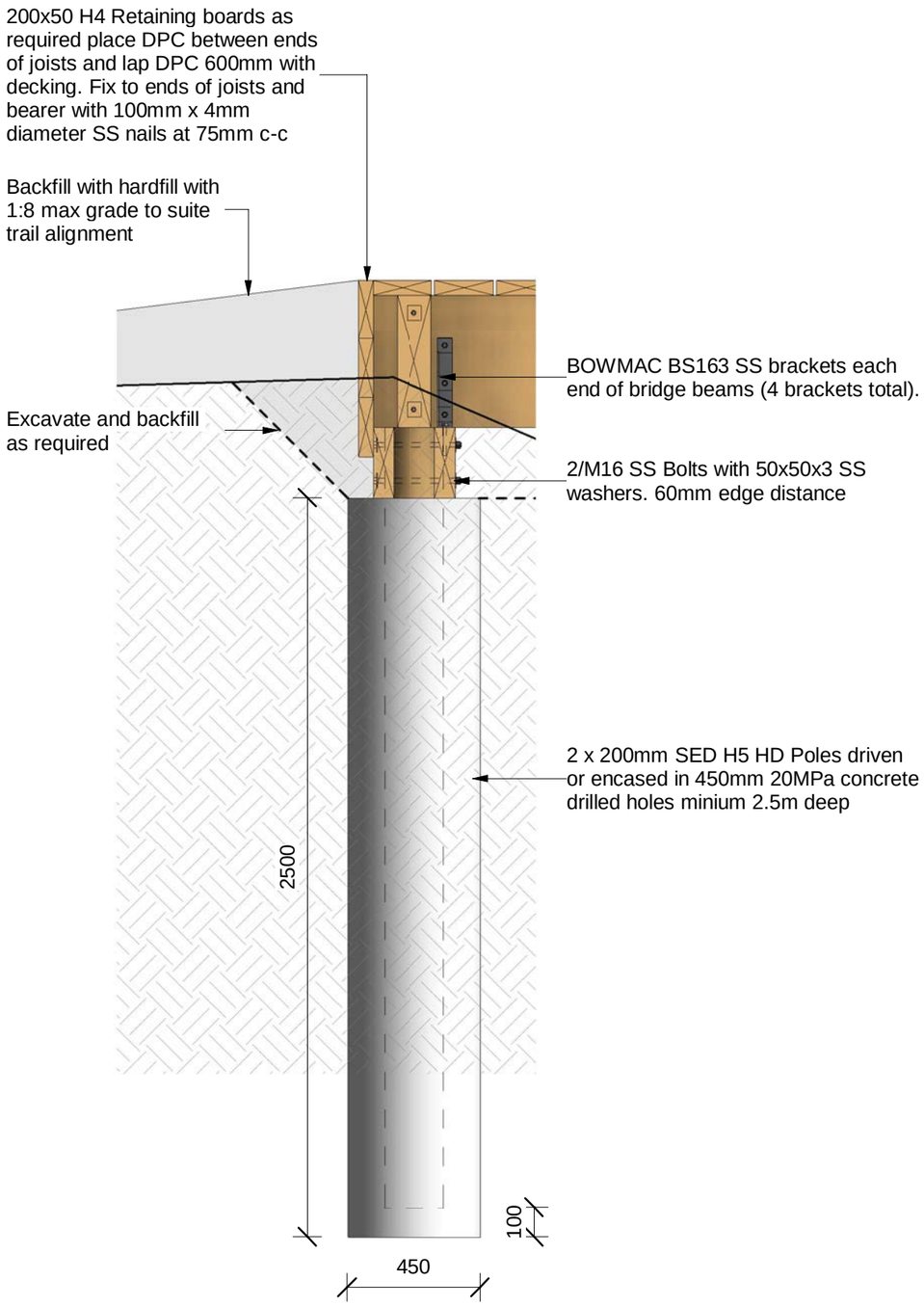
Drawing Name

Bridge 6.31.B
S-130

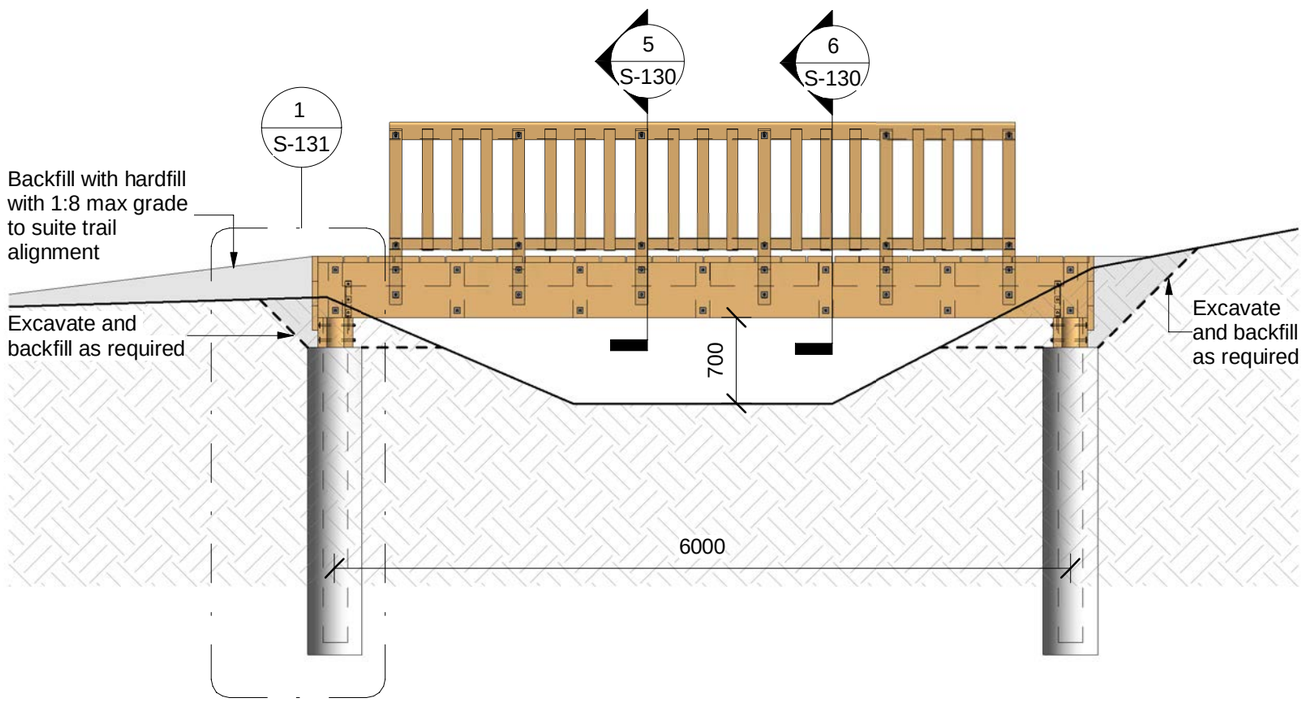
DATE: **07/08/2024**

DRAWN:	CHECKED:
JLA	**NW**

SCALE	REV.
As indicated	**A**



1 / S-130 **Detail** 1 : 20



2 / S-130 **Section** 1 : 50

FLOOD LEVELS PROVIDED BY CHEAL CONSULTANTS

Table 2 - Flood flow hydraulic analysis

Proposed Bridge	Manning's 'n'	Peak flow Depth (m)	Minimum bridge Sofifit Height (m)	Recommended Bridge Span (m)	Arg. Velocity (m/sec)
5.8	0.066	2.0	2.5	34	3.3
6.27	0.070	0.8	1.3	5	2.9
6.29	0.070	0.3	0.8	4	4.4
6.31	0.058	0.2	0.7	6	3.3
7.2	0.058	0.3	0.8	8	1.8
8.3	0.065	1.8	2.3	20	3.3
9.1	0.070	1.3	1.8	14	2.9
9.3	0.070	1.5	2.0	19	2.7

*Height above stream bed, includes 0.5m Freeboard

Rev	By	Amendment	Date
A	JLA	Concept	17.10.24

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Te Ara Mangawhero Trail

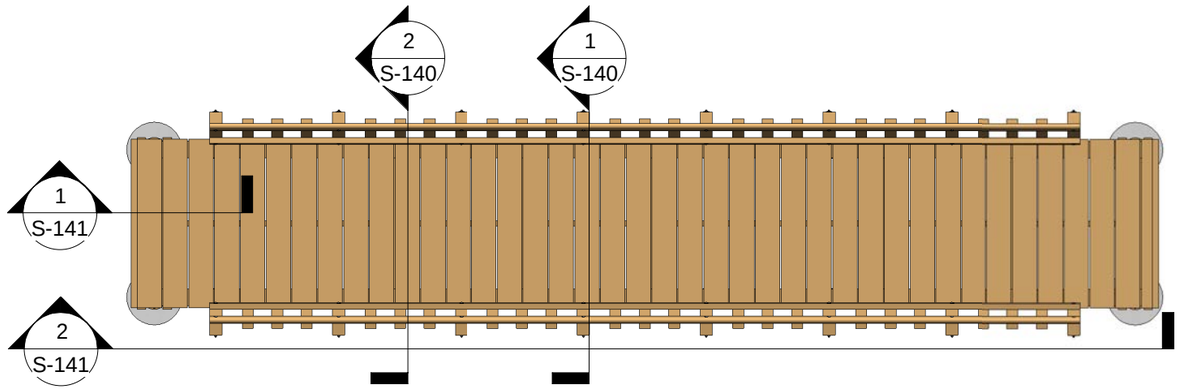
Drawing Name

Bridge 6.31.B
S-131

DATE: **07/08/2024**

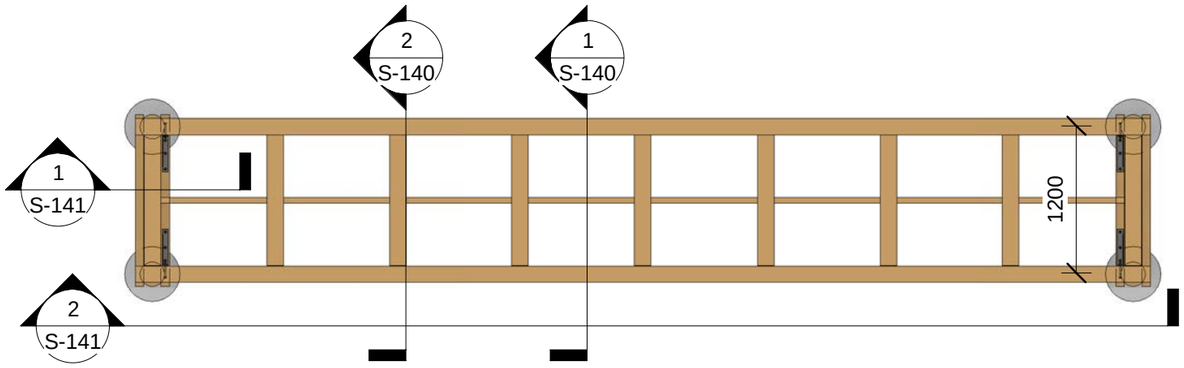
DRAWN: **JLA** | CHECKED: **NW**

SCALE **As indicated** | REV. **A**



Floor Plan

1 : 50



Framing Plan

1 : 50

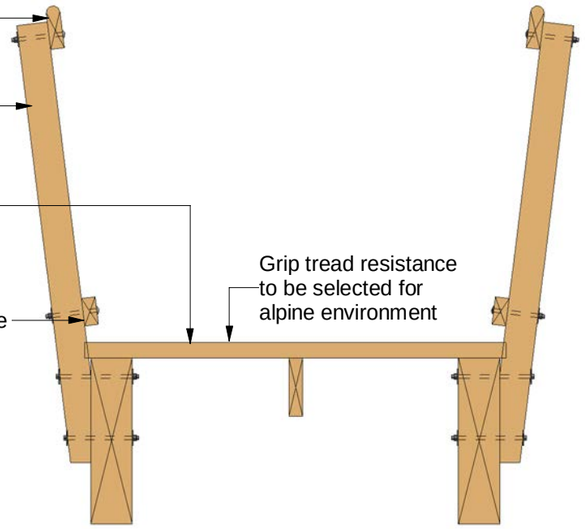


140x45 SG8 H3.2 With rounded top edge. Fixed with 1/M12 SS coach bolt set flush to inside with 50x50x3 SS washer to outside.

100x100 SG8 H4 posts @ 1m centers with 7 degree angle

200 x 50 H5 SG8 Decking with 10-15mm gaps between. Screw to beams using 2 x 125mm long type 17 - 14gauge SS bugle screws each end and to central nog

90x45 SG8 H4 bottom rail, fixed with 1/M12 SS coach bolt set flush to inside with 50x50x3 SS washer to outside



1 / S-140 **Section** 1 : 20

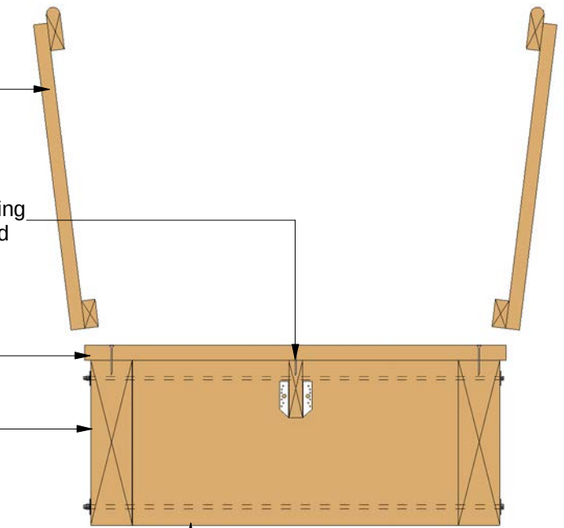
90x45 SG8 H3.2 vertical infill with 150mm (max 200mm) openings between infill fixed top and bottom with 75mm SS 14g type 17 bugle screws and 2 skew SS nails.

190 x 45 H3.2 SG8 blocking on centerline fix each end to glulam blocking using JH 47x120 SS joist hangers fixed to manufacturer pecifications

20mm min overhang typical

540x135 GL8 H4 Glulam Bridge Beams

540x135 GL8 H4 Glulam blocking at 1m c-c. With 12mm SS tie rods drilled through entire length top and bottom bolted to bridge beams with 50x50x3 SS washers



2 / S-140 **Section** 1 : 20

Rev	By	Amendment	Date
A	JLA	Concept	17.10.24

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Northland, New Zealand 0200

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Te Ara Mangawhero Trail

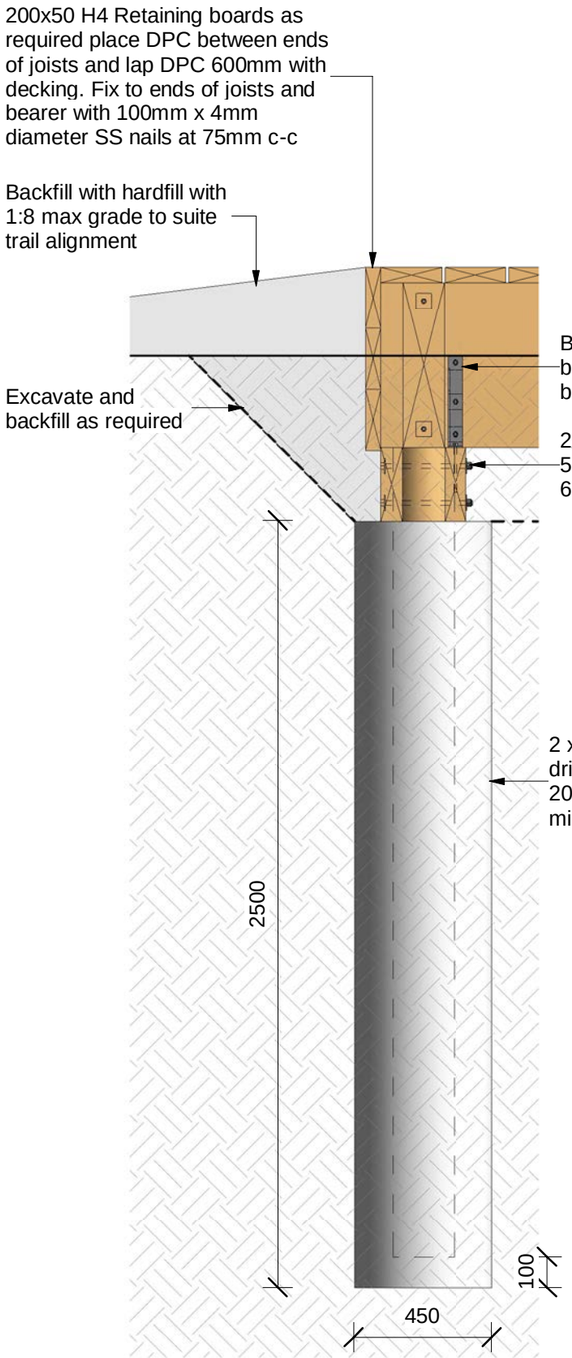
Drawing Name

Bridge 7.2.B
S-140

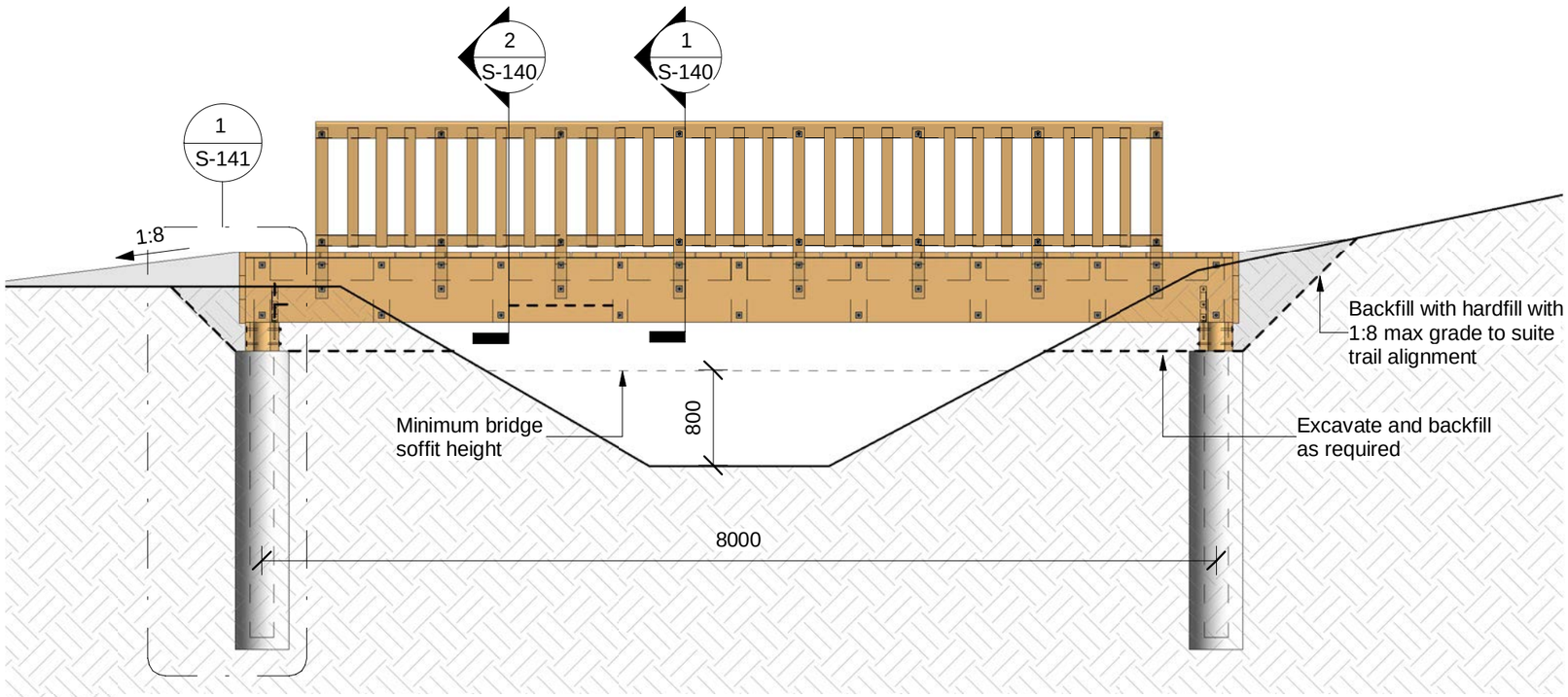
DATE: **07/08/2024**

DRAWN:	CHECKED:
JLA	**NW**

SCALE	REV.
As indicated	**A**



1 / S-140 **Detail** 1 : 20



2 / S-140 **Section** 1 : 50

FLOOD LEVELS PROVIDED BY CHEAL CONSULTANTS

Table 2 - Flood flow hydraulic analysis

Proposed Bridge	Manning's 'n'	Peak flow Depth (m)	Minimum bridge Sofifit Height (m)	Recommended Bridge Span (m)	Arg. Velocity (m/sec)
5.8	0.066	2.0	2.5	34	3.3
6.27	0.070	0.8	1.3	5	2.9
6.29	0.070	0.3	0.8	4	4.4
6.31	0.058	0.2	0.7	6	3.3
7.2	0.058	0.3	0.8	8	1.8
8.3	0.065	1.8	2.3	20	3.3
9.1	0.070	1.3	1.8	14	2.9
9.3	0.070	1.5	2.0	19	2.7

*Height above stream bed, includes 0.5m Freeboard

Rev	By	Amendment	Date
A	JLA	Concept	17.10.24

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Bridges 6.27, 6.29, 6.31, 7.2, 9.13 & Boardwalks 9.11, 9.29, 9.31

Te Ara Mangawhero Trail

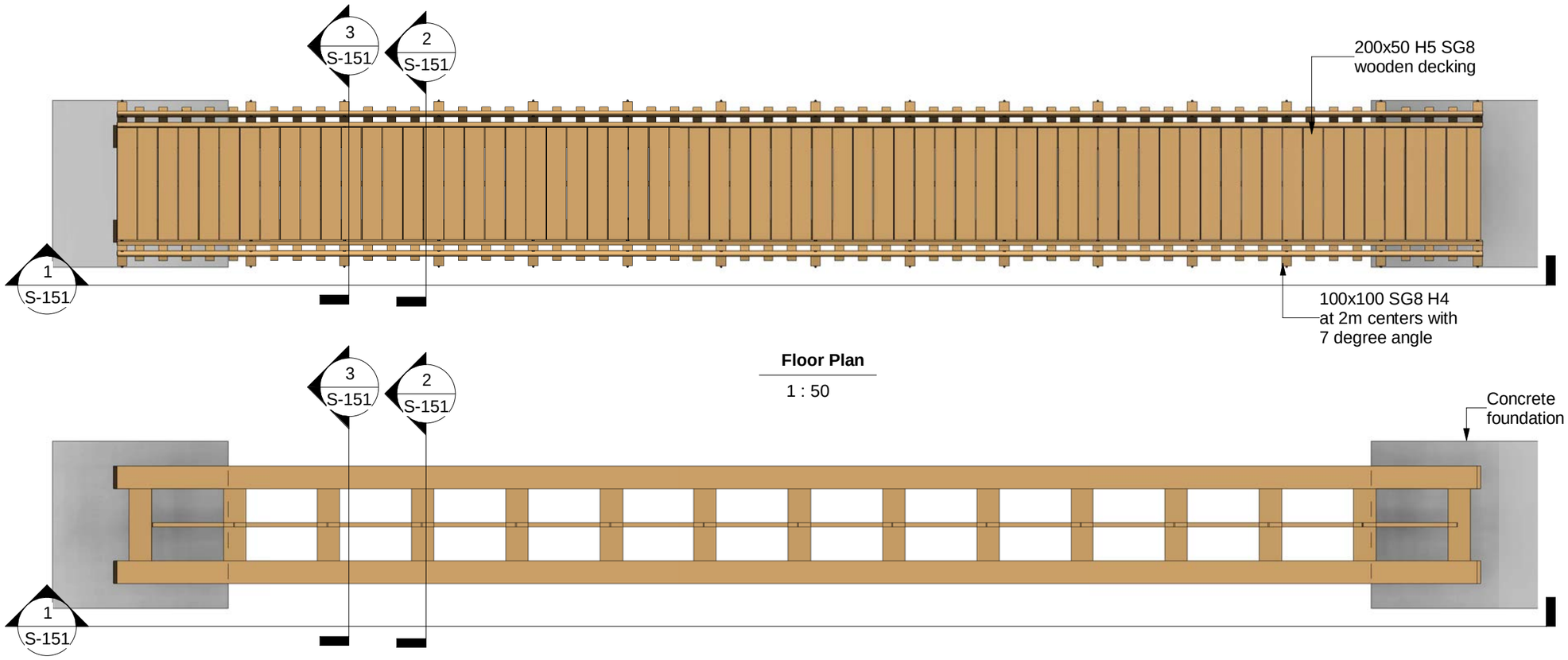
Drawing Name

Bridge 7.2.B
S-141

DATE: **07/08/2024**

DRAWN:	CHECKED:
JLA	**NW**

SCALE	REV.
As indicated	**A**

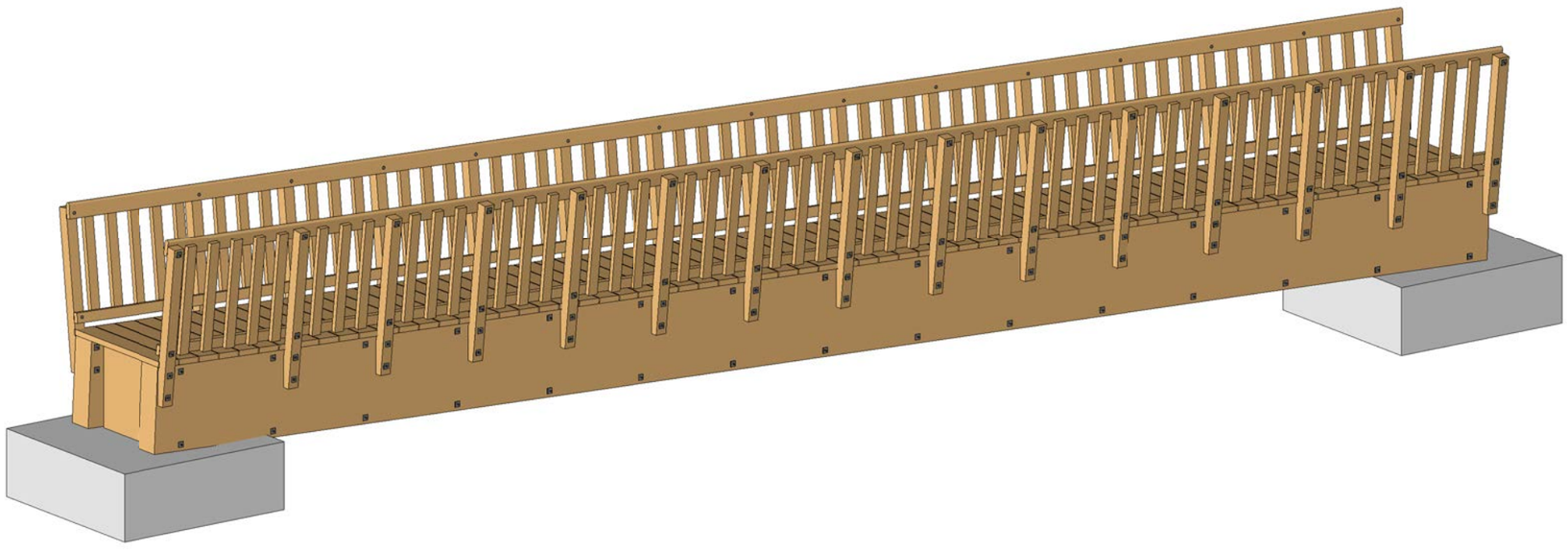


Floor Plan

1 : 50

Framing Plan

1 : 50



Rev	By	Amendment	Date
A	JLA	Concept	17.10.24

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15 Hihitahi Rise Paihia,
Northland, New Zealand 0200

Bridges 6.27, 6.29, 6.31, 7.2, 9.13 & Boardwalks 9.11, 9.29, 9.31

Te Ara Mangawhero Trail

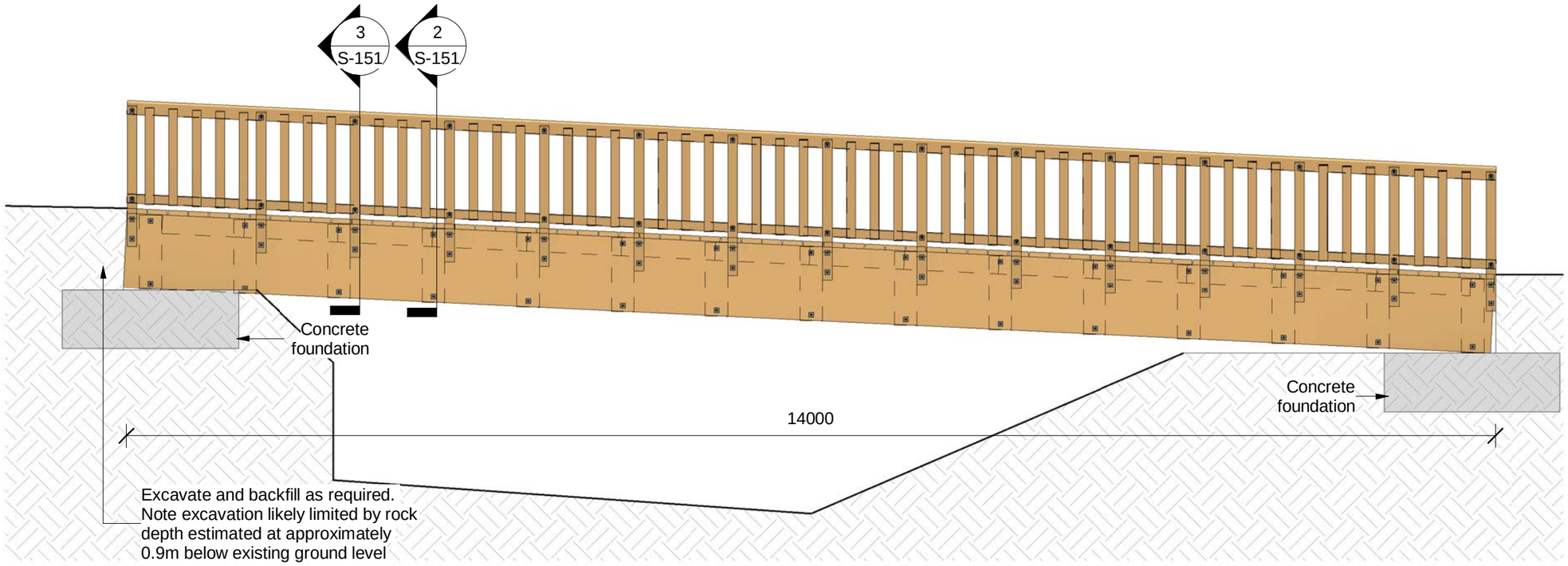
Drawing Name

Bridge 9.13.B
S-150

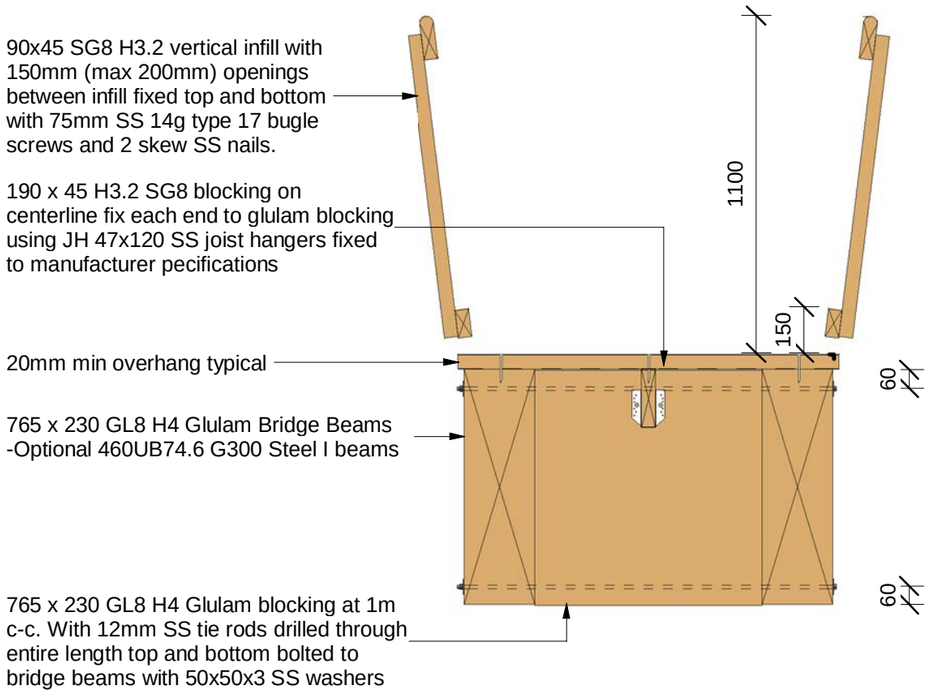
DATE: **07/08/2024**

DRAWN:	CHECKED:
JLA	**NW**

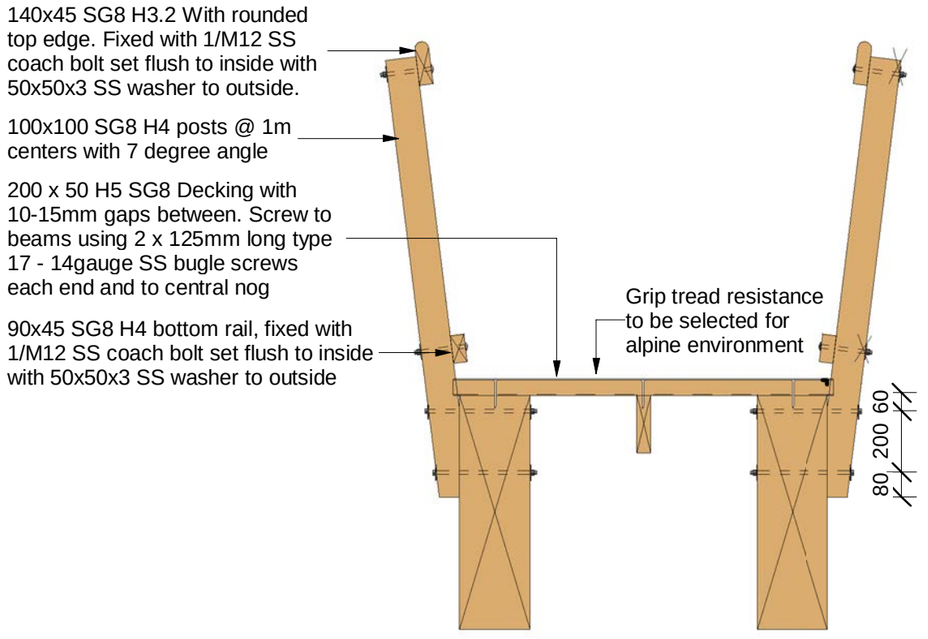
SCALE	REV.
1 : 50	**A**



1 / S-150 **Section** 1 : 50



2 / S-150 **Section** 1 : 20



3 / S-150 **Section** 1 : 20

Rev	By	Amendment	Date
A	JLA	Concept	17.10.24

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15 Hihitahi Rise Paihia,
Northland, New Zealand 0200

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Te Ara Mangawhero Trail

Drawing Name

Bridge 9.13.B
S-151

DATE: **07/08/2024**

DRAWN:	CHECKED:
JLA	**NW**

SCALE	REV.
As indicated	**A**

12
S-247

11
S-247

10
S-244

9
S-243

8
S-241

7
S-241

6
S-239

5
S-239

4
S-236

9.31.W
Barriered
Boardwalk

2
S-232

3
S-235

1
S-231

9.29.W
Barriered
Boardwalk

2
S-221

1
S-221

1
S-211

2
S-212

9.11.W
Barriered
Boardwalk

Boardwalks Site Plan

1 : 2000

Rev	By	Amendment	Date
A	JLA	Concept	17.10.24

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15 Hihitahi Rise Paihia,
Northland, New Zealand 0200

Bridges 6.27, 6.29, 6.31, 7.2, 9.13 & Boardwalks 9.11, 9.29, 9.31

Te Ara Mangawhero Trail

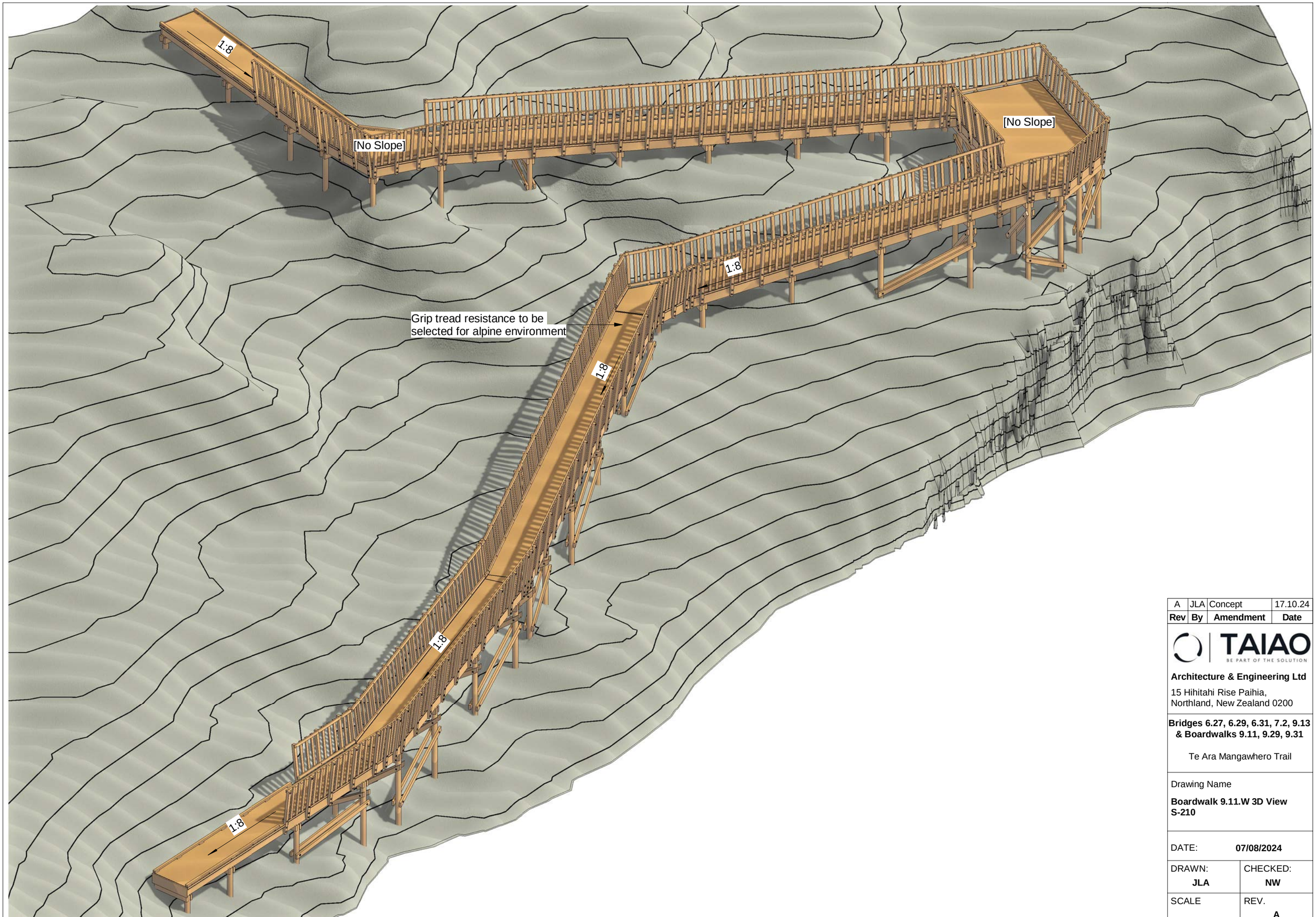
Drawing Name

Boardwalks Site Plan
S-200

DATE: **07/08/2024**

DRAWN:	CHECKED:
JLA	**NW**

SCALE	REV.
1 : 2000	**A**



Rev	By	Amendment	Date
A	JLA	Concept	17.10.24

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15 Hihitahi Rise Paihia,
Northland, New Zealand 0200

Bridges 6.27, 6.29, 6.31, 7.2, 9.13 & Boardwalks 9.11, 9.29, 9.31

Te Ara Mangawhero Trail

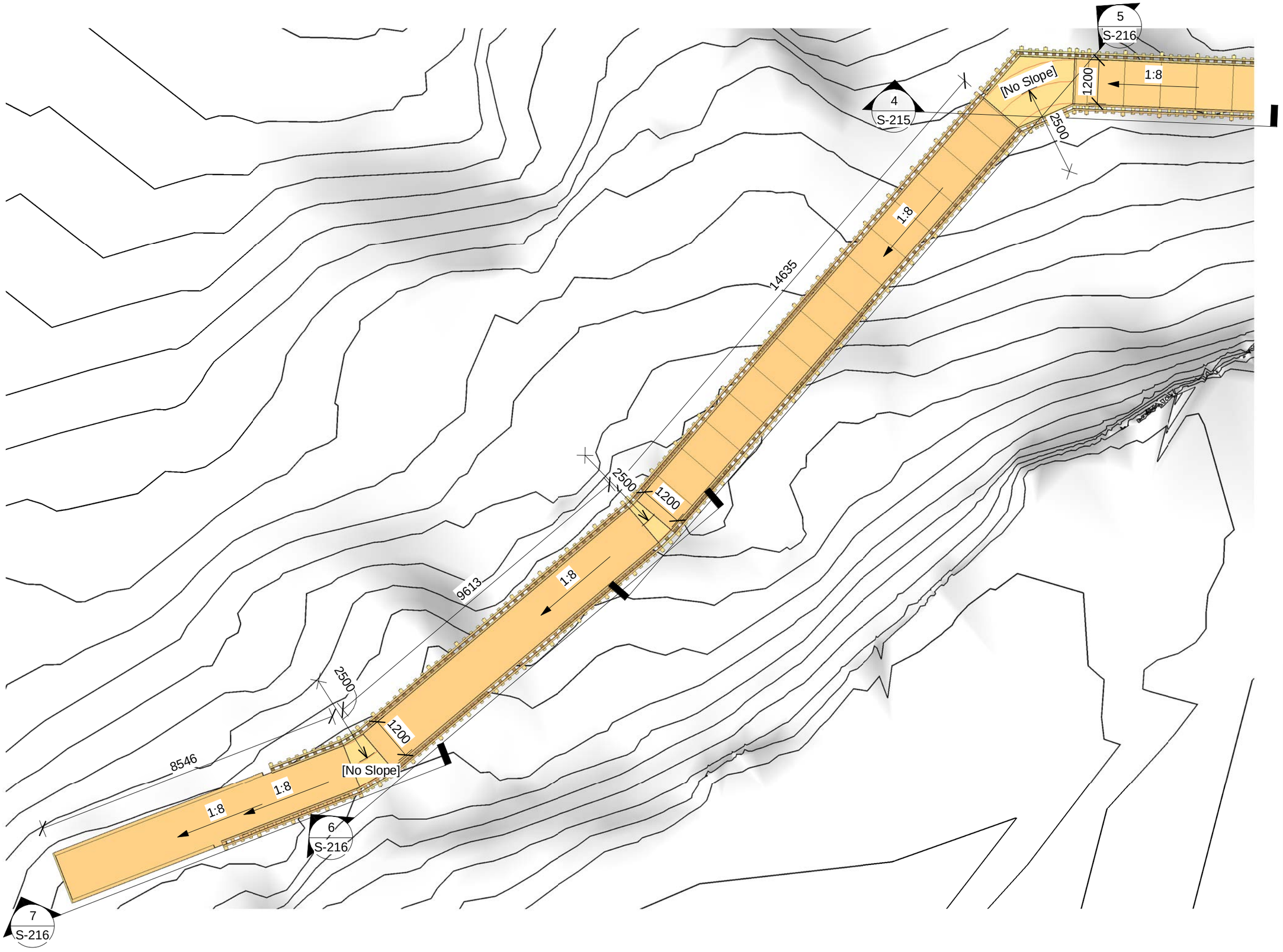
Drawing Name

Boardwalk 9.11.W 3D View S-210

DATE: **07/08/2024**

DRAWN:	CHECKED:
JLA	**NW**

SCALE	REV.
	A



1 / S-200 **Boardwalk 9.11.W Plan**
1 : 100

Rev	By	Amendment	Date
A	JLA	Concept	17.10.24

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15 Hihitahi Rise Paihia,
Northland, New Zealand 0200

Bridges 6.27, 6.29, 6.31, 7.2, 9.13 & Boardwalks 9.11, 9.29, 9.31

Te Ara Mangawhero Trail

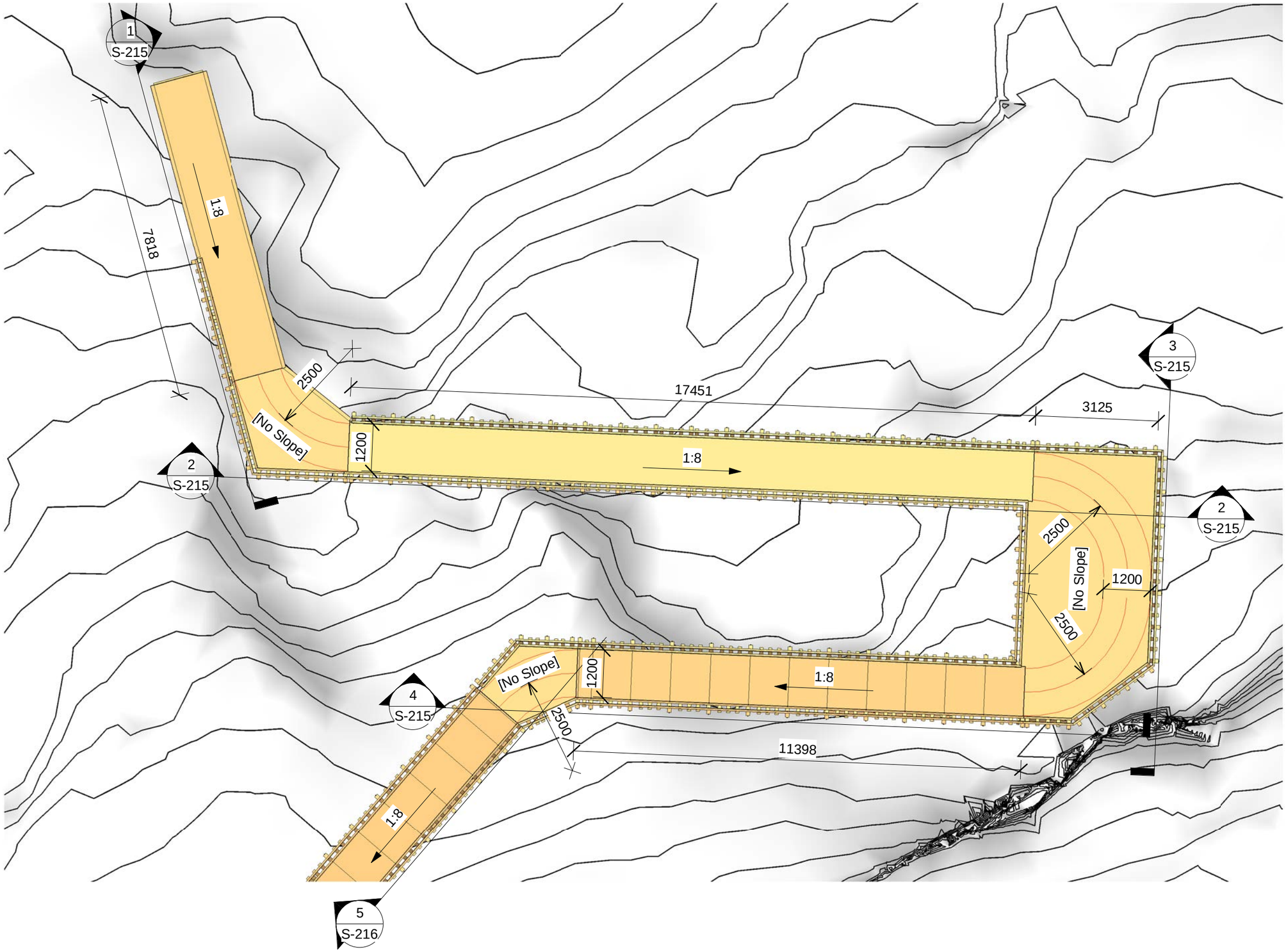
Drawing Name

Boardwalk 9.11.W Plan 1
S-211

DATE: **07/08/2024**

DRAWN:	CHECKED:
JLA	**NW**

SCALE	REV.
1 : 100	**A**



2 S-200 **Boardwalk 9.11.W Plan**
1 : 100

Rev	By	Amendment	Date
A	JLA	Concept	17.10.24

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Northland, New Zealand 0200

Bridges 6.27, 6.29, 6.31, 7.2, 9.13 & Boardwalks 9.11, 9.29, 9.31

Te Ara Mangawhero Trail

Drawing Name

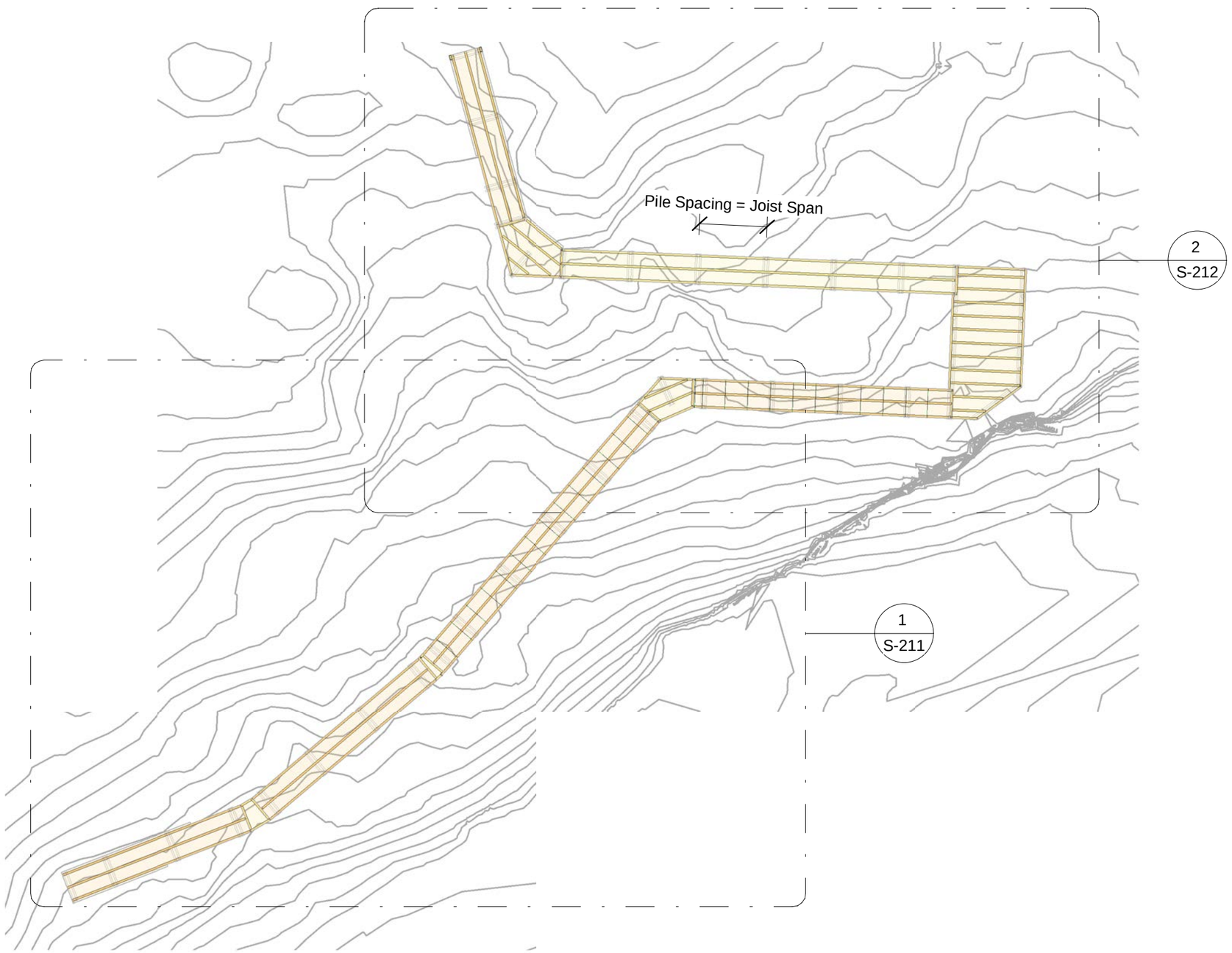
Boardwalk 9.11.W Plan 2
S-212

DATE: **07/08/2024**

DRAWN:	CHECKED:
JLA	**NW**

SCALE	REV.
1 : 100	**A**

Summary:						
Joist Depth (mm)	**Joist Thick (mm)**	**Joist Spacing (mm)**	**Joist SPAN (m)**	**Bearer Depth (mm)**	**Bearer Thick (mm)**	**Bearer Bolts to Piles**
190	90	600	1.5	190	70	2/M16
240	90	600	2.4	190	70	2/M16
290	90	600	3	190	70	2/M16



Boardwalk 9.11.W Joists Plan

1 : 200

Rev	By	Amendment	Date
A	JLA	Concept	17.10.24

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Northland, New Zealand 0200

Bridges 6.27, 6.29, 6.31, 7.2, 9.13 & Boardwalks 9.11, 9.29, 9.31

Te Ara Mangawhero Trail

Drawing Name

Boardwalk 9.11.W Joists Plan S-213

DATE: **07/08/2024**

DRAWN:	CHECKED:
JLA	**NW**

SCALE	REV.
As indicated	**A**

Summary:						
Joist Depth (mm)	**Joist Thick (mm)**	**Joist Spacing (mm)**	**Joist SPAN (m)**	**Bearer Depth (mm)**	**Bearer Thick (mm)**	**Bearer Bolts to Piles**
190	90	600	1.5	190	70	2/M16
240	90	600	2.4	190	70	2/M16
290	90	600	3	190	70	2/M16



Boardwalk 9.11.W Bearers & Piles Plan

1 : 200

Rev	By	Amendment	Date
A	JLA	Concept	17.10.24

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Te Ara Mangawhero Trail

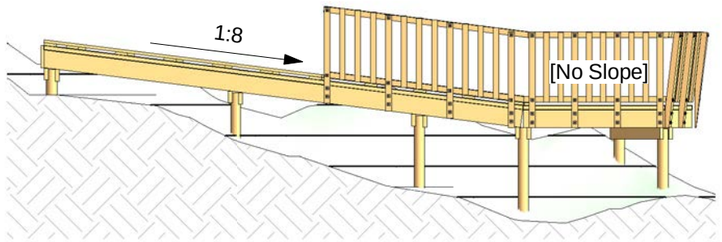
Drawing Name

Boardwalk 9.11.W Bearers & Piles Plan
S-214

DATE: **07/08/2024**

DRAWN:	CHECKED:
JLA	**NW**

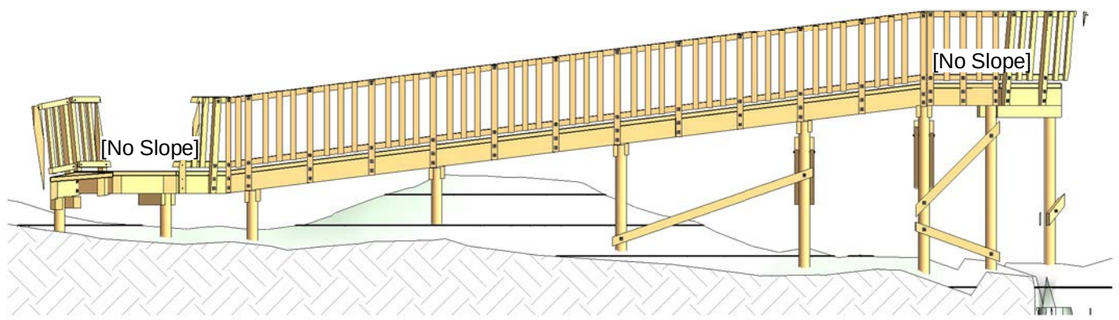
SCALE	REV.
As indicated	**A**



1 S-212 **9.11.W Section**
1 : 100



2 S-212 **9.11.W Section**
1 : 100



4 S-211 **9.11.W Section**
1 : 100



3 S-212 **9.11.W Section**
1 : 100

Rev	By	Amendment	Date
A	JLA	Concept	17.10.24

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Northland, New Zealand 0200

Bridges 6.27, 6.29, 6.31, 7.2, 9.13 & Boardwalks 9.11, 9.29, 9.31

Te Ara Mangawhero Trail

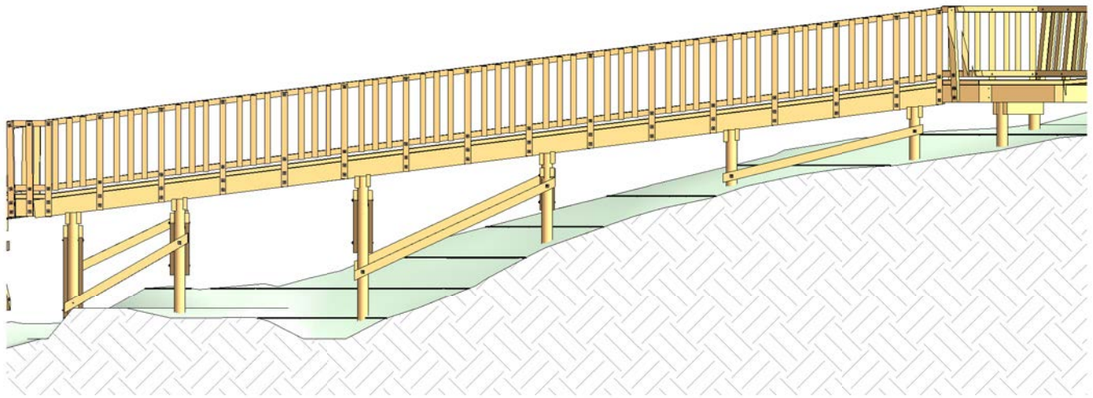
Drawing Name

Boardwalk 9.11.W Sections S-215

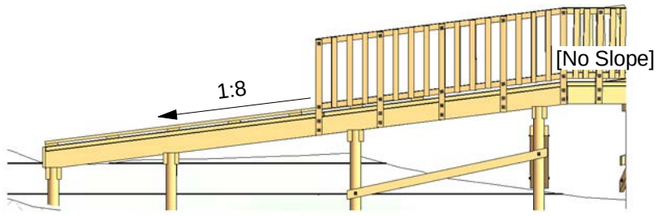
DATE: **07/08/2024**

DRAWN:	CHECKED:
JLA	**NW**

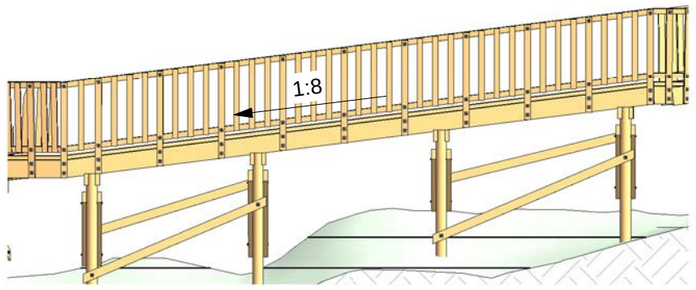
SCALE	REV.
1 : 100	**A**



5 / S-211 **9.11.W Section**
1 : 100



7 / S-211 **9.11.W Section**
1 : 100



6 / S-211 **9.11.W Section**
1 : 100

Rev	By	Amendment	Date
A	JLA	Concept	17.10.24

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Northland, New Zealand 0200

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Te Ara Mangawhero Trail

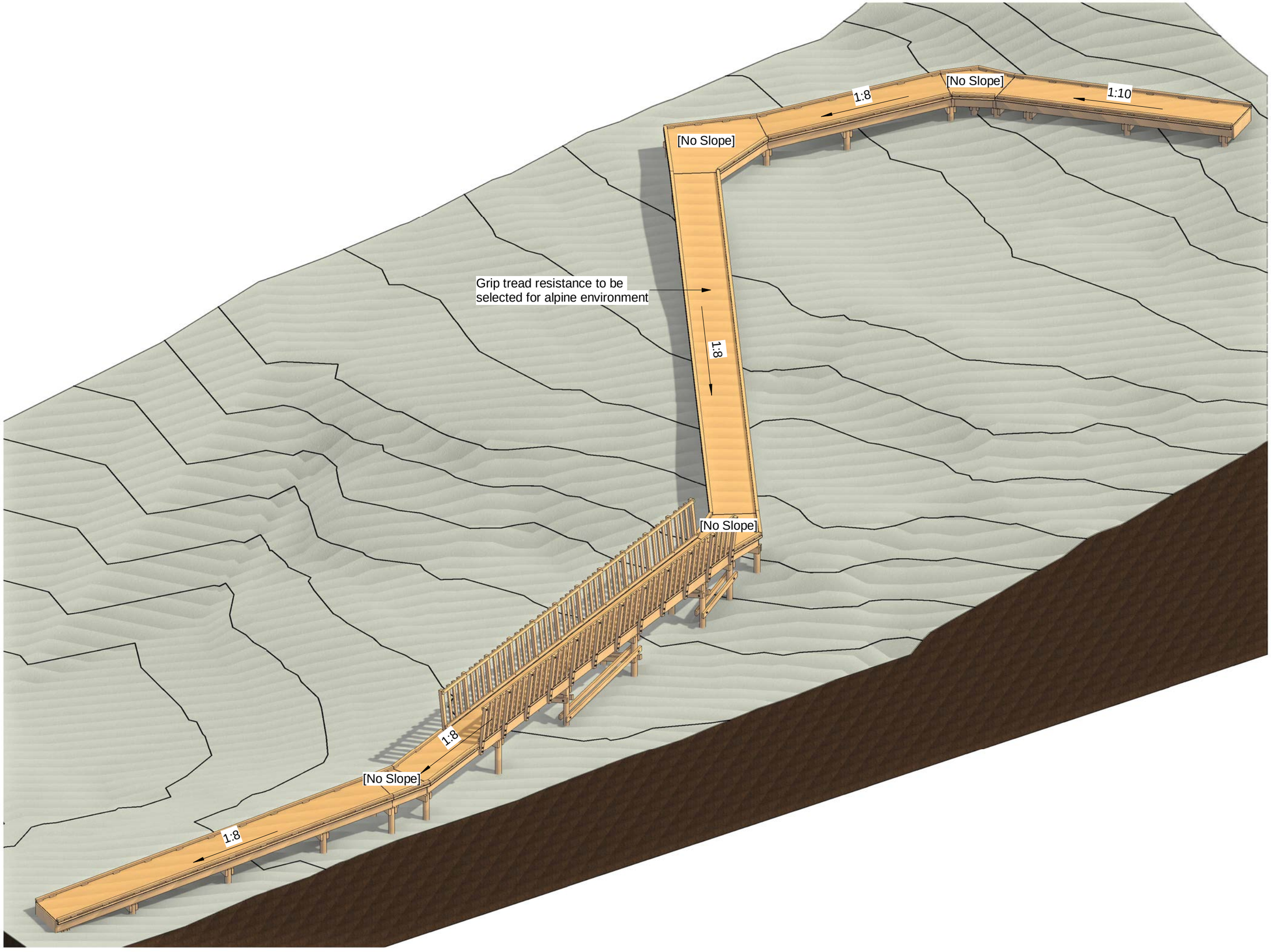
Drawing Name

Boardwalk 9.11.W Sections S-216

DATE: **07/08/2024**

DRAWN:	CHECKED:
JLA	**NW**

SCALE	REV.
1 : 100	**A**



Rev	By	Amendment	Date
A	JLA	Concept	17.10.24

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Te Ara Mangawhero Trail

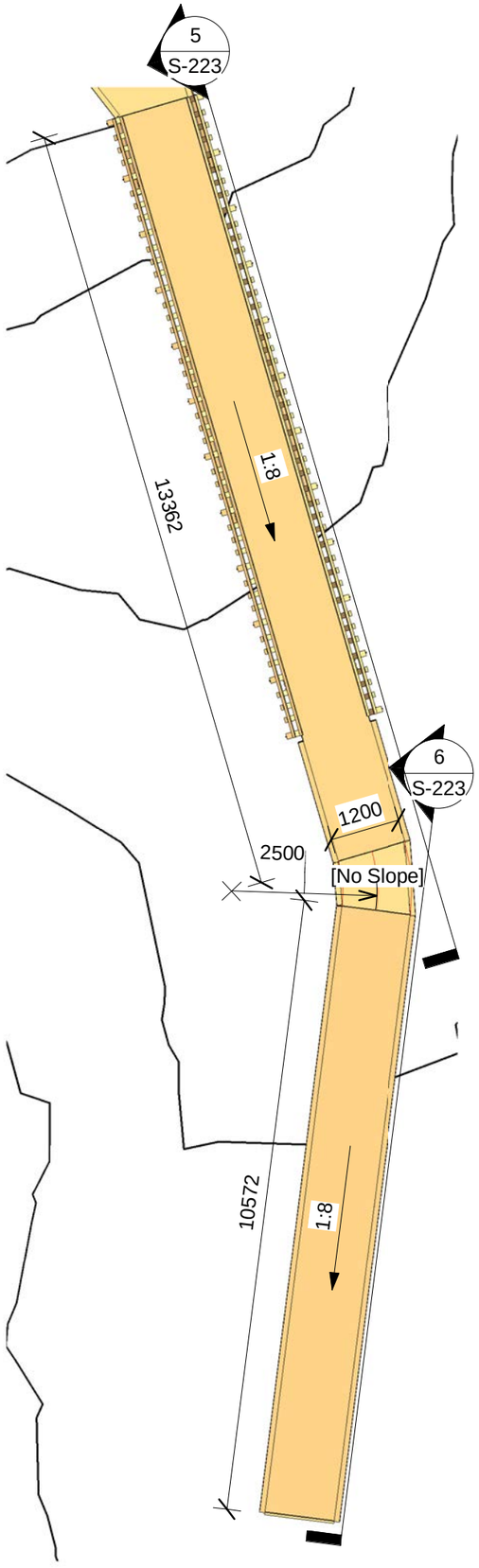
Drawing Name

Boardwalk 9.29W 3D View S-220

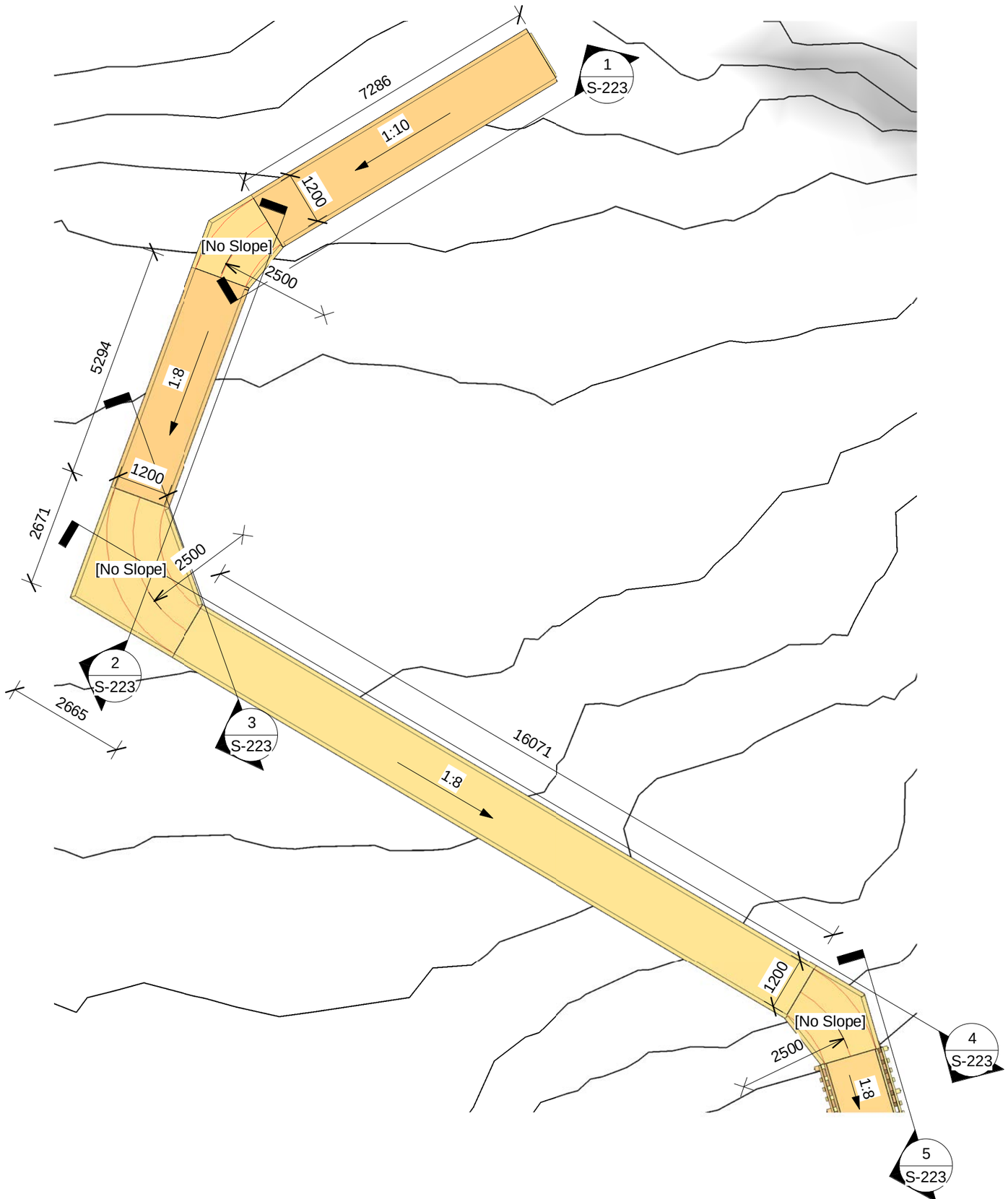
DATE: **07/08/2024**

DRAWN:	CHECKED:
JLA	**NW**

SCALE	REV.
	A



1 S-200 **Boardwalk 9.29.W**
1 : 100



2 S-200 **Boardwalk 9.29.W**
1 : 100

Rev	By	Amendment	Date
A	JLA	Concept	17.10.24

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Northland, New Zealand 0200

Bridges 6.27, 6.29, 6.31, 7.2, 9.13 & Boardwalks 9.11, 9.29, 9.31

Te Ara Mangawhero Trail

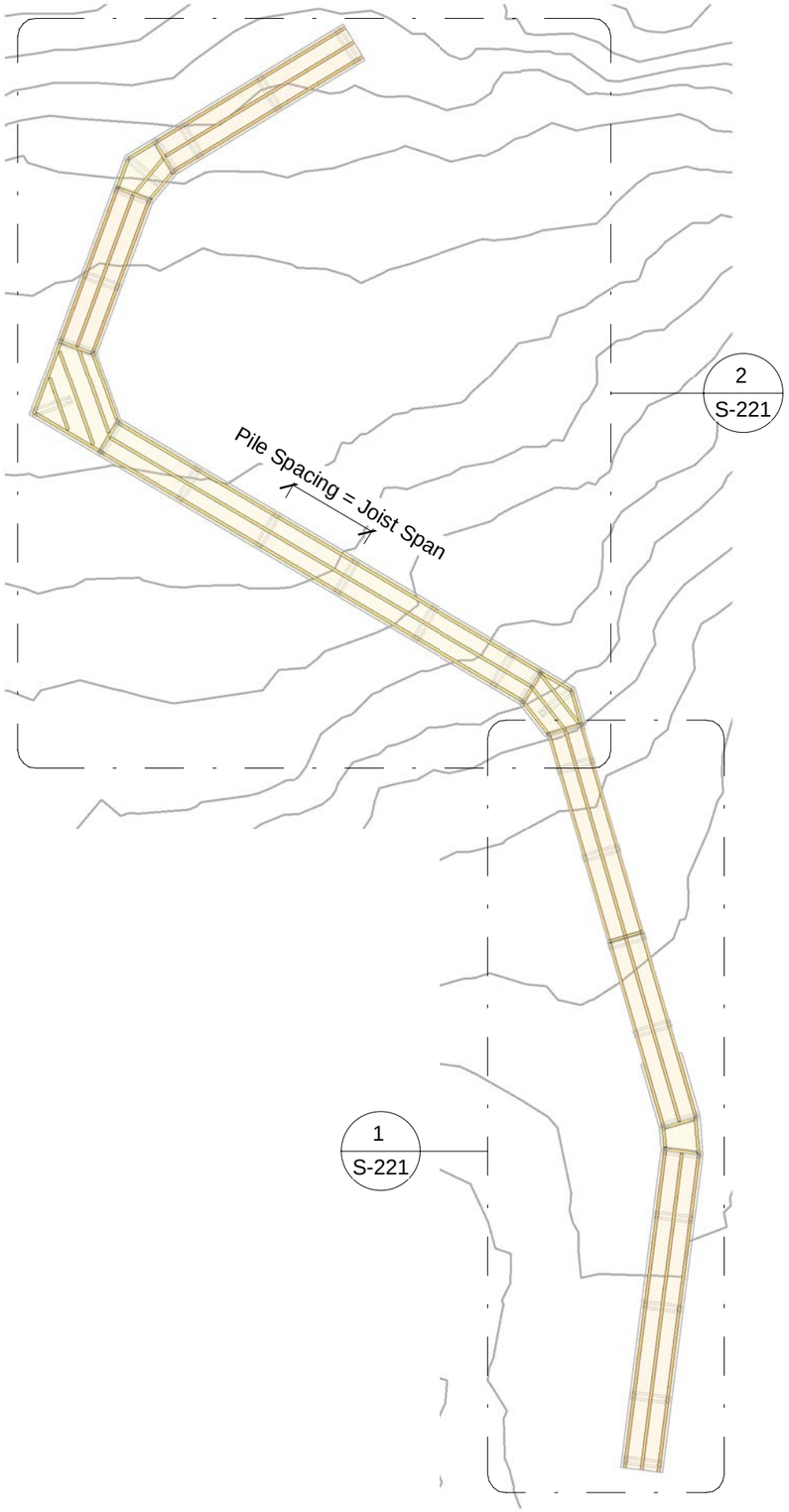
Drawing Name

Boardwalk 9.29W Plan 1 & 2 S-221

DATE: **07/08/2024**

DRAWN:	CHECKED:
JLA	**NW**

SCALE	REV.
1 : 100	**A**



Boardwalk 9.29.W Joists Plan

1 : 200



Boardwalk 9.29.W Joists Bearers & Piles Plan

1 : 200

Summary:						
Joist Depth (mm)	**Joist Thick (mm)**	**Joist Spacing (mm)**	**Joist SPAN (m)**	**Bearer Depth (mm)**	**Bearer Thick (mm)**	**Bearer Bolts to Piles**
190	90	600	1.5	190	70	2/M16
240	90	600	2.4	190	70	2/M16
290	90	600	3	190	70	2/M16

Rev	By	Amendment	Date
A	JLA	Concept	17.10.24

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Te Ara Mangawhero Trail

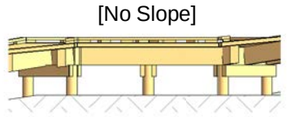
Drawing Name

Boardwalk 9.29W Joist, Bearers & Piles
S-222

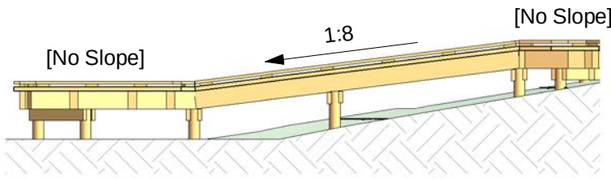
DATE: **07/08/2024**

DRAWN:	CHECKED:
JLA	**NW**

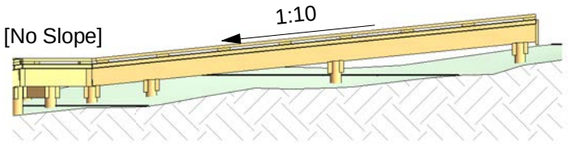
SCALE	REV.
As indicated	**A**



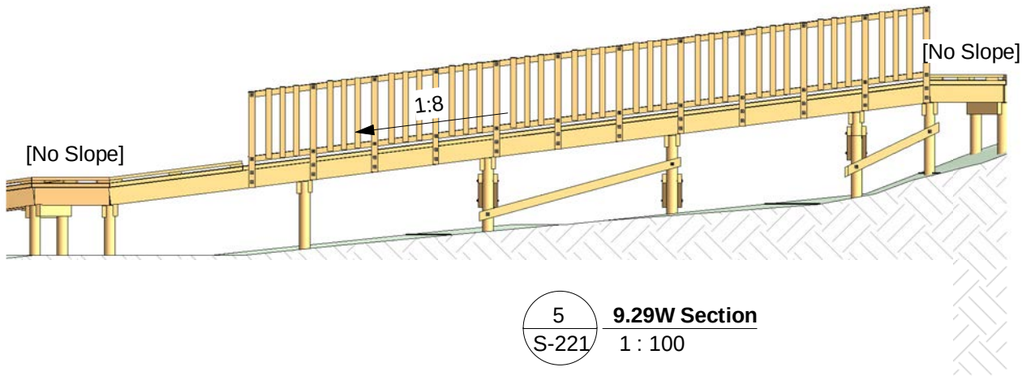
3 S-221 **9.29W Section** 1 : 100



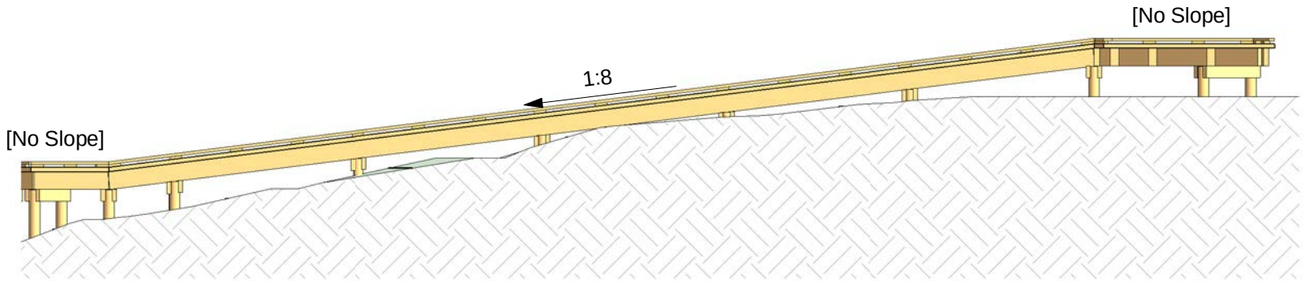
2 S-221 **9.29W Section** 1 : 100



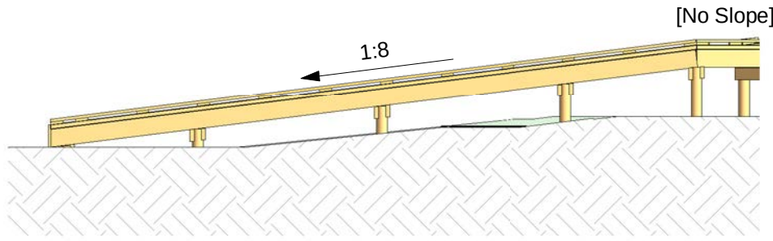
1 S-221 **9.29W Section** 1 : 100



5 S-221 **9.29W Section** 1 : 100



4 S-221 **9.29W Section** 1 : 100



6 S-221 **9.29W Section** 1 : 100

Rev	By	Amendment	Date
A	JLA	Concept	17.10.24

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Bridges 6.27, 6.29, 6.31, 7.2, 9.13 & Boardwalks 9.11, 9.29, 9.31

Te Ara Mangawhero Trail

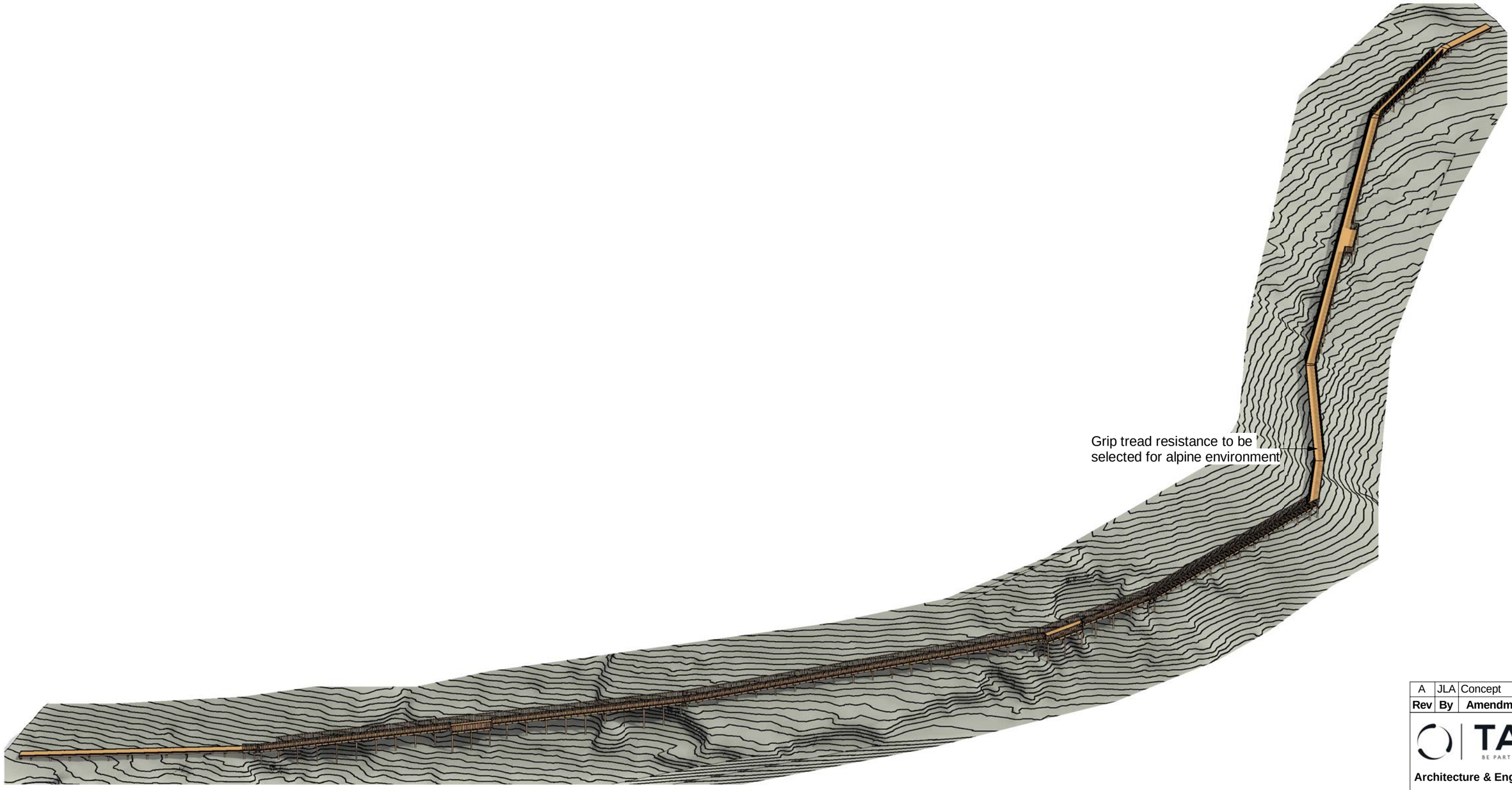
Drawing Name

Boardwalk 9.29W Sections S-223

DATE: **07/08/2024**

DRAWN:	CHECKED:
JLA	**NW**

SCALE	REV.
1 : 100	**A**



Rev	By	Amendment	Date
A	JLA	Concept	17.10.24

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Te Ara Mangawhero Trail

Drawing Name

Boardwalk 9.31W 3D View S-230

DATE: **07/08/2024**

DRAWN:	CHECKED:
JLA	**NW**

SCALE	REV.
1 : 2000	**A**



1 / S-200 **Boardwalk 9.13W Plan**
1 : 100

Rev	By	Amendment	Date
A	JLA	Concept	17.10.24

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Northland, New Zealand 0200

Bridges 6.27, 6.29, 6.31, 7.2, 9.13 & Boardwalks 9.11, 9.29, 9.31

Te Ara Mangawhero Trail

Drawing Name

Boardwalk 9.31W Plan1
S-231

DATE: **07/08/2024**

DRAWN:	CHECKED:
JLA	**NW**

SCALE	REV.
1 : 100	**A**



2 S-200 **Boardwalk 9.13W Plan**
1 : 100

Rev	By	Amendment	Date
A	JLA	Concept	17.10.24

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Northland, New Zealand 0200

Bridges 6.27, 6.29, 6.31, 7.2, 9.13 & Boardwalks 9.11, 9.29, 9.31

Te Ara Mangawhero Trail

Drawing Name

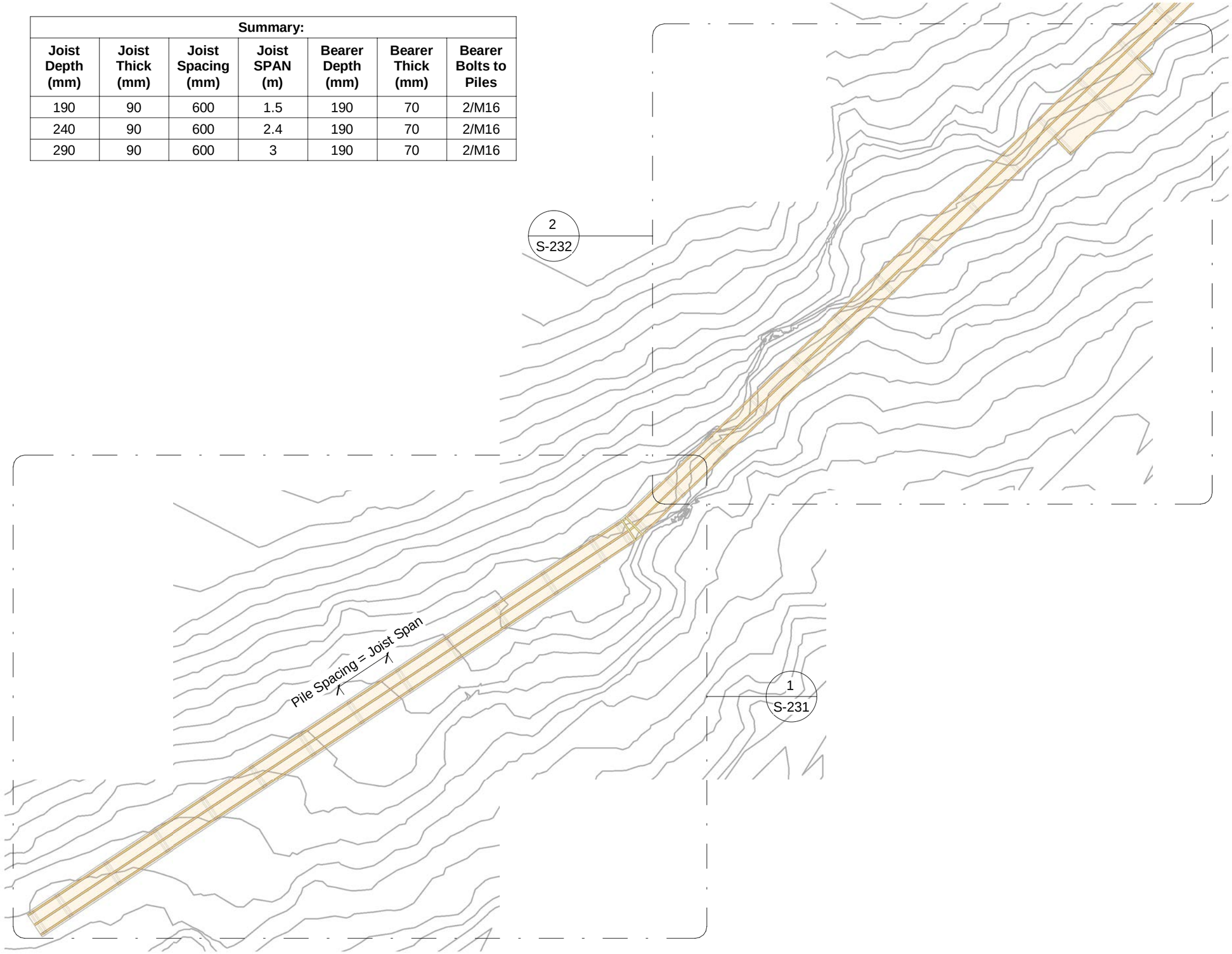
Boardwalk 9.31W Plan 2
S-232

DATE: **07/08/2024**

DRAWN:	CHECKED:
JLA	**NW**

SCALE	REV.
1 : 100	**A**

Summary:						
Joist Depth (mm)	**Joist Thick (mm)**	**Joist Spacing (mm)**	**Joist SPAN (m)**	**Bearer Depth (mm)**	**Bearer Thick (mm)**	**Bearer Bolts to Piles**
190	90	600	1.5	190	70	2/M16
240	90	600	2.4	190	70	2/M16
290	90	600	3	190	70	2/M16



1 **Boardwalk 9.13W Plan**
1 : 200

Rev	By	Amendment	Date
A	JLA	Concept	17.10.24

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Northland, New Zealand 0200

Bridges 6.27, 6.29, 6.31, 7.2, 9.13 & Boardwalks 9.11, 9.29, 9.31

Te Ara Mangawhero Trail

Drawing Name

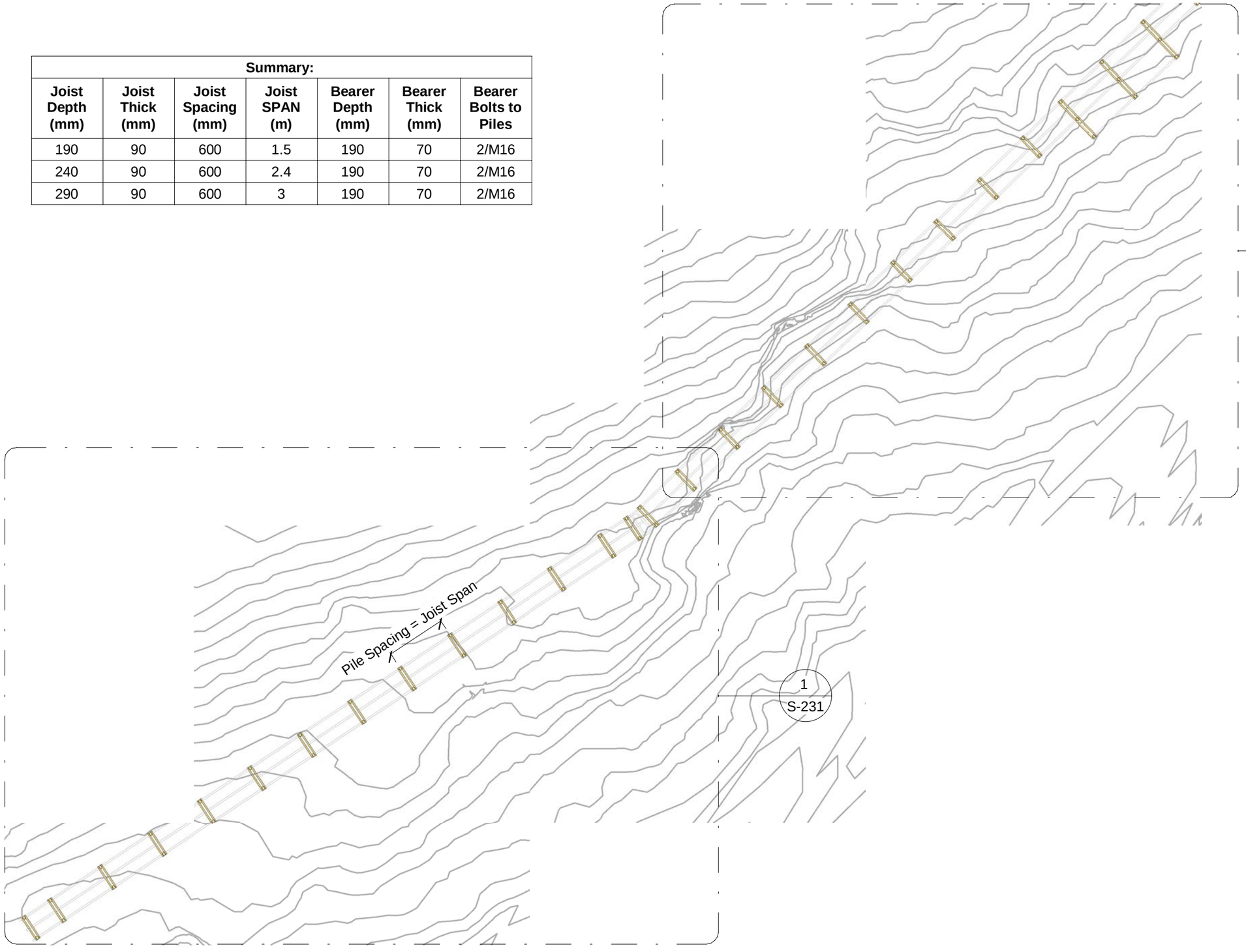
Boardwalk 9.31W Plan 1 & 2 Joists
S-233

DATE: **07/08/2024**

DRAWN:	CHECKED:
JLA	**NW**

SCALE	REV.
As indicated	**A**

Summary:						
Joist Depth (mm)	**Joist Thick (mm)**	**Joist Spacing (mm)**	**Joist SPAN (m)**	**Bearer Depth (mm)**	**Bearer Thick (mm)**	**Bearer Bolts to Piles**
190	90	600	1.5	190	70	2/M16
240	90	600	2.4	190	70	2/M16
290	90	600	3	190	70	2/M16



Boardwalk 9.13W Plan

1 : 200

Rev	By	Amendment	Date
A	JLA	Concept	17.10.24

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Northland, New Zealand 0200

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Te Ara Mangawhero Trail

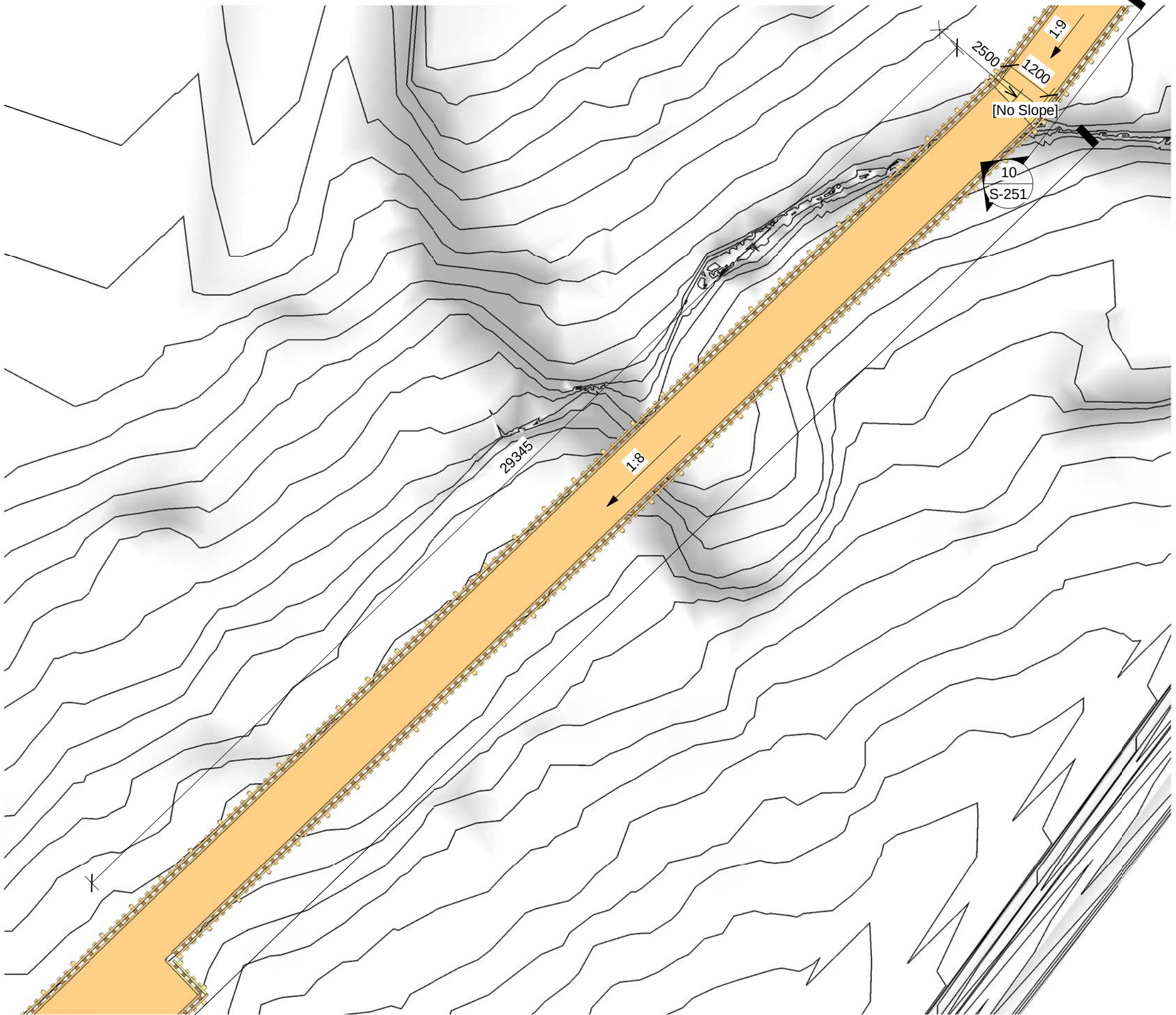
Drawing Name

Boardwalk 9.31W Plan 1 & 2 Bearers & Piles
S-234

DATE: **07/08/2024**

DRAWN:	CHECKED:
JLA	**NW**

SCALE	REV.
As indicated	**A**



3 S-200 **Boardwalk 9.13W Plan**
1 : 100

Rev	By	Amendment	Date
A	JLA	Concept	17.10.24

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Northland, New Zealand 0200

Bridges 6.27, 6.29, 6.31, 7.2, 9.13 & Boardwalks 9.11, 9.29, 9.31

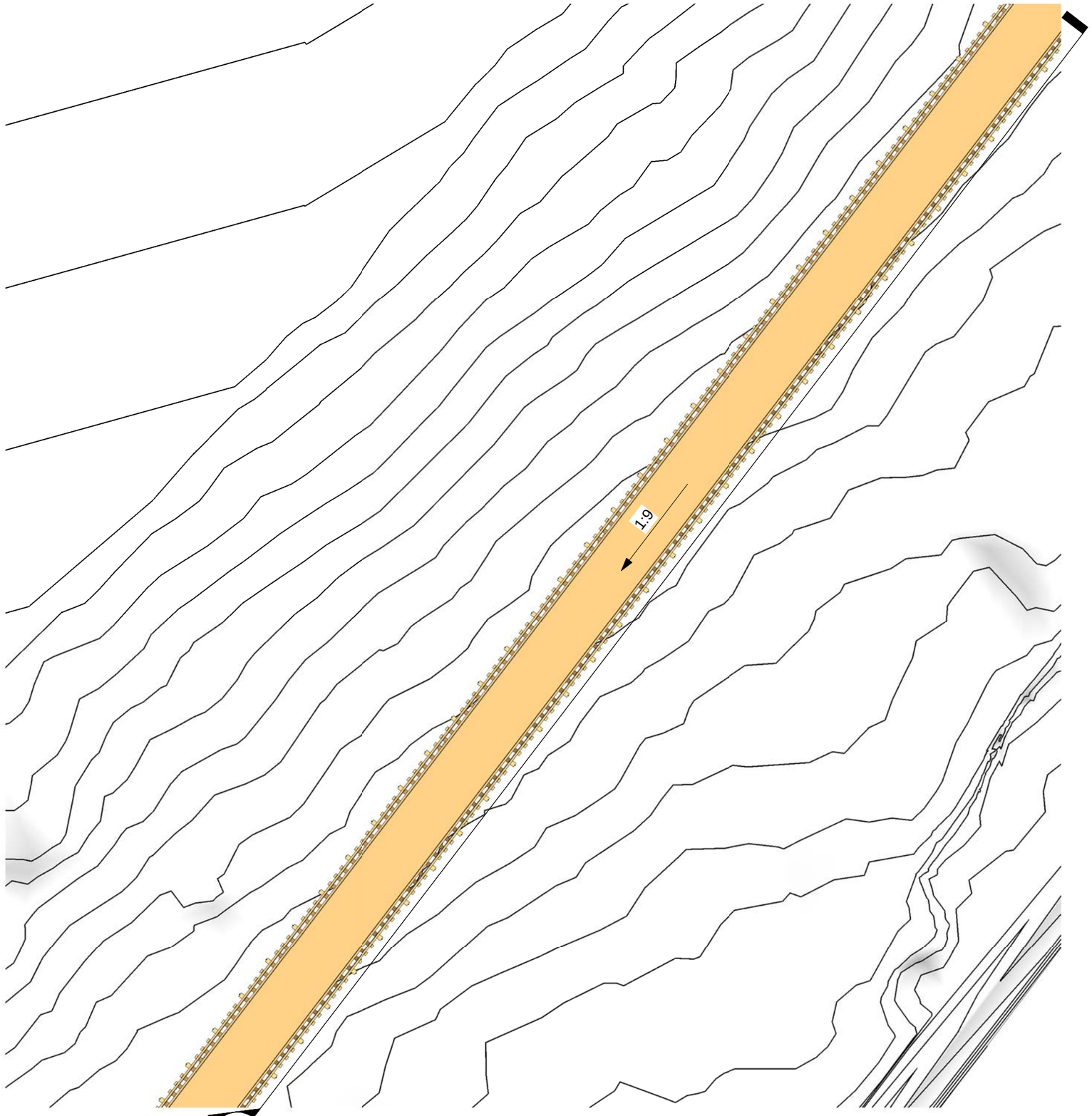
Te Ara Mangawhero Trail

Drawing Name

Boardwalk 9.31W Plan 3
S-235

DATE: **07/08/2024**

DRAWN:	CHECKED:
JLA	**NW**
SCALE **1 : 100**	REV. **A**



4
S-200
Boardwalk 9.13W Plan
1 : 100

Rev	By	Amendment	Date
A	JLA	Concept	17.10.24

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Northland, New Zealand 0200

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Te Ara Mangawhero Trail

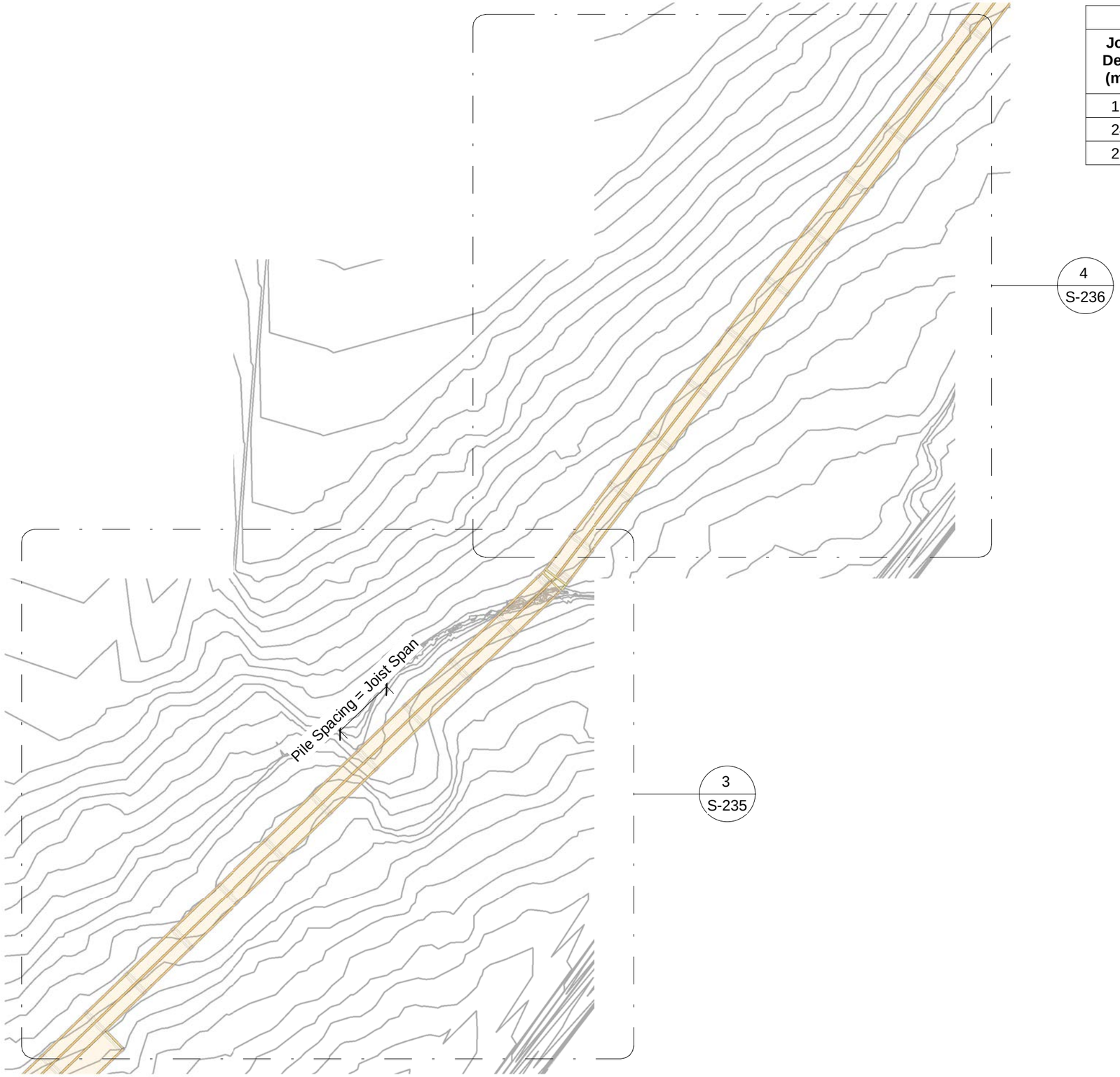
Drawing Name

Boardwalk 9.31W Plan 4
S-236

DATE: **07/08/2024**

DRAWN:	CHECKED:
JLA	**NW**

SCALE	REV.
1 : 100	**A**



Boardwalk 9.13W Plan

1 : 200

Summary:						
Joist Depth (mm)	**Joist Thick (mm)**	**Joist Spacing (mm)**	**Joist SPAN (m)**	**Bearer Depth (mm)**	**Bearer Thick (mm)**	**Bearer Bolts to Piles**
190	90	600	1.5	190	70	2/M16
240	90	600	2.4	190	70	2/M16
290	90	600	3	190	70	2/M16

Rev	By	Amendment	Date
A	JLA	Concept	17.10.24

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Northland, New Zealand 0200

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Te Ara Mangawhero Trail

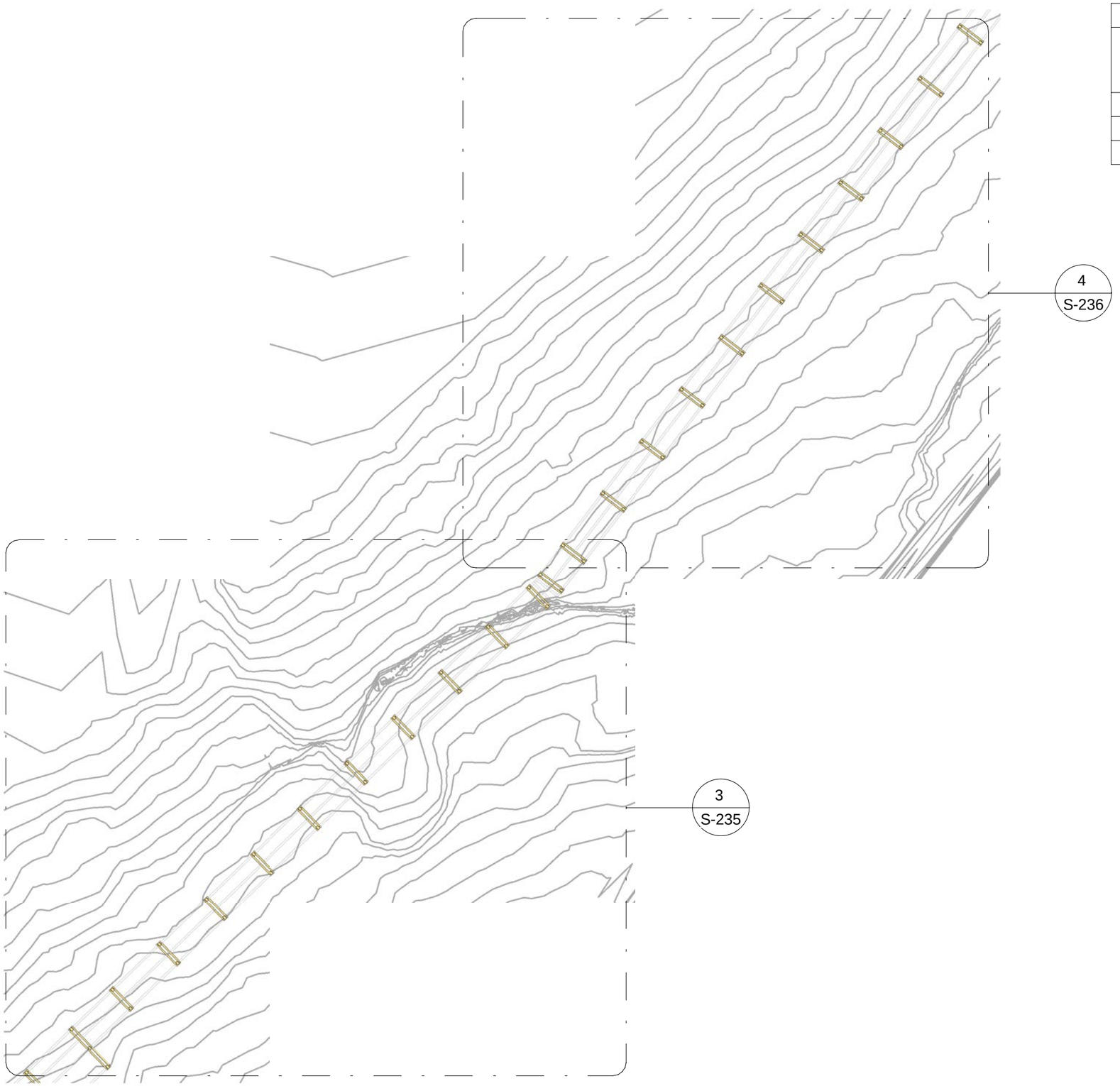
Drawing Name

Boardwalk 9.31W Plan 3 & 4 Joists
S-237

DATE: **07/08/2024**

DRAWN:	CHECKED:
JLA	**NW**

SCALE	REV.
As indicated	**A**



Boardwalk 9.13W Plan

1 : 200

Summary:						
Joist Depth (mm)	**Joist Thick (mm)**	**Joist Spacing (mm)**	**Joist SPAN (m)**	**Bearer Depth (mm)**	**Bearer Thick (mm)**	**Bearer Bolts to Piles**
190	90	600	1.5	190	70	2/M16
240	90	600	2.4	190	70	2/M16
290	90	600	3	190	70	2/M16

Rev	By	Amendment	Date
A	JLA	Concept	17.10.24

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Te Ara Mangawhero Trail

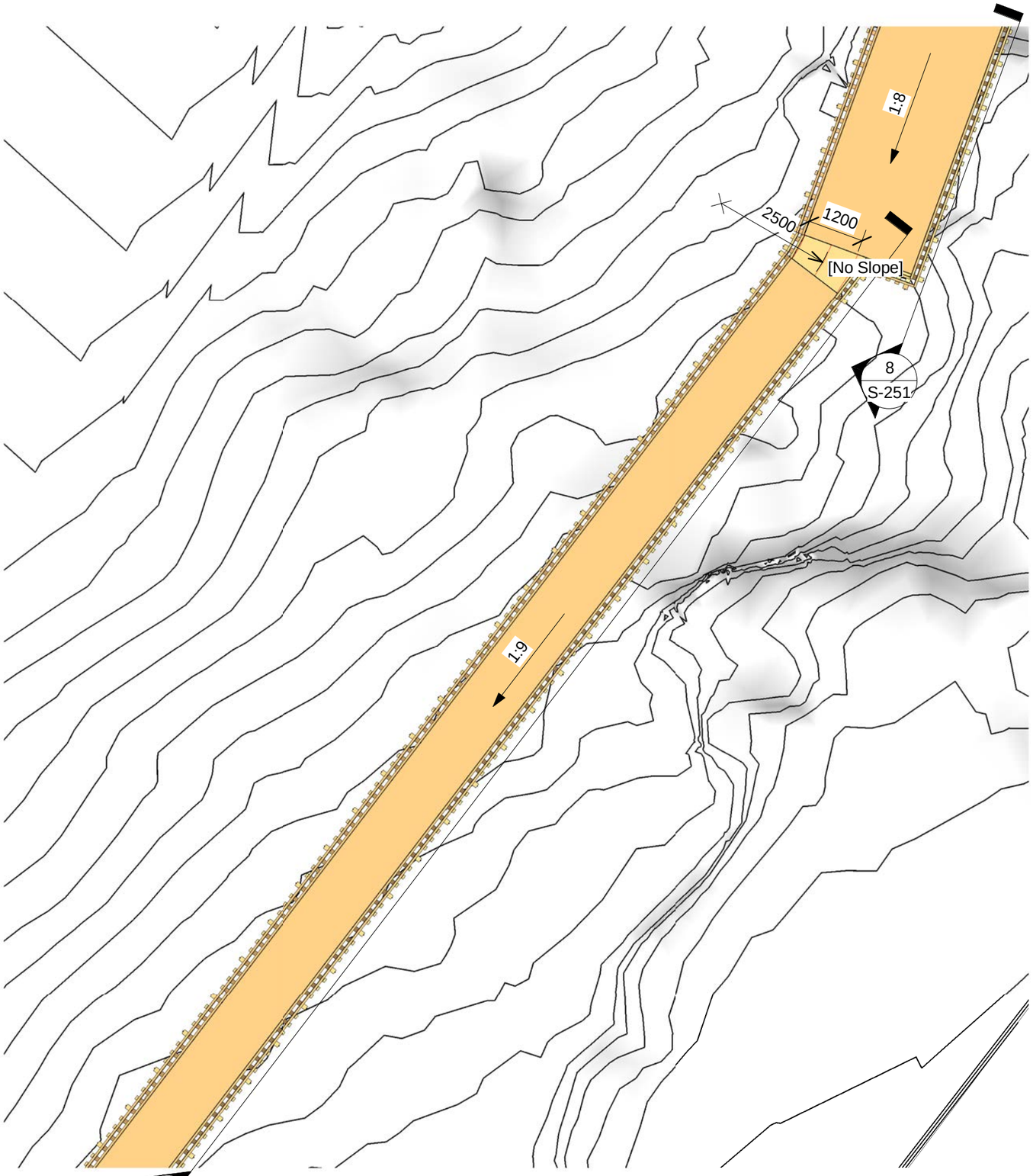
Drawing Name

Boardwalk 9.31W Plan 3 & 4 Bearers & Piles
S-238

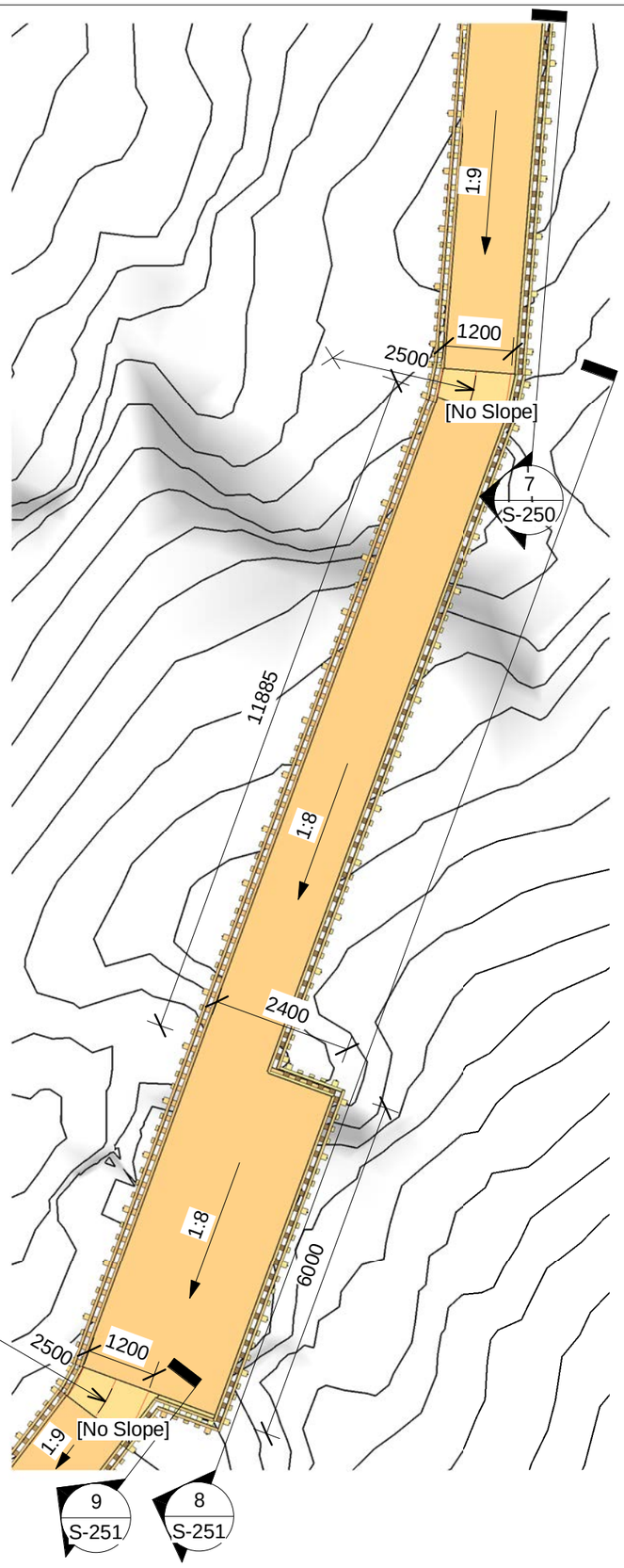
DATE: **07/08/2024**

DRAWN:	CHECKED:
JLA	**NW**

SCALE	REV.
As indicated	**A**



5 S-200 **Boardwalk 9.13W Plan**
1 : 100



6 S-200 **Boardwalk 9.13W Plan**
1 : 100

Rev	By	Amendment	Date
A	JLA	Concept	17.10.24

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Te Ara Mangawhero Trail

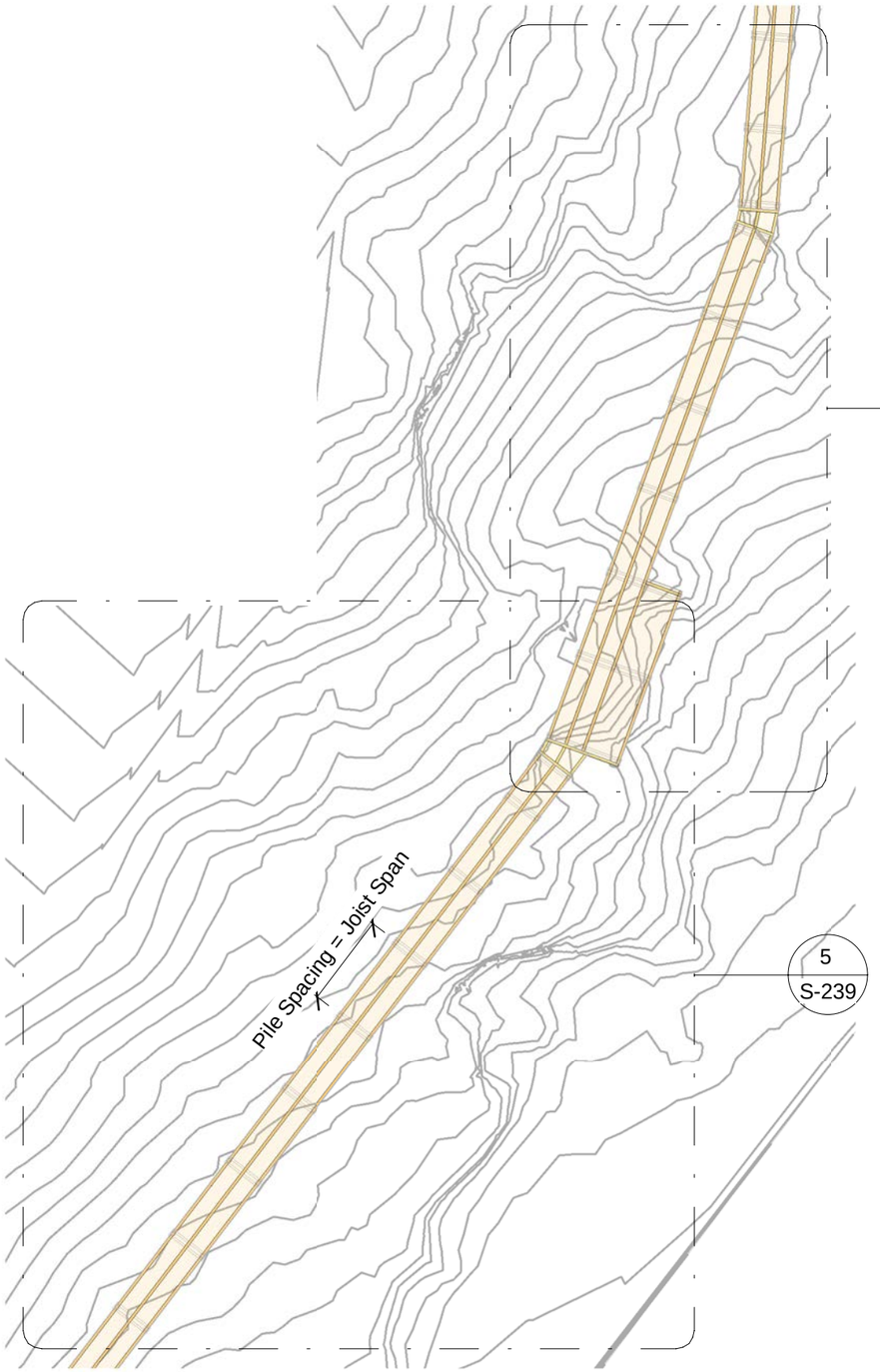
Drawing Name

Boardwalk 9.31W Plans 5 & 6 S-239

DATE: **07/08/2024**

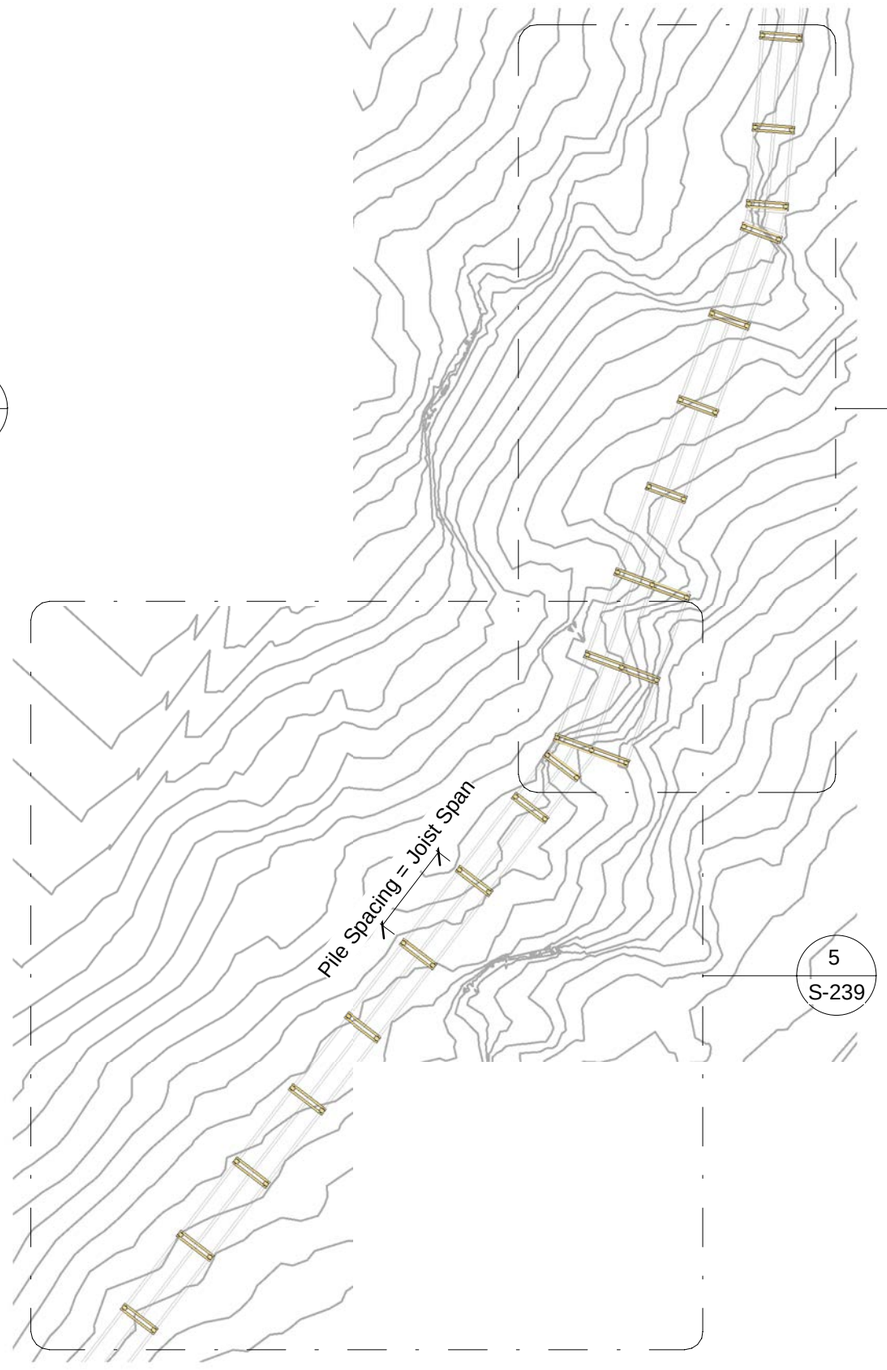
DRAWN:	CHECKED:
JLA	**NW**
SCALE **1 : 100**	REV. **A**

Summary:						
Joist Depth (mm)	**Joist Thick (mm)**	**Joist Spacing (mm)**	**Joist SPAN (m)**	**Bearer Depth (mm)**	**Bearer Thick (mm)**	**Bearer Bolts to Piles**
190	90	600	1.5	190	70	2/M16
240	90	600	2.4	190	70	2/M16
290	90	600	3	190	70	2/M16



Boardwalk 9.13W Plan

1 : 200



Boardwalk 9.13W Plan

1 : 200

Rev	By	Amendment	Date
A	JLA	Concept	17.10.24

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Northland, New Zealand 0200

Bridges 6.27, 6.29, 6.31, 7.2, 9.13 & Boardwalks 9.11, 9.29, 9.31

Te Ara Mangawhero Trail

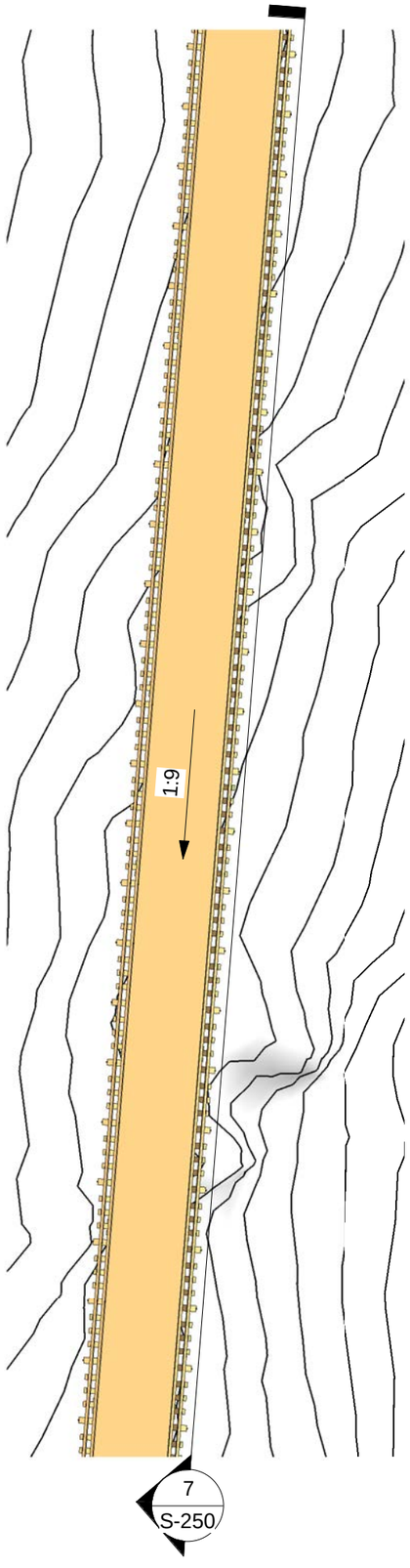
Drawing Name

Boardwalk 9.31W Plans 5 & 6 Joist, Bearers & Piles
S-240

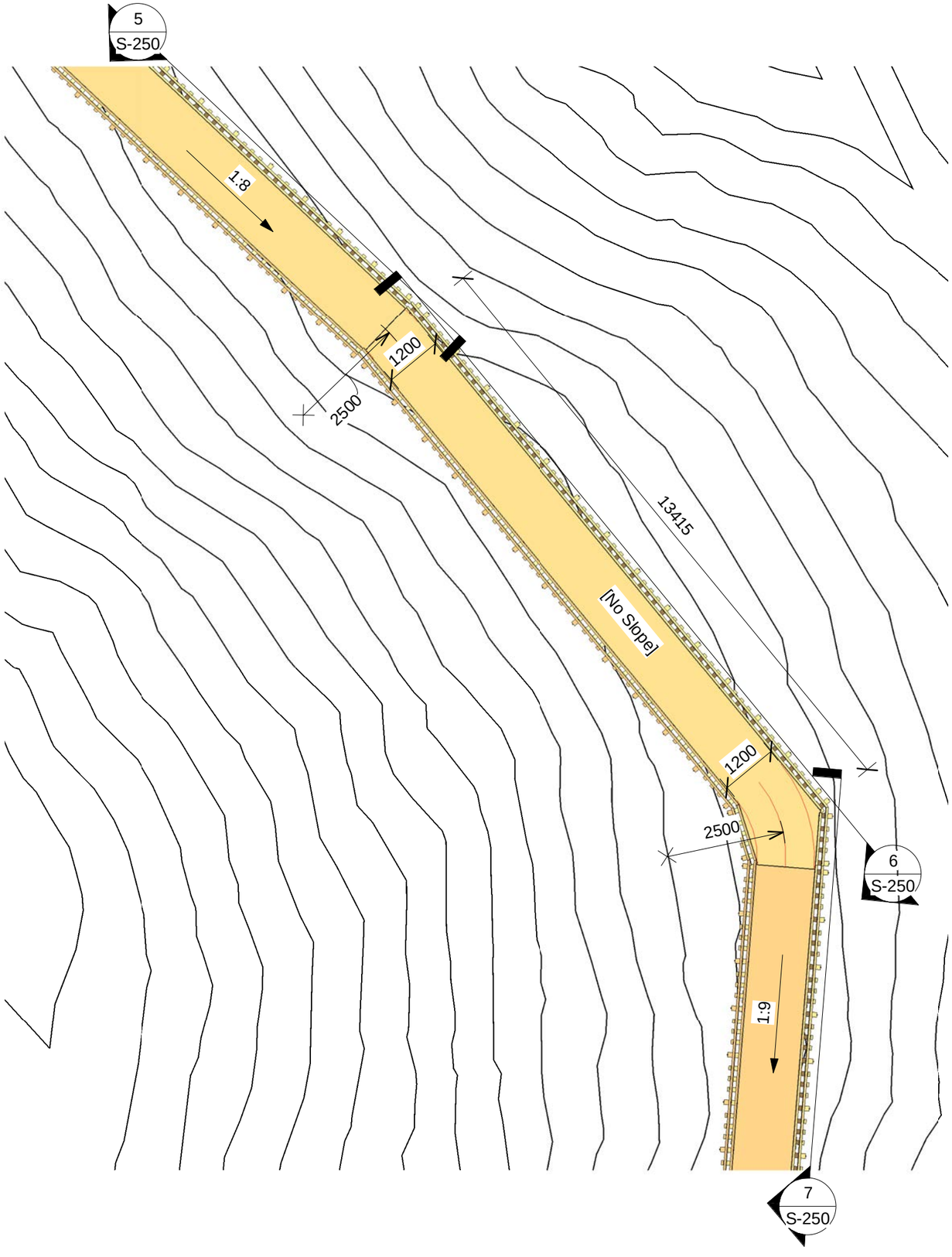
DATE: **07/08/2024**

DRAWN:	CHECKED:
JLA	**NW**

SCALE	REV.
As indicated	**A**



7 S-200 **Boardwalk 9.13W Plan**
1 : 100



8 S-200 **Boardwalk 9.13W Plan**
1 : 100

Rev	By	Amendment	Date
A	JLA	Concept	17.10.24

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Bridges 6.27, 6.29, 6.31, 7.2, 9.13 & Boardwalks 9.11, 9.29, 9.31

Te Ara Mangawhero Trail

Drawing Name

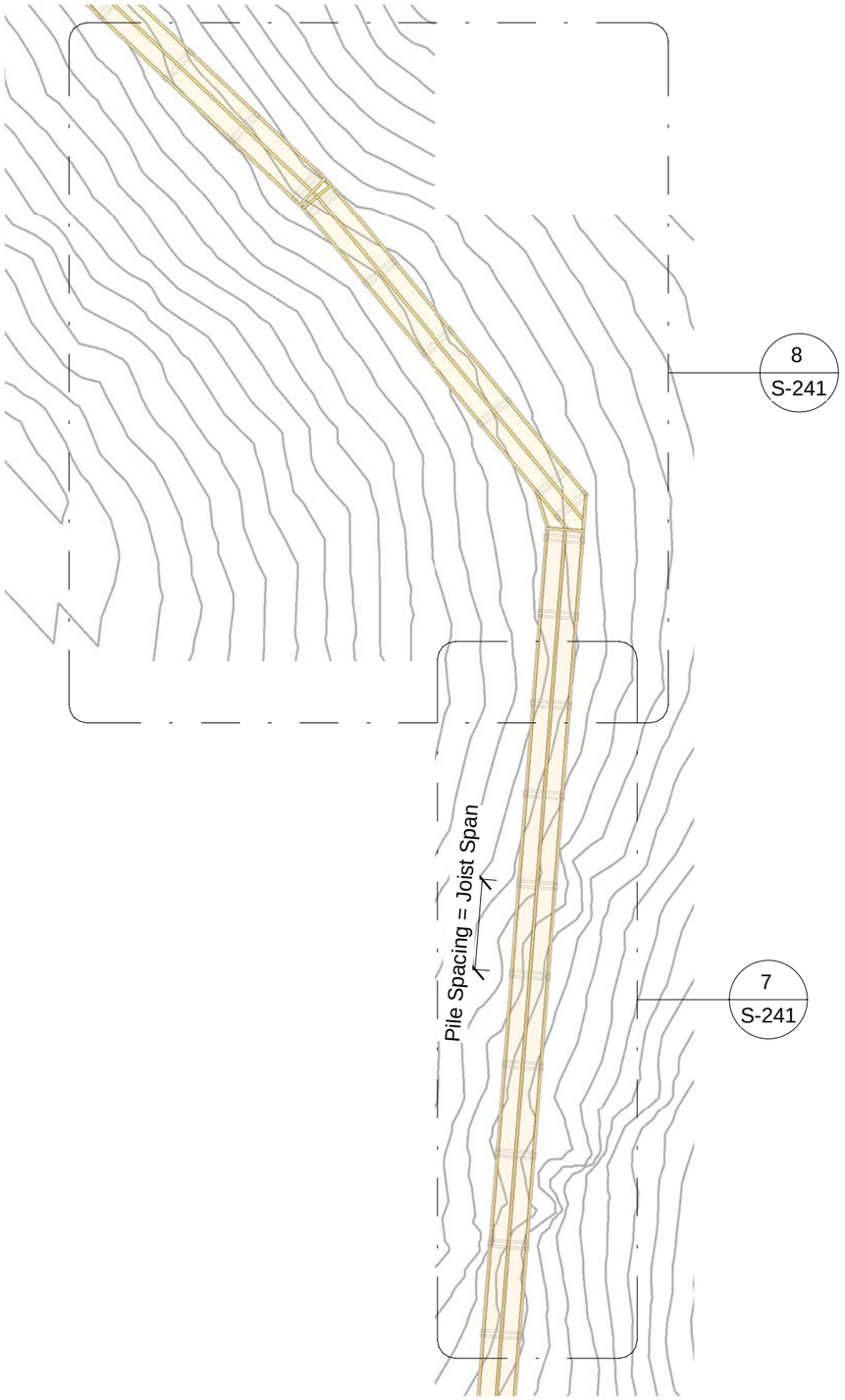
Boardwalk 9.31W Plans 7 & 8 S-241

DATE: **07/08/2024**

DRAWN:	CHECKED:
JLA	**NW**

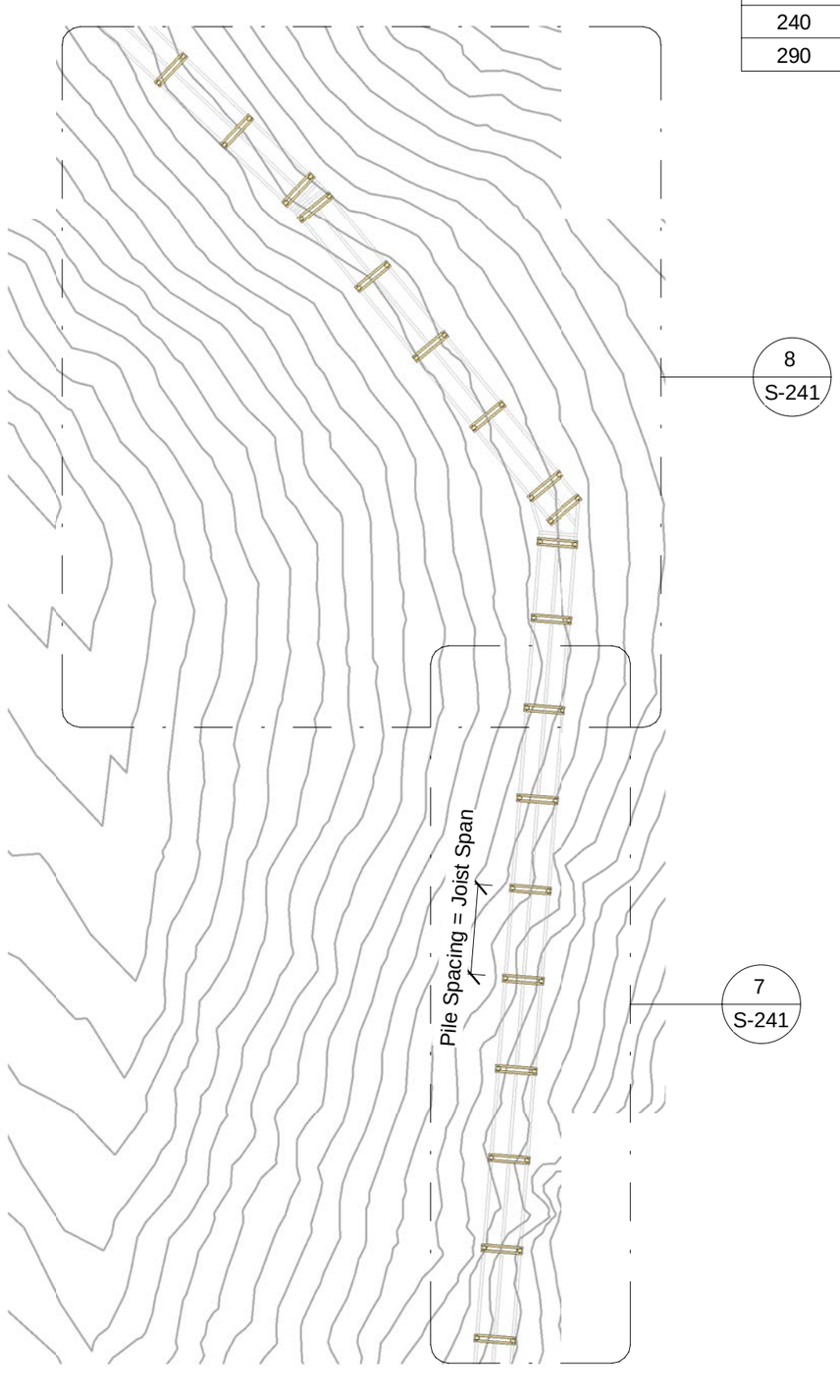
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1 : 100	**A**

Summary:						
Joist Depth (mm)	**Joist Thick (mm)**	**Joist Spacing (mm)**	**Joist SPAN (m)**	**Bearer Depth (mm)**	**Bearer Thick (mm)**	**Bearer Bolts to Piles**
190	90	600	1.5	190	70	2/M16
240	90	600	2.4	190	70	2/M16
290	90	600	3	190	70	2/M16



Boardwalk 9.13W Plan

1 : 200



Boardwalk 9.13W Plan

1 : 200

Rev	By	Amendment	Date
A	JLA	Concept	17.10.24

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Te Ara Mangawhero Trail

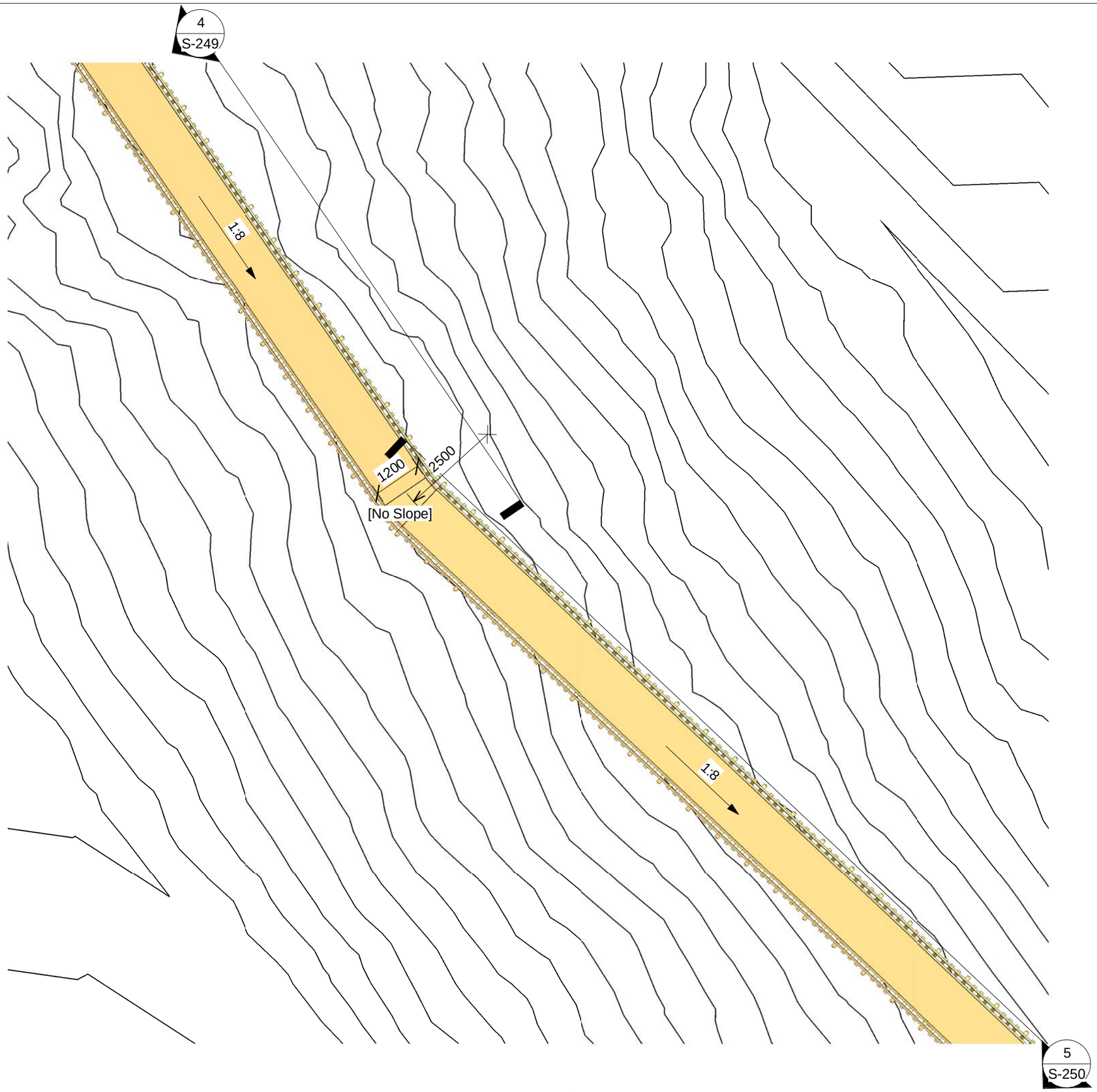
Drawing Name

Boardwalk 9.31W Plans 7 & 8 Joist, Bearers & Piles
S-242

DATE: **07/08/2024**

DRAWN:	CHECKED:
JLA	**NW**

SCALE	REV.
As indicated	**A**



9 S-200 **Boardwalk 9.13W Plan**
1 : 100

Rev	By	Amendment	Date
A	JLA	Concept	17.10.24

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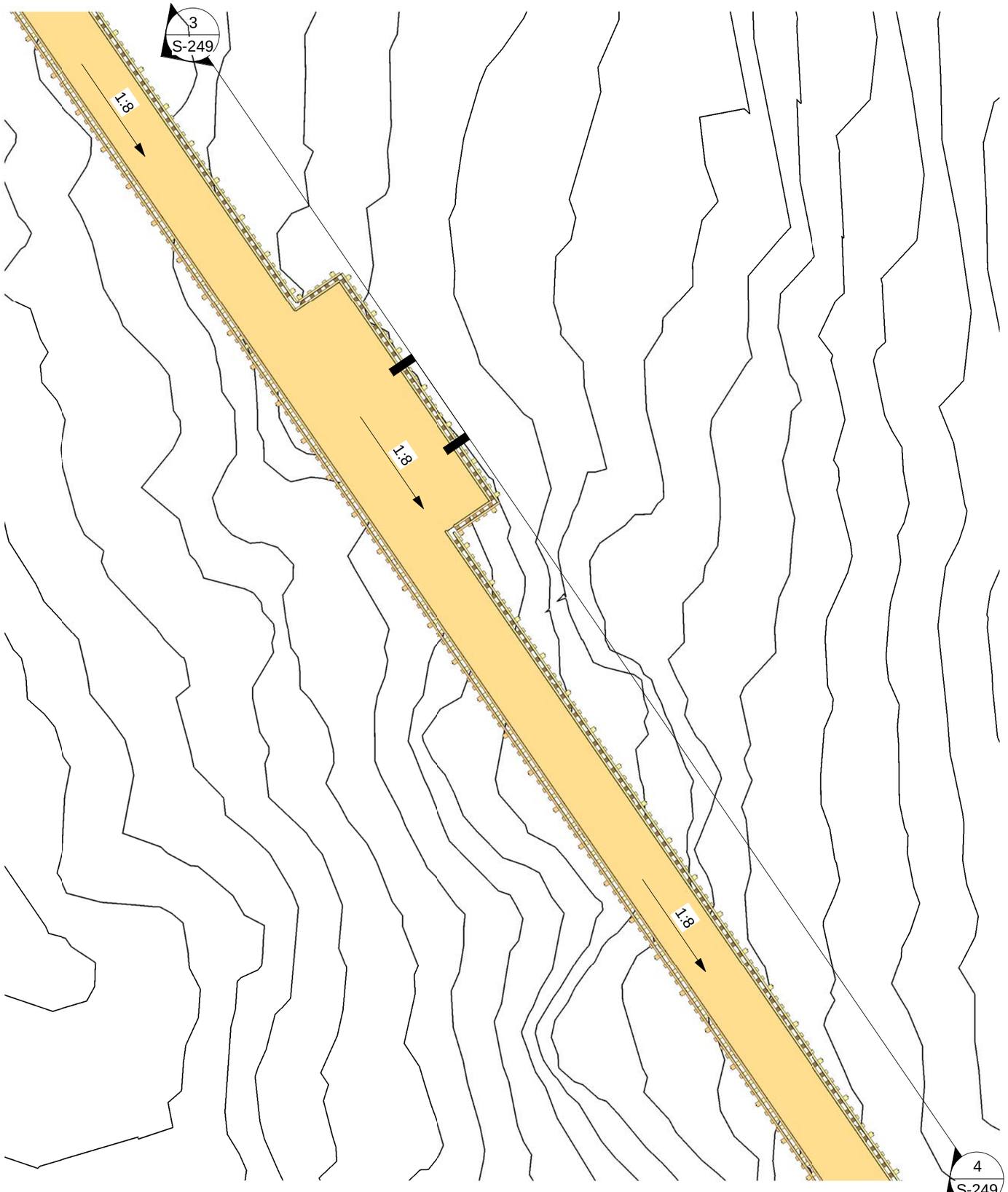
Drawing Name

Boardwalk 9.31W Plan 9
S-243

DATE: **07/08/2024**

DRAWN:	CHECKED:
JLA	**NW**

SCALE	REV.
1 : 100	**A**



10 / S-200 **Boardwalk 9.13W Plan**
1 : 100

Rev	By	Amendment	Date
A	JLA	Concept	17.10.24

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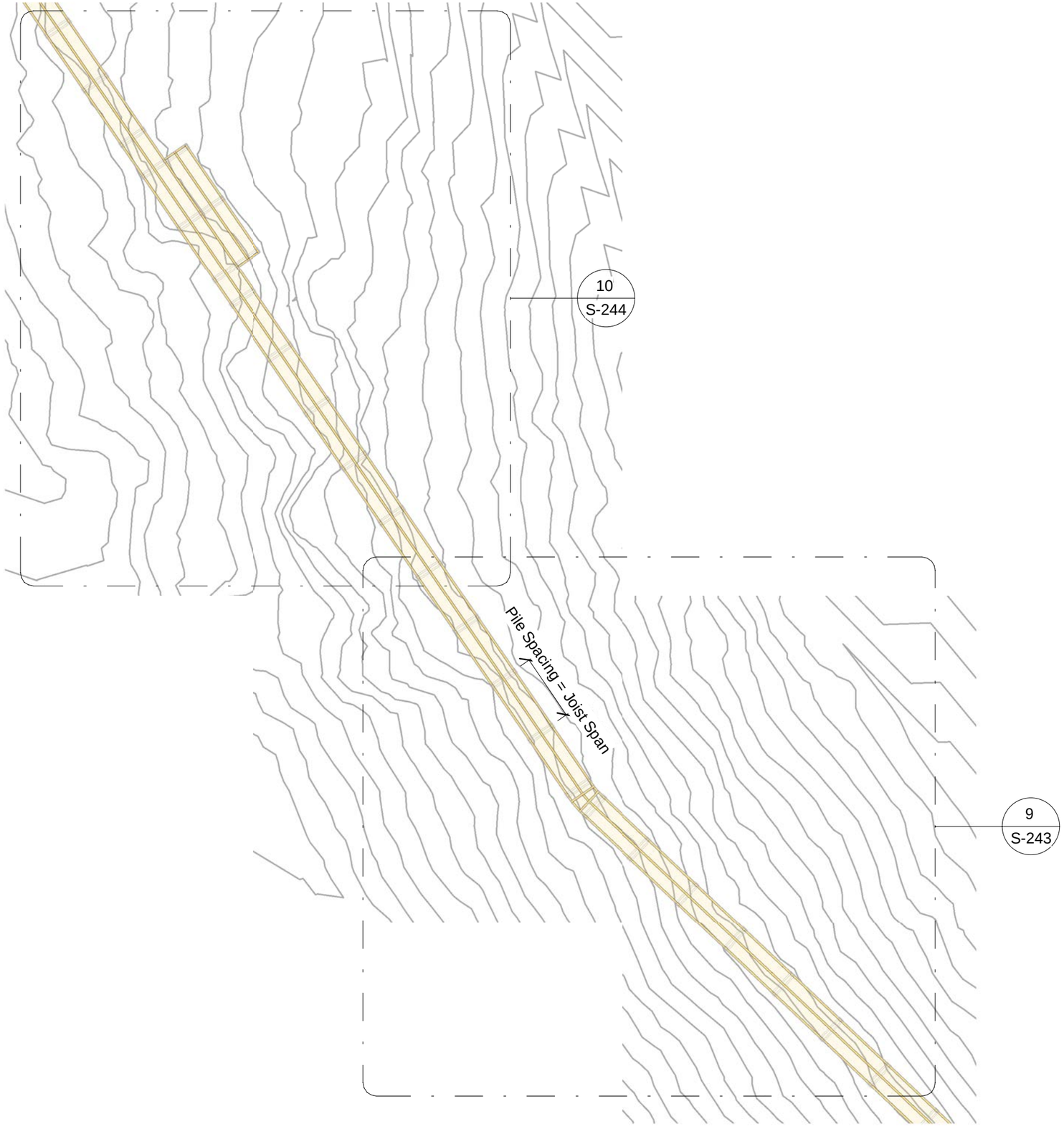
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Boardwalk 9.31W Plan10 S-244

DATE: **07/08/2024**

DRAWN:	CHECKED:
JLA	**NW**

SCALE	REV.
1 : 100	**A**



Boardwalk 9.13W Plan

1 : 200

Summary:						
Joist Depth (mm)	**Joist Thick (mm)**	**Joist Spacing (mm)**	**Joist SPAN (m)**	**Bearer Depth (mm)**	**Bearer Thick (mm)**	**Bearer Bolts to Piles**
190	90	600	1.5	190	70	2/M16
240	90	600	2.4	190	70	2/M16
290	90	600	3	190	70	2/M16

Rev	By	Amendment	Date
A	JLA	Concept	17.10.24

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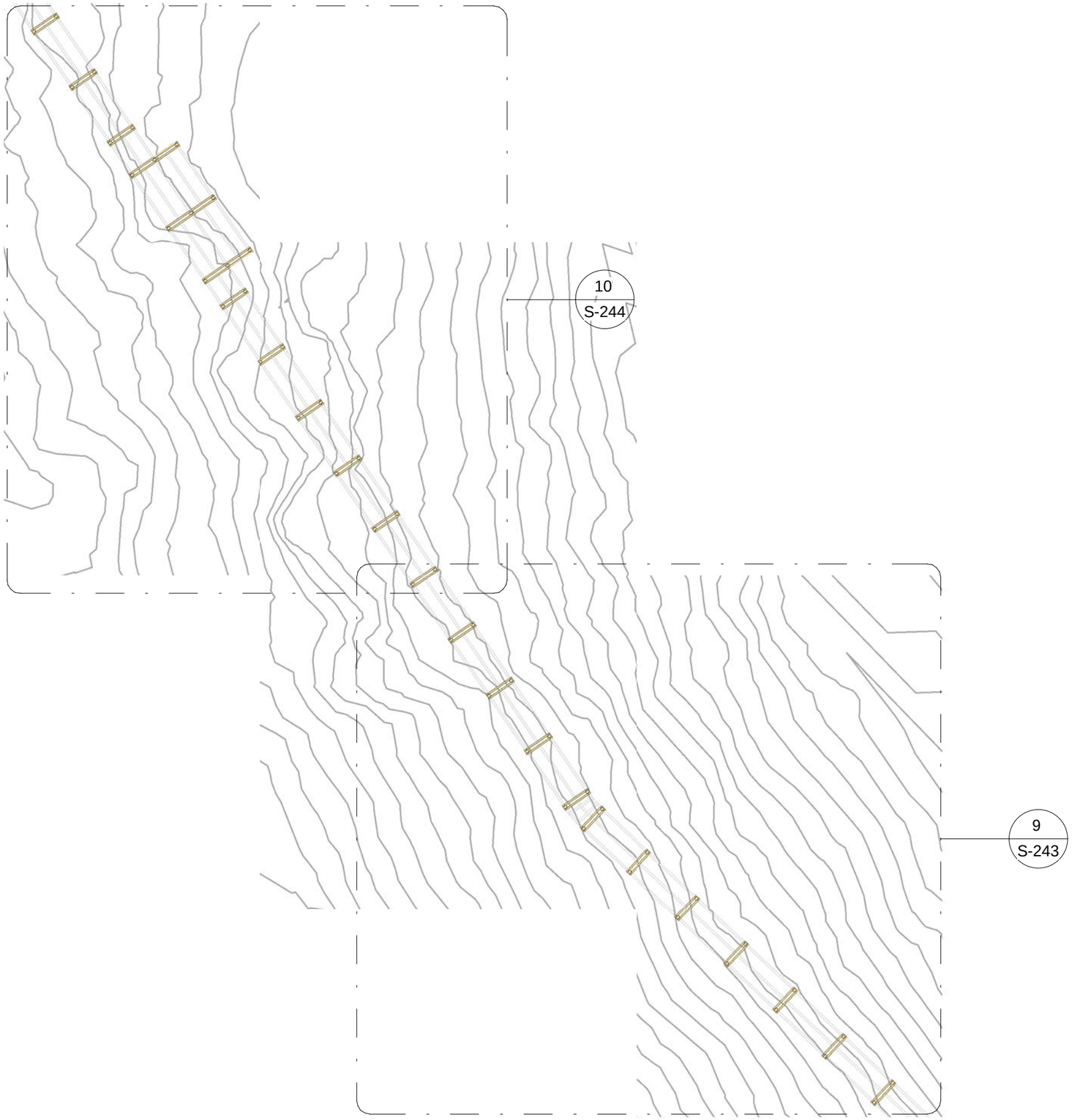
Drawing Name

Boardwalk 9.31W Plans 9 & 10 Joists
S-245

DATE: **07/08/2024**

DRAWN:	CHECKED:
JLA	**NW**

SCALE	REV.
As indicated	**A**



Boardwalk 9.13W Plan

1 : 200

Summary:						
Joist Depth (mm)	**Joist Thick (mm)**	**Joist Spacing (mm)**	**Joist SPAN (m)**	**Bearer Depth (mm)**	**Bearer Thick (mm)**	**Bearer Bolts to Piles**
190	90	600	1.5	190	70	2/M16
240	90	600	2.4	190	70	2/M16
290	90	600	3	190	70	2/M16

Rev	By	Amendment	Date
A	JLA	Concept	17.10.24

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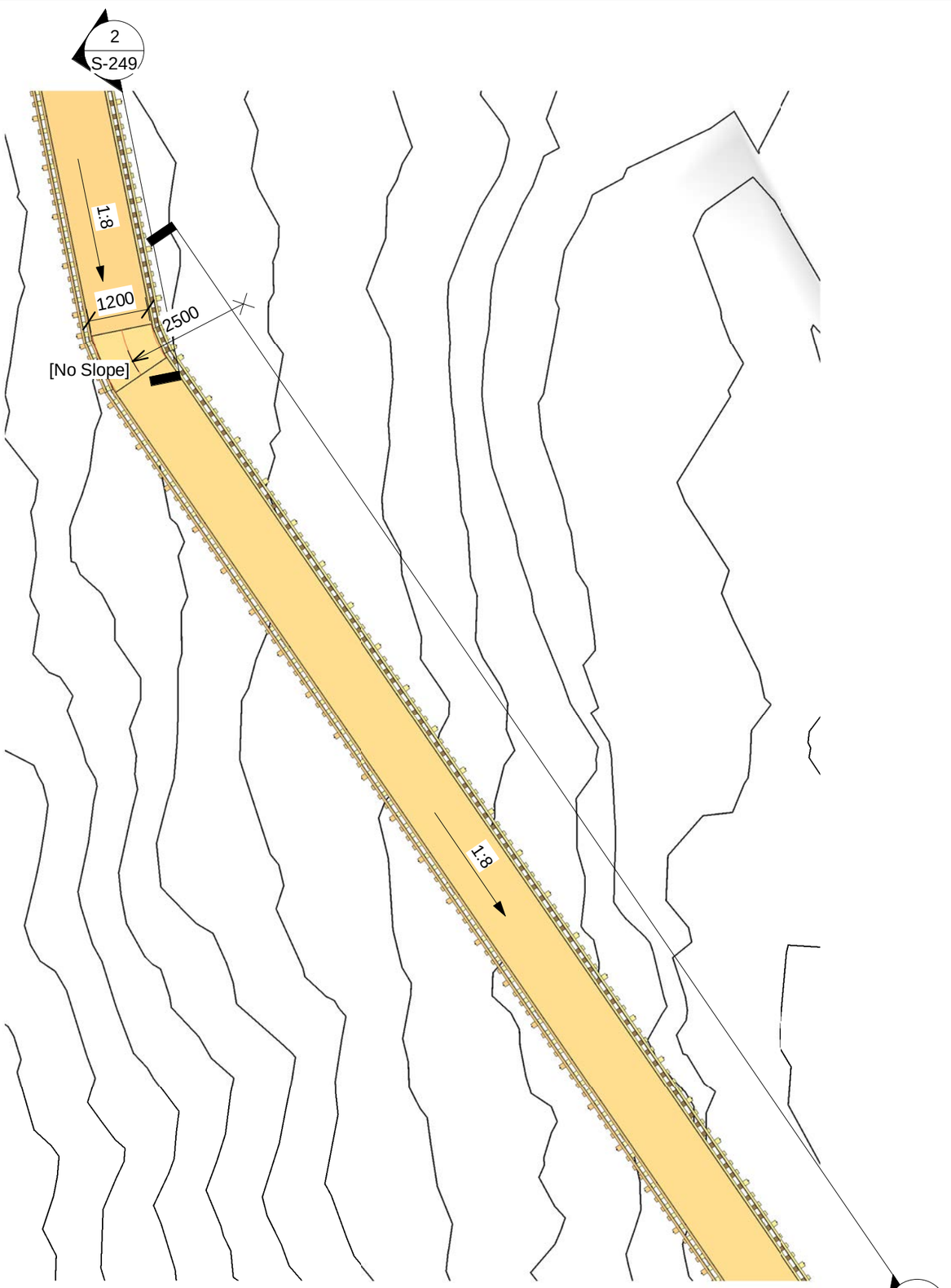
Drawing Name

Boardwalk 9.31W Plans 9 & 10 Bearers & Piles
S-246

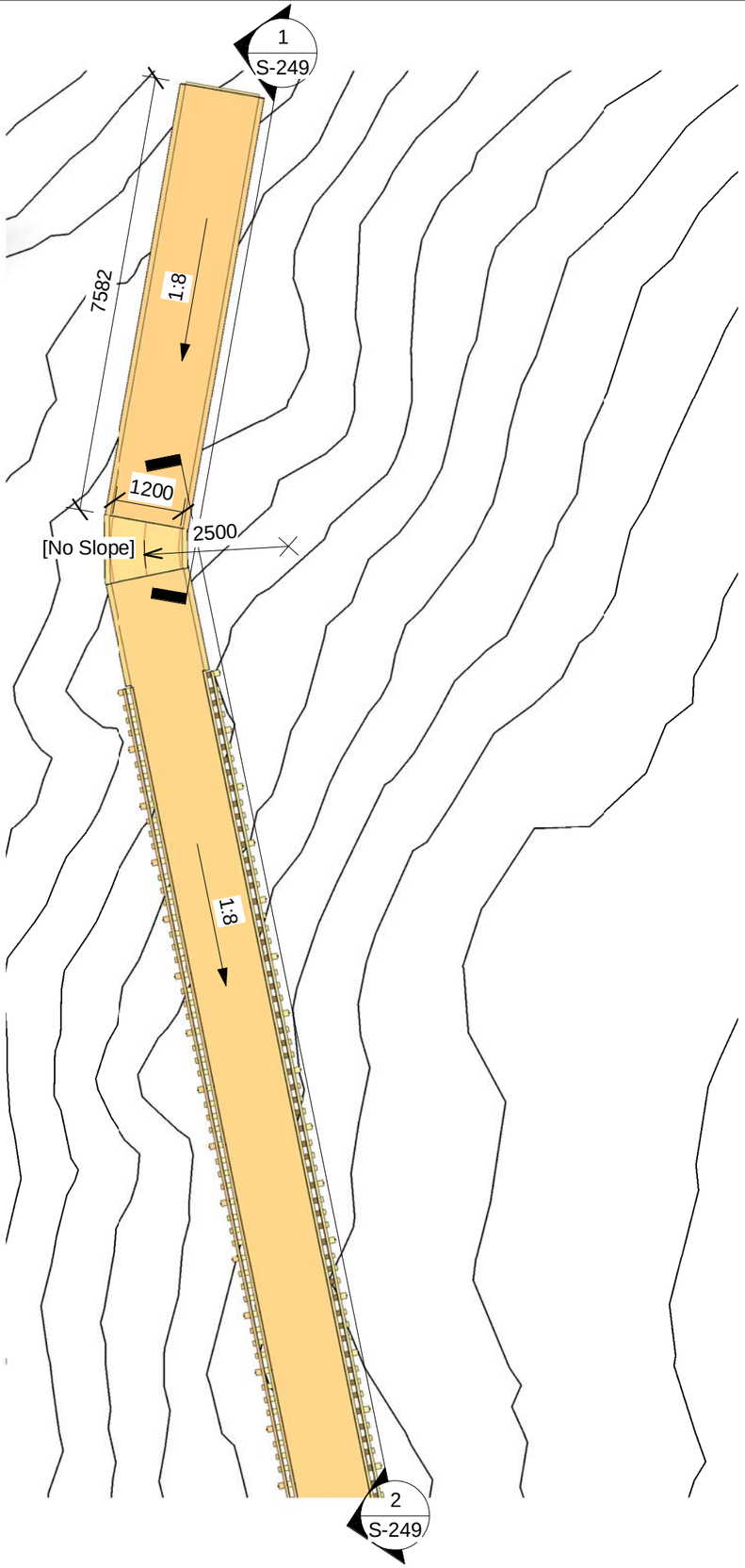
DATE: **07/08/2024**

DRAWN:	CHECKED:
JLA	**NW**

SCALE	REV.
As indicated	**A**



11 S-200 **Boardwalk 9.13W Plan**
1 : 100



12 S-200 **Boardwalk 9.13W Plan**
1 : 100

Rev	By	Amendment	Date
A	JLA	Concept	17.10.24

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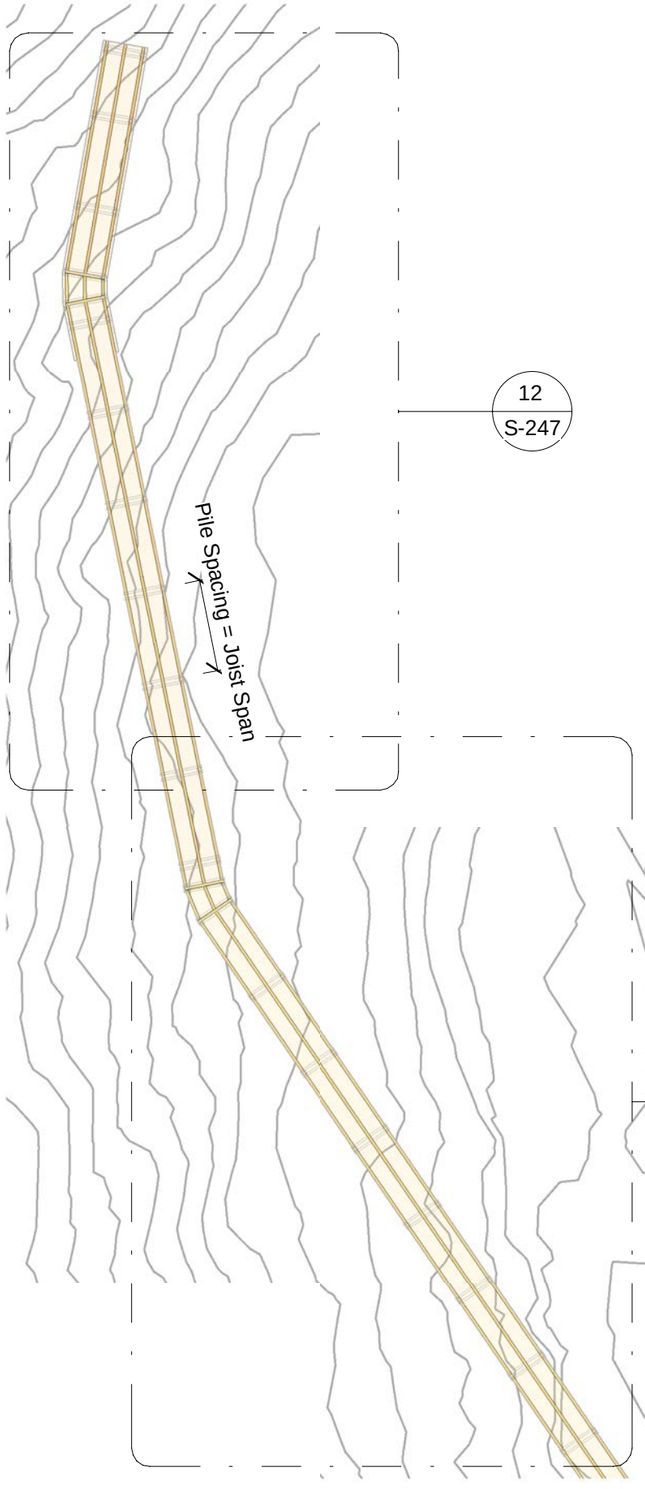
Drawing Name

Boardwalk 9.31W Plans 11 & 12 S-247

DATE: **07/08/2024**

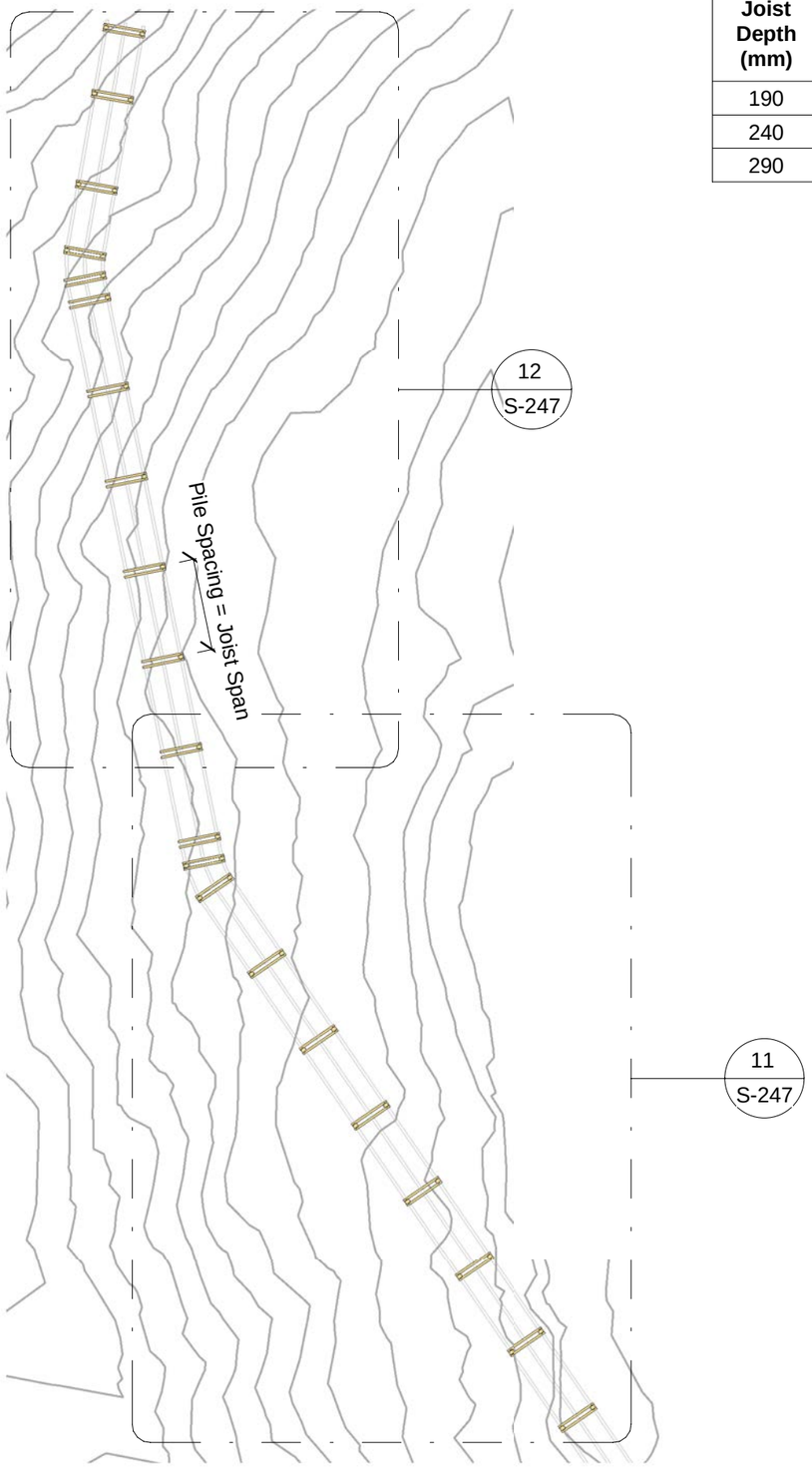
DRAWN:	CHECKED:
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SCALE	REV.
1 : 100	**A**



Boardwalk 9.13W Plan

1 : 200



Boardwalk 9.13W Plan

1 : 200

Summary:						
Joist Depth (mm)	**Joist Thick (mm)**	**Joist Spacing (mm)**	**Joist SPAN (m)**	**Bearer Depth (mm)**	**Bearer Thick (mm)**	**Bearer Bolts to Piles**
190	90	600	1.5	190	70	2/M16
240	90	600	2.4	190	70	2/M16
290	90	600	3	190	70	2/M16

Rev	By	Amendment	Date
A	JLA	Concept	17.10.24

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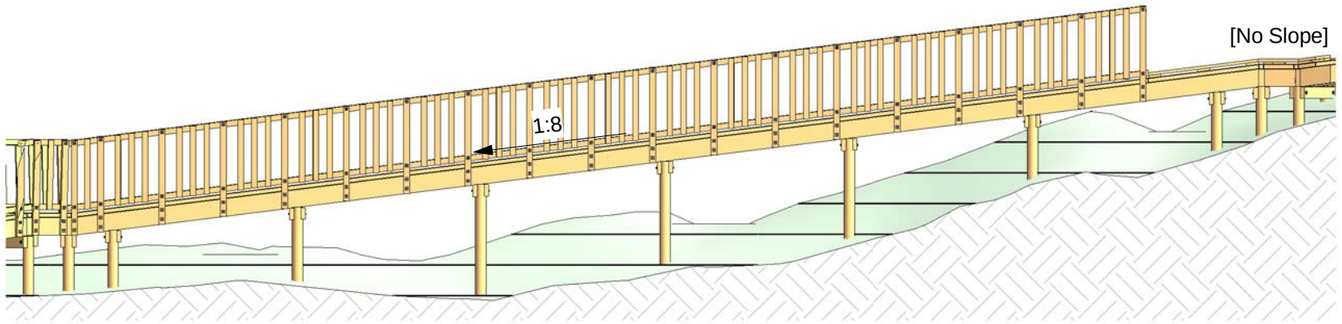
Drawing Name

Boardwalk 9.31W Plans 11 & 12 Joist, Bearers & Piles S-248

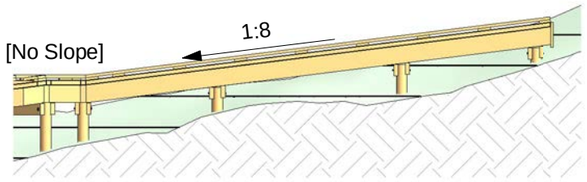
DATE: **07/08/2024**

DRAWN:	CHECKED:
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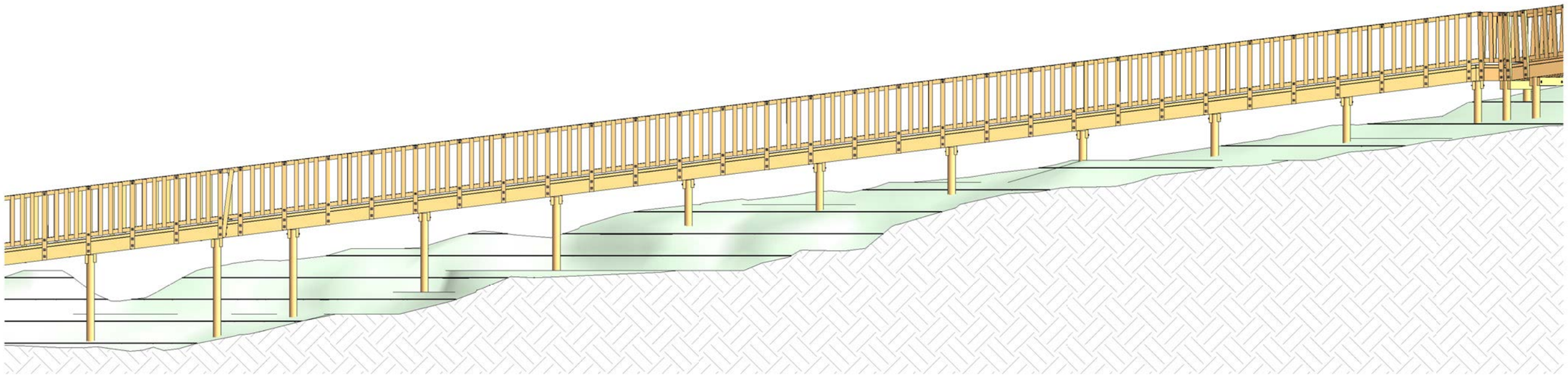
SCALE	REV.
As indicated	**A**



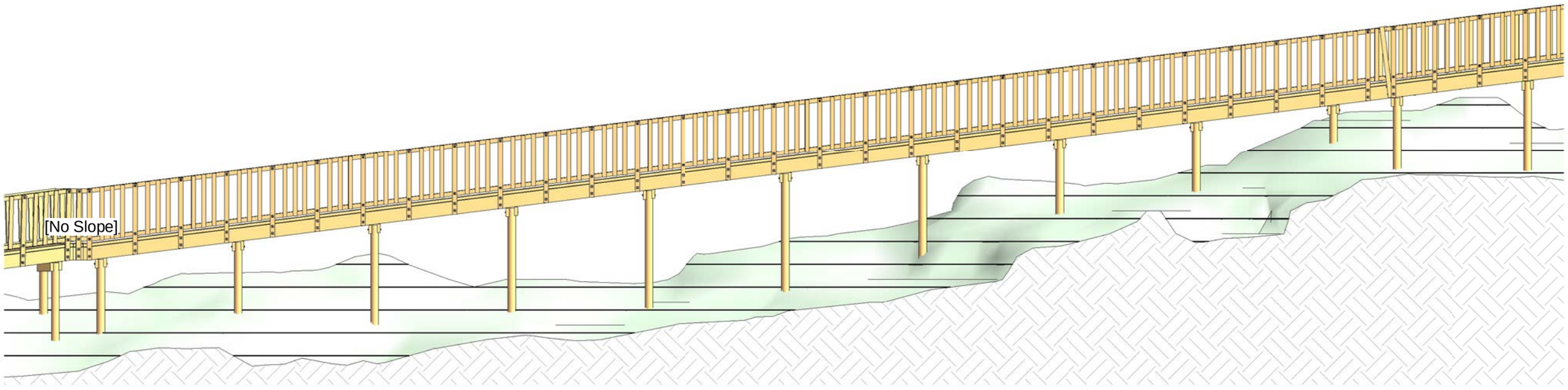
2 S-247 **9.31W Section** 1 : 100



1 S-247 **9.31W Section** 1 : 100



3 S-244 **9.31W Section** 1 : 100



4 S-243 **9.31W Section** 1 : 100

Rev	By	Amendment	Date
A	JLA	Concept	17.10.24

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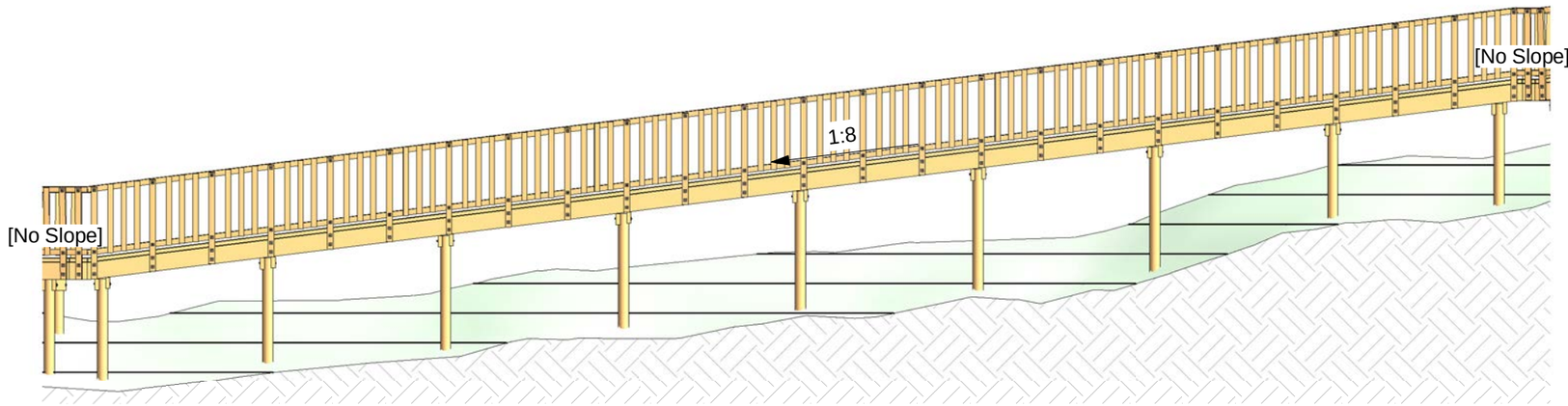
Drawing Name

Boardwalk 9.31W Sections S-249

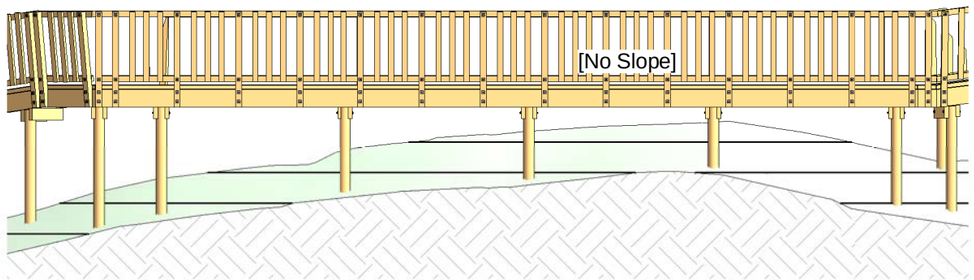
DATE: **07/08/2024**

DRAWN:	CHECKED:
JLA	**NW**

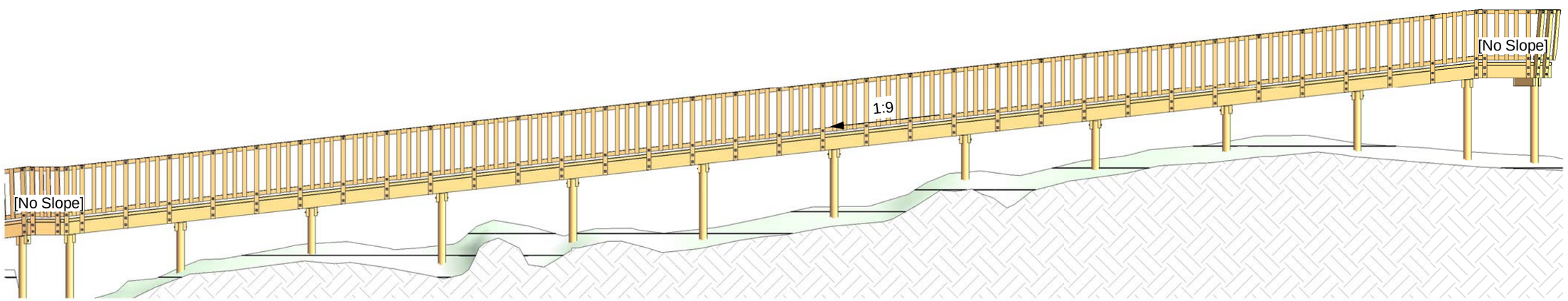
SCALE	REV.
1 : 100	**A**



5 / S-241 **9.31W Section** 1 : 100



6 / S-241 **9.31W Section** 1 : 100



7 / S-239 **9.31W Section** 1 : 100

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A	JLA	Concept	17.10.24

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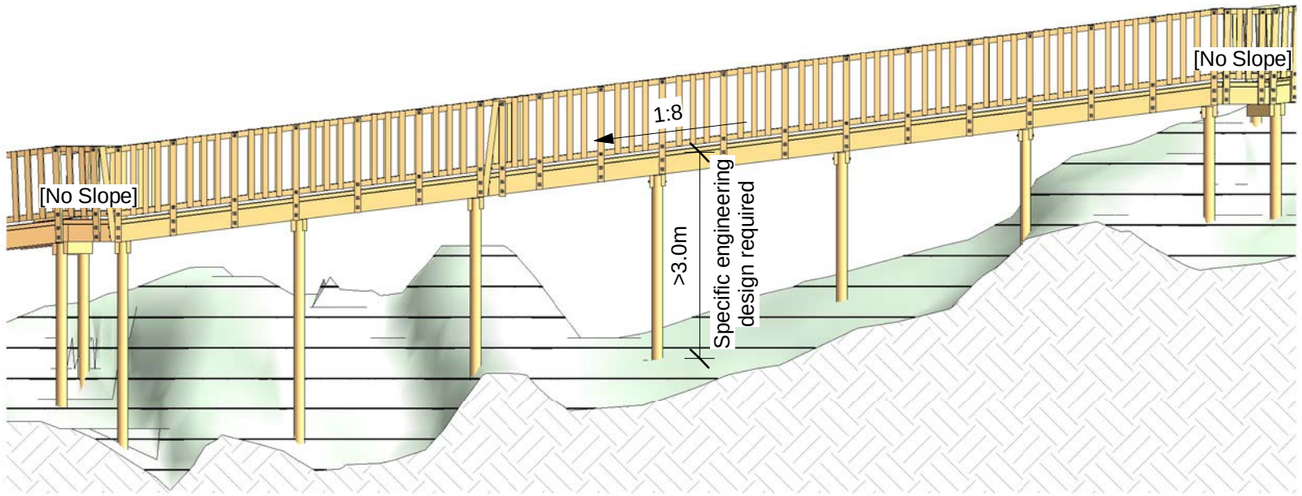
Drawing Name

Boardwalk 9.31W Sections S-250

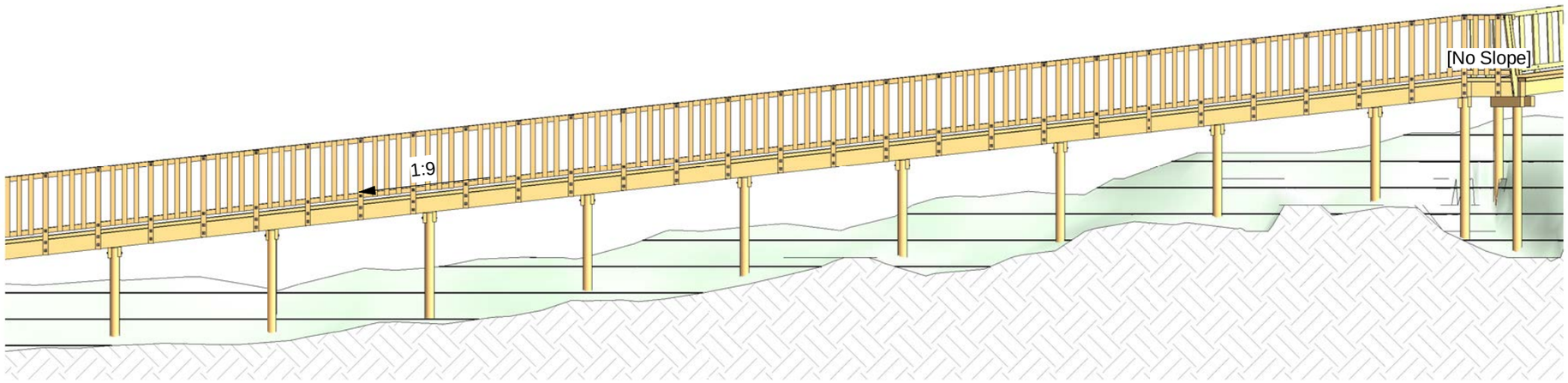
DATE: **07/08/2024**

DRAWN:	CHECKED:
JLA	**NW**

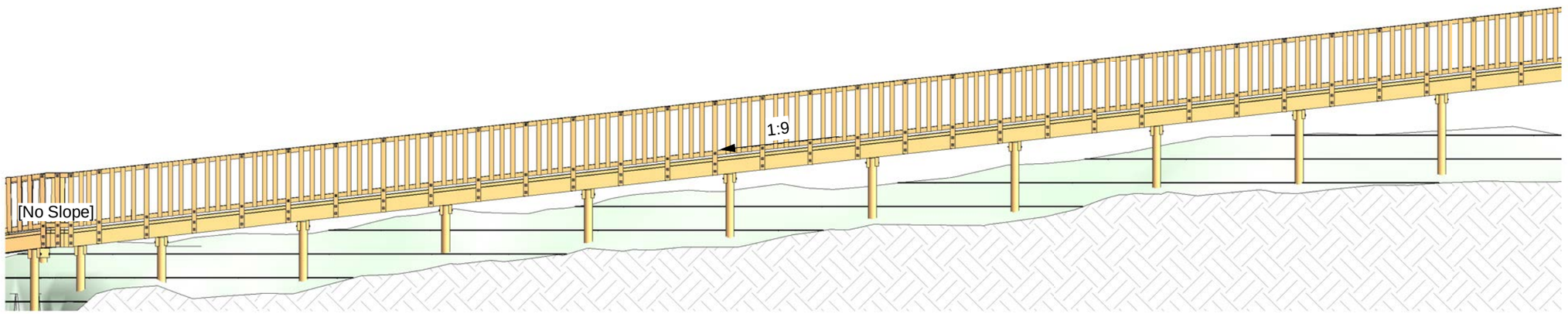
SCALE	REV.
1 : 100	**A**



8 / S-239 **9.31W Section** 1 : 100



9 / S-236 **9.31W Section** 1 : 100



10 / S-235 **9.31W Section** 1 : 100

Rev	By	Amendment	Date
A	JLA	Concept	17.10.24

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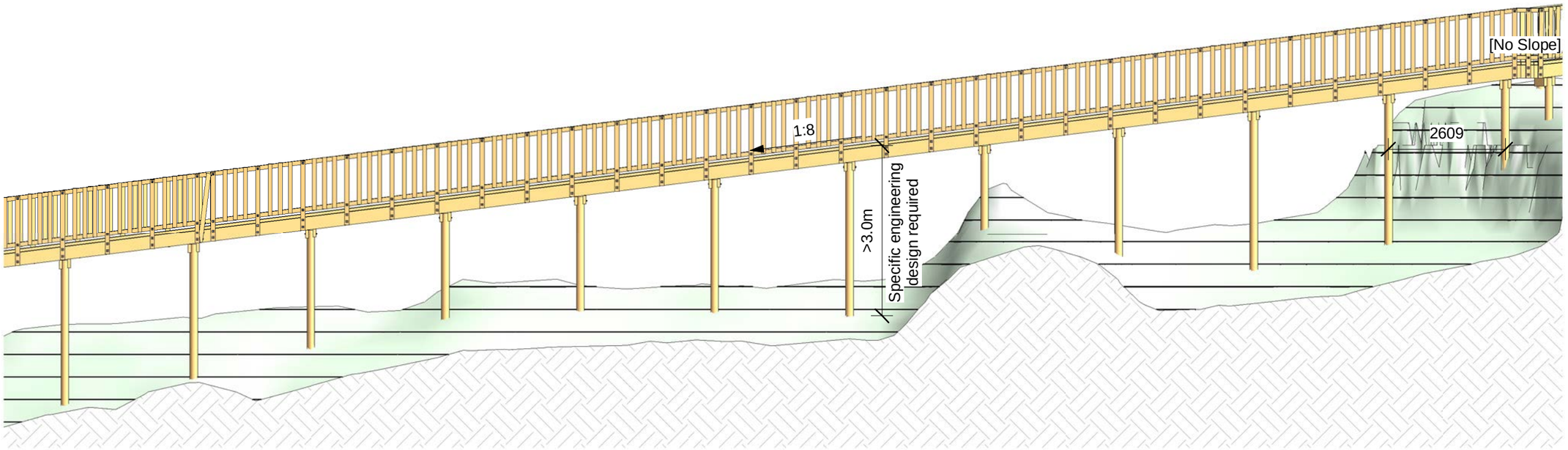
Drawing Name

Boardwalk 9.31W Sections S-251

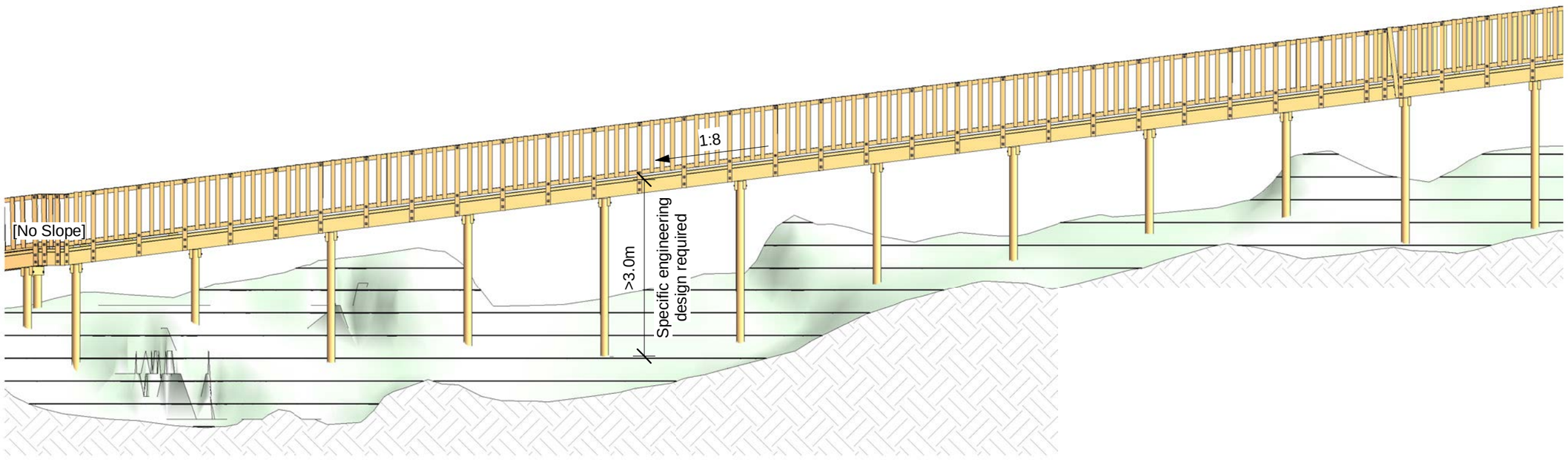
DATE: **07/08/2024**

DRAWN:	CHECKED:
JLA	**NW**

SCALE	REV.
1 : 100	**A**



11 / S-232 **9.31W Section**
1 : 100



12 / S-231 **9.31W Section**
1 : 100

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A	JLA	Concept	17.10.24

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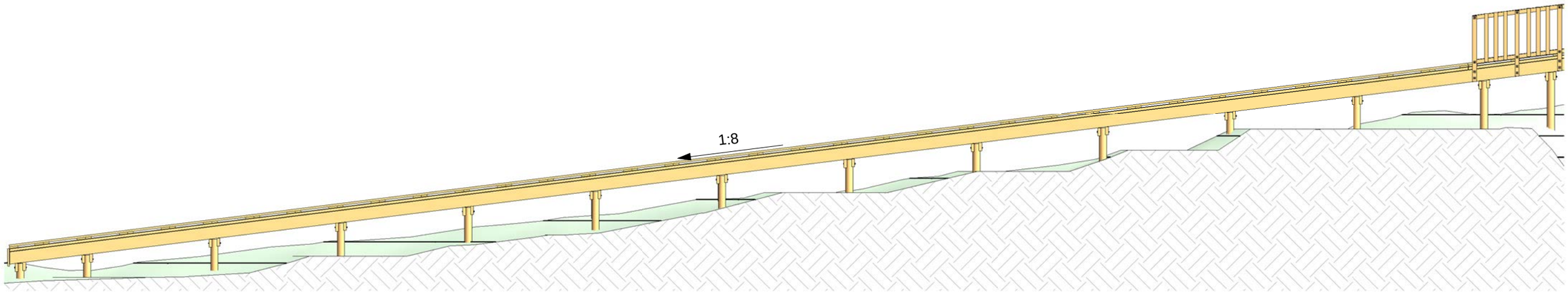
Drawing Name

Boardwalk 9.31W Sections S-252

DATE: **07/08/2024**

DRAWN:	CHECKED:
JLA	**NW**

SCALE	REV.
1 : 100	**A**



13
S-231

9.31W Section
1 : 100

A	JLA	Concept	17.10.24
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Drawing Name

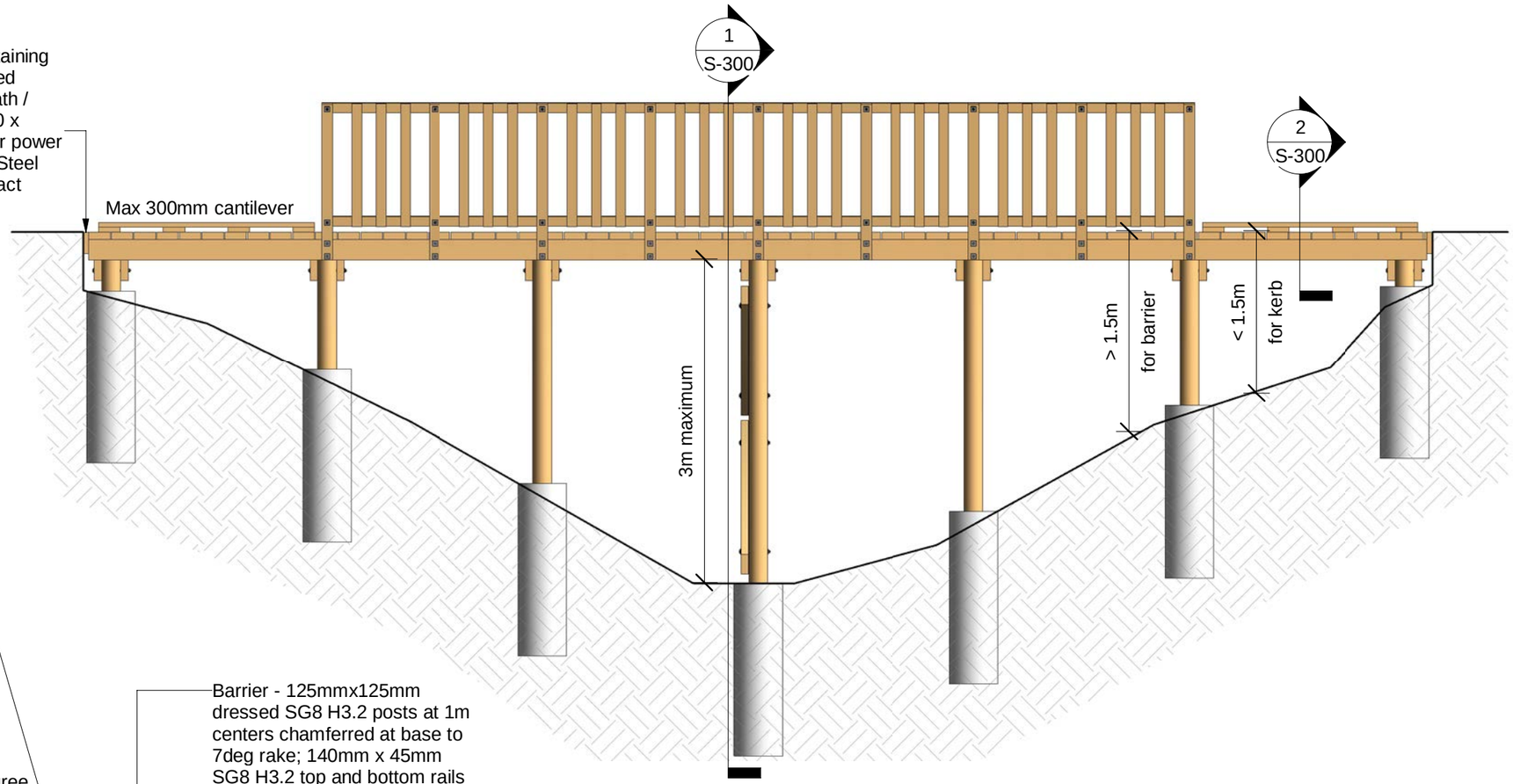
Boardwalk 9.31W Sections S-253

DATE: **07/08/2024**

DRAWN:	CHECKED:
JLA	**NW**

SCALE	REV.
1 : 100	**A**

B4 - H4 SG8 Retaining boards as required to transition to path / ground fix with 90 x 3.15mm diameter power driven Stainless Steel nails. Well compact backfill.



Typical Boardwalk Long Section

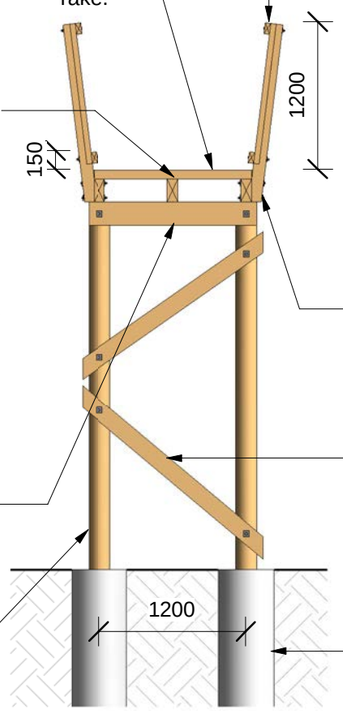
1 : 50

B3 - Ex. 200mm x 70mm SG8 H4 Decking screw fix to joists with 2 x 150mm long bugle head 14g type 17 SS screws

B2 - Minimum 190mm x 90mm SG8 H4 Timber Joists @ 600mm c-c. Fix to every bearer crossing with 3/90x3.15mm dia.SS power driven nails. Provide standard 6kN joist to bearer fixings to all joists at brace pile locations. Provide solid blocking at 1m c-c fixed with 1 pair of CPC40 SS cleats top and bottom use 75mm screws to 90mm member. Offset blocking to not clash with barrier bolts or joist to bearer fixings; maximum offset from CL barrier post to blocking = 100mm. Splice joists over centerline of piles with 600x45 splices to each side nailed with 90x3.15mm diameter power driven nails at 50mm c-c around perimeter

B1 - 190mm x 70mm SG8 H4 bearers one each side of pile fix with 2/M16 SS bolts + 50x50x3mm SS washers to poles. Overhang bearer min 60mm past outside line of joist to allow for 6kN bearer to pile fixings

P1 - 175mm SED H5 High Density Poles



Barrier - 125mmx125mm dressed SG8 H3.2 posts at 1m centers chamferred at base to 7deg rake; 140mm x 45mm SG8 H3.2 top and bottom rails fixed with 1/M12 SS coach bolt to post set flush to inside with 50x50x3mm SS washer to outside. Top of bottom rail to be max 150mm above deck. 90mm x 45mm H3.2 SG8 vertical infill with approx 150mm (200mm max) openings between fixed top and bottom with 75mm SS 14g type 17 bugle screws and 2/skew SS nails.

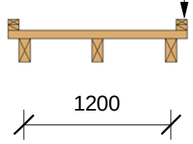
Bolt barrier posts to edge joists with 2/M12 SS bolts + 50x50x3mm washers; 30mm edge distance top and bottom to joist.

Braces - 140x70 SG8 H4 to both sides of pile fix with M16 SS bolt + 50x50x3mm SS washers (min 200mm; max 400mm from bearer or from ground respectively). Max 45 degreee angle. Place bolts centrally with a minimum end distance of 128mm to end of brace.

Refer to sheets S-301 & S-302 for piles options

1 S-300 **Section** 1 : 50

Kerb 90x45 SG8 dressed timber H3.2 fix through B5 - 90x45 SG8 H3.2 blocking 200mm long at 800mm centers with M12 SS coach bolts for smooth head finish with kerb



2 S-300 **Section** 1 : 50

Member Schedule:
B1 - Bearer - H4 - SG8 - 2/190mm x 70mm
B2 - Joists - H4 - SG8 - Refer table for size
B3 - Decking - H4 - SG8 - Ex.200mm x 70mm
B4 - Ret.Boards - H4 - SG8 - Ex.200mm x 50mm
P1 - Pole/Piles - H5 - High Density - 175mmSED
Braces - H4 - SG8 - 2/140mm x 70mm
Handrail Barrier - H3.2 - SG8 125mm X 125mm
Handrail Top Rail - H3.2 - SG8 90mm x 45mm
Handrail Bott. Rail - H3.2 - SG8 90mm x 45mm
Handrail Infill - H3.2 - SG8 90mm x 45mm

Notes:

1) Where pile height above ground continuously exceeds >900mm above ground level provide two 100mm x 100mm H3.2 SG8 braces (one each side) longitudinally along the piles every 8m. Fix with M16 SS Bolts and 50x50x3mm SS washers to poles. Fix longitudinal brace to opposite side of transverse braces top and bottom.

2) Pile hole diameter for bored piles = 450mm for "good ground" with > 300kPa ULS bearing capacity. Increase to 600mm if >200kPa ULS bearing. Consult design engineer if worse soil bearing capacity conditions are encountered. Soil bearing capacity to be determined on-site by geotechnical engineer.

3) All bolts shall have 50sq x 3mm stainless steel washers placed between timber face and all heads and nuts unless noted otherwise. The threaded protrusion past the nut shall be at least two thread pitches after tightening.

4) Where treated timber is cut, notched, bored or otherwise processed after treatment, the processed area shall be well dried and be brush-treated with a liberal application of either creosote, zinc napthenate, tbto or tbtn.

5) Cover deck boards with Tensar SS20 or Duragrid mesh, extend to within 25mm of edges and ends, fixed with SS staples @ 100crs on edges and 200crs internally.
SS staples to be a minimum of 19mm and must straddle the mesh ribs, not penetrate them. Or other approved slip resistance altertantive measures.

6) Bored Pile Hole backfill concrete shall be 20MPa at28 days.

7) Horizontal and vertical alignment to be confirmed on-site. Recommended maximum gradient is 1:8.

8) Bolt edge distance to bearer = 50mm minimum

9) All timber piles shall be high density poles complying with table 7.1 NZS 3603:1993.

10) All fixings to be grade 316 Stainless Steel

11) Safety from falling barrier to be provided where deck exceeds 1m - 1.5m above ground level to be determined by trail alignment designer with reference to SNZHB8630:2004

12) Foundation design assumes stable ground - to be confirmed by geotechnical engineer.

13) Where ground side slope to piles exceeds 15 degrees increase foundation depth by 500mm; where ground side slope exceeds 25 degrees increase foundation depth by 1m. If ground side slope exceeds 30 degrees consult design engineer.

14) Rough sawn SG8 equivalent sized timber may be used if an undressed finish is acceptable to project stakeholders. Check with project manager.

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Bridges 6.27, 6.29, 6.31, 7.2, 9.13 & Boardwalks 9.11, 9.29, 9.31

Te Ara Mangawhero Trail

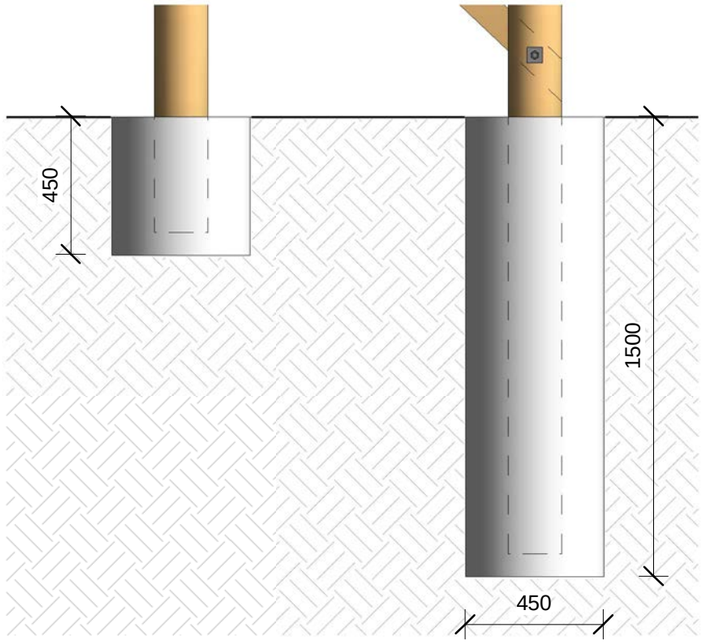
Drawing Name

Boardwalks Typical details S-300

DATE: **07/08/2024**

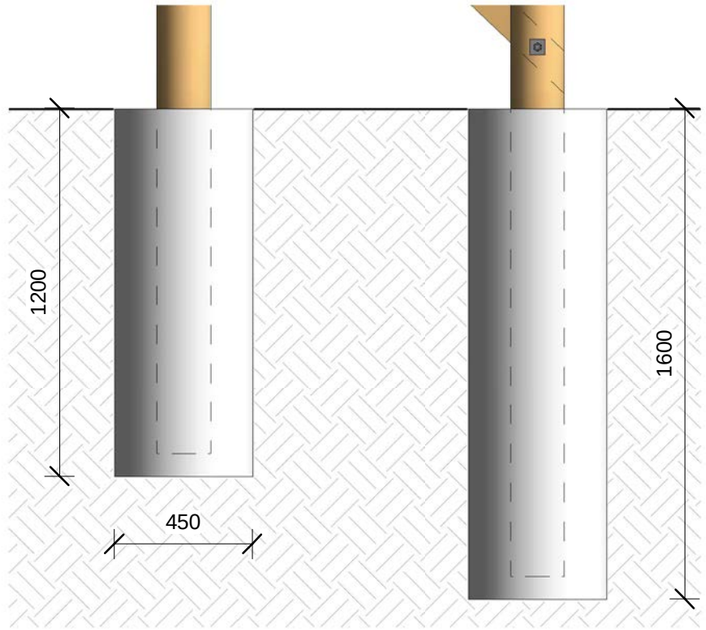
DRAWN:	CHECKED:
JLA	**NW**

SCALE	REV.
As indicated	**A**



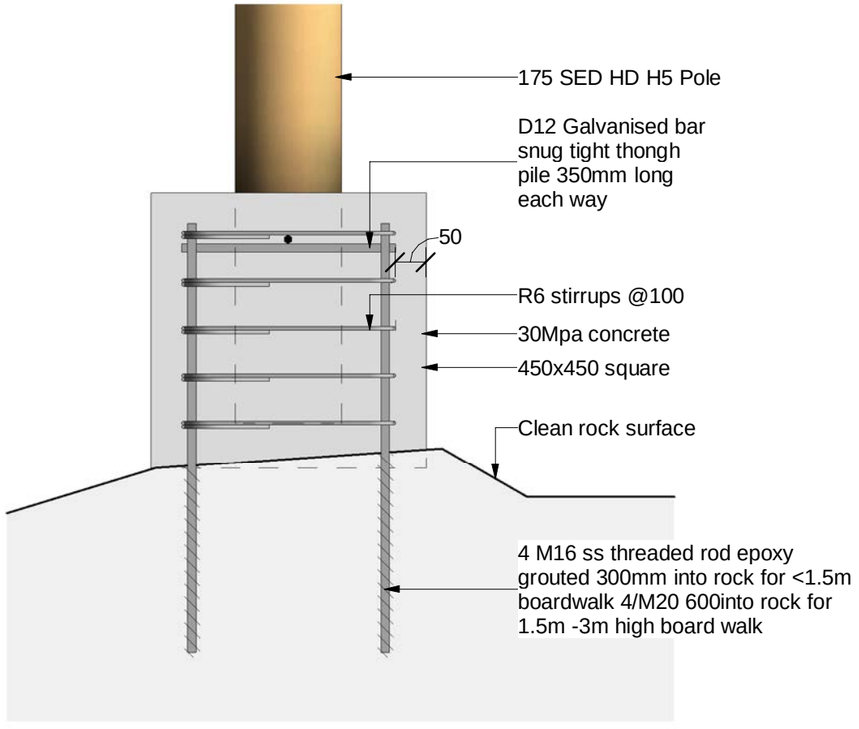
Stable Ground Foundation < 1.5m high boardwalk

1 : 20



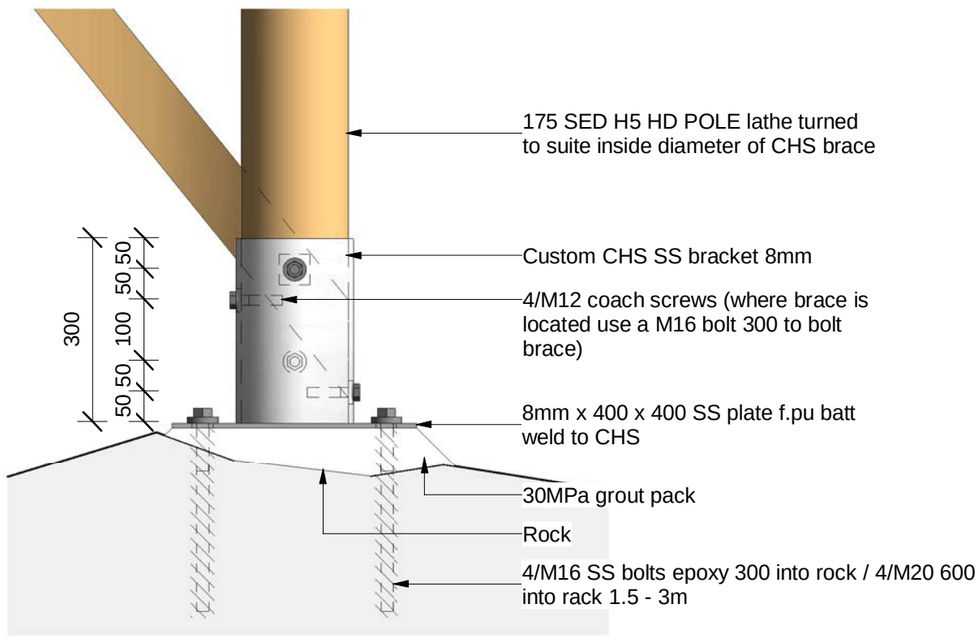
Stable Ground Foundation 1.5m-3m high boardwalk

1 : 20



Foundation on Rock - Option 1

1 : 10



Foundation on Rock - Option 2

1 : 10

Rev	By	Amendment	Date
A	JLA	Concept	17.10.24

TAIAO
BE PART OF THE SOLUTION
Architecture & Engineering Ltd
15 Hihitahi Rise Paihia,
Northland, New Zealand 0200

Bridges 6.27, 6.29, 6.31, 7.2, 9.13 & Boardwalks 9.11, 9.29, 9.31

Te Ara Mangawhero Trail

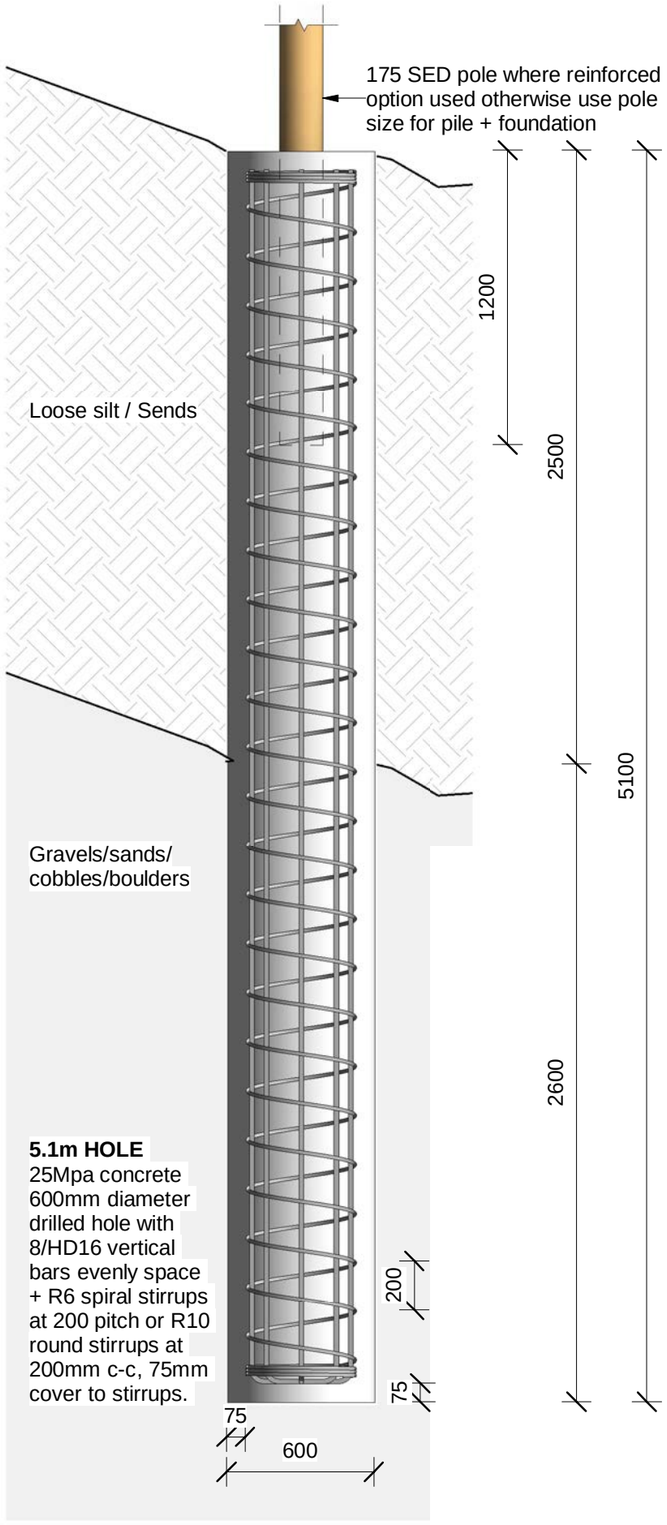
Drawing Name

Boardwalks Typ. Piles Details S-301

DATE: **07/08/2024**

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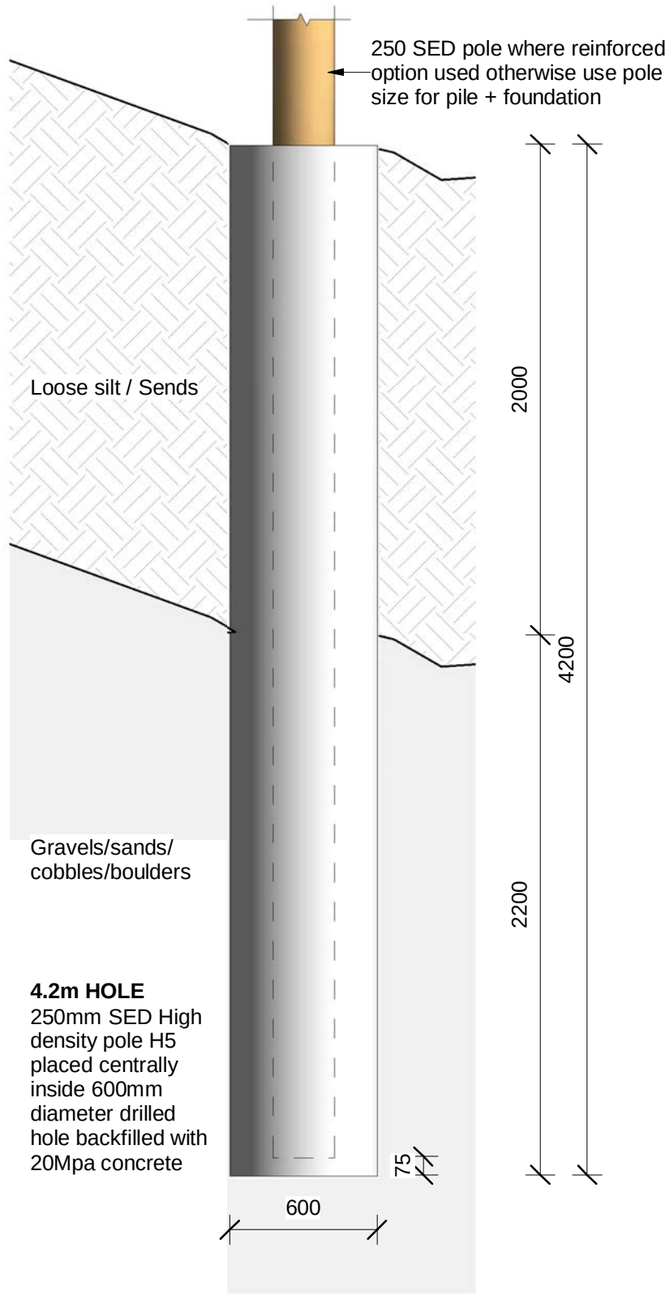
SCALE	REV.
As indicated	**A**



5.1m HOLE
25Mpa concrete 600mm diameter drilled hole with 8/HD16 vertical bars evenly space + R6 spiral stirrups at 200 pitch or R10 round stirrups at 200mm c-c, 75mm cover to stirrups.

Sloping Ground > 15° Foundation Detail 5.1m Hole

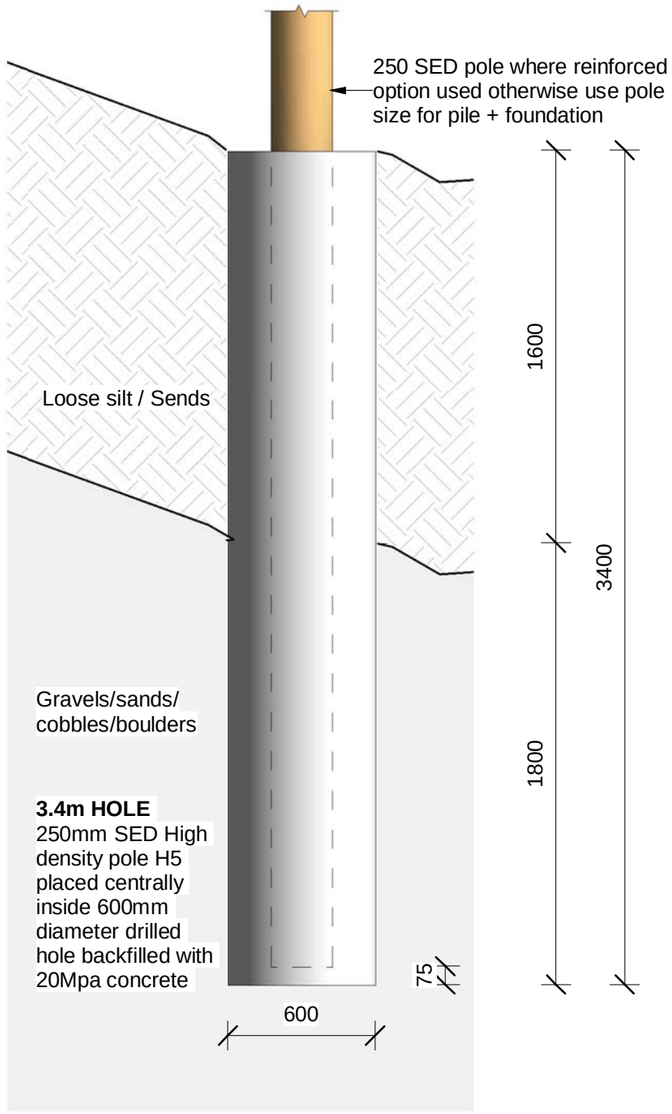
1 : 25



4.2m HOLE
250mm SED High density pole H5 placed centrally inside 600mm diameter drilled hole backfilled with 20Mpa concrete

Sloping Ground > 15° Foundation Detail 4.2m Hole

1 : 25



3.4m HOLE
250mm SED High density pole H5 placed centrally inside 600mm diameter drilled hole backfilled with 20Mpa concrete

Sloping Ground > 15° Foundation Detail 3.4m Hole

1 : 25

Rev	By	Amendment	Date
A	JLA	Concept	17.10.24

TAIAO
BE PART OF THE SOLUTION

Architecture & Engineering Ltd

15 Hihitahi Rise Paihia, Northland, New Zealand 0200

Bridges 6.27, 6.29, 6.31, 7.2, 9.13 & Boardwalks 9.11, 9.29, 9.31

Te Ara Mangawhero Trail

Drawing Name

Boardwalks Typ. Piles Details S-302

DATE: **07/08/2024**

DRAWN:	CHECKED:
JLA	**NW**

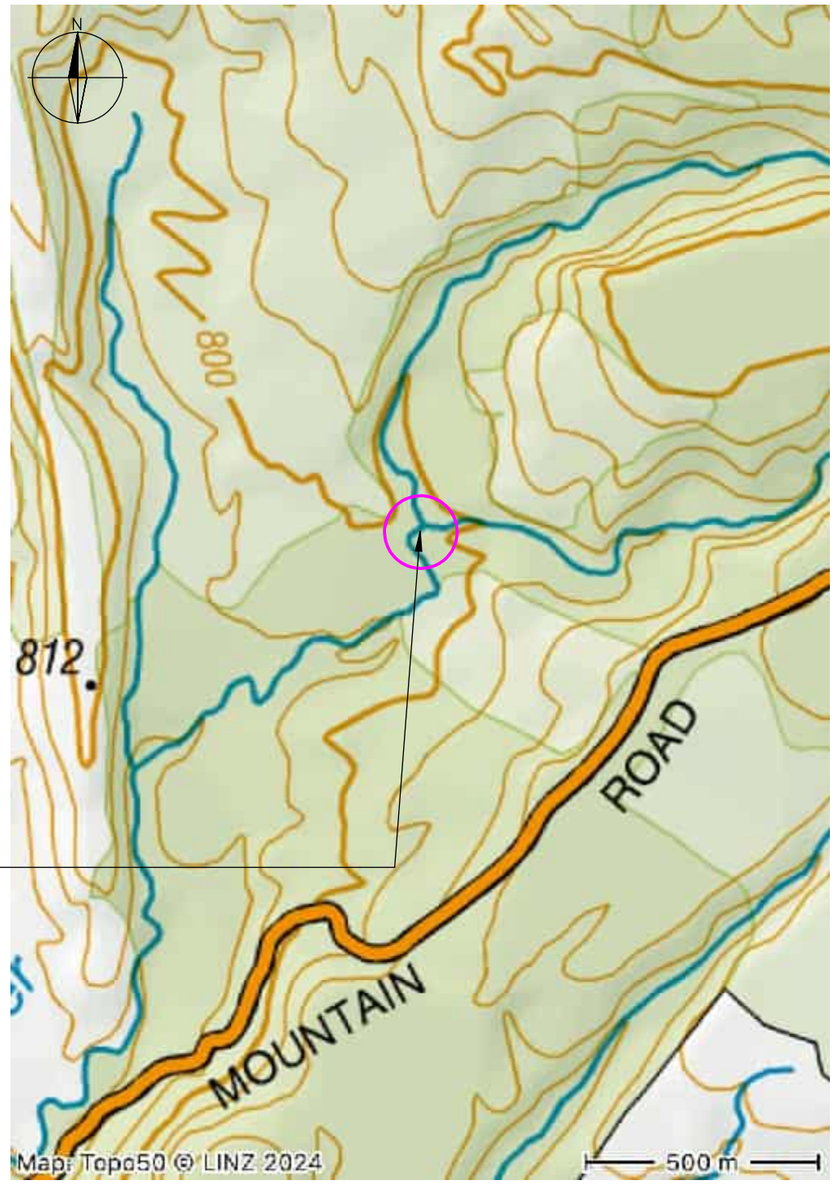
SCALE	REV.
1 : 25	**A**

Appendix 6. Large Bridge Designs

Bridge 5.8

24m Suspension Bridge

DESIGN PARAMETERS	
Standard	SNZ HB 8630:2004
User Group	2. Short Stop Traveller
Deck Length	24m
Deck Design Load	10 Person
Fall Surface	Unfavourable
Effective Fall Height	>3m
Barrier Type	A
Load Test	TBC



Bridge Location

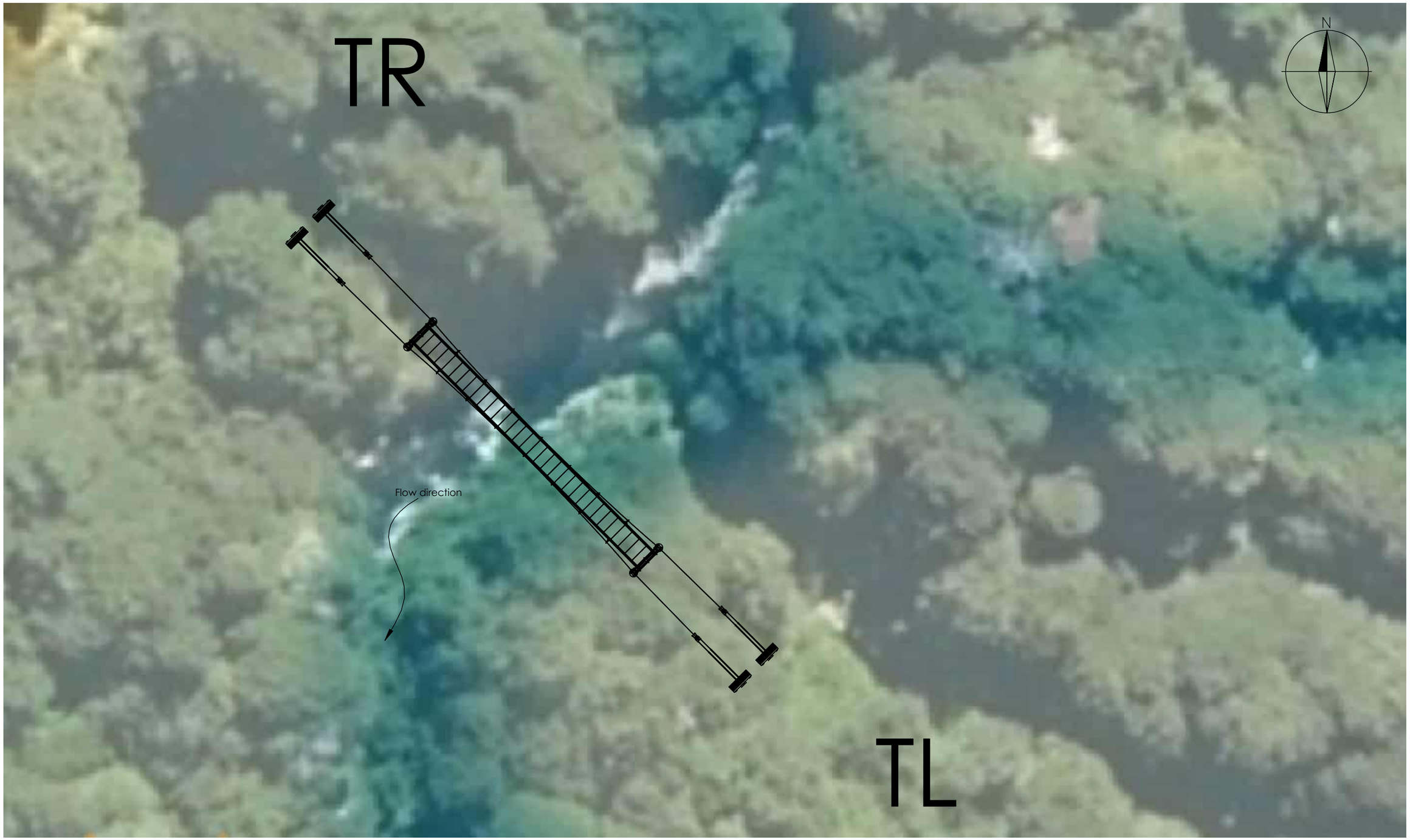
Approximate location
S 39°21'54.0", E 175°27'04.4"

REVISION TABLE		
REV.	DESCRIPTION	DATE
A	Draft concept	23/08/2024
B	Revised concept	30/10/2024

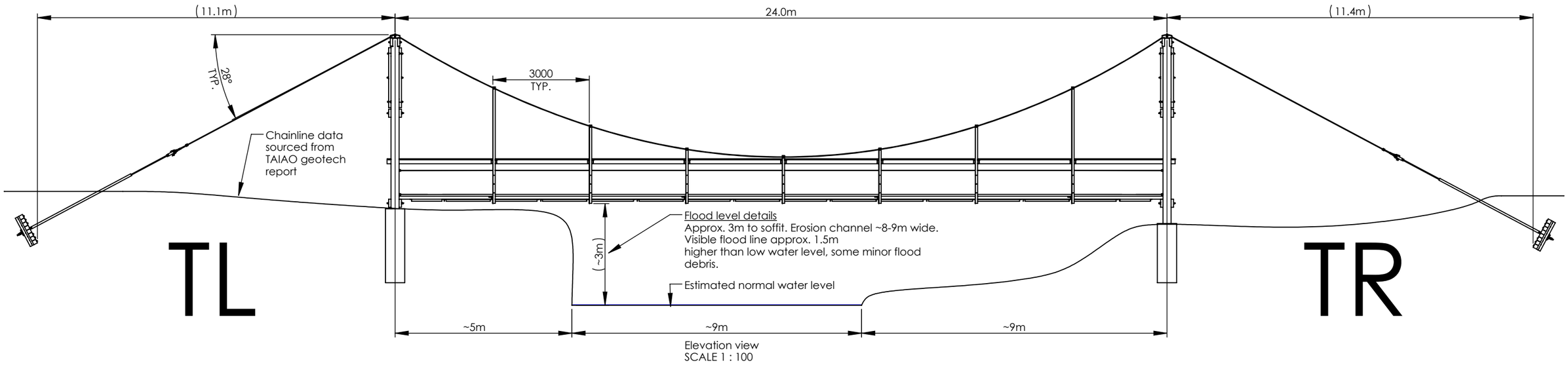
ABSEIL ACCESS
CIVIL · INFRASTRUCTURE · ENVIRONMENTAL



Client: Te Ara Mangawhero	Sheet Title: Concept drawing	Location: Mt Ruapehu	ABSEIL ACCESS	Design	Drawn: DC
Project: Bridge 5.8	Render	Drawing Number: AA-1997-DWG-5.8-2		Checked: MW	Date: 30/10/2024
				Approved	Scale: Various
				Status: Concept	Revision: B



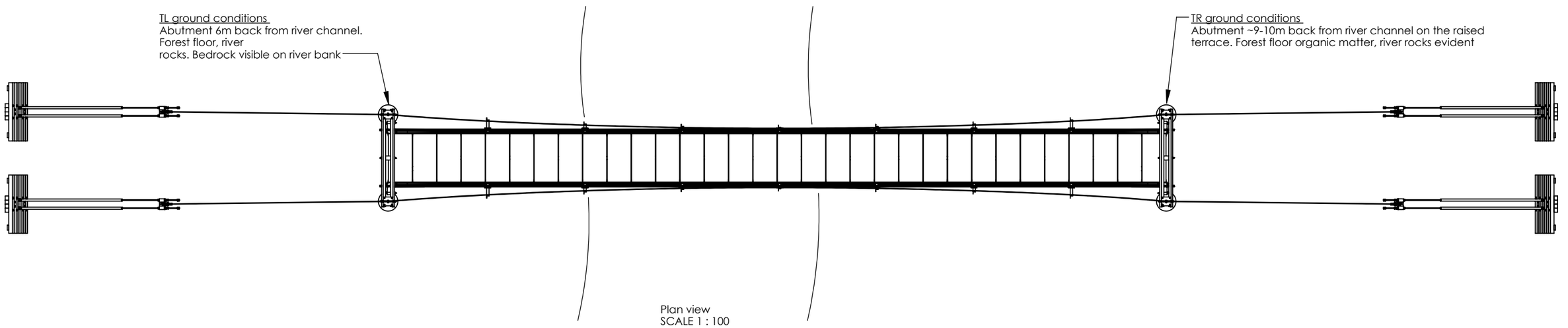
Client: Te Ara Mangawhero	Sheet Title: Concept drawing	Location: Mt Ruapehu	ABSEIL ACCESS	Design	Drawn: DC
Project: Bridge 5.8	Site overview	Drawing Number: AA-1997-DWG-5.8-3		Checked: MW	Date: 30/10/2024
				Approved	Scale: Various
				Status: Concept	Revision: B



Elevation view
SCALE 1 : 100

Tower height	5.15m
Hanger spacing	3.0m
Span	24m
Sag	3.8m
Hog *	0m
Angle of hangers	6 °
Optimum angle (backspans)	28 °
Deck width	1.5m

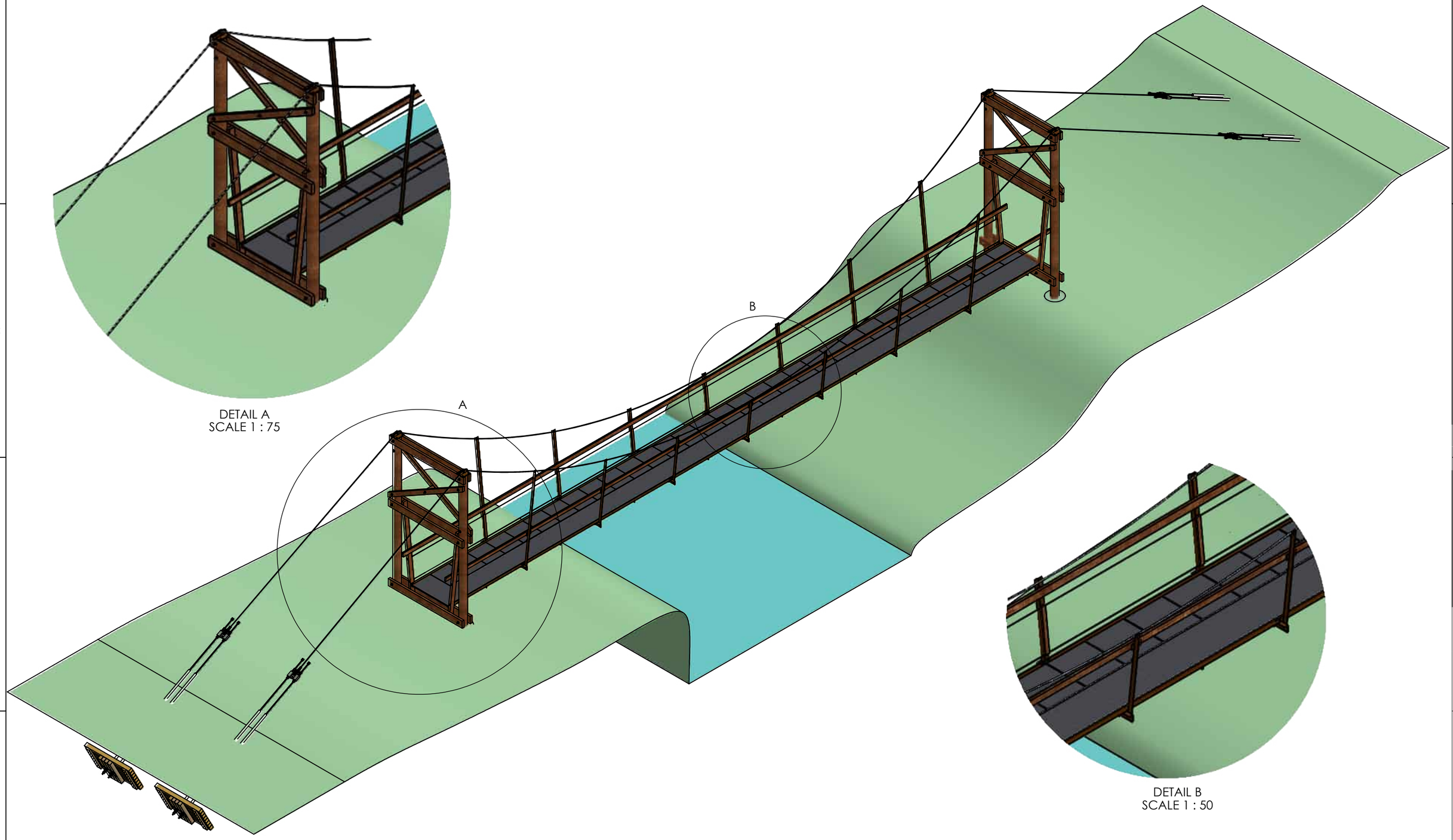
* Concept drawing drawn with flat deck.
200-500mm hog may be added, TBC.



Plan view
SCALE 1 : 100

Client: Te Ara Mangawhero	Sheet Title: Concept drawing	Location: Mt Ruapehu	ABSEIL ACCESS	Design	Drawn: DC
Project: Bridge 5.8	Concept overview	Drawing Number: AA-1997-DWG-5.8-4		Checked: MW	Date: 30/10/2024
				Approved	Scale: Various
				Status: Concept	Revision: B

DETAIL A
SCALE 1 : 75



DETAIL B
SCALE 1 : 50

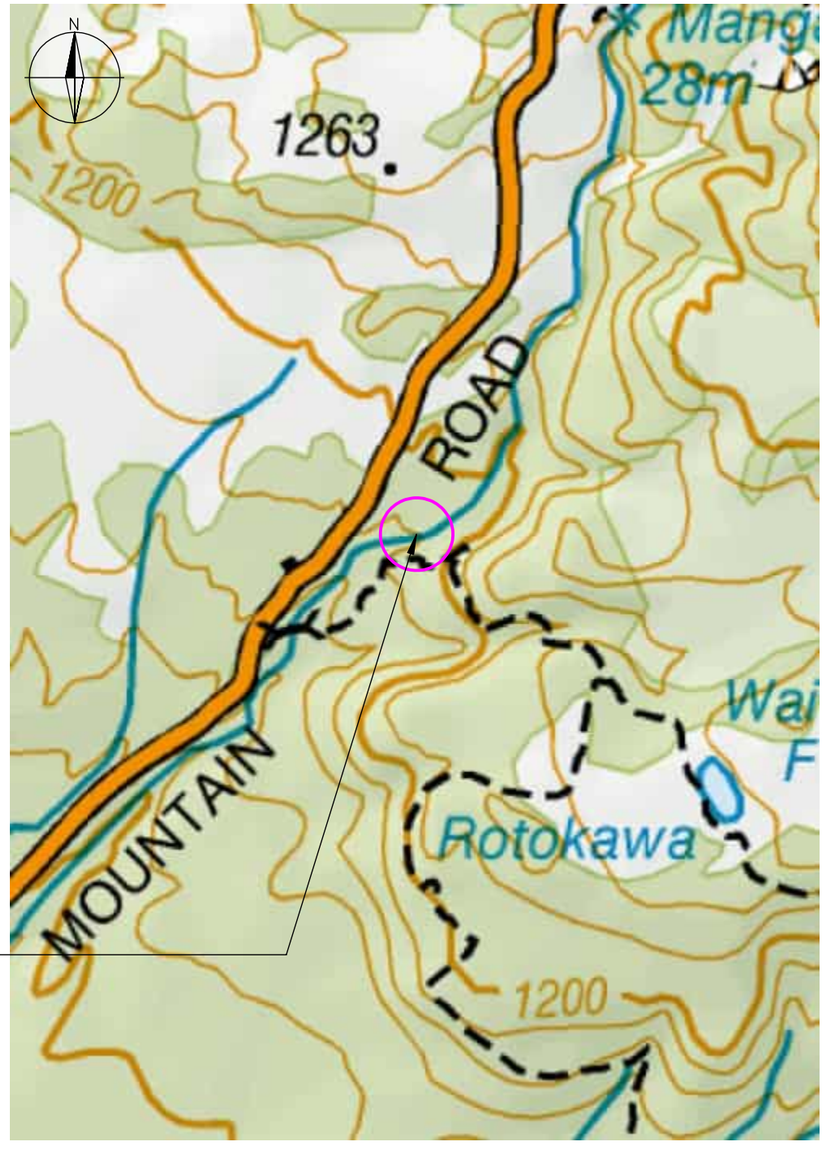
Client: Te Ara Mangawhero	Sheet Title: Concept drawing	Location: Mt Ruapehu	ABSEIL ACCESS
Project: Bridge 5.8	3D overview	Drawing Number: AA-1997-DWG-5.8-5	

Design		Drawn	DC
Checked	MW	Date	30/10/2024
Approved		Scale	Various
Status	Concept	Revision	B

Bridge 8.3

21m Bridge

DESIGN PARAMETERS	
Standard	SNZ HB 8630:2004
User Group	2. Short Stop Traveller
Deck Length	21m
Deck Design Load	10 person
Fall Surface	Unfavourable
Effective Fall Height	>3m
Barrier Type	A
Load Test	TBC



Bridge Location

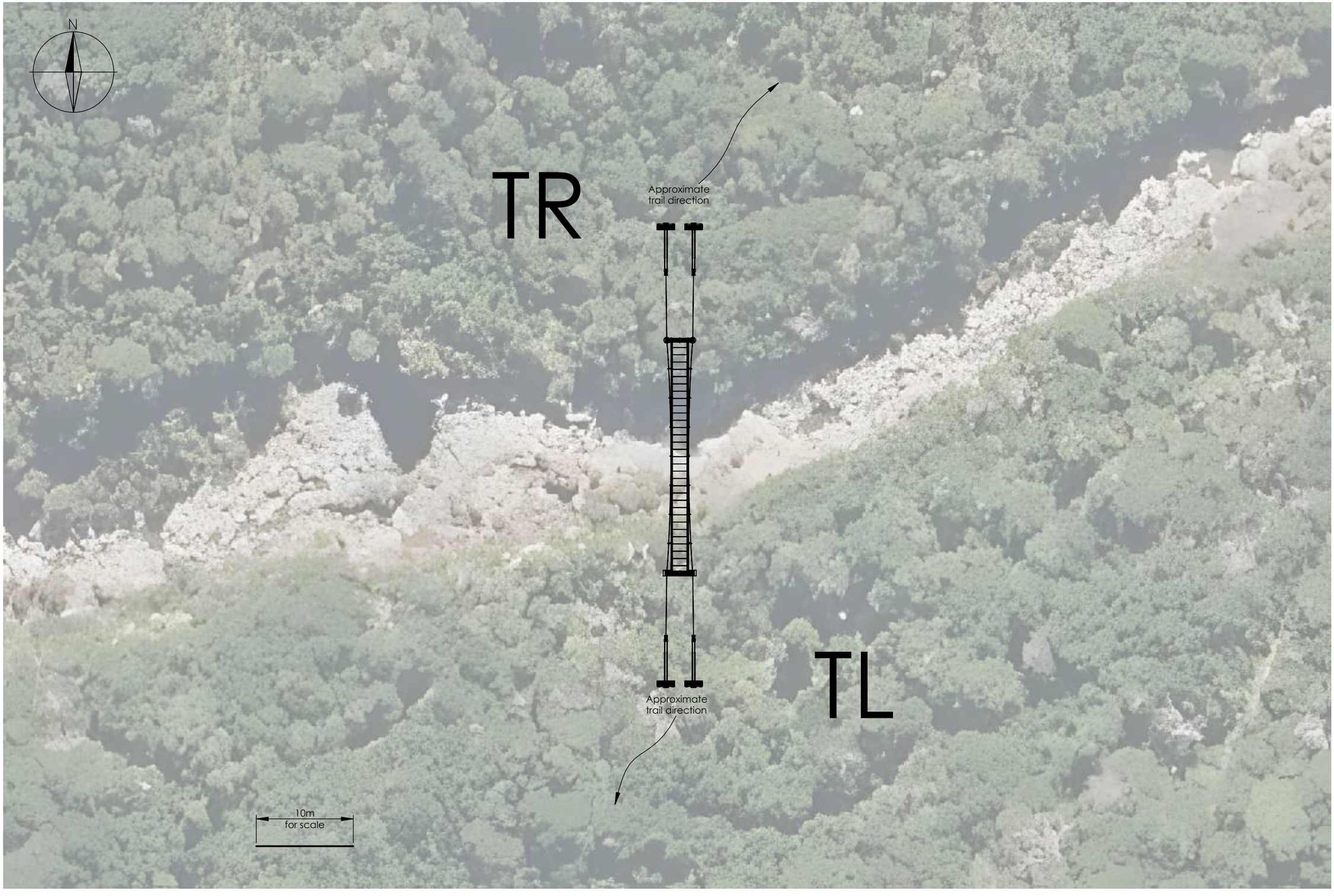
Approximate location
S 39°19'40.5", E 175°29'55.1"

REVISION TABLE		
REV.	DESCRIPTION	DATE
A	Draft concept	26/08/2024
B	Revised concept	30/10/2024

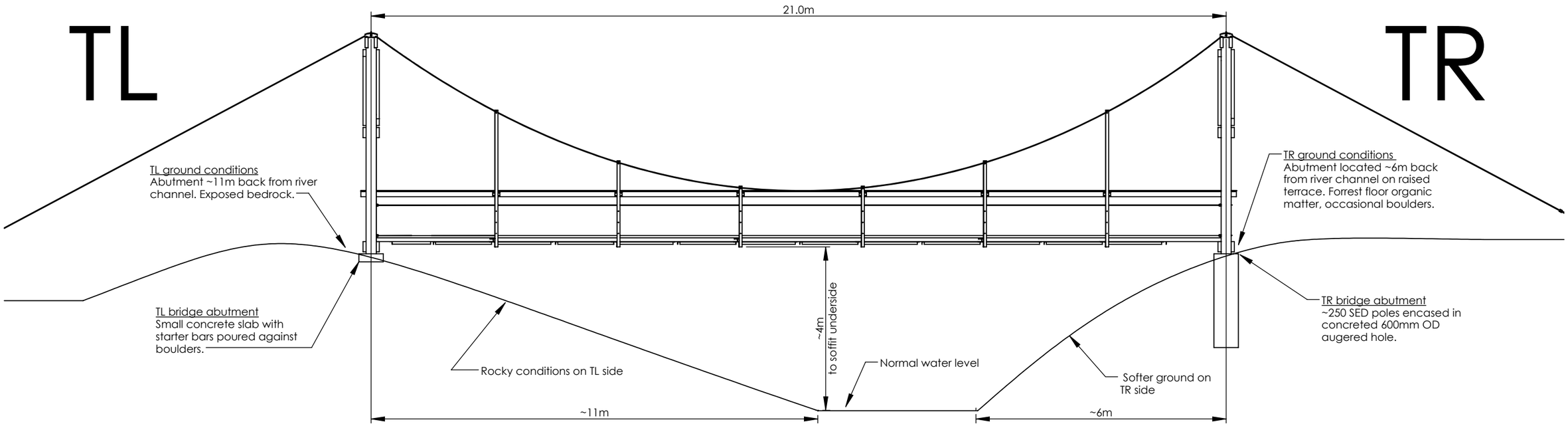
ABSEIL ACCESS
CIVIL · INFRASTRUCTURE · ENVIRONMENTAL



Client: Te Ara Mangawhero	Sheet Title: Concept drawing	Location: Mt Ruapehu	ABSEIL ACCESS	Design	Drawn: DC
Project: Bridge 8.3	Render	Drawing Number: AA-1997-DWG-8.3-2		Checked: MW	Date: 30/10/2024
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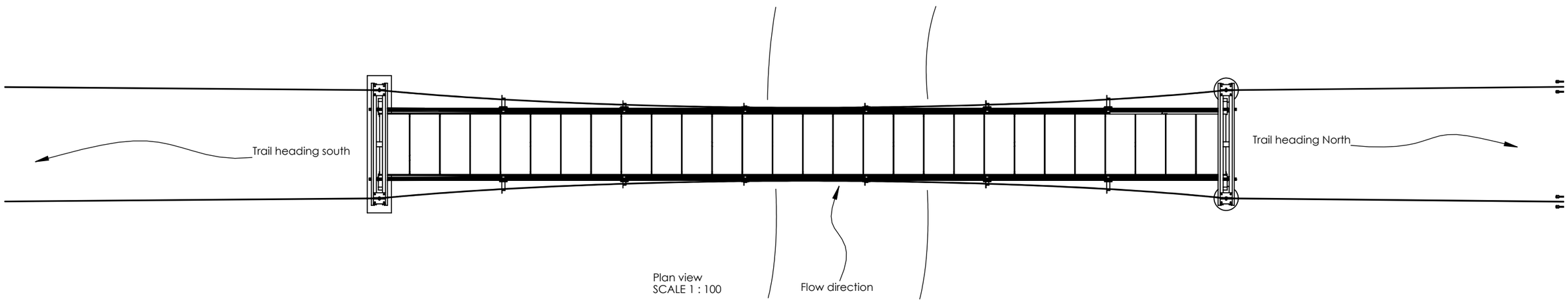
Client: Te Ara Mangawhero	Sheet Title: Concept drawing	Location: Mt Ruapehu	ABSEIL ACCESS	Design	Drawn: DC
Project: Bridge 8.3	Site overview	Drawing Number: AA-1997-DWG-8.3-3		Checked: MW	Date: 30/10/2024
				Approved	Scale: Various
				Status: Concept	Revision: B



Elevation view
SCALE 1 : 100

General Table	
Tower height	5.15m
Hanger spacing	3.0m
Span	21m
Sag	3.8m
Hog *	0m
Angle of hangers	6 °
Optimum angle (backspans)	28 °
Deck width	1.5m

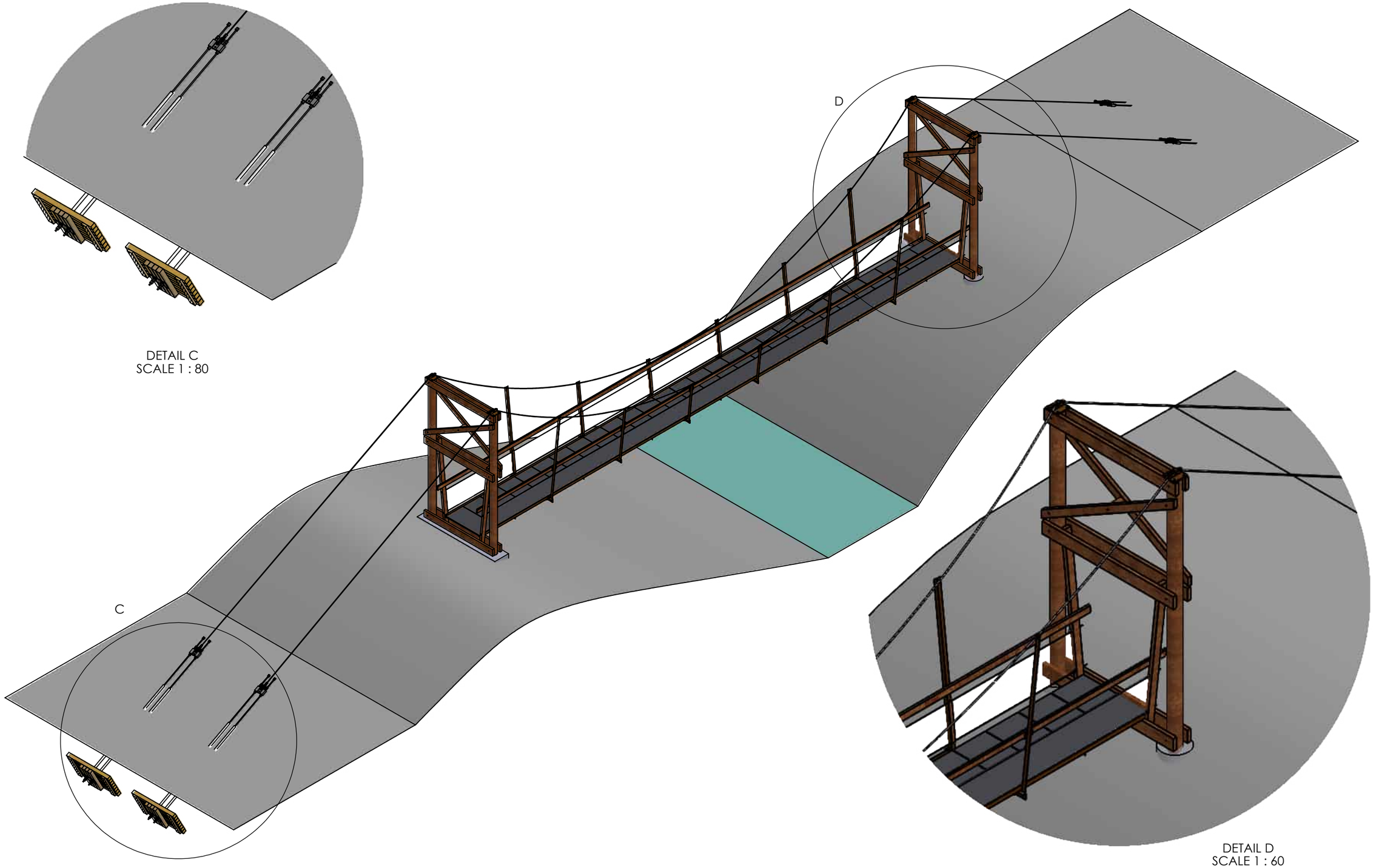
* Concept drawing drawn with flat deck.
200-500mm hog may be added, TBC.



Plan view
SCALE 1 : 100

Client: Te Ara Mangawhero	Sheet Title: Concept drawing	Location: Mt Ruapehu	Design / Checked MW / Approved / Status Concept	Drawn DC / Date 30/10/2024 / Scale Various / Revision B
Project: Bridge 8.3	Concept overview	Drawing Number: AA-1997-DWG-8.3-4		

DETAIL C
SCALE 1 : 80



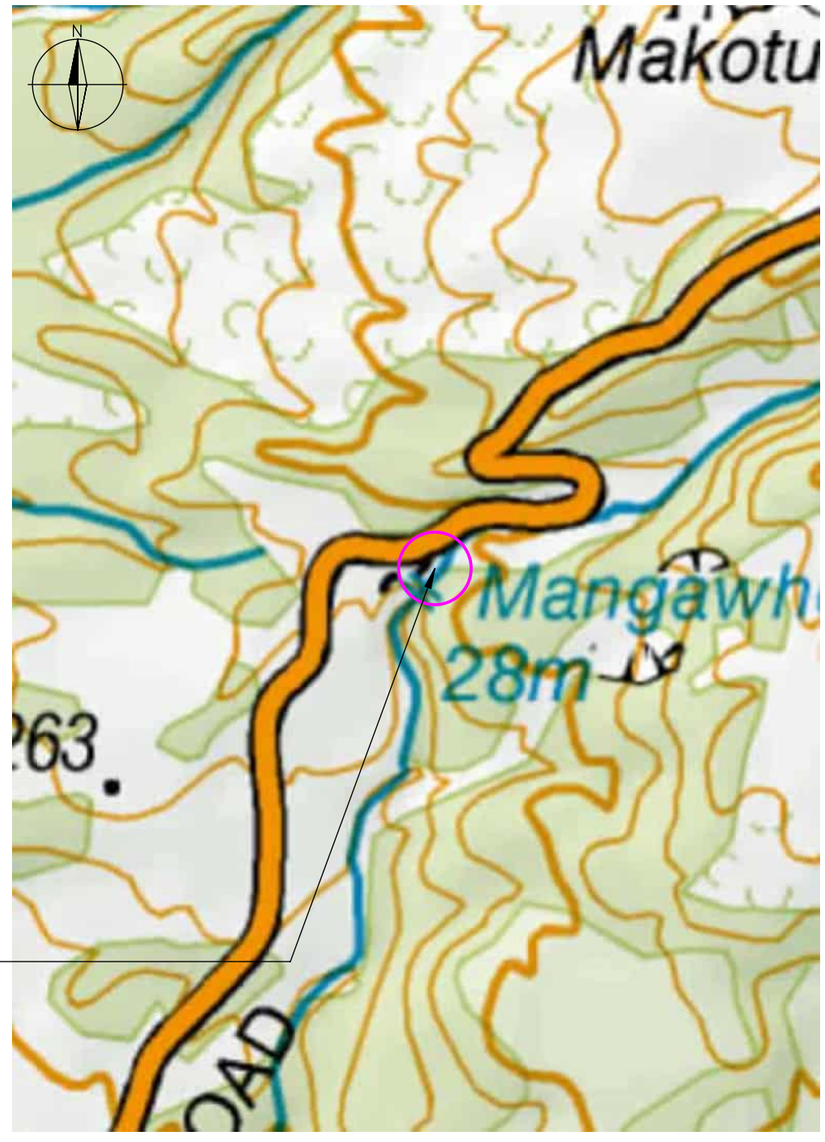
DETAIL D
SCALE 1 : 60

Client: Te Ara Mangawhero	Sheet Title: Concept drawing	Location: Mt Ruapehu	ABSEIL ACCESS	Design	Drawn: DC
Project: Bridge 8.3	3D overview	Drawing Number: AA-1997-DWG-8.3-5		Checked: MW	Date: 30/10/2024
				Approved	Scale: Various
				Status: Concept	Revision: B

Bridge 9.1

15m Bridge

DESIGN PARAMETERS	
Standard	SNZ HB 8630:2004
User Group	2. Short Stop Traveller
Deck Length	15m
Deck Design Load	10 person
Fall Surface	Unfavourable
Effective Fall Height	>3m
Barrier Type	A
Load Test	N/A



Bridge Location

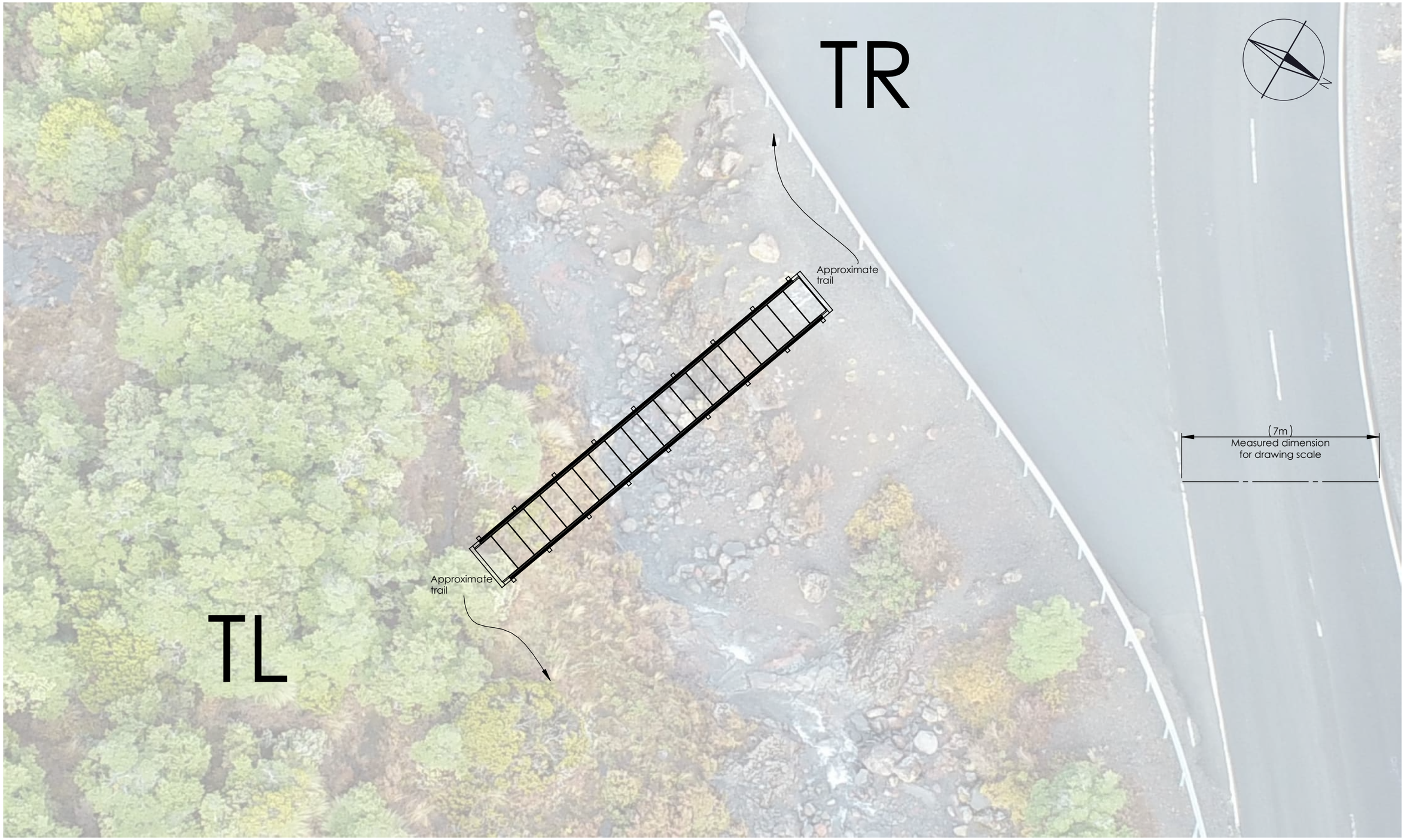
Approximate location
S 39°19'09.2", E 175°30'11.1"

REVISION TABLE		
REV.	DESCRIPTION	DATE
A	Draft concept	23/08/2024
B	Revised concept	30/10/2024

ABSEIL ACCESS
CIVIL · INFRASTRUCTURE · ENVIRONMENTAL



Client: Te Ara Mangawhero	Sheet Title: Concept drawing	Location: Mt Ruapehu	ABSEIL ACCESS	Design	Drawn: DC
Project: Bridge 9.1	Render	Drawing Number: AA-1997-DWG-9.1-2		Checked: MW	Date: 30/10/2024
				Approved	Scale: Various
				Status: Concept	Revision: B



Client: Te Ara Mangawhero	Sheet Title: Concept drawing	Location: Mt Ruapehu	ABSEIL ACCESS	Design	Drawn: DC
Project: Bridge 9.1	Site overview	Drawing Number: AA-1997-DWG-9.1-3		Checked: MW	Date: 30/10/2024
				Approved	Scale: Various
				Status: Concept	Revision: B

TL ground conditions
Firm ground, rocks and boulders.
Approximately level with TR side.

15000

TR ground conditions
Firm ground level with carpark, reclaimed land.
Approximately level with TL side

TR Termination abutment
Small concrete slab with notch to suit bridge termination & hold down position. Compacted dirt / gravel ramp used for smooth transition to deck.

3-4m to soffit

0.5m
Estimated flood level

Signs that the water level raises by 0.5m in the eroded channel, no water carried debris visible.

TR Termination abutment
Small concrete slab with notch to suit bridge termination & hold down position. Compacted dirt / gravel ramp used for smooth transition to deck

TL

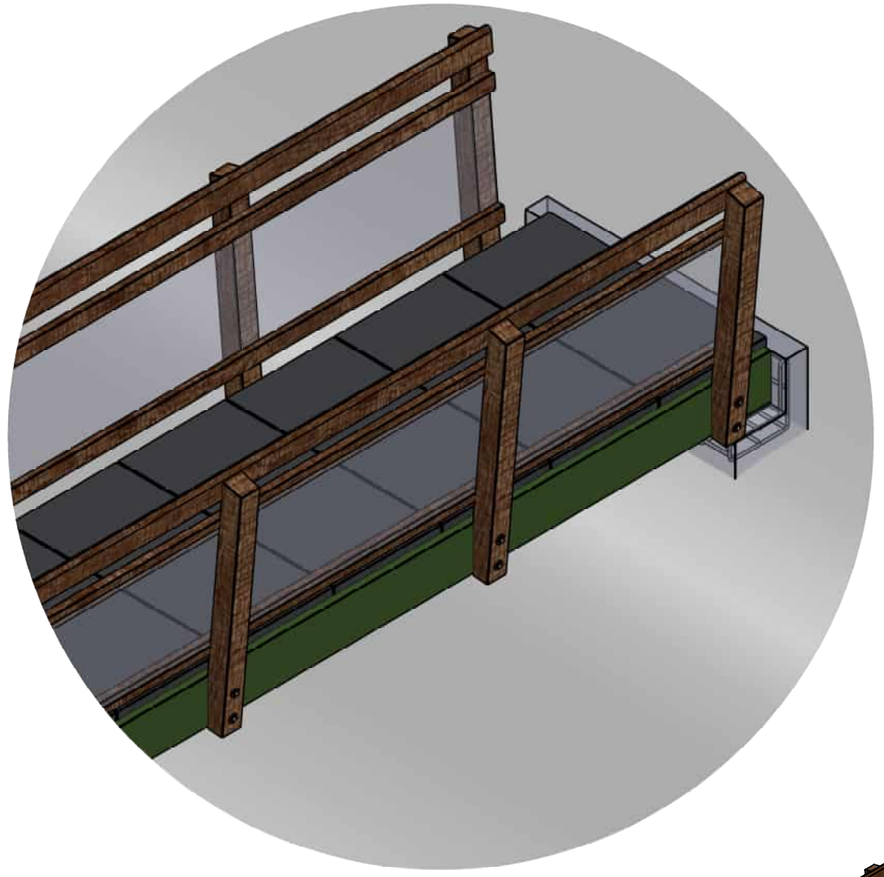
TR

Elevation view
SCALE 1 : 50

Flow direction

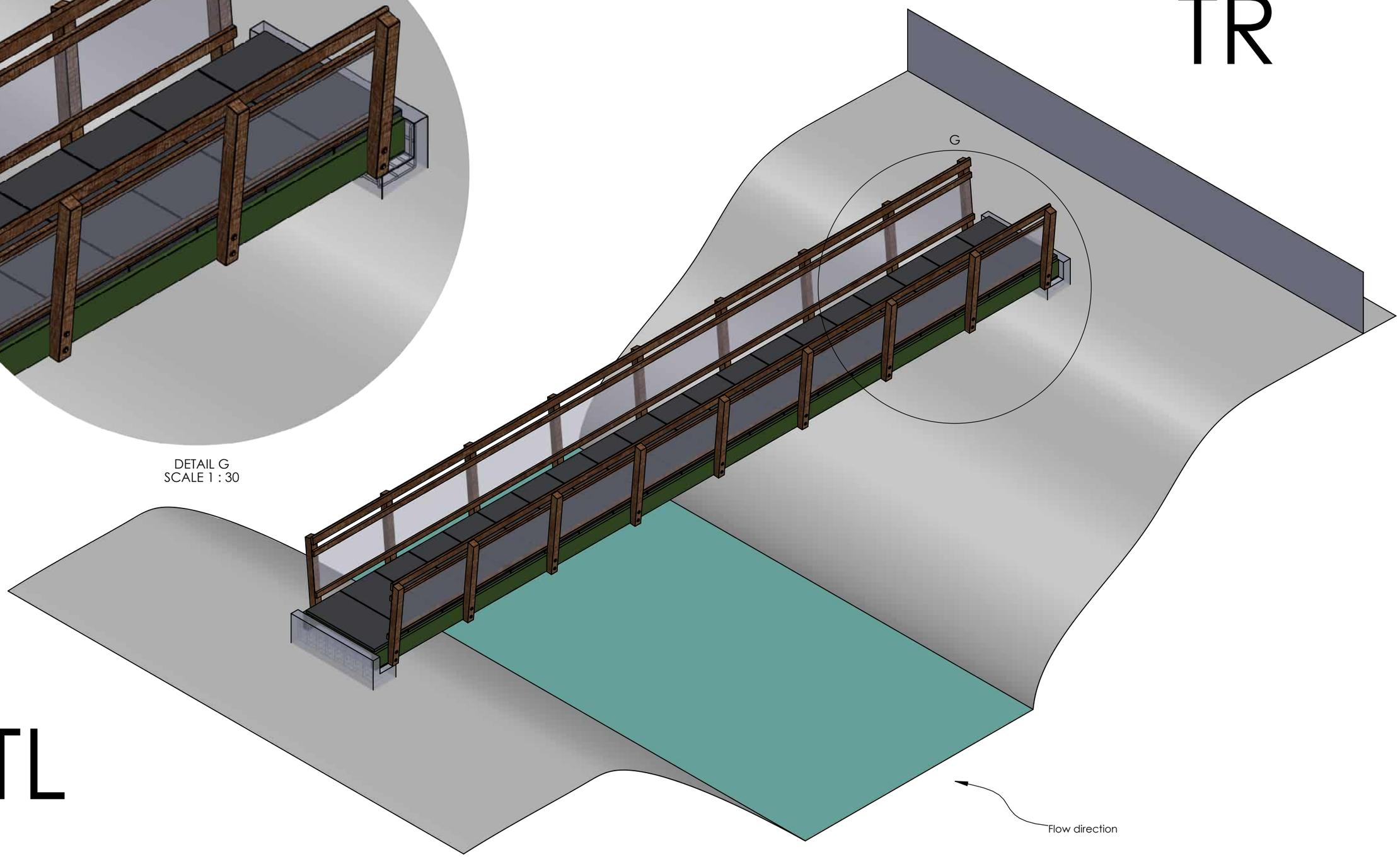
Plan view
SCALE 1 : 50

Client: Te Ara Mangawhero	Sheet Title: Concept drawing	Location: Mt Ruapehu	ABSEIL ACCESS	Design	Drawn: DC
Project: Bridge 9.1	Concept overview	Drawing Number: AA-1997-DWG-9.1-4		Checked: MW	Date: 30/10/2024
				Approved	Scale: Various
				Status: Concept	Revision: B



DETAIL G
SCALE 1 : 30

TR



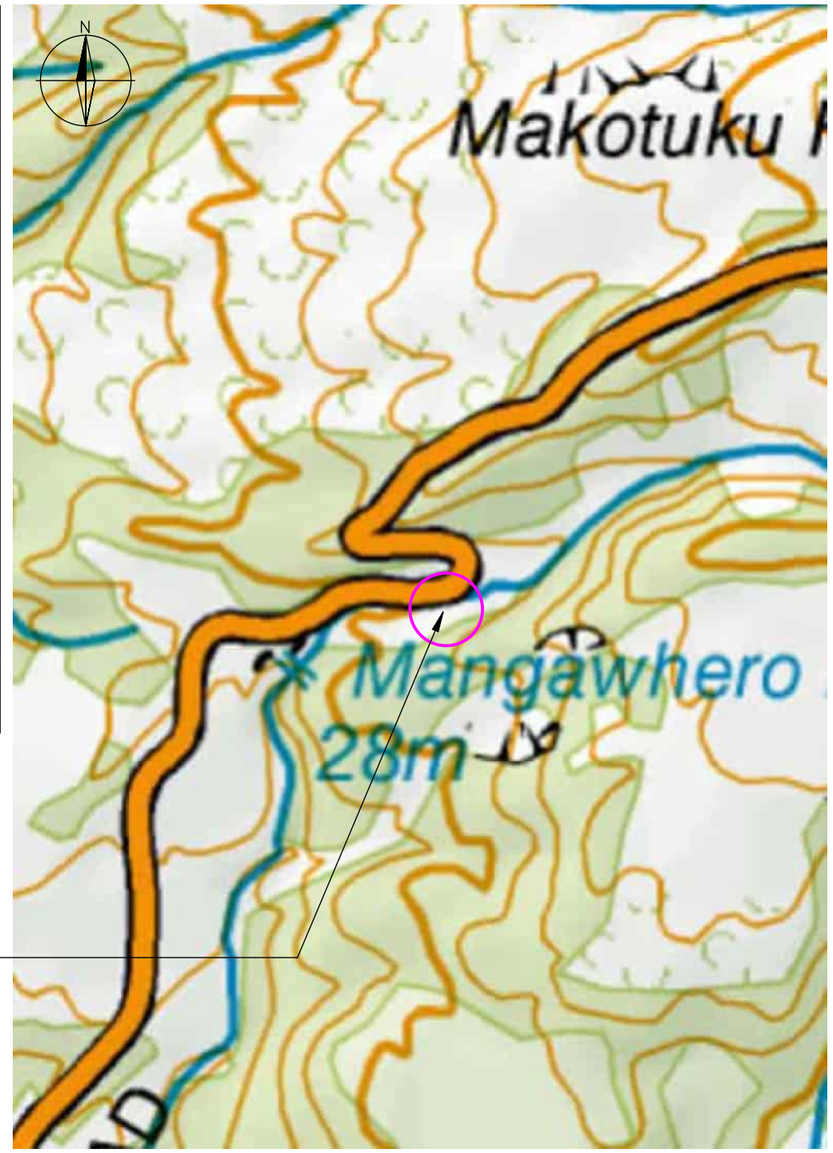
TL

Client: Te Ara Mangawhero	Sheet Title: Concept drawing	Location: Mt Ruapehu	ABSEIL ACCESS	Design	Drawn: DC
Project: Bridge 9.1	3D overview	Drawing Number: AA-1997-DWG-9.1-5		Checked: MW	Date: 30/10/2024
				Approved	Scale: Various
				Status: Concept	Revision: B

Bridge 9.3

21m Bridge

DESIGN PARAMETERS	
Standard	SNZ HB 8630:2004
User Group	2. Short Stop Traveller
Deck Length	21m
Deck Design Load	10 person
Fall Surface	Unfavourable
Effective Fall Height	>3m
Barrier Type	A
Load Test	N/A



Bridge Location

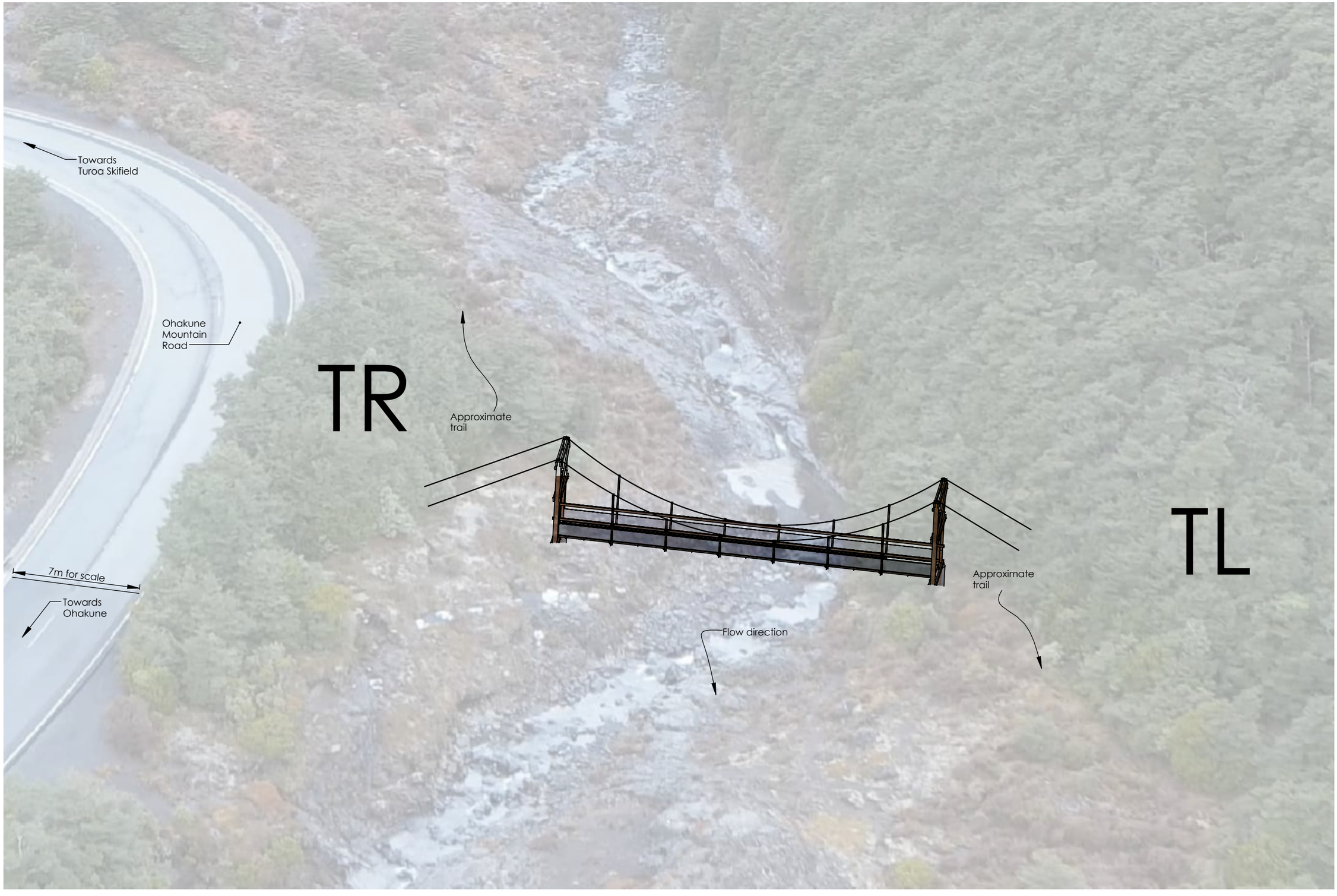
Approximate location
S 39°19'08.4", E 175°30'17.4"

REVISION TABLE		
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B	Revised concept	30/10/2024

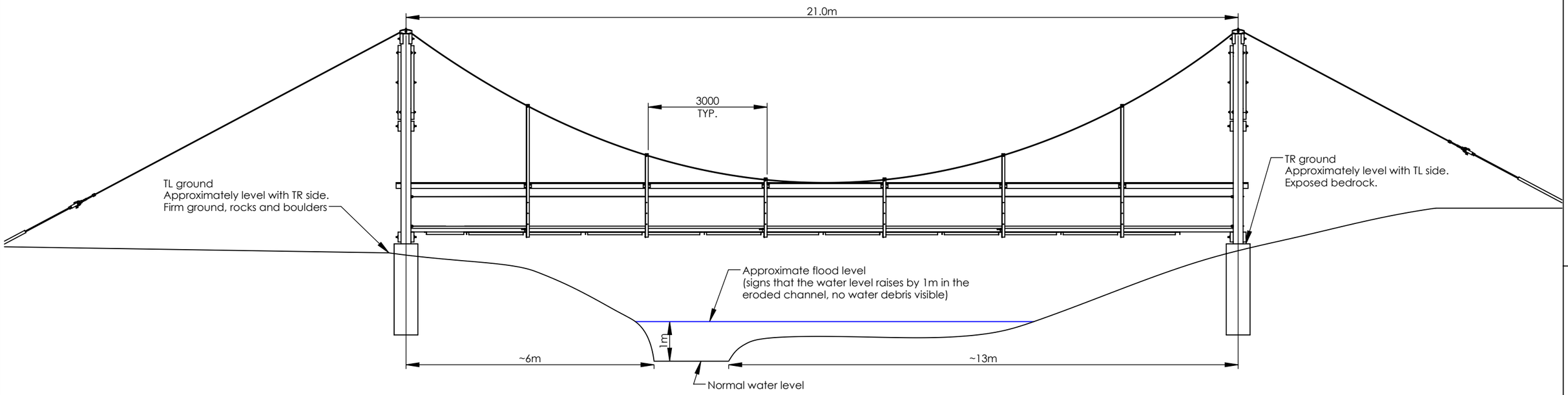
ABSEIL ACCESS
CIVIL · INFRASTRUCTURE · ENVIRONMENTAL



Client: Te Ara Mangawhero	Sheet Title: Concept drawing	Location: Mt Ruapehu	ABSEIL ACCESS	Design	Drawn: DC
Project: Bridge 9.3	Render (looking upstream)	Drawing Number: AA-1997-DWG-9.3-2		Checked: MW	Date: 30/10/2024
				Approved	Scale: Various
				Status: Concept	Revision: B



Client: Te Ara Mangawhero	Sheet Title: Concept drawing	Location: Mt Ruapehu		Design	Drawn: DC
Project: Bridge 9.3	Site overview	Drawing Number: AA-1997-DWG-9.3-3	ABSEIL ACCESS	Checked: MW	Date: 30/10/2024
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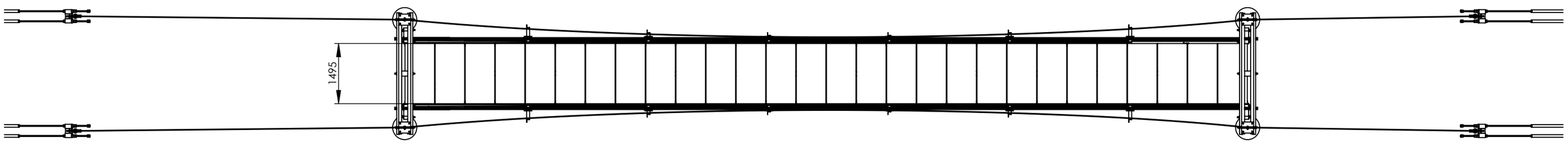


Elevation view
SCALE 1 : 100

TL

TR

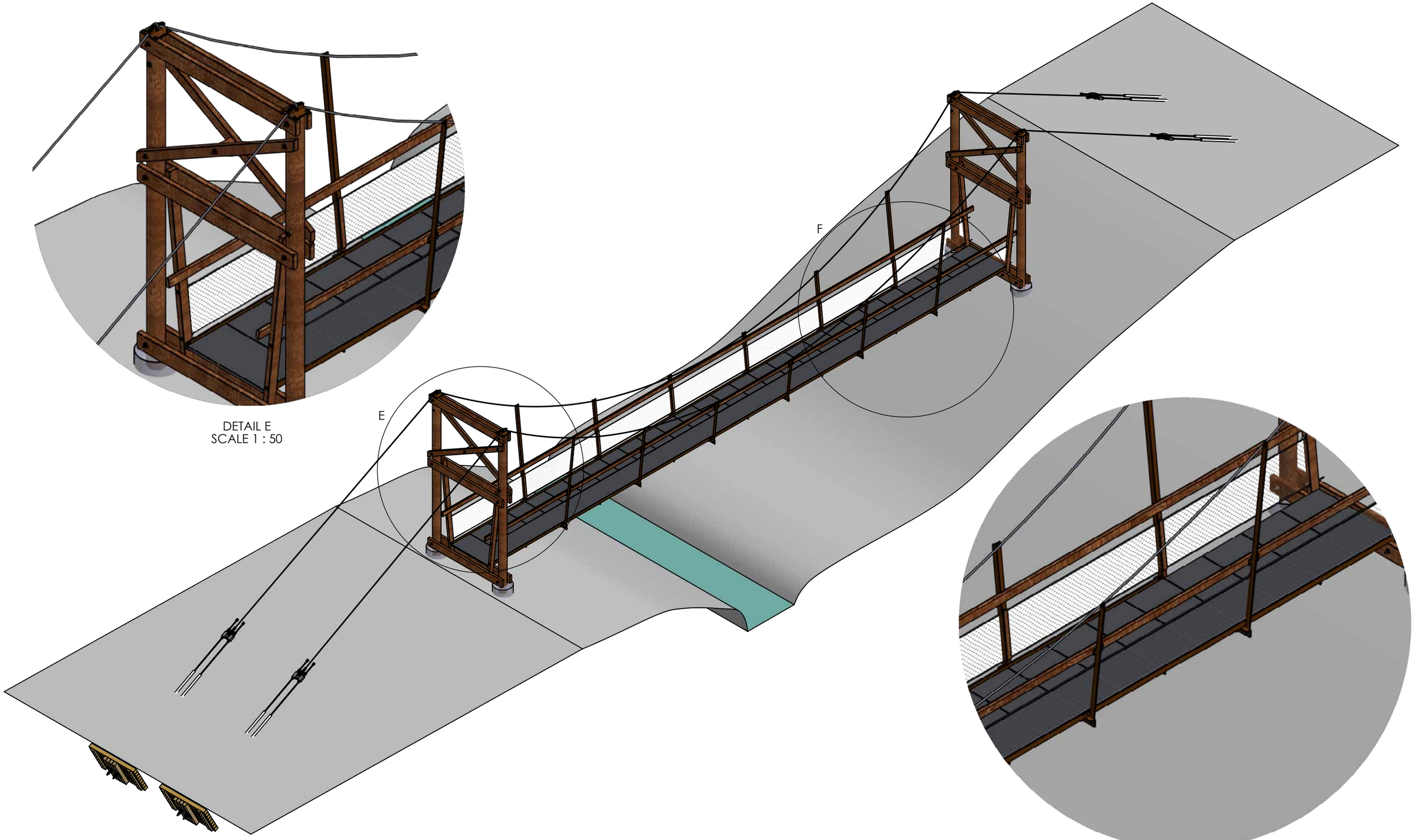
Key parameters	
Tower height	5.15m
Hanger spacing	3.0m
Span	21m
Sag	3.8m
Hog *	0m
Angle of hangers	6 °
Optimum angle (backspans)	28 °
Deck width	1.5m



Plan view
SCALE 1 : 100

Client: Te Ara Mangawhero	Sheet Title: Concept drawing	Location: Mt Ruapehu	ABSEIL ACCESS	Design	Drawn: DC
Project: Bridge 9.3	Concept overview	Drawing Number: AA-1997-DWG-9.3-4		Checked: MW	Date: 30/10/2024
				Approved	Scale: Various
				Status: Concept	Revision: B

DETAIL E
SCALE 1 : 50



DETAIL F
SCALE 1 : 50

Client: Te Ara Mangawhero	Sheet Title: Concept drawing	Location: Mt Ruapehu	ABSEIL ACCESS	Design	Drawn: DC
Project: Bridge 9.3	3D overview	Drawing Number: AA-1997-DWG-9.3-5		Checked: MW	Date: 30/10/2024
				Approved	Scale: Various
				Status: Concept	Revision: B

Te Ara Mangawhero Trail

Bridge construction Method Statement

Structures: 5.8, 8.3, 9.1 & 9.3

October 2024






Document Ref:	AA-MS-TeAraMangawhero
Revision:	2
Issue Date:	31/10/24

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1 Introduction

The construction of 4 bridge structures is required as part of the new cycle trail Te Ara Mangawhero.

Abseil Access has been engaged by Cheal and Ngati Rangi to design and build the new bridges.

Project Information				
Project Name:	**Te Ara Mangawhero**	Project Number:		
HWN:				
Location of Project:	Address:	Oakune Mountain Road		
	GPS Location			
	Location at Address:	Various: 5.6, 8.3, 9.3, 9.13 see trail map		

	Project Management	Project Supervisor	Client	Engineer
Contact	Martin Wilson	Matt Thom	Helen Leahy/Dayle Brooks	Simon Devoy
Company	Abseil Access	Abseil Access	Ngati Rangi, Oakune	Gray Matter
Position	Director	Site Supervisor, H&S and Environmental management	Client	CPENG
Ph #	0274495408	027 486 4803		021 165 7028
Email	Martin.wilson@abseilaccess.co.nz			Simon.Devoy@graymatter.co.nz

2 Scope of Work

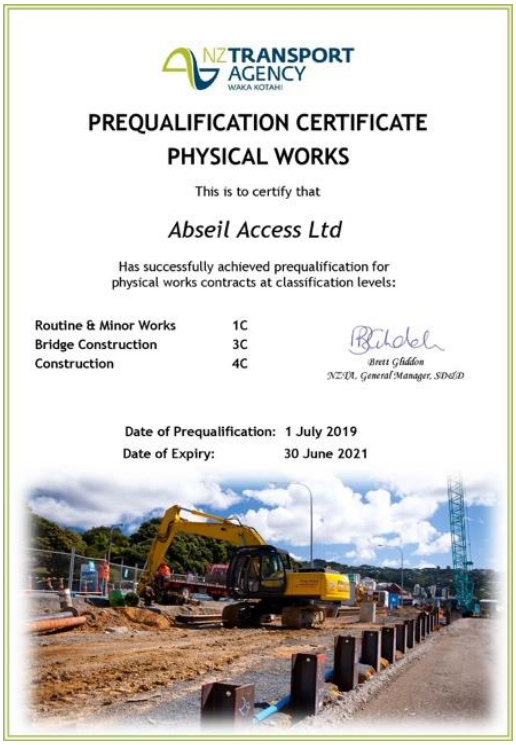
This Scope of Work has been broken down into the below categories and specific controls and methodologies have been outlined in this document. The works will be completed by Abseil Access who are being directly engaged by Ngati Rangi. Project managers are Cheal (Dean Sherrit and Jake Saathof).

- Pre Works
- Site setup and clearing vegetation.
- Foundation installation
- Span Construction
- Span Installation
- Deck and handrail formations
- Final inspection

The same scope applies to all structures

3 Health & safety

Abseil Access have achieved ISO 9001, 14001 and 45001 quality health and safety and environmental management systems, NZTA 1C, 3C & 4C. This is now recognised in the CHASNZ Totika system.



NZ TRANSPORT AGENCY
WAKA KOTAHI

PREQUALIFICATION CERTIFICATE
PHYSICAL WORKS

This is to certify that

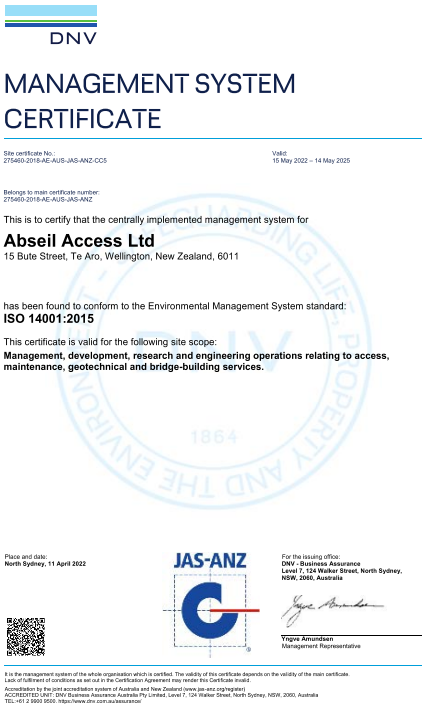
Abseil Access Ltd

Has successfully achieved prequalification for physical works contracts at classification levels:

Routine & Minor Works	1C
Bridge Construction	3C
Construction	4C

Brett Gliddon
NZTA, General Manager, SD&D

Date of Prequalification: 1 July 2019
Date of Expiry: 30 June 2021



DNV

MANAGEMENT SYSTEM CERTIFICATE

Site certificate No.:
275460-2018-AE-AUS-JAS-ANZ-CC5

Valid:
15 May 2022 – 14 May 2025

Belongs to main certificate number:
275460-2018-AE-AUS-JAS-ANZ

This is to certify that the centrally implemented management system for

Abseil Access Ltd
15 Bute Street, Te Aro, Wellington, New Zealand, 6011

has been found to conform to the Environmental Management System standard:
ISO 14001:2015

This certificate is valid for the following site scope:
Management, development, research and engineering operations relating to access, maintenance, geotechnical and bridge-building services.

Place and date:
North Sydney, 11 April 2022

JAS-ANZ

For the issuing office:
DNV - Business Assurance
Level 7, 124 Walker Street, North Sydney, NSW, 2060, Australia

Yngve Amundsen
Management Representative

It is the management system of the whole organization which is certified. The validity of this certificate depends on the validity of the main certificate.
Lack of fulfilment of conditions as set out in the Certification Agreement may render this Certificate invalid.
Accreditation by the joint accreditation system of Australia and New Zealand (www.jas-anz.org/register)
ACCREDITED UNIT: DNV Business Assurance Australia Pty Limited, Level 7, 124 Walker Street, North Sydney, NSW, 2060, Australia
TEL: +61 2 8906 0800 https://www.dnv.com.au/assurance



DNV

MANAGEMENT SYSTEM CERTIFICATE

Site certificate No.:
275461-2018-AQ-AUS-JAS-ANZ-CC5

Valid:
15 May 2022 – 14 May 2025

Belongs to main certificate number:
275461-2018-AQ-AUS-JAS-ANZ

This is to certify that the centrally implemented management system for

Abseil Access Ltd
15 Bute Street, Te Aro, Wellington, New Zealand, 6011

has been found to conform to the Quality Management System standard:
ISO 9001:2015

This certificate is valid for the following site scope:
Management, development, research and engineering operations relating to access, maintenance, geotechnical and bridge-building services.

Place and date:
North Sydney, 11 April 2022

JAS-ANZ

For the issuing office:
DNV - Business Assurance
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TEL:+61 2 9900 9500. https://www.dnv.com.au/assurance/



DNV

MANAGEMENT SYSTEM CERTIFICATE

Site certificate No.:
275462-2018-AHSO-AUS-JAS-ANZ-CC5

Valid:
15 May 2022 – 14 May 2025

Belongs to main certificate number:
275462-2018-AHSO-AUS-JAS-ANZ

This is to certify that the centrally implemented management system for

Abseil Access Ltd
15 Bute Street, Te Aro, Wellington, New Zealand, 6011

has been found to conform to the Occupational Health and Safety Management System standard:
ISO 45001:2018

This certificate is valid for the following site scope:
Management, development, research and engineering operations relating to access, maintenance, geotechnical and bridge-building services.

Place and date:
North Sydney, 11 April 2022

JAS-ANZ

For the issuing office:
DNV - Business Assurance
Level 7, 124 Walker Street, North Sydney, NSW, 2060, Australia

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TEL:+61 2 9900 9500. https://www.dnv.com.au/assurance/

A Site-Specific Safety Plan will be developed prior to works starting and submitted Ruapehu DC for review. The safety plan is to include safe work method statements for any high-risk activities and a site-specific hazard register for bridge building activities.

Daily toolbox meetings will be held, and minutes kept.

All workers will complete a site induction. New workers, visitors and subcontractors will need to complete a site induction and sign on to the safety plan.

Subcontractors: these firms will have to complete the AA subcontractor assessment and follow SSSP procedures.

Expected subcontractors:

- Concrete Supplier & Pumpers
- Various delivery trucks and digger contractor
- Monkeytoe for pre-made alloy spans

3.1.1 Covid Management

A specific Covid Management Plan will be implemented prior to the works to reflect the current government guidelines on management of work sites. Due to the changing nature of Covid-19 and government guidelines and specific plan will be prepared close to the anticipated start date and submitted to the client for review.

4 Site Setup and General layout

4.1 Site access

Site office and site induction station will be positioned in Oakune.

The bridge sites can be access by either side by foot.

Bridge 5.6 will be access from the Oakune mountain road.

Bridge 8.3 will be accessed from the Waitonga Falls carpark

Bridge 9.1 and 9.3 will be access from the Mangawhero Falls carpark

Signs will be posted warning pedestrians and other users about the construction site. There is no need to close any tracks.

4.2 Materials Management to sites

4.2.1 Overview & site access

Traffic management is not required on nearby roads. There will be off road parking.

4.2.2 Materials drop-off

During delivery of materials to site a medium size hi-ab truck will be required to lift off materials. The truck will stay on the formed roads. Materials will be carried to site manually or flown in by heli-lift

4.2.3 Concrete delivery

Concrete will be hand mixed from certified pre-mix bags. Bags will be carried to site or heli-lifted in.

4.2.4 Site Layout

Site perimeter will be clearly marked with Danger No Access tape. This will also define the work area and the no-go areas.

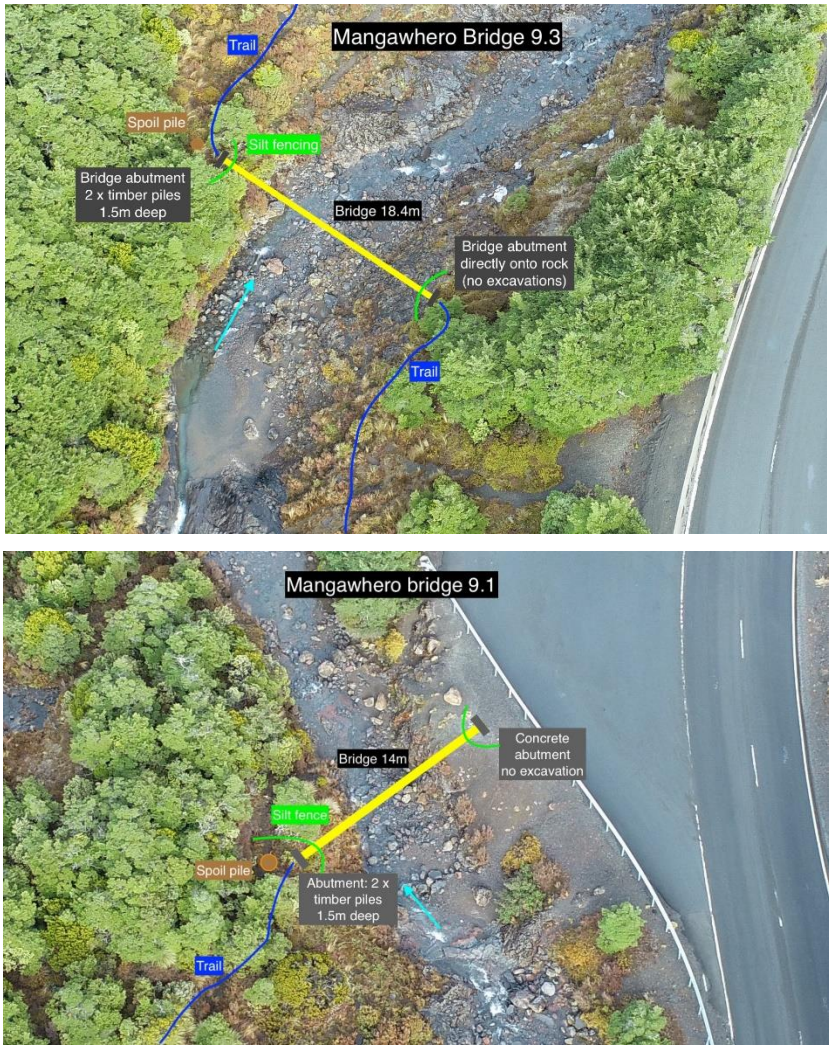
Bridge position will be adjusted for minimal damage to significant vegetation and ideal approach ramps. Final location will be decided with client.

4.2.5 Helicopter use

Heavy materials (including premade rigid bridge structures) will be flown in by helicopter. A lifting plan will be put in place. Heavy materials will be stored in the large chain fitting bays on the road side. Loads will be assembled, weighed and prepared for lifting. The helicopter will have a staging and set down area nearby. Traffic management will be required on the lifting days, flying operations will be targeted to quite periods on the road e.g. early morning.

The nearby public tracks will need to be closed during the lifting operations.

5 Erosion and Sediment Control Plan (E&SCP). Tower and anchor excavations.



Bridge 9.1 and 9.3: Examples of ESCP plans showing protection of the river from silt run off. Silt fences positioned between the excavation and the river.

Aerial photos of 5.6 and 8.3 are not available, ESCP will be comparable.

5.1 Underground Services checks

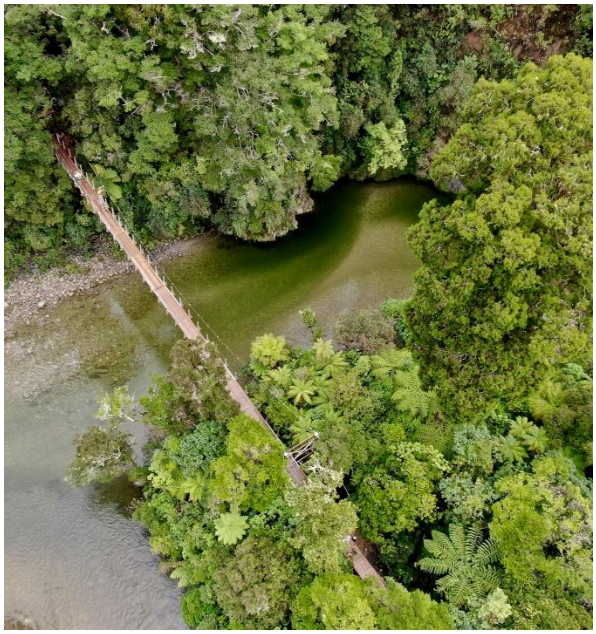
A service check is to be completed prior to excavations for all four areas to be excavated. No known services are in this area.

5.2 Excavation method

All excavation will be completed using manual labour. Pile auger holes will be excavated using a petrol powered handheld auger. If the track building digger is nearby it will be utilised. Each bridge structure will have

a single set of support piles at each end. All spoil is to be stored beside excavation on the non-river side, all spoil will then be used at backfill and track fill. Back fill be compacted to reduce future erosion.

Having built 106 bridge so far, many of which were in National Parks for DoC we are experts at minimal damage to the vegetation.





Pakuratahi bridge (90m) built by us in the Kaitoke Regional Park with minimal damage to vegetation

5.3 Excavation summary:

Excavation	Volume	Distance from riverbed	comments
Bridge 5.6: True right tower support pile	1m3	3m+	Area: 2 augered holes 1.5m deep max
Bridge 5.6: True right Anchor	5m3	3m+	Area: 4m wide 1.5m deep max
Bridge 5.6: True left tower support pile	1m3	3m+	Area: 2 augered holes 1.5m deep max
Bridge 5.6: True left anchor	5m3	3m+	Area: 4m wide 1.5m deep max
Bridge 8.3: True right bridge structure support pile	1m3	3m+	Area: 2 augered holes 1.5m deep max
Bridge 8.3 True left bridge structure support pile	0m3	3m+	Concrete footing fixed to bedrock

Bridge 9.1: True right bridge structure support pile	0.1m3	3m+	Concrete footing fixed to roadside fill
Bridge 9.1 True left bridge structure support pile	1m3	3m+	Area: 2 augered holes 1.5m deep max
Bridge 9.3: True right bridge structure support pile	0.1m3	3m+	Concrete footing fixed to bedrock
Bridge 9.3 True left bridge structure support pile	1m3	3m+	Area: 2 augered holes 1.5m deep max

5.4 Control of runoff from spoil piles, sediment control plan.

1. Waterways: Silt fences are to be installed around the excavation areas such that they prevent the flow of silt into the waterways. Location to be discussed on site in order to position fences in the silt flow areas. Fences are to be made from silt cloth and star pickets. Follow construction guidelines in the appendix. The bottom edge of the silt fence is to be dug in or buried 200mm. Temporary silt socks 200mm deep are to be used around spoil pile from anchor blocks and tower foundations.
2. Silt fences to be cleared periodically or if they appear to be maxing out. Silt to be taken off site.
3. No excavation to happen during wet weather.
4. Minimal vegetation to be removed - see aerial plan
5. 'No Go area' to be observed in order to reduce surrounding vegetation damage
6. No Clean fill on site without prior planning
7. All spoil piles to be covered each night in case of rain. Spoil pile locations indicated on the sediment management plan. Spoil piles positioned such that run off returns to the excavation.
8. In the event of a heavy rain forecast return the spoil to the excavation hole and compact down. Cover with tarp. Check run off direction is not directly toward waterways.
9. No discharge of dirty water or run off into the Awa Mangawhero stream.
10. Erosion and Sediment control plan and site environmental protection to be checked every morning before work starts and during any new excavations. Note changes or improvements on the daily toolbox form.
11. Matt Thom to be responsible for environmental management operations and maintenance and all sediment control structures.
12. Concrete spill. When pumping and pouring wet concrete precautions should be in place for the immediate reactive management to spills. Excess concrete should be removed from site.

5.5 Reinstatement of disturbed ground

All ground that has been cleared will be reinstated by planting or sowing at the discretion of the client. This is to be done as soon as the bridge is constructed, and further site work is minimised.

6 Approach tracks (TL&TR)

Approach tracks will be built by others.

7 Pile support pads

7.1 Soft ground

2 holes will be angered at 450mm diameter to approx. 1.5m deep (or where good ground is met). Timber 250 SED H5 piles will be concreted into the holes using 20mPa concrete from pre-mixed bags.

The 2 piles will be joined with a timber pile cap suitable for support of the bridge structure

7.2 Firm ground (bedrock)

Rock to be cleaned and scabbled. 20mPa Concrete support pad will be poured directly. The steel cage will be bonded to the bedrock with epoxied in starter bars.

8 Span construction and delivery

The bridge spans will be manufactured off site by MonkeyToe. They will be delivered to site and unloaded in the chain fitting bays.

The bridges will then be airlifted into position one by one. Due to the mass being over 1.5T we will need to use the Iroquois heavy lift helicopter based in Eltham. For this reason the lifting in of all 3 bridges will be done in one operation.

9 External cladding

The fixed span alloy bridges will have timber exterior cladding. This will be added to the structure after installation. The timber, staining and pattern of the cladding can be adjusted to assist with the structure blending into the surrounding area. Some suggested options:

1. Vertical slats of eco sourced native timber or hardwood. Slats can be varying length, thickness and width to break up/randomise the surface.
2. As 1 above but differing timbers or stained with slightly different colour to increase the random/native look

3. As 1 or 2 above but the slats are not all vertical but differing angles to give the impression of a forest. There could be a second layer of smaller slats, also at varying angles to give the impression of branches

Any option we do would be done the Ngati Rangi on board who would be involved with supplying the timber and labour. Adding features like this is a great way to include artists and locals.

Behind the slats (on the inside face of the bridge) would be dark green PVC coated chainlink mesh. This meets the Type A fall barrier requirements and also adds natural colour.

10 FRP decking

We are proposing to use FRP regular grade decking in green. This has good long term grip and snow/frost shedding.

11 Site specific method statement

The following site specific information

Bridge 5.6 24m. Mangawhero river	
Access to site	15 min walk downhill from the road. Ideally the track is built before we construct the bridge. The river can be crossed easily upstream of the site.
Site preparation	Some minor clearing of vegetation will be required for flying in the abutment materials and the pre-constructed span.
True Right foundation	Forest floor organic matter but river rocks expected within approx. 1.5m depth. Auger holes until 300kPa ground is encountered. Concrete in 2 x 250SED H5 piles and connect with timber capping beam. Excavation is approx. 8m back from the creek edge. Silt fence required
True left foundation	Forest floor organic matter but bed rock expected within approx. 1.5m depth. Auger holes until 300kPa ground is encountered. Concrete in 2 x 250SED H5 piles and connect with timber capping beam. Excavation is approx. 5m back from the creek edge. Silt fence required
Bridge span	Cables are positioned across the river and the hanger frames added. Decking and handrails and infill cables added. On completion the bridge gets a 5T load test and final inspection by the CPENG.

Bridge 8.3 19.6m. Mangawhero river	
Access to site	10 min walk upstream from the Waitonga Falls carpark and trail. Ideally the track is built before we construct the bridge. The creek is approx. 6m wide and can be crossed easily in low flow. An aerial rope way can be installed for crossing in higher water.
Site preparation	Some minor clearing of vegetation will be required for flying in the abutment materials and the pre-constructed span.
True Right foundation	Forest floor organic matter but river rocks expected within approx. 1.5m depth. Auger holes until 300kPa ground is encountered. Concrete in 2 x 250SED H5 piles and connect with timber capping beam. Excavation is approx. 6m back from the creek edge. Silt fence required
True left foundation	Bedrock will be used and a concrete plinth poured against this Excavation is approx. 4m back from the creek edge. Silt fence required
Heli-lift span	Trail staging area is the layby at southern end of the visitor carpark. Deliver 8.3 span here. Heli-lift does not need to cross the road

Bridge 9.1 14m. Mangawhero river	
Access to site	0 min walk downhill from the Mangawhero Falls carpark. The creek is approx. 4m wide and can be crossed easily
Site preparation	Some minor clearing of vegetation will be required for flying in the abutment materials and the pre-constructed span.
True Right foundation	Gravelled carpark. Minimal excavation required prior to building a concrete support block. Silt fence required.
True left foundation	Forest floor organic matter but bed rock expected within approx. 1.5m depth. Auger holes until 300kPa ground is encountered. Concrete in 2 x 250SED H5 piles and connect with timber capping beam. Excavation is approx. 4m back from the creek edge. Silt fence required
Heli-lift span	Trail staging area is the layby at southern end of the visitor carpark. Deliver 9.1 spans here. Heli-lift does not need to cross the road

Bridge 9.3 18.6m. Mangawhero river	

Access to site	1 min walk upstream from the Mangawhero Falls carpark and trail. The creek is approx. 6m wide and can be crossed easily in low flow. An aerial rope way can be installed for crossing in higher water.
Site preparation	Some minor clearing of vegetation will be required for flying in the abutment materials and the pre-constructed span.
True Right foundation	Bedrock will be used and a concrete plinth poured against this Excavation is approx. 6m back from the creek edge. Silt fence required
True left foundation	Forest floor organic matter but river rocks expected within approx. 1.5m depth. Auger holes until 300kPa ground is encountered. Concrete in 2 x 250SED H5 piles and connect with timber capping beam. Excavation is approx. 4m back from the creek edge. Silt fence required
Heli-lift span	Trail staging area is the layby at southern end of the visitor carpark. Deliver 9.3 span here. Heli-lift does not need to cross the road

12 Quality Assurance

Item	QA
Timber	Tanalising certs
Alloy span	PS1 and material certs from MonkeyToe
Concrete	Mix certs (if pre-mix is used) or certified bags.

13 Final inspection

On completion the structures will be inspected. Load test not required on the rigid spans.

14 Refuelling

No storage, refuelling or servicing of machinery in locations which could lead to a spill to the watercourse.

Spill management:

A spill kit is required to be always on site. Diggers and hydraulic machinery shall be monitored at all times for hydraulic oil leaks.

15 Construction Duration

The construction will be delivered in 2024-2025 and this bridge build is estimated at Eight weeks on site.

5.6 Approx 4 weeks

8.3: approx. 12 days

9.1: approx. 12 days

9.3: approx. 12 days

16 Completion

All construction materials will be removed from site and a sweep of the greater area will be done to ensure nothing is left behind.

17 Heritage Archaeological Findings

Should we discover any archaeological objects, we will comply with the Heritage New Zealand act 2014. We will stop work as required and inform the local authorities of the findings.

18 Appendix

18.1 Silt Fences: design and construction criteria

The following points are design essentials:

- Make sure that the silt fence height is 600 mm above ground level.
- Apply the maximum slope lengths and spacing of returns and angles given in Silt fence design criteria table.
- If there is a change in slope, no section of the fence should exceed a grade of 5% for more than 15 m.
- Put supporting posts/waratahs for silt fences 2–4 m apart, and use tensioned wire (2.5 mm HT) for support along the top.
- If you are using a strong woven fabric with a wire support, the distance between posts can be up to 4 m. Double the silt fence fabric over and fasten it to the wire with silt fence clips, 500 mm apart.
- Embed supporting posts/waratahs at least 400 mm into the ground.
- Always install silt fences along the contour (at a break in slope). If this is not possible, or if there are long sections of silt fence, install short silt fence returns projecting upslope from the silt fence to minimise the concentration of flows. Silt fence returns should be at least 2 m long and can incorporate a tie back. You usually make them by continuing the silt fence around the return and doubling back, to eliminate joins.
- Join lengths of silt fence by doubling over fabric ends around a waratah or by stapling the fabric ends to a batten and butting the two battens together.
- Install silt fence returns at either end of the fence, projecting upslope high enough to prevent outflanking.
- If the catchment is over 0.3 ha, you need to consider whether a silt fence works well enough for that site. A different control measure may be better, e.g. a super silt fence.



Battens joining silt fence fabric ends (Source: Southern Skies).



Doubling the fabric over at the end around the waratah (Source: Southern Skies).



Contours create the same effect as returns in this case; in other situations ensure returns are installed (Source: Southern Skies).

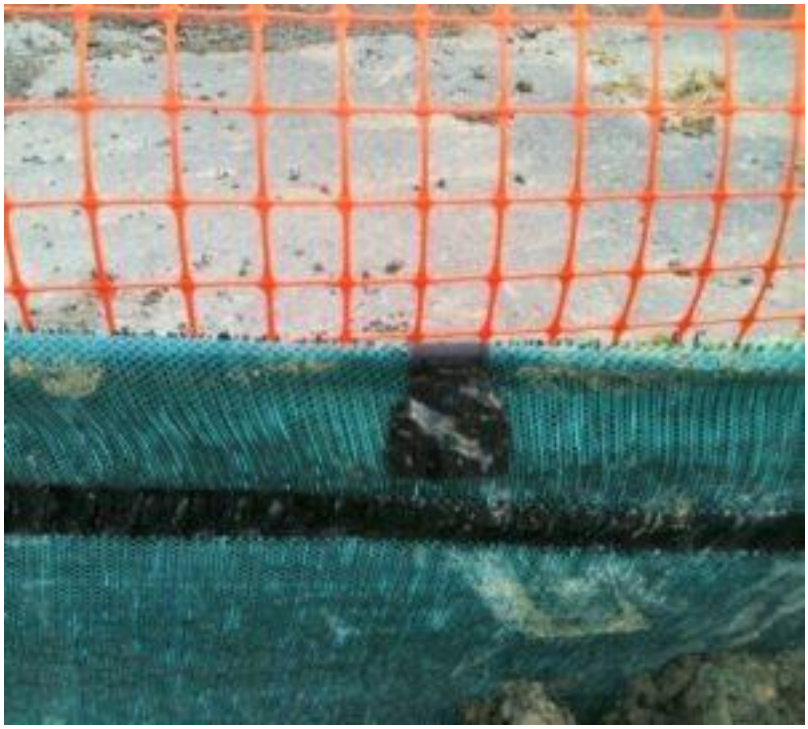
Silt fence design criteria table

Slope steepness	Slope length (m) (maximum)	Spacing of returns (m)	Silt fence length (m) (maximum)
Flatter than 2%	Unlimited	N/A	Unlimited
2–10%	40	60	300
10–20%	30	50	230
20–33%	20	40	150
33–50%	15	30	75
>50%	6	20	40

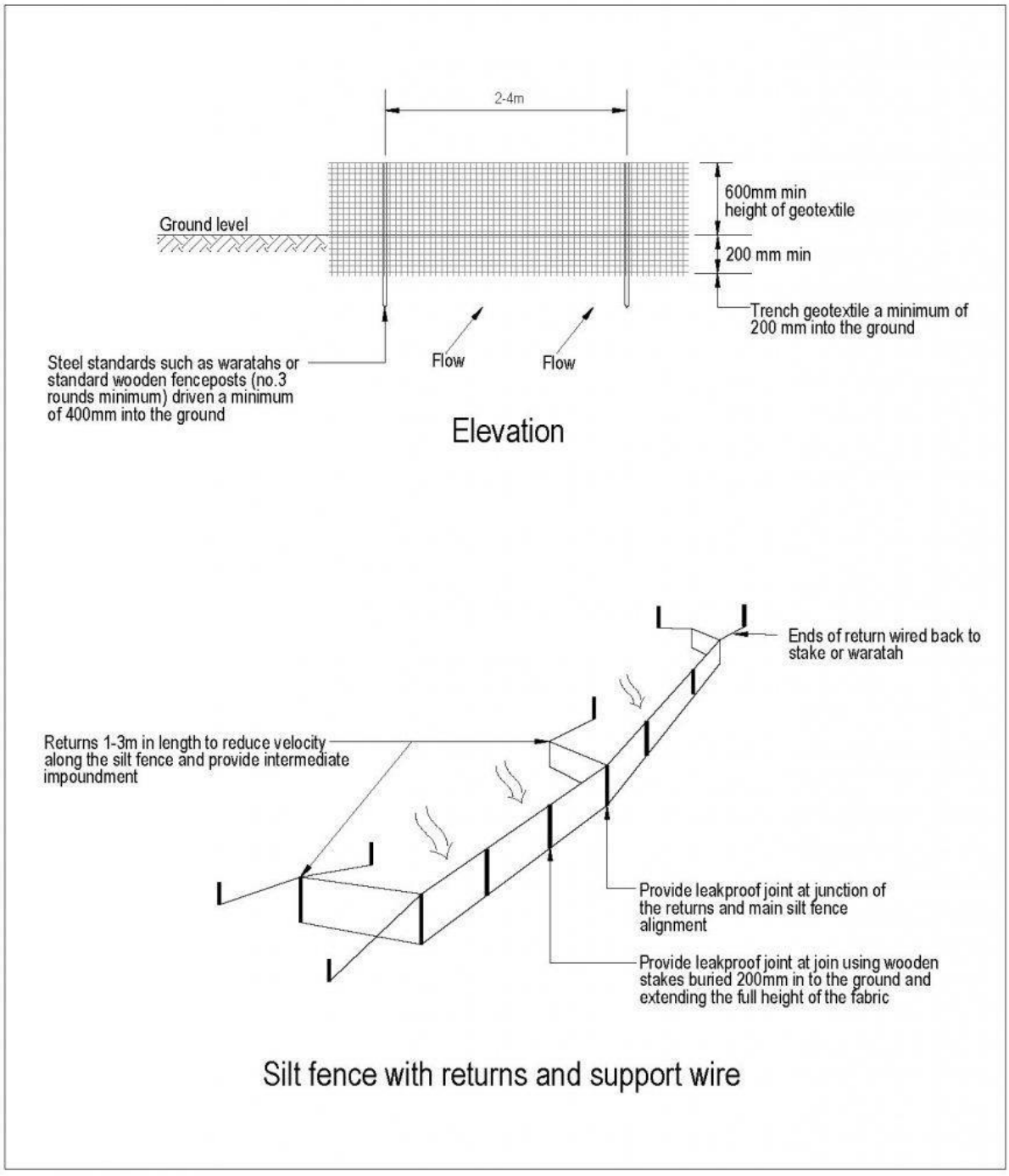
- If water might pond regularly behind the silt fence, give the fence extra support with tie backs from the silt fence to a central stable point on the upward side. You can also string wire between the support stakes and connect the filter fabric to this wire.
- As a minimum, the silt fence cloth must meet the following criteria for geotextile fabric:
    - Grab tensile strength: >440N (ASTM D4632)
    - Tensile modulus: 0.140 pa (minimum)
    - Apparent opening Size: 0.1–0.5 mm (ASTM D4751).

Construction and operation of silt fences

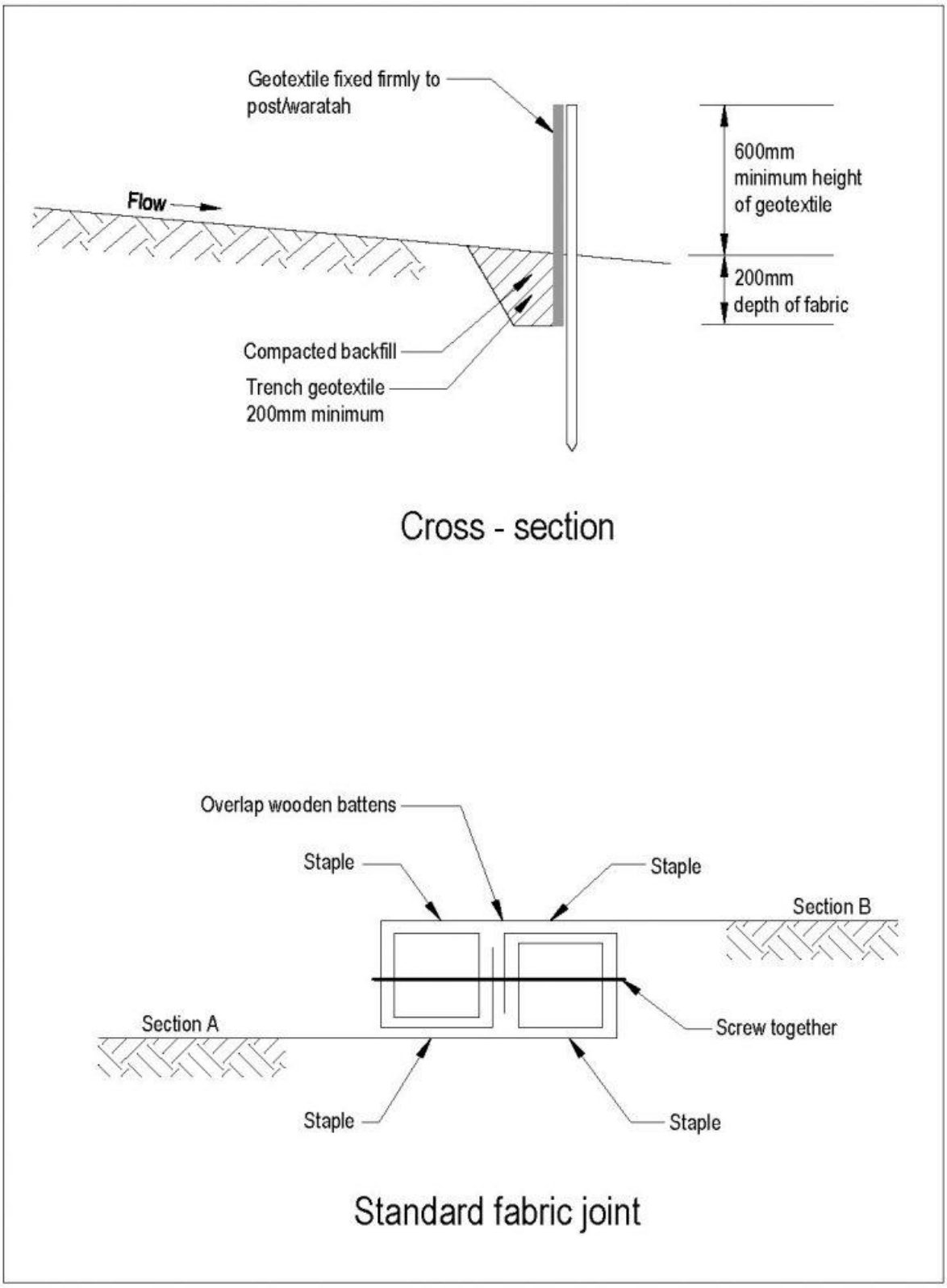
- Use silt fence material appropriate to the site conditions and according to the manufacturer's specifications.
- Always install silt fences along the contour.
- Excavate a trench at least 100 mm wide and 200 mm deep along the proposed line of the silt fence.
- Use waratahs at least 1.5 m long.
- Install the support waratahs on the **downslope edge of the trench** and silt fence fabric on the **upslope side of the support waratahs** to the full depth of the trench. Then backfill the trench with compacted soil.
- **Install the waratahs so that they are as flat as possible against the silt fence.** If the waratah edge is against the silt fence, it will rub and eventually rip against the waratah.
- Use the right silt fence clips to secure the fence material to the top wire. Don't use wire ties and staples because these rip the material if the weight of the impounded water pushes against it.
- Reinforce the top of the silt fence fabric with a support made of high tensile 2.5 mm diameter galvanised wire. Tension the wire using permanent wire strainers attached to angled waratahs at the end of the silt fence.
- Where the ends of silt fence fabric come together, make sure that they are overlapped, folded, and stapled or screwed to stop sediment bypass.



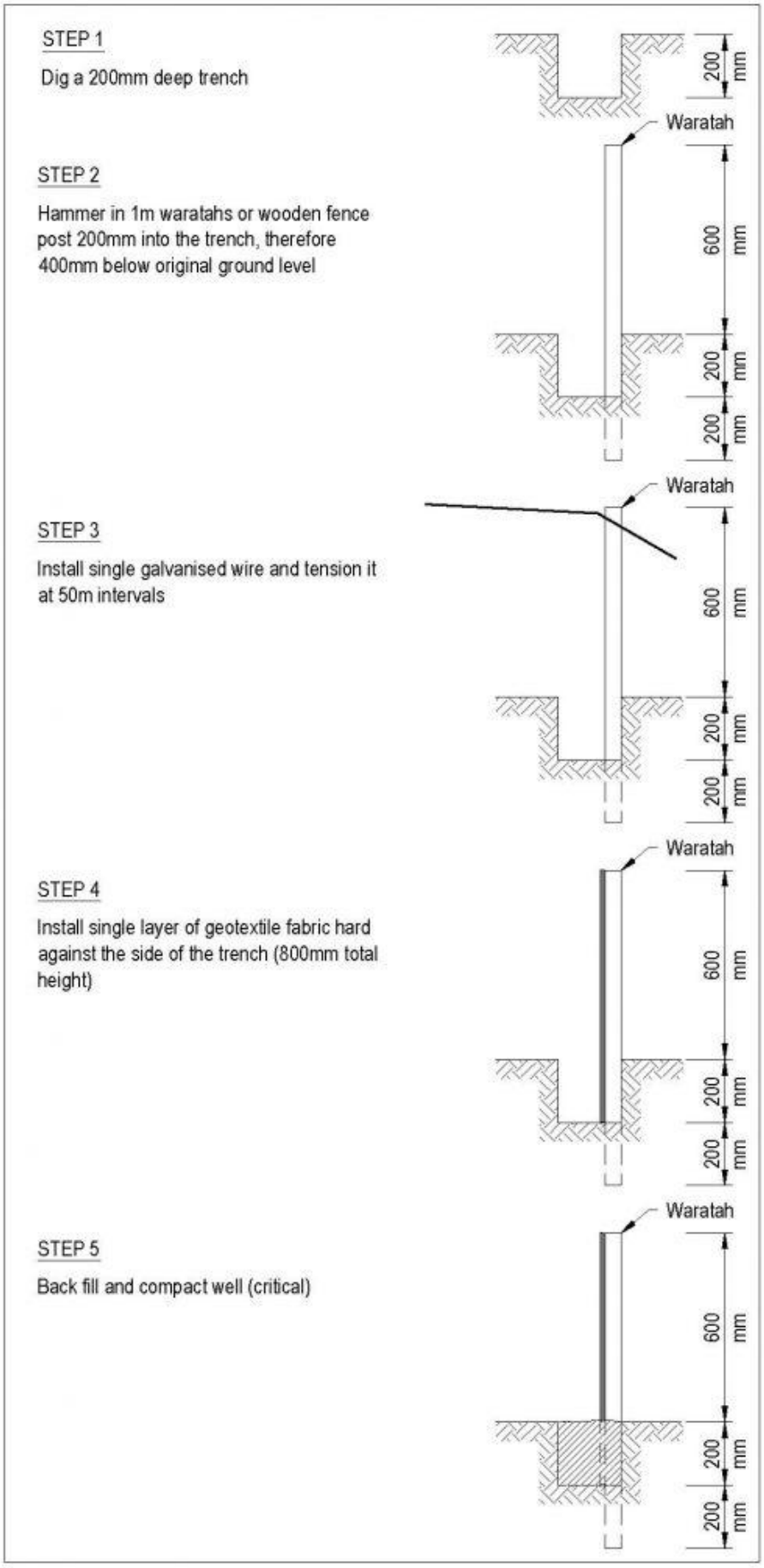
Silt fence correctly secured to the top wire using silt fence clips (Source: Southern Skies).



Schematic of silt fence construction, showing returns and support wires.



Silt fence cross section and fabric joint.


STEP 1
Dig a 200mm deep trench
200 mm
Waratah
STEP 2
Hammer in 1m waratahs or wooden fence post 200mm into the trench, therefore 400mm below original ground level
600 mm
200 mm
200 mm
Waratah
STEP 3
Install single galvanised wire and tension it at 50m intervals
600 mm
200 mm
200 mm
Waratah
STEP 4
Install single layer of geotextile fabric hard against the side of the trench (800mm total height)
600 mm
200 mm
200 mm
Waratah
STEP 5
Back fill and compact well (critical)
600 mm
200 mm
200 mm

Appendix 7. Geotechnical Assessment

Taiao Architecture and Engineering Ltd
team@taiao-design.com
Phone: 0226483241

Geotechnical Factual Report

Client:	**Cheal Consultants**
Project:	**Te Ara Mangawhero Trail – Bridges and Boardwalks**
Site:	**Te Ara Mangawhero Trail – Phase 2, Mount Ruapehu**
Reference:	**140**
Revision:	**A**
Date:	**18/09/2024**

Authored By:	Neville Wilson	B.E Civil (Hons), CPEng
Report Peer Reviewed By:	Gareth Cottrell (CORE Engineering Solutions Ltd)	CPEng (Geotechnical) Principal Geotechnical Engineer
Approved for Issue By:	Neville Wilson	Director
Report Prepared for:	Cheal Consultants	Client
Report Issued to:	Dean Sherrit	DeanS@cheal.co.nz

Executive Summary

Cheal Consultants has engaged Taiao Architecture and Engineering Ltd. to carry out a Geotechnical Factual Report for the proposed bridges and boardwalk structures on the Te Ara Mangawhero Trail – Phase 2, Mount Ruapehu.

The purpose of this report is to record the factual results of investigations carried out by Taiao Architecture and Engineering Ltd. for the purposes of foundation design for the bridge and boardwalk structures in accordance with the scope of work carried out, the information relied upon, and the limitations of the assessment.

The ground conditions for structural foundation design are reported within this document and are summarised in the table on the following page along with other relevant information.

Geology:	**Geology Type 1: Mangawhero Formation andesite of Tongariro Volcanic Centre** **Geology Type 2: Middle – Late Pleistocene River Deposits**
Testing Depth Range:	Hand augers and scalas: 0m - 3.0m below existing ground level
Soil Types:	SILTS, SANDS and ROCK – refer to detailed descriptions in bore logs in Appendix C
Groundwater:	Refer to bore logs in Appendix C and cross-sections in Appendix B
Seismic Subsoil Class:	**Class B and Class C** as per NZS1170.5:2004
Territorial Authority	Ruapehu District Council
Regional Authority	Horizons Regional Council

Other Important Information

For completeness, the Client / Trail operator will need to consider all natural hazards affecting these sites and surrounds, in particular for slope stability and flash flooding events. Nevertheless, to assist with structural design, etc. a preliminary assessment of liquefaction risks at the proposed sites is provided, refer 7.1.

During construction, all sites will require inspection (and if deemed necessary testing) by a Chartered Professional Geotechnical Engineer or their Agent who is familiar with these sites and the contents of this report.

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1. Scope of Work

Cheal Consultants has engaged Taiao Architecture and Engineering Ltd to carry out a geotechnical factual report for the proposed Te Ara Mangawhero Trail – Bridges and Boardwalks at Te Ara Mangawhero Trail – Phase 2, Mount Ruapehu. The scope of the assessment was requested by Dean Sherrit, of Cheal Consultants, and is to present the geotechnical testing results for the purpose of foundation design for the proposed bridge and boardwalk structures listed as follows:

Bridge 5.8 **Bridge 6.27** **Bridge 6.29** **Bridge 6.31** **Bridge 7.2** **Bridge 8.3**

Bridge 9.1 **Bridge 9.3** **Bridge 9.13** **Boardwalk 9.11** **Boardwalk 9.31**

Refer to the Trail Plan titled "Ruapehu WorX Limited: Te Ara Mangawhero Trail, Phase Two Construction Trail Sections Overview" prepared by Cheal Consultants for the location of these proposed structures, attached in Appendix A.

Cheal Consultants have requested hand testing methods for subsoil investigations due to the access difficulties for CPT or machine bore testing for the majority of the sites. The scope of field investigations is therefore limited to hand auger, shear vane and scala penetrometer testing methods only.

2. Relevant Standards

The relevant design standards and guidance documents relating to the structures for this project are listed in the following table:

New Zealand Geotechnical Design Modules 1-5	New Zealand Geotechnical Society Field Description of Soil and Rock Guidelines
New Zealand Building Code B1/VM4	NZS1170.5:2004
NZS1170.0:2002	SNZ HB 8630:2004
NZS1170.1:2002	NZS1170.2:2021
NZS1170.3:2003	

Table 1 – Relevant Design Standards

Standards must be checked by the Designer for currency and relevancy at the time of design, etc.

3. Geology

The New Zealand Institute of Geological and Nuclear Sciences maps the various sites as follows:

3.1. Bridge 5.8

"**Middle – Late Pleistocene River Deposits**". Which is described as "*Moderately weathered undifferentiated poorly sorted gravel, sand, clay and loess"* – This geology is consistent with the subsoils identified in the site testing.

3.2. Bridges 6.27 to 9.13 inclusive & Boardwalks 9.11 and 9.31

"**Mangawhero Formation (Ruapehu Group) andesite of Tongariro Volcanic Centre**" which is described as "*Medium grey, phenocryst-rich andesite lava and breccia."* – This geology is consistent with the subsoils identified in the site testing.

4. Geotechnical Site Investigations

Hand auger boreholes with shear vane readings at regular intervals in combination with Scala Penetrometer tests were carried out on each bank of the proposed bridge locations and at the location of boardwalk 9.31. Testing was not undertaken at the location of boardwalk 9.11 due to the presence of near surface rock.

Refer to the bridge cross sections attached in appendix B and the bore logs attached in appendix C.

5. Earthquake Loading

The structure design life is 50 years in terms of NZS1170.0:2002.

The structure importance level is Importance Level 2 in terms of NZS1170.0:2002.

The peak ground acceleration for this site for a 500 year return period earthquake defined in Appendix A of the New Zealand Geotechnical Modules, Module 1 is **0.36g**.

The Earthquake Magnitude for this site for a 500 year return period earthquake defined in Appendix A of the New Zealand Geotechnical Modules, Module 1 is **6.3**.

Proposed structures must be designed to account for seismic shaking and ground motions.

6. Geotechnical Investigations

The geotechnical investigations carried out at each bridge / boardwalk location included a combination of hand augers, shear vane testing and scala penetrometer testing. At each location the relevant cross-section profile was estimated using an inclinometer and tape measure and the location of the boreholes recorded on the cross-section. The site locations and relevant testing logs are summarised in the following table:

Site Location	Borehole and Scala Penetrometer Testing Logs
Bridge 5.8	BH5, BH6, BH7, BH8
Bridge 6.27	BH9, BH10
Bridge 6.29	BH11, BH12
Bridge 6.31	BH13, BH14
Bridge 7.2	BH1, BH2
Bridge 8.3	BH3, BH4
Bridge 9.1	BH15, BH16
Bridge 9.3	BH17, BH18
Bridge 9.13	BH19, BH20,
Boardwalk 9.31	BHA, BHB, BHC, BHD, BHE

Table 2 – Site Location Testing Logs

6.1. Bridge 5.8

The trail planning team propose an approximately 34m swing bridge to cross the Te Ara Mangawhero River at Bridge 5.8. Abseil Access the swing bridge designers had previously visited the site prior to testing and marked the location of the proposed abutments (approximately 24m apart) on either side of the stream with white spray paint. Boreholes 5 and 7 were located near the abutment markings, boreholes 6 and 8 were carried out to provide information for likely deadman locations.

The geotechnical investigations at the location of Bridge 5.8 encountered poor ground conditions until depths of approximately 1m below existing ground level for the true left abutment and 1.1m below existing ground level for the true right abutment. It is also noted that the true left abutment is proposed in a location that is partly undercut by river erosion.

Ultimate Limit State ground bearing of 300kPa can be assumed at a depth of 1.1m below existing ground level for the bridge abutments, 1.2m below ground level for the true left deadman and 1.8m below ground level for the true right deadman. This assumption must be verified during construction by a Chartered Professional Engineer with Construction Monitoring to Engineering CM2 standards as a minimum.

GNS Sciences map a possibly active nearby fault approximately 500-600m west of the bridge location.

Refer to bore logs BH5, BH6, BH7, and BH8 attached in appendix C.



Bridge 5.8 – Photo Source Abseil Access

6.2. Bridge 6.27

The geotechnical investigations at the location of Bridge 6.27 encountered poor ground conditions until depths of approximately 0.8m below existing ground level for the true left abutment and 1.5m below existing ground level for the true right abutment.

Ultimate Limit State ground bearing of 300kPa can be assumed at a depth of 0.8m below existing ground level for the bridge abutment on the true left bank and 1.5m below ground level on the true right bank. This assumption must be verified during construction by a Chartered Professional Engineer with Construction Monitoring to Engineering CM2 standards as a minimum.

Foundation design of the abutments needs to account for lateral earth “at-rest pressure” within the upper 1m layer of soils.

Refer to bore logs BH9 and BH10 attached in appendix C.

6.3. Bridge 6.29

The geotechnical investigations at the location of Bridge 6.29 encountered poor ground conditions until depths of approximately 1.2m below existing ground level for the true left abutment and 1.2m below existing ground level for the true right abutment.

Ultimate Limit State ground bearing of 300kPa can be assumed at a depth of 1.2m below existing ground level for the bridge abutment on the true left bank and 1.2m below ground level on the true right bank. This assumption must be verified during construction by a Chartered Professional Engineer with Construction Monitoring to Engineering CM2 standards as a minimum.

Foundation design of the abutments needs to account for lateral earth “at-rest pressure” within the upper 1m layer of soils.

Refer to bore logs BH11 and BH12 attached in appendix C.

6.4. Bridge 6.31

The geotechnical investigations at the location of Bridge 6.31 encountered poor ground conditions until depths of approximately 0.5m below existing ground level for the true left abutment and 0.9 m below existing ground level for the true right abutment.

Ultimate limit state ground bearing of 300kPa can be assumed at a depth of 0.5m below existing ground level for the bridge abutment on the true left bank and 0.9m below ground level on the true right bank. This assumption must be verified during construction by a Chartered Professional Engineer with Construction Monitoring to Engineering CM2 standards as a minimum.

Foundation design of the abutments needs to account for lateral earth “at-rest pressure” within the upper 1m layer of soils.

Refer to bore logs BH13 and BH14 attached in appendix C.

6.5. Bridge 7.2

The geotechnical investigations at the location of Bridge 7.2 encountered poor ground conditions until depths of approximately 1.3m below existing ground level for the true left abutment and 1.6 m below existing ground level for the true right abutment.

Ultimate Limit State ground bearing of 300kPa can be assumed at a depth of 1.3m below existing ground level for the bridge abutment on the true left bank and 1.6m below ground level on the true right bank. This assumption must be verified during construction by a Chartered Professional Engineer with Construction Monitoring to Engineering CM2 standards as a minimum.

Foundation design of the abutments needs to account for lateral earth “at-rest pressure” within the upper 1.5m layer of soils.

Refer to bore logs BH1 and BH2 attached in appendix C.

6.6. Bridge 8.3

The trail planning team propose an approximately 20m rigid span bridge to cross the Te Ara Mangawhero River at Bridge 8.3. Abseil Access the bridge designers had previously visited the site prior to testing and marked the location of the proposed abutments on either side of the stream with white spray paint. Borehole 4 was located near the abutment markings on the true right of the river; borehole 5 was carried out on the small knoll of soil behind the proposed true left abutment location to provide information on the depth of soils on this knoll which overly the rock.

The geotechnical investigations at the location of Bridge 8.3 encountered rock as the ground condition for the true left abutment and poor soil conditions until depths of approximately 0.7m below existing ground level for the true right abutment. It is noted that scala refusal was not reached until 2.4m depth at the true right abutment, this may be the depth of the underlying rock at this location.

Ultimate Limit State ground bearing in excess of 300kPa can be assumed near surface for the true left bridge abutment and an Ultimate Limit State ground bearing of 300kPa can be assumed at 0.8m below ground level for the true right abutment. This assumption must be verified during construction by a Chartered Professional Engineer with Construction Monitoring to Engineering CM2 standards as a minimum.

Refer to bore logs BH3 and BH4 attached in appendix C.



Bridge 8.3 – Photo Source Abseil Access

6.7. Bridge 9.1

The trail planning team propose an approximately 14m rigid span bridge to cross the Te Ara Mangawhero River at Bridge 9.1.

The geotechnical investigations at the location of Bridge 9.1 encountered poor ground conditions until depths of approximately 0.7m below existing ground level for the true left abutment. The ground conditions on the right-hand abutment could not be ascertained by hand auger due to the roading chip at the surface, however good ground bearing is expected.

Ultimate Limit State ground bearing in excess of 300kPa can be assumed at a depth of 0.7m for the true left bridge abutment. The true right abutment conditions need to be checked at excavation stage to determine ground bearing conditions are as expected as it is possible some un-controlled filling has been undertaken here during the previous roading construction. Field notes have a visual of cobbles and boulders underlying the roading chip to a depth of 1-2m where rock is expected.

These assumptions must be verified during construction by a Chartered Professional Engineer with Construction Monitoring to Engineering CM2 standards as a minimum.

Refer to bore logs BH15 and BH16 attached in appendix C.



Bridge 9.1 – Photo Source Abseil Access

6.8. Bridge 9.3

The trail planning team propose an approximately 18m rigid span bridge to cross the Te Ara Mangawhero River at Bridge 9.3.

The geotechnical investigations at the location of Bridge 9.3 encountered poor ground conditions until depths of approximately 0.4m below existing ground level for the true left abutment and 0.8m below existing ground level for the true right abutment.

Ultimate Limit State ground bearing in excess of 300kPa can be assumed at a depth of 0.4m for the true left bridge abutment and 0.8m depth for the true right abutment. These assumptions must be verified during construction by a Chartered Professional Engineer with Construction Monitoring to Engineering CM2 standards as a minimum.

Refer to bore logs BH17 and BH18 attached in appendix C.



Bridge 9.3 – Photo Source Abseil Access

6.9. Bridge 9.13

The geotechnical investigations at the location of Bridge 9.13 encountered rock near surface on the true right abutment and poor soil conditions until depths of approximately 0.9 m below existing ground level for the true left abutment.

Ultimate Limit State ground bearing of 300kPa can be assumed at a depth of 0.9m below existing ground level for the bridge abutment on the true left bank and near surface on the true right bank. This assumption must be verified during construction by a Chartered Professional Engineer with Construction Monitoring to Engineering CM2 standards as a minimum.

Refer to bore logs BH19 and BH20 attached in appendix C.

6.10. Boardwalk 9.11

Boardwalk 9.11 is proposed on the true right bank of the Te Ara Mangawhero in a rock lined gorge. Much of the boardwalk is proposed in an area where rock is either near surface or at the ground surface.

Excavation for foundations in the rock material will be difficult and foundation solutions need to be designed taking the shallow depth to rock into account.

6.11. Boardwalk 9.31

Boardwalk 9.31 is proposed on the true right bank of the upper Te Ara Mangawhero River descending from Massey Hut a length of approximately 340m. The proposed alignment crosses one significant area where a slump has occurred, and several minor localised areas of ground slumping.

The soil conditions in this section of the trail generally consist of highly erodible and low strength silts and sands overlying more competent gravelly/cobbly/bouldery soil that was unable to be penetrated by hand testing methods. Boreholes and associated scala penetrometer tests A-E show the general soil conditions and the comparison between soils that have not slumped and those that have slumped and regressed to stable conditions.

Boardwalk foundations require design to account for lateral earth pressures associated with shallow seated land slumping and to allow possible soil slumping to move around the foundation. The boardwalk deck structure needs to be sufficiently elevated above ground level to prevent slumping ground and associated debris flows from loading the deck.

7. Natural Hazards

As this is a factual report (and in accordance with our Scope of Work) the assessment of natural hazards affecting all the proposed construction sites has not been undertaken. However, for completeness the Client / Trail operator will need to consider all natural hazards affecting these sites and surrounds, in particular for slope stability and flash flooding events. Nevertheless, to assist with structural design, etc. a preliminary assessment of liquefaction risks at the proposed sites is provided below. Liquefaction

7.1. Liquefaction

The following site locations are considered to have a low likelihood of liquefaction due to the presence of shallow underlying andesitic rock observed during the site walk-over and ground testing and mapped on the New Zealand Institute of Geological and Nuclear Sciences geological mapping of the area.

Bridge 6.27 **Bridge 6.29** **Bridge 6.31** **Bridge 7.2** **Bridge 8.3**

Bridge 9.1 **Bridge 9.3** **Bridge 9.13** **Boardwalk 9.11** **Boardwalk 9.31**

The following site locations are considered to have a moderate risk of liquefaction due to the SILT/SAND soil type, high groundwater table, late Pleistocene river deposit geology and the possible peak ground accelerations that may be experienced in an earthquake event, refer also section 5 of this report.

Bridge 5.8

8. Ground Freeze-Thaw and Snow/Ice build-up

8.1. Ground Freeze-Thaw

All foundation locations are expected to be subject to ground freeze-thaw effects near surface.

8.2. Snow/Ice build-up

All the following foundation locations are expected to be subject to regular significant snow and ice build-up and thawing effects.

Bridge 8.3 **Bridge 9.1** **Bridge 9.3** **Bridge 9.13** **Boardwalk 9.11**

Boardwalk 9.31

9. Soil Parameters

Based on our observations across the sites there are generally 4 main material types encountered, these are summarised in table 1.0 with relevant estimated soil parameters as follows:

Unit	Soil Description	Typical Scala Results	Density	Friction Angle	Cohesion	Undrained Shear Strength
A	SILTS – Brownish Grey and Orange/Brown, sandy and/or clayey	1 Blow/200mm	14kN/m^3	27° (21°) saturated	Nil	15kPa
B	SANDS – Loose, Brown and/or Blackish Grey and/or Grey	1 Blow/100mm	15kN/m^3	28°	N/A	N/A
C	SANDS/GRAVELS – Dense, silty/clayey with cobbles and boulders	>4 Blows/100mm	18kN/m^3	32°	5kPa	N/A
D	ROCK (andesite lava)	N/A	21kN/ m^3	47 °	N/A	N/A

Table 3.0 – Soil Strength Parameters

10. Limitations

The recommendations and opinions contained in this report are based on our site visit, the geotechnical site investigations carried out by Cheal Consultants and Taiao Architecture and Engineering Ltd and the description of the proposed Te Ara Mangawhero Phase 2 Trail supplied to us by Cheal Consultants. The extent of our work is limited to the scope defined within section 1 of this report. It needs to be appreciated that we have made assumptions about the project, based on the documented information supplied to us. The factual reporting and any recommendations made at each site are inferred from the investigations attached in appendix C and the geology described within this report, it needs be appreciated that the inferred ground conditions across the site and assumed below the tested depth are not guaranteed.

During construction, all sites will require inspection (and if deemed necessary testing) by a Chartered Professional Geotechnical Engineer or their Agent who is familiar with these sites and the contents of this report. Should ground conditions differ during construction from those assumed within this report, Taiao Architecture and Engineering Ltd must be notified immediately in order to advise accordingly.

The soil performance outlined within this report is dependent on construction activity and action of builders and other contractors. Inappropriate actions prior to or during the construction phase may cause undesirable soil behaviour which is outside the limits provided within this report.

This report has been prepared solely for the benefit of Cheal Consultants acting as our client for the purposes of the specific scope stated in this report. No liability or duty of care is acknowledged or

accepted by Taiao Architecture and Engineering Ltd in respect to any matters arising from the use of the information given in this report by any other person, party or entity for any other purpose.

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We trust this provides the information required. Please contact us if we can assist further.

Yours faithfully



Neville Wilson

B.E Civil (Hons), CPEng, CMEngNZ

Director

Taiao Architecture and Engineering Ltd

Report Peer Reviewed by:

 18/09/24

Gareth Cottrell

CPEng, CMEngNZ (Geotechnical)

Principal Geotechnical Engineer

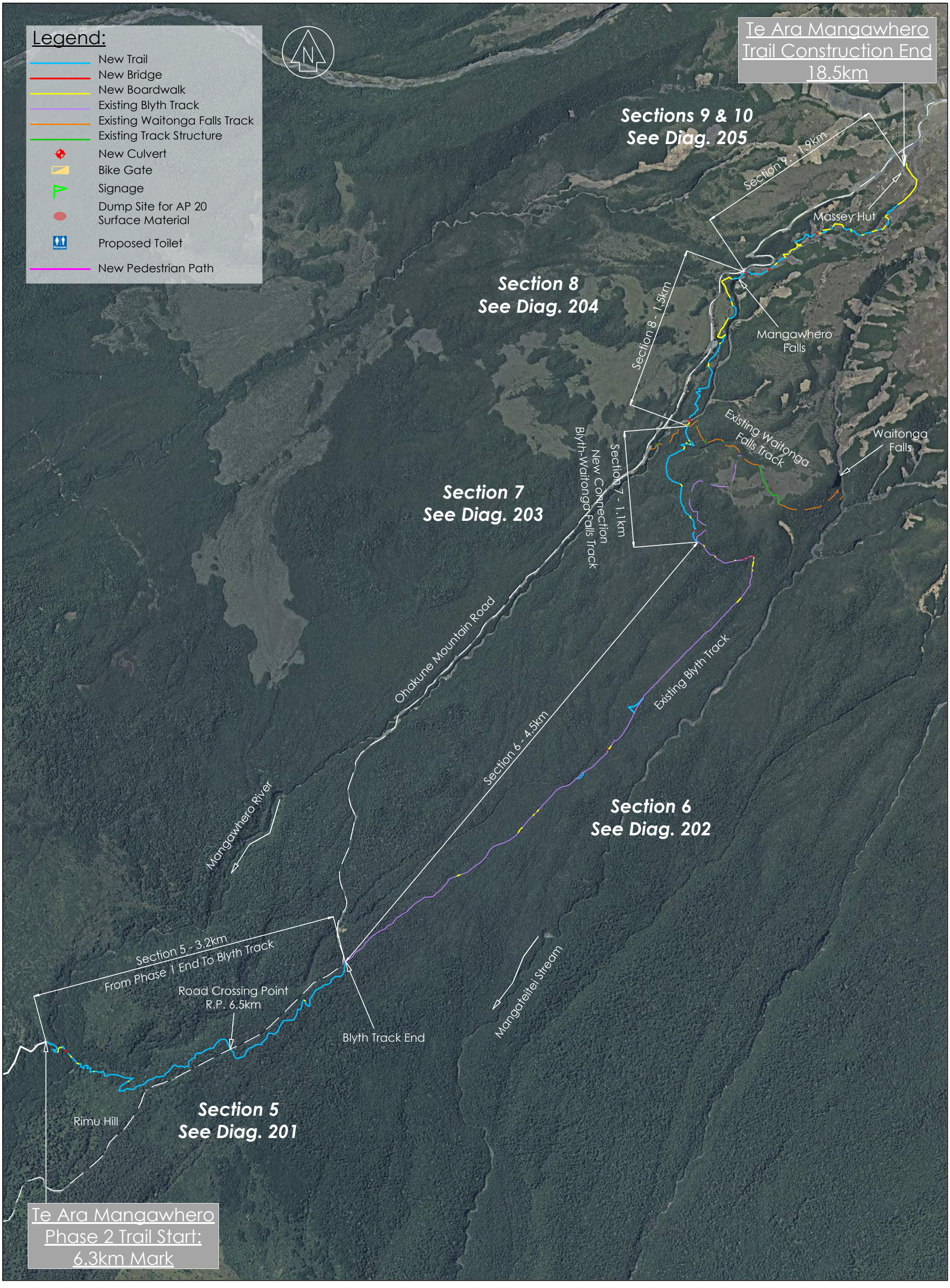
On behalf of Taiao Architecture and Engineering Ltd

Taiao Architecture and Engineering Ltd
team@taiao-design.com
Phone: 0226483241

Quality Assurance Steps Prior to Issue of Report; refer to Engineering New Zealand QA Guidance:

Stage:	Description	Items Checked	Checked by Author	Date	Checked by Reviewer	Date
Stage One	Draft Report	File Name Job Number Client Details Site Location Project Description	Correct - NW Correct - NW Correct - NW Correct - NW Correct - NW Correct - NW	30/7/24	N/A	30/7/24
Stage Two	Preliminary Checks	Inputs Recommendations Conclusions Limitations Drawings Appendices	NW NW NW NW NW NW	30/7/24	GJC	09/09/24
Stage Three	Update Report	Tracked Changes	PR Updates - NW	11/9/24		
Stage Four	Final Check	Check Final Draft	NW	11/9/24	GJC	17/09/24
Stage Five	Issue Document	Save as “Issued Revision A”	NW	18/9/24		

Appendix A – Trail Plan – Cheal Consultants



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Rev	Date	Amendment	By	Chk	App
A	12/08/24	First Issue	AJW	DS	DS

Project Title
Ngā Waihua o Paerangi Trust
Te Ara Mangawhero Trail

Drawing Title
Phase Two Construction Trail Sections Overview

Surveyed	D.Sherrit	Sept-Nov 23	DS
Designed	C.J.Olmi	01/12/23	CJO
Drawn	A.White	12/08/24	AJW
Checked	D.Sherrit	12/08/24	DS
Approved	D.Sherrit	12/08/24	DS

Status **INFORMATION**

Scale A3 1:22500 | A3

Drawing Number 210700-200 | Rev A

Legend:

- New Pedestrian Path
- New Trail
- New Bridge
- New Boardwalk
- Existing Blyth Track
- Existing Waitonga Falls Track
- Existing Track Structure
- New Culvert
- Bike Gate
- Signage
- Dump Site for AP 20
- Surface Material
- Proposed Toilet

Section 9
Diag. 205

Section 8
Diag. 204

Section 7
Diag. 203

Section 6
Diag. 202

Section 5
Diag. 201

Waitonga Falls

Road

Mountain

Mangawhero River

Ohakune

Mangateitei Stream

A

B

Locality Plan

Scale 1:50000

Section 5/6 Transition

POWER

Existing Blyth Track Carpark

Turoa Ski Field Power Cable (Ground)

Wharepaku

5.20.W
Boardwalk
8m

5.21

Ohakune Mountain Road

5.18
Ohakune Mountain Road
R.P. 6.5km existing sealed road
New 2 x 300Ø culverts in existing table drains

5.19

225m min. Sight Distance

5.17

250m min. Sight Distance

Turoa Ski Field Power Cable (Ground)

Diag. 201 B

Phase 1
Last Segment
(4.4)

5.4.W
Boardwalk
11m

5.8.B
Mangawhero Bridge
24m

5.5

5.3

5.6.W
Boardwalk
3m

5.7

5.1

5.10.W
Boardwalk
10m

5.9

5.12.W
Boardwalk
12m

5.11

5.2.W
Boardwalk
14m

5.13

5.15

5.17

5.14.W
Boardwalk
3m

5.16.W
Boardwalk
5m
(Tree roots)

Mangawhero River

Rimu Hill

Ohakune Mountain Road

Phase 2
Trail Construction Start:
6.3km Mark

Diag. 201 A

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Rev	Date	Amendment	By	Chk	App
A	12/08/24	First Issue	AJW	DS	DS

Project Title
Ngā Waihua o Paerangi Trust
Te Ara Mangawhero Trail

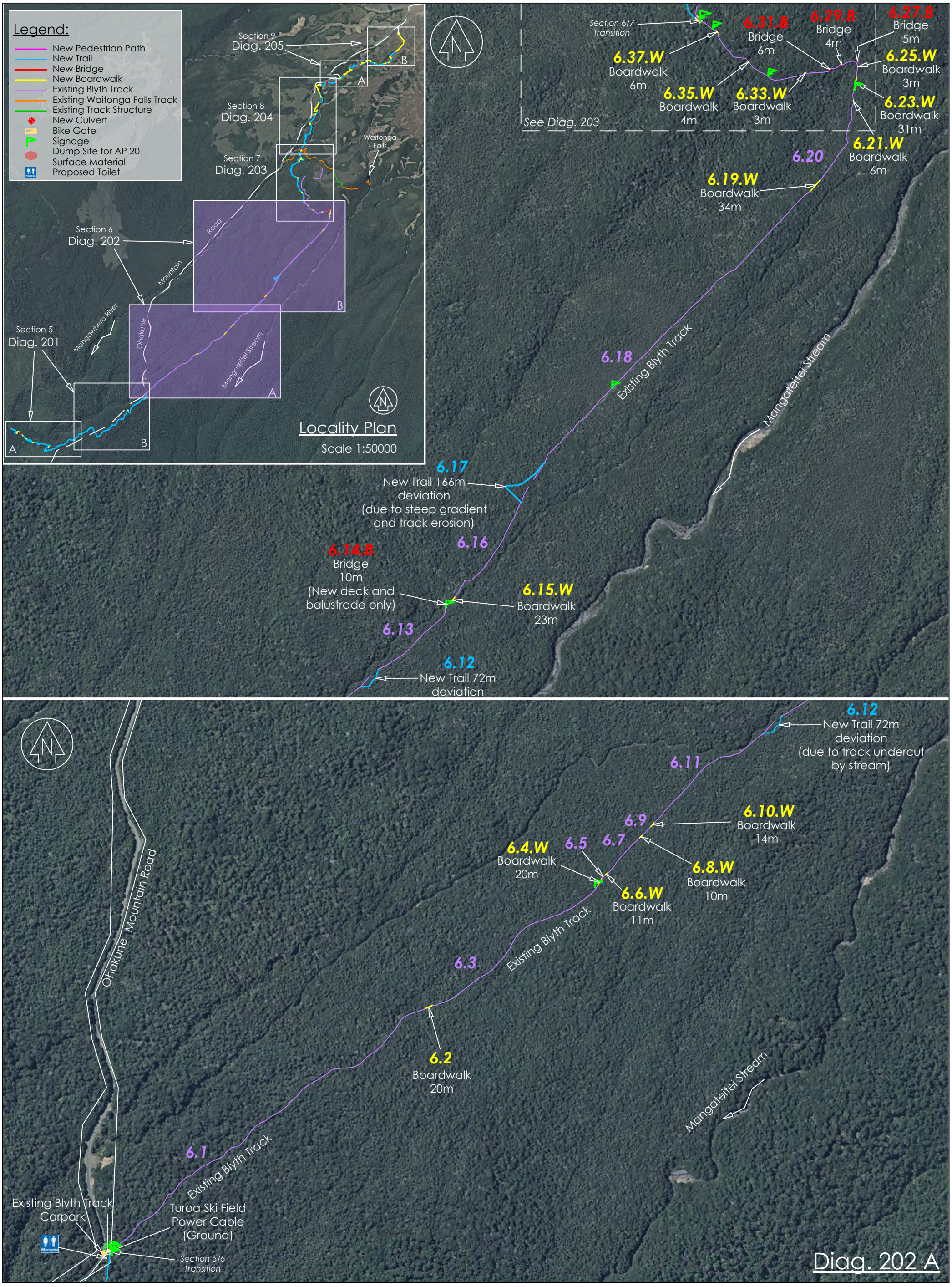
Drawing Title
Phase Two Construction
Trail Section Detail

Surveyed	D.Sherrit	Sept-Nov 23	DS
Designed	C.J.Olmi	01/12/23	CJO
Drawn	A.White	12/08/24	AJW
Checked	D.Sherrit	12/08/24	DS
Approved	D.Sherrit	12/08/24	DS

Status **INFORMATION**

Scale A3 1:4000 | A3

Drawing Number 210700-201 | Rev A



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Rev	Date	Amendment	By	Chk	App
A	12/08/24	First Issue	AJW	DS	DS

Project Title
Ngā Waihua o Paerangi Trust
Te Ara Mangawhero Trail

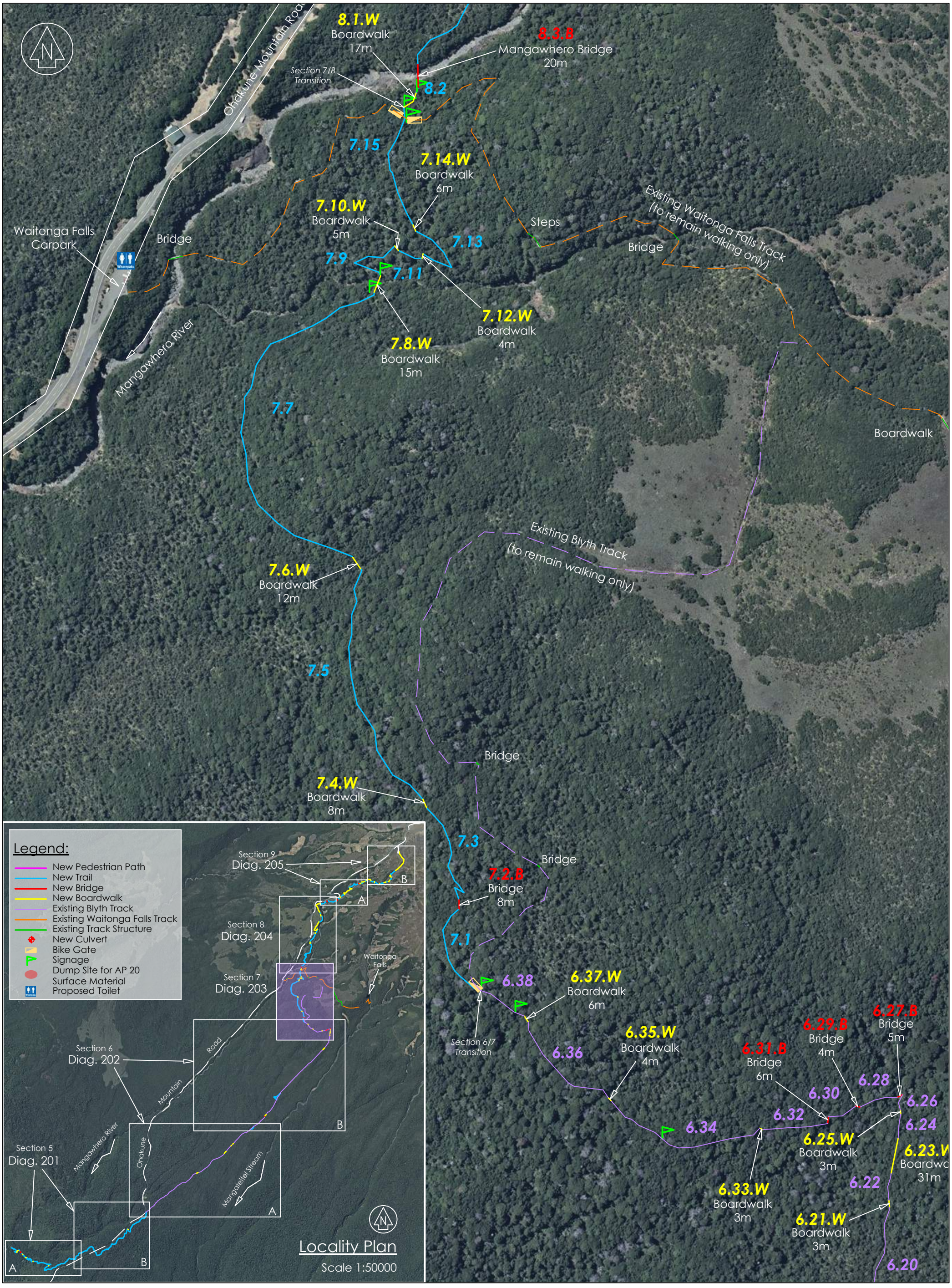
Drawing Title
Phase Two Construction
Trail Section Detail

Surveyed	D.Sherrit	Sept-Nov 23	DS
Designed	C.J.Olmi	01/12/23	CJO
Drawn	A.White	12/08/24	AJW
Checked	D.Sherrit	12/08/24	DS
Approved	D.Sherrit	12/08/24	DS

Status **INFORMATION**

Scale A3 1:8000 | A3

Drawing Number 210700-202 | Rev A



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Rev	Date	Amendment	By	Chk	App
A	12/08/24	First Issue	AJW	DS	DS

Project Title
Ngā Waihua o Paerangi Trust
Te Ara Mangawhero Trail

Drawing Title
Phase Two Construction
Trail Section Detail

Surveyed	D.Sherrit	Sept-Nov 23	DS
Designed	C.J.Olmi	01/12/23	CJO
Drawn	A.White	12/08/24	AJW
Checked	D.Sherrit	12/08/24	DS
Approved	D.Sherrit	12/08/24	DS

Status INFORMATION

Scale A3 1:3000 | A3

Drawing Number 210700-203 | Rev A

Legend:

- New Pedestrian Path
- New Trail
- New Bridge
- New Boardwalk
- Existing Blyth Track
- Existing Waitonga Falls Track
- Existing Track Structure
- New Culvert
- Bike Gate
- Signage
- Dump Site for AP 20
- Surface Material
- Proposed Toilet

Section 9
Diag. 205

Section 8
Diag. 204

Section 7
Diag. 203

Section 6
Diag. 202

Section 5
Diag. 201

Waitonga Falls

Road

Mountain

Ohakune

Mangawhero River

Mangateitei Stream

A

B

Locality Plan

Scale 1:50000

Section 8/9 Transition

Existing steps to be ramped

8.15

9.2

9.1.B
Mangawhero Bridge
14m

8.14.W
Boardwalk
195m

Mangawhero Falls

8.13

8.12.W
Boardwalk
25m

8.11

8.10.W
Boardwalk
174m

Barrier
15m

8.9.W
Elevated Boardwalk
and Barrier
25m

8.8

8.7.W
Boardwalk
7m

8.6

Mangawhero River

Ohakune Mountain Road

8.5.W
Boardwalk
20m

8.4

8.1.W
Boardwalk
17m

8.3.B
Mangawhero Bridge
20m

Section 7/8 Transition

8.2

Existing Waitonga Falls Track

7.15

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Rev	Date	Amendment	By	Chk	App
A	12/08/24	First Issue	AJW	DS	DS

Project Title
Ngā Waihua o Paerangi Trust
Te Ara Mangawhero Trail

Drawing Title
Phase Two Construction
Trail Section Detail

Surveyed	D.Sherrit	Sept-Nov 23	DS
Designed	C.J.Olmi	01/12/23	CJO
Drawn	A.White	12/08/24	AJW
Checked	D.Sherrit	12/08/24	DS
Approved	D.Sherrit	12/08/24	DS

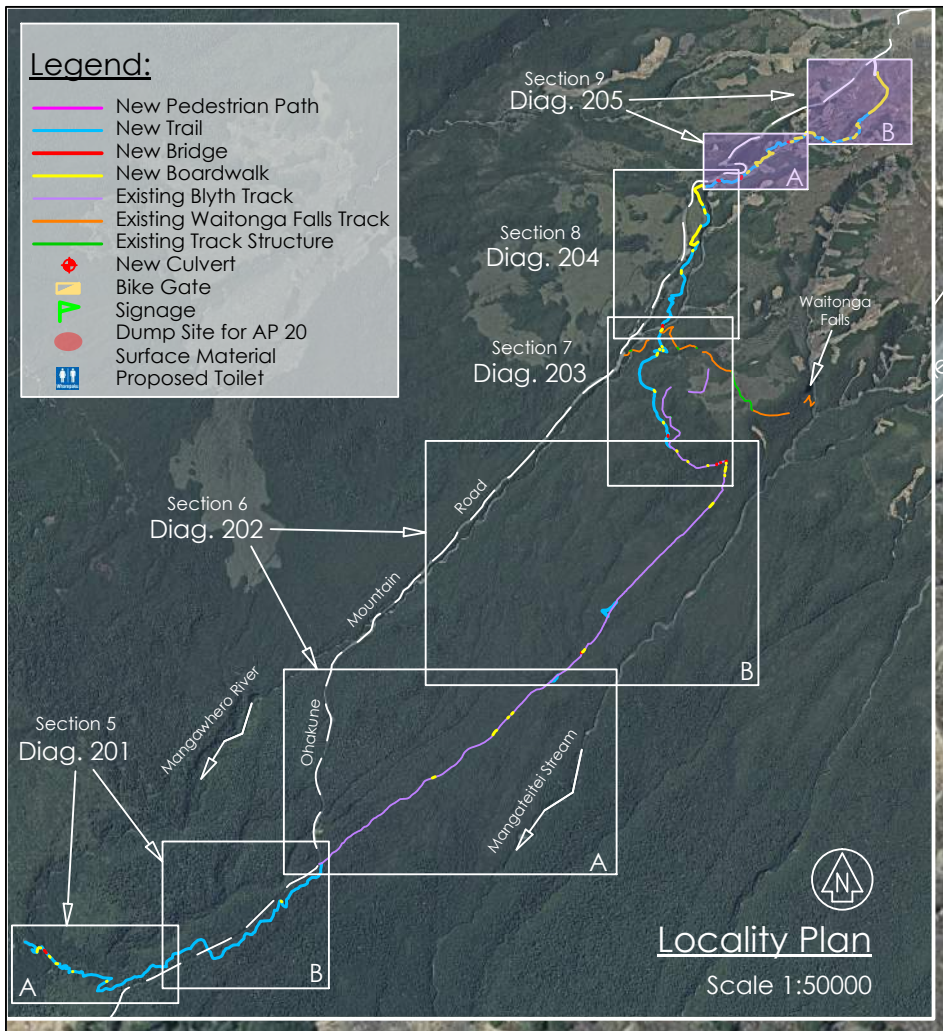
Status **INFORMATION**

Scale A3 1:3000 | A3

Drawing Number 210700-204 | Rev A

Legend:

- New Pedestrian Path
- New Trail
- New Bridge
- New Boardwalk
- Existing Blyth Track
- Existing Waitonga Falls Track
- Existing Track Structure
- New Culvert
- Bike Gate
- Signage
- Dump Site for AP 20
- Surface Material
- Proposed Toilet



Locality Plan

Scale 1:50000

Existing access road (gravel)

Phase 2
Trail Construction End:
18.5km

Massey Hut

Barriered Boardwalk 340m

Mangawhero River

9.32 9.31.W 9.30 9.29.W Boardwalk 46m 9.28 9.27.W Boardwalk 36m 9.26 9.25.W Boardwalk 30m 9.24 9.23.W Boardwalk 12m 9.22 9.21.W Boardwalk 10m 9.20 9.19.W Boardwalk 85m

Diag. 205 B

9.18 9.15.W Boardwalk 13m 9.13.B Bridge 14m 9.16 9.14 9.12 9.17.W Barriered Boardwalk 46m

Ohakune Mountain Road

9.11.W Barriered Boardwalk 85m 9.10 9.9.W 50m Boardwalk with 30m Barrier 9.8 9.7.W Boardwalk 57m 9.6 9.5.W Boardwalk 16m 9.4 9.3.B Bridge 18m 9.2 8.15 9.1.B Mangawhero Bridge 14m

Section 8/9 Transition

Diag. 205 A

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Rev	Date	Amendment	By	Chk	App
A	12/08/24	First Issue	AJW	DS	DS

Project Title
Ngā Waihua o Paerangi Trust
Te Ara Mangawhero Trail

Drawing Title
Phase Two Construction
Trail Section Detail

Surveyed	D.Sherrit	Sept-Nov 23	DS
Designed	C.J.Olmi	01/12/23	CJO
Drawn	A.White	12/08/24	AJW
Checked	D.Sherrit	12/08/24	DS
Approved	D.Sherrit	12/08/24	DS

Status **INFORMATION**

Scale A3 1:2500 | A3

Drawing Number 210700-205 | Rev A



Trail Section Details

Section	Segment	Name	Length (m)	Start Chainage (m)	End Chainage (m)	Description
5	5.1	New Trail	171	6358	6529	
	5.2.W	Boardwalk	14	6529	6543	New
	5.3	New Trail	7	6543	6550	
	5.4.W	Boardwalk	11	6550	6561	New
	5.5	New Trail	10	6561	6571	
	5.6.W	Boardwalk	3	6571	6574	New
	5.7	New Trail	53	6574	6627	
	5.8.B	Bridge	24	6627	6651	New over Mangawhero River
	5.9	New Trail	28	6651	6679	
	5.10.W	Boardwalk	10	6679	6689	New
	5.11	New Trail	60	6689	6749	
	5.12.W	Boardwalk	12	6749	6761	New
	5.13	New Trail	221	6761	6982	
	5.14.W	Boardwalk	3	6982	6985	New
	5.15	New Trail	326	6985	7311	
	5.16.W	Boardwalk	5	7311	7316	New
	5.17	New Trail	1022	7316	8338	
	5.18	New Trail	9	8338	8347	Ohakune Mountain Road intersection
	5.19	New Trail	756	8347	9103	
	5.20.W	Boardwalk	8	9103	9111	New
	5.21	New Trail	474	9111	9585	
6	6.1	Existing formed trail	973	9585	10558	Existing Blyth Track
	6.2	Boardwalk	20	10558	10578	New
	6.3	Existing formed trail	486	10578	11064	Existing Blyth Track
	6.4.W	Boardwalk	20	11064	11084	New
	6.5	Existing formed trail	9	11084	11093	Existing Blyth Track
	6.6.W	Boardwalk	11	11093	11104	New
	6.7	Existing formed trail	108	11104	11212	Existing Blyth Track
	6.8.W	Boardwalk	10	11212	11222	New
	6.9	Existing formed trail	27	11222	11249	Existing Blyth Track
	6.10.W	Boardwalk	14	11249	11263	New
	6.11	Existing formed trail	333	11263	11596	Existing Blyth Track
	6.12	New Trail	72	11596	11668	Deviation
	6.13	Existing formed trail	220	11668	11888	Existing Blyth Track
	6.14.B	Bridge	10	11888	11898	New Deck Only
	6.15.W	Boardwalk	23	11898	11921	New
	6.16	Existing formed trail	277	11921	12198	Existing Blyth Track
	6.17	New Trail	166	12198	12364	Deviation
	6.18	Existing formed trail	890	12364	13254	Existing Blyth Track
	6.19.W	Boardwalk	34	13254	13288	New
	6.2	Existing formed trail	207	13288	13495	Existing Blyth Track
	6.21.W	Boardwalk	3	13495	13498	New
	6.22	Existing formed trail	24	13498	13522	Existing Blyth Track
	6.23.W	Boardwalk	31	13522	13553	New
	6.24	Existing formed trail	22	13553	13575	Existing Blyth Track
	6.25.W	Boardwalk	3	13575	13578	New
	6.26	Existing formed trail	14	13578	13592	Existing Blyth Track
	6.27.B	Bridge	5	13592	13597	New
	6.28	Existing formed trail	34	13597	13631	Existing Blyth Track
	6.29.B	Bridge	4	13631	13635	New
	6.3	Existing formed trail	26	13635	13661	Existing Blyth Track
	6.31.B	Bridge	6	13661	13667	New
	6.32	Existing formed trail	57	13667	13724	Existing Blyth Track
	6.33.W	Boardwalk	3	13724	13727	New
	6.34	Existing formed trail	148	13727	13875	Existing Blyth Track
	6.35.W	Boardwalk	4	13875	13879	New
	6.36	Existing formed trail	104	13879	13983	Existing Blyth Track
	6.37.W	Boardwalk	6	13983	13989	New
	6.38	Existing formed trail	45	13989	14034	Existing Blyth Track
7	7.1	New Trail	90	14034	14124	
	7.2.B	Bridge	8	14124	14132	New
	7.3	New Trail	106	14132	14238	
	7.4.W	Boardwalk	8	14238	14246	New
	7.5	New Trail	227	14246	14473	
	7.6.W	Boardwalk	12	14473	14485	New
	7.7	New Trail	346	14485	14831	
	7.8.B	Bridge	15	14831	14846	New
	7.9	New Trail	67	14846	14913	
	7.10.W	Boardwalk	5	14913	14918	New
	7.11	New Trail	22	14918	14940	
	7.12.W	Boardwalk	4	14940	14944	New
	7.13	New Trail	74	14944	15018	
	7.14.W	Boardwalk	6	15018	15024	New
	7.15	New Trail	110	15024	15134	Intersection with Waitonga Falls Track
8	8.1.W	Boardwalk	17	15134	15151	New
	8.2	New Trail	5	15151	15156	
	8.3.B	Bridge	20	15156	15176	New over Mangawhero River
	8.4	New Trail	509	15176	15685	
	8.5.W	Boardwalk	20	15685	15705	New
	8.6	New Trail	154	15705	15859	
	8.7.W	Boardwalk	7	15859	15866	New
	8.8	New Trail	69	15866	15935	
	8.9.W	Boardwalk	25	15935	15960	New elevated and barriered
	8.10.W	Boardwalk	174	15960	16134	New, 15m barrier
	8.11	New Trail	127	16134	16261	
	8.12.W	Boardwalk	25	16261	16286	New
	8.13	New Trail	34	16286	16320	
	8.14.W	Boardwalk	195	16320	16515	New
	8.15	New Trail	105	16515	16620	
9	9.1.B	Bridge	14	16620	16634	New over Mangawhero River
	9.2	New Trail	158	16634	16792	
	9.3.B	Bridge	19	16792	16811	New over Mangawhero River
	9.4	New Trail	42	16811	16853	
	9.5.W	Boardwalk	16	16853	16869	New
	9.6	New Trail	69	16869	16938	
	9.7.W	Boardwalk	57	16938	16995	New
	9.8	New Trail	13	16995	17008	
	9.9.W	Boardwalk	50	17008	17058	New with 30m barrier
	9.1	New Trail	10	17058	17068	
	9.11.W	Boardwalk	85	17068	17153	New barriered
	9.12	New Trail	191	17153	17344	
	9.13.B	Bridge	14	17344	17358	New
	9.14	New Trail	7	17358	17365	
	9.15.W	Boardwalk	13	17365	17378	New
	9.16	New Trail	70	17378	17448	
	9.17.W	Boardwalk	46	17448	17494	New barriered
	9.18	New Trail	31	17494	17525	
	9.19.W	Boardwalk	85	17525	17610	New
	9.2	New Trail	62	17610	17672	
	9.21.W	Boardwalk	10	17672	17682	New
	9.22	New Trail	105	17682	17787	
	9.23.W	Boardwalk	12	17787	17799	New
	9.24	New Trail	63	17799	17862	
	9.25.W	Boardwalk	30	17862	17892	New
	9.26	New Trail	34	17892	17926	
	9.27.W	Boardwalk	36	17926	17962	New
	9.28	New Trail	51	17962	18013	
	9.29.W	Boardwalk	46	18013	18059	New
	9.3	New Trail	119	18059	18178	
	9.31.W	Boardwalk	340	18178	18518	New barriered
	9.32	New Trail	21	18518	18539	Massey Hut - Trail End 18.5km

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Rev	Date	Amendment	By	Chk	App
A	12/08/24	First Issue	AJW	DS	DS

Project Title

Ngā Waihua o Paerangi Trust
Te Ara Mangawhero Trail

Drawing Title

Phase Two Construction
Engineering Table

Surveyed	D.Sherrit	Sept-Nov 23	DS
Designed	C.J.Olmi	01/12/23	CJO
Drawn	A.White	12/08/24	AJW
Checked	D.Sherrit	12/08/24	DS
Approved	D.Sherrit	12/08/24	DS

Status **INFORMATION**

Scale A3 Not To Scale | A3

Drawing Number 210700-206 | Rev A

Appendix B – Bridge Cross-Sections

Drawing List

Number	Name	Rev.
S-101	Sections 5.8	A
S-102	Sections 6.27 & 6.29	A
S-103	Sections 6.31	A
S-104	Sections 7.2	A
S-105	Sections 8.3	A
S-106	Sections 9.1	A
S-107	Sections 9.3	A
S-108	Sections 9.13	A
S-109	Sections Slip A-C	A
S-110	Sections Adjacent Slip D-E	A

Te Ara Mangawhero Trail
Geotechnical Field Investigation

Cross Sections

TAIAO

Architecture & Engineering

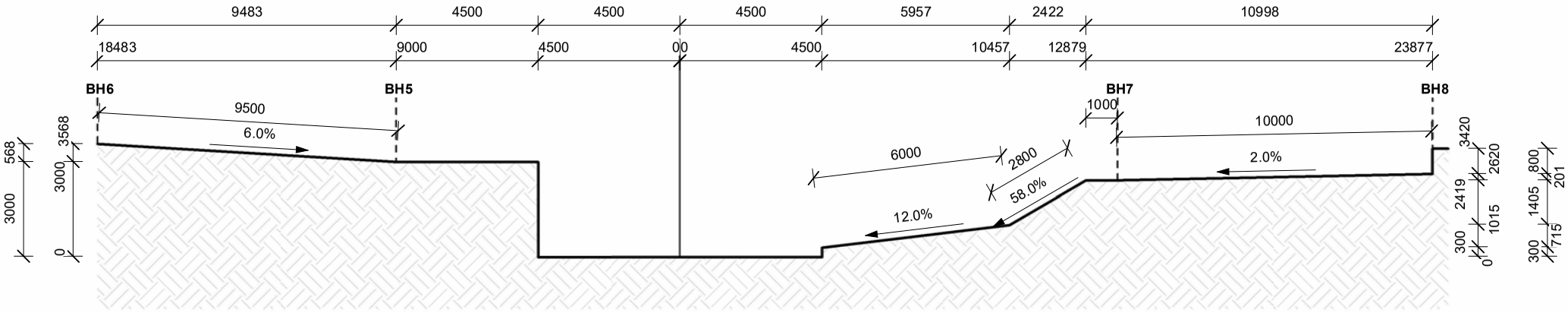
15 Hihitahi Rise Paihia, New Zealand, 0200 W I www.taiao-design.com

Note:

All sections are facing downstream

A For Geotechnical Report

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5.8B

Rev	By	Amendment	Date
A	JLA	For Geotechnical Report	18.09.24

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Te Ara Mangawhero Trail
Geotechnical Field Investigation

Cross Sections

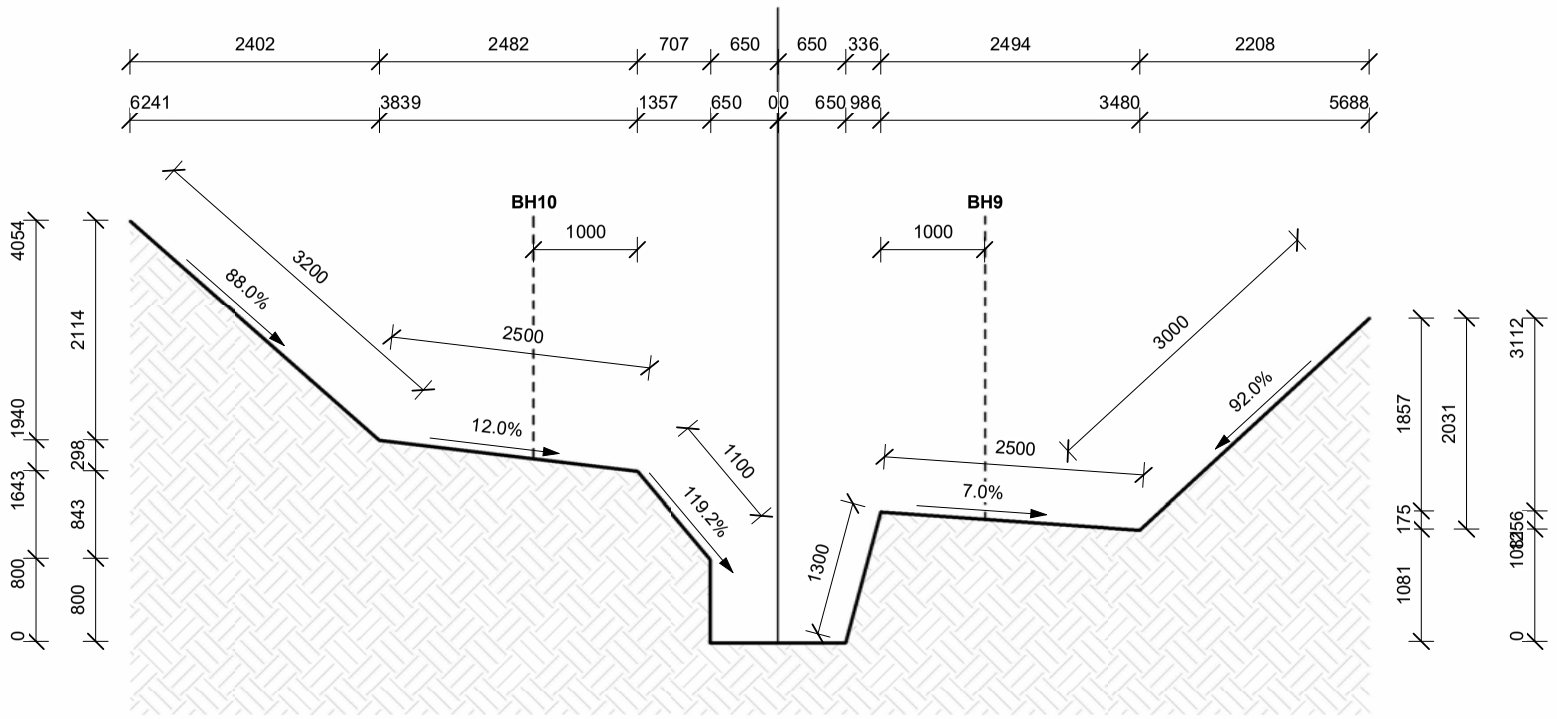
Drawing Name

Sections 5.8
S-101

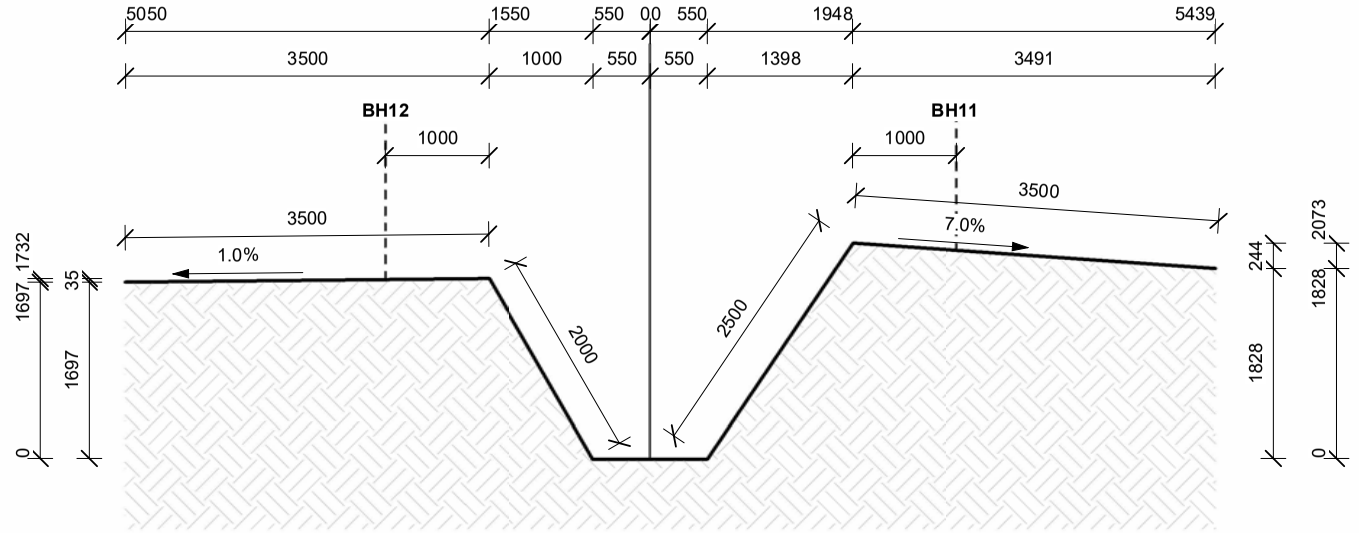
DATE: **07/08/2024**

DRAWN:	CHECKED:
JLA	**NW**

SCALE	REV.
1 : 125	**A**



6.27B



6.29B

Rev	By	Amendment	Date
A	JLA	For Geotechnical Report	18.09.24

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Geotechnical Field Investigation

Cross Sections

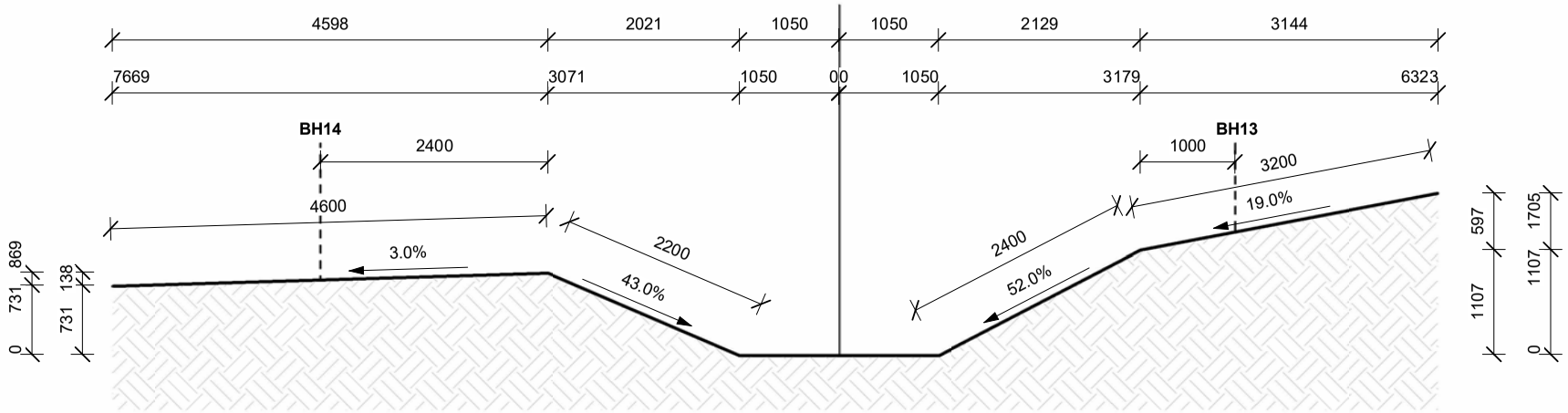
Drawing Name

Sections 6.27 & 6.29
S-102

DATE: **07/08/2024**

DRAWN:	CHECKED:
JLA	**NW**

SCALE	REV.
1 : 50	**A**



6.31B

Rev	By	Amendment	Date
A	JLA	For Geotechnical Report	18.09.24

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Te Ara Mangawhero Trail
Geotechnical Field Investigation

Cross Sections

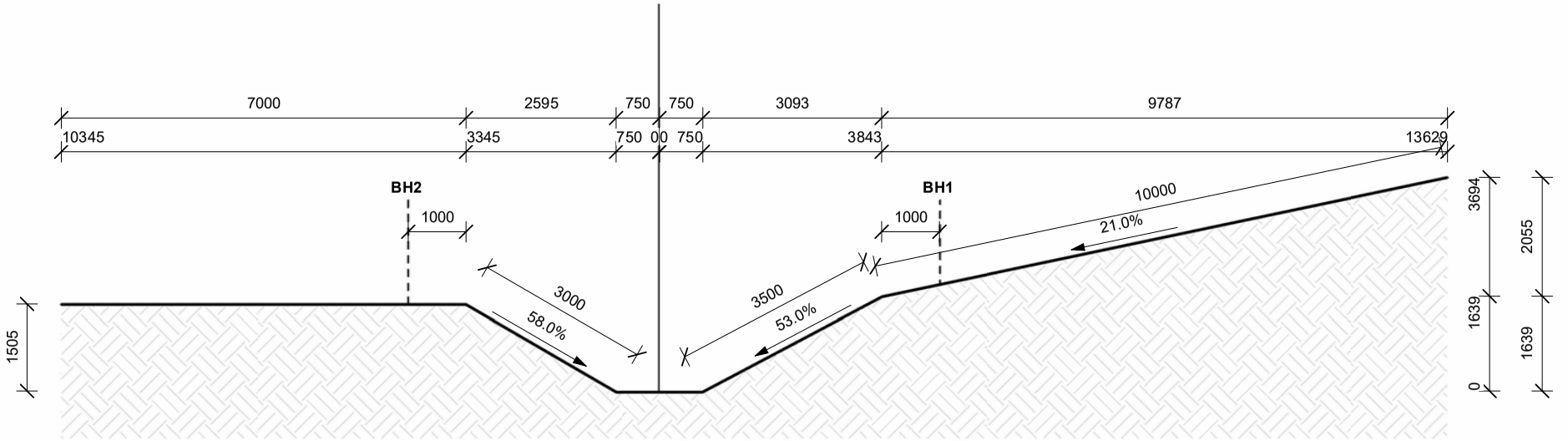
Drawing Name

Sections 6.31
S-103

DATE: **07/08/2024**

DRAWN:	CHECKED:
JLA	**NW**

SCALE	REV.
1 : 50	**A**



7.2B

Rev	By	Amendment	Date
A	JLA	For Geotechnical Report	18.09.24

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Northland, New Zealand 0200

Te Ara Mangawhero Trail
Geotechnical Field Investigation

Cross Sections

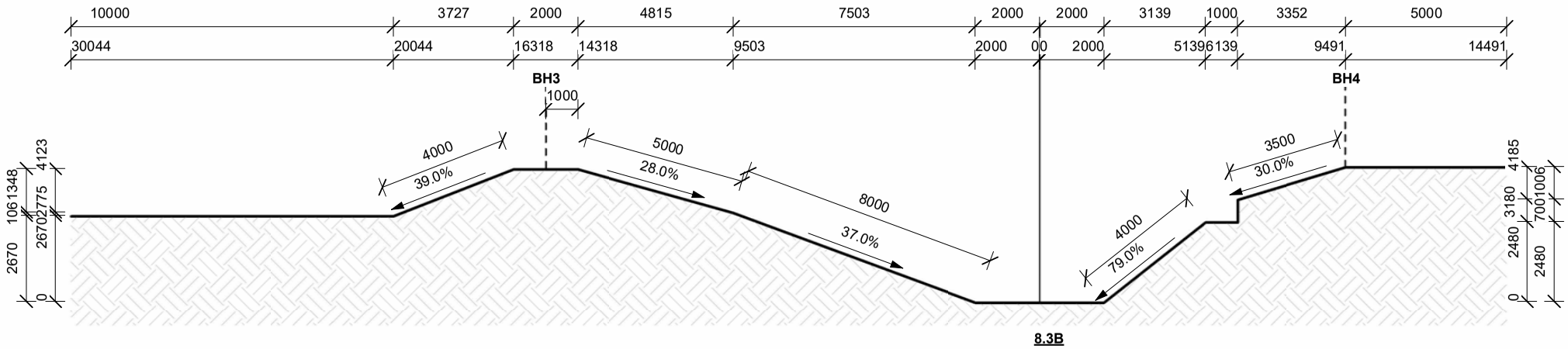
Drawing Name

Sections 7.2
S-104

DATE: **07/08/2024**

DRAWN:	CHECKED:
JLA	**NW**

SCALE	REV.
1 : 75	**A**



Rev	By	Amendment	Date
A	JLA	For Geotechnical Report	18.09.24

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Te Ara Mangawhero Trail
Geotechnical Field Investigation

Cross Sections

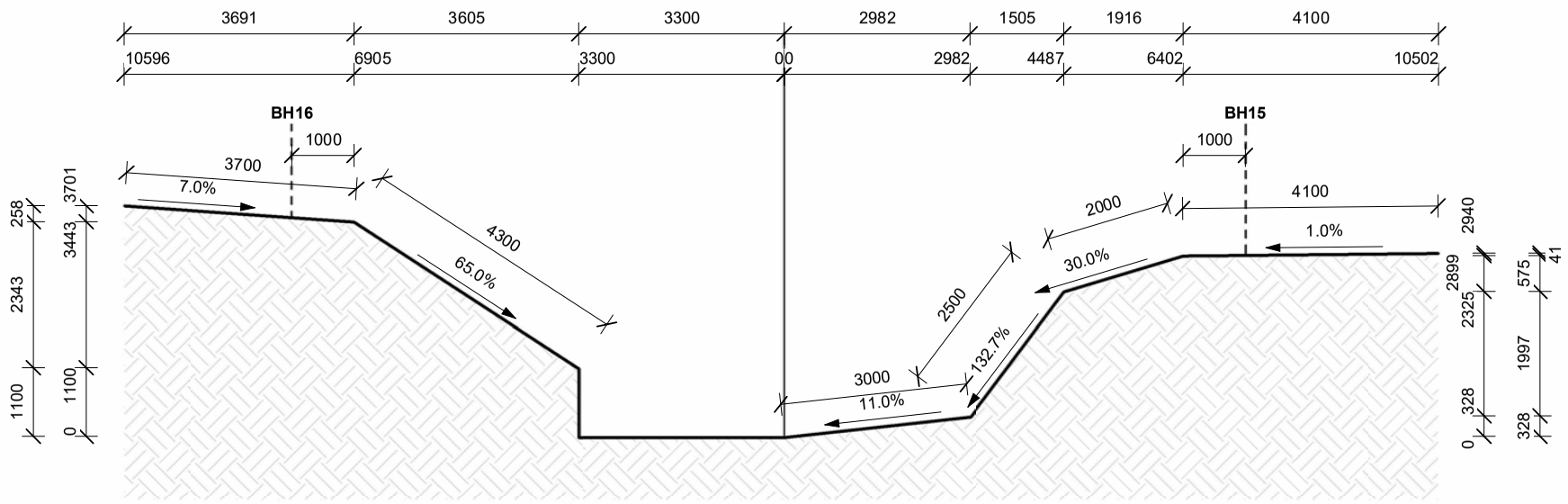
Drawing Name

Sections 8.3
S-105

DATE: **07/08/2024**

DRAWN:	CHECKED:
JLA	**NW**

SCALE	REV.
1 : 125	**A**



9.1B

Rev	By	Amendment	Date
A	JLA	For Geotechnical Report	18.09.24

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Geotechnical Field Investigation

Cross Sections

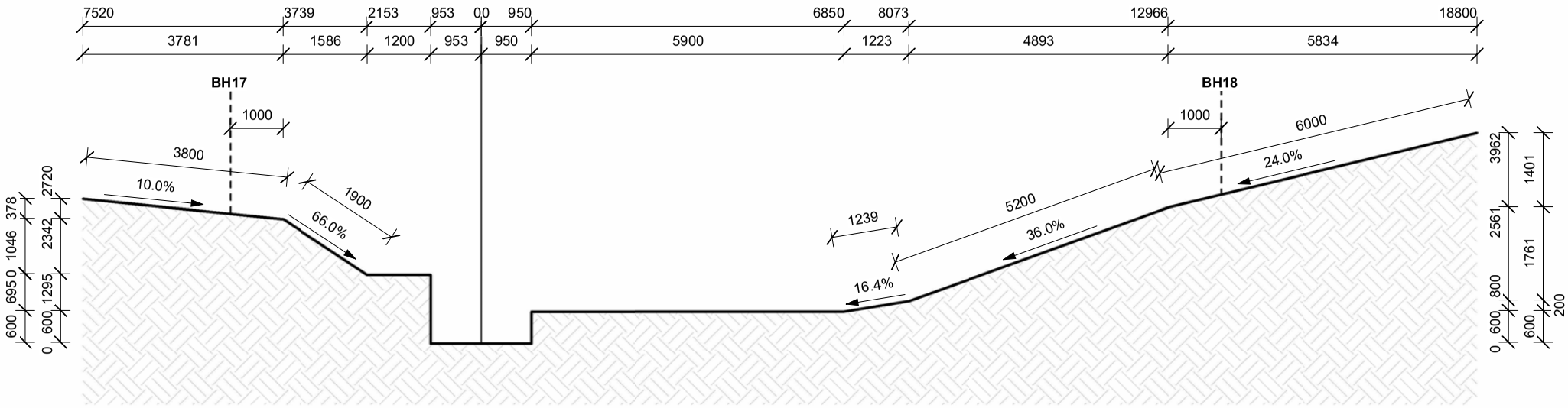
Drawing Name

Sections 9.1
S-106

DATE: **07/08/2024**

DRAWN:	CHECKED:
JLA	**NW**

SCALE	REV.
1 : 75	**A**



9.3B

Rev	By	Amendment	Date
A	JLA	For Geotechnical Report	18.09.24

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Te Ara Mangawhero Trail
Geotechnical Field Investigation

Cross Sections

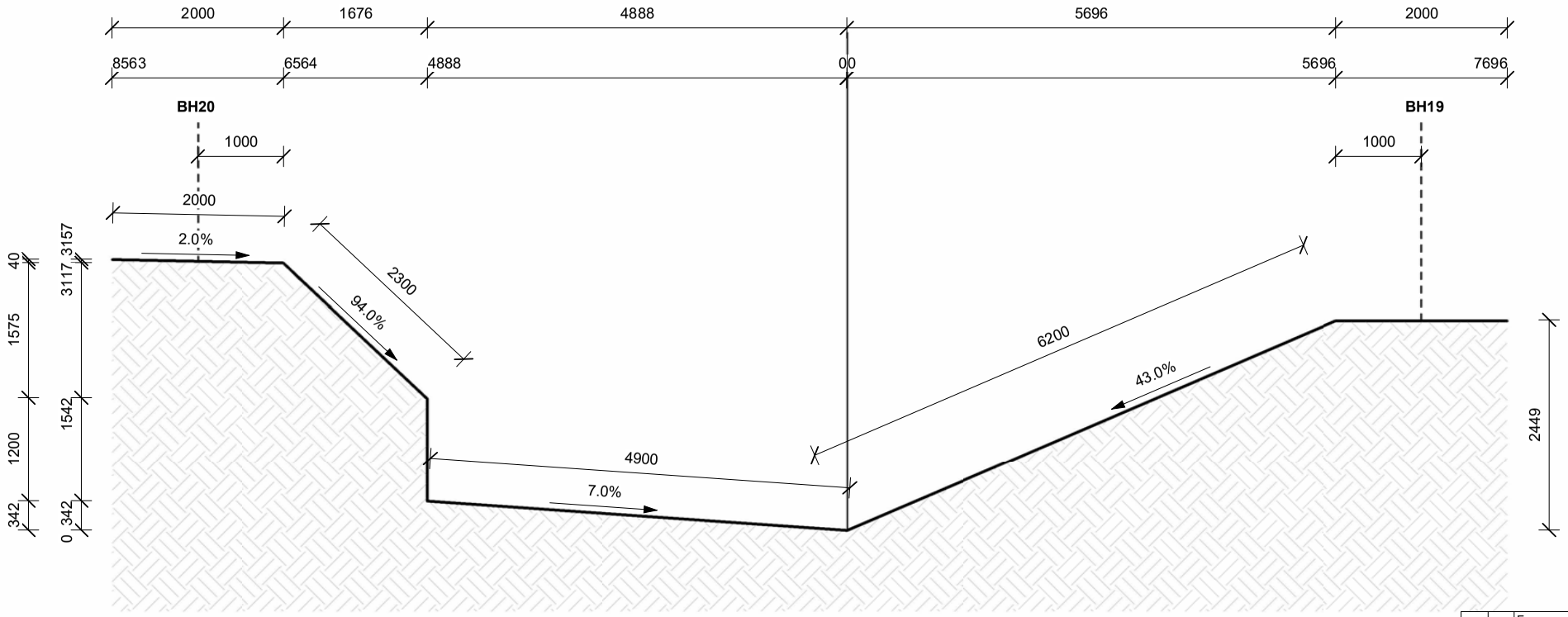
Drawing Name

Sections 9.3
S-107

DATE: **07/08/2024**

DRAWN:	CHECKED:
JLA	**NW**

SCALE	REV.
1 : 75	**A**



9.13B

Rev	By	Amendment	Date
A	JLA	For Geotechnical Report	18.09.24

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Te Ara Mangawhero Trail
Geotechnical Field Investigation

Cross Sections

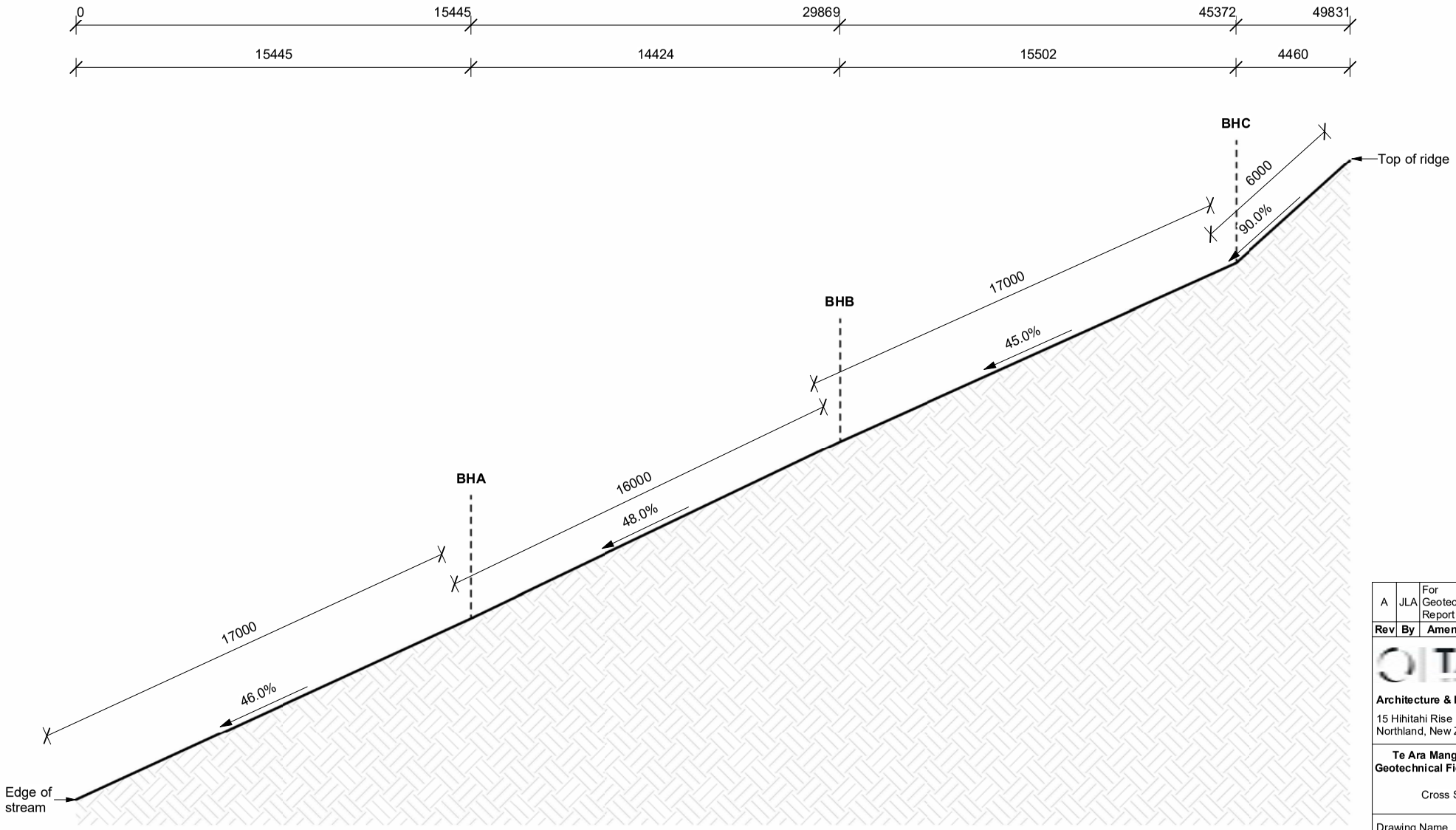
Drawing Name

Sections 9.13
S-108

DATE: **07/08/2024**

DRAWN:	CHECKED:
JLA	**NW**

SCALE	REV.
1 : 50	**A**



9.31

Rev	By	Amendment	Date
A	JLA	For Geotechnical Report	18.09.24

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Te Ara Mangawhero Trail Geotechnical Field Investigation

Cross Sections

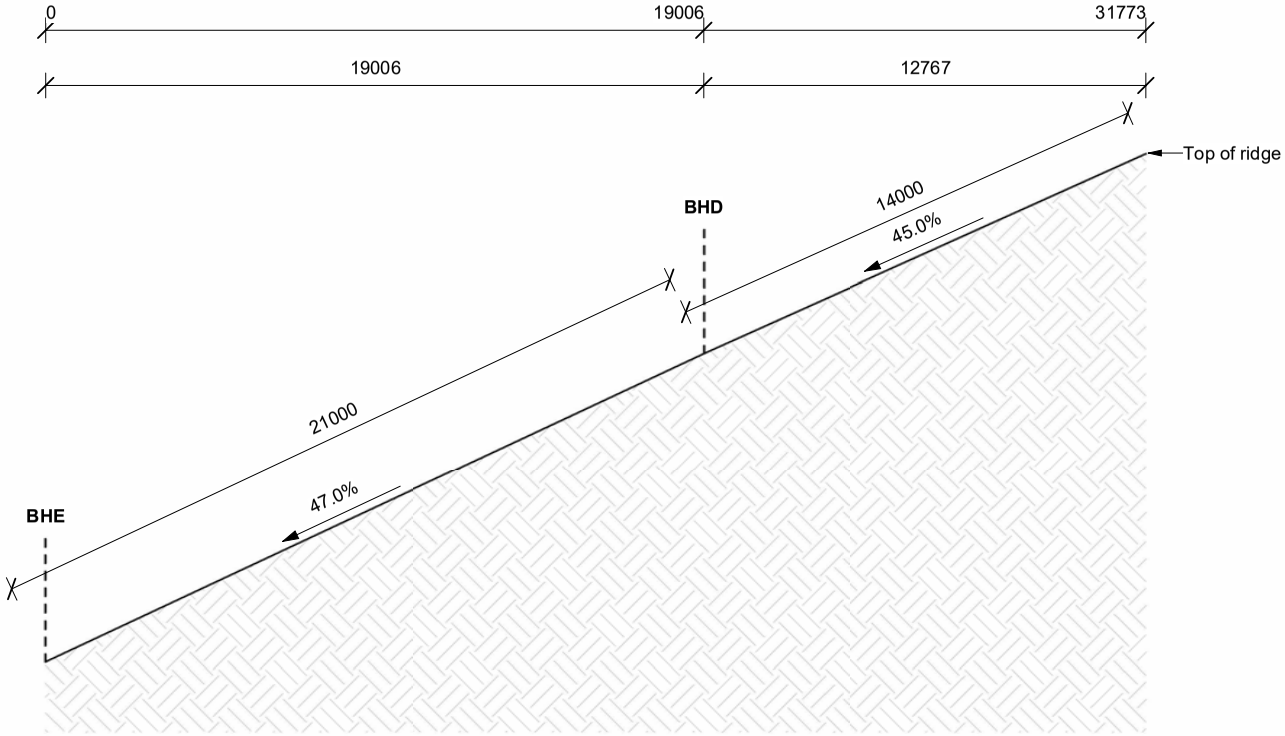
Drawing Name

Sections Slip A-C
S-109

DATE: **07/08/2024**

DRAWN:	CHECKED:
JLA	**NW**

SCALE	REV.
1 : 150	**A**



Cross Section of Slope adjacent to slump

Rev	By	Amendment	Date
A	JLA	For Geotechnical Report	18.09.24

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Te Ara Mangawhero Trail Geotechnical Field Investigation

Cross Sections

Drawing Name

Sections Adjacent Slip D-E S-110

DATE: **07/08/2024**

DRAWN:	CHECKED:
JLA	**NW**

SCALE	REV.
1 : 150	**A**

Appendix C – Bore Logs and Scala Testing

INVESTIGATION LOG

TAIAO
BE PART OF THE SOLUTION

HOLE NO.: 7.2B BH1

CLIENT: Cheal Consultants
PROJECT: Te Ara Mangawhero Trail

JOB NO.: 24-0242

SITE LOCATION: Mount Ruapehu - Te Ara Mangawhero Trail Bridge 7.2 - Refer Cross Section
CO-ORDINATES:

START DATE: 02/07/2024
END DATE: 02/07/2024
LOGGED BY: NW

MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	GEOLOGY	DEPTH (m)	LEGEND	SCALA PENETROMETER (Blows / 100mm)	VANE SHEAR STRENGTH (kPa) Vane: SV1 Cheal	Values	WATER
TOPSOIL.		0.0 – 0.4	TS	1, 1, 1, 1, 1			
Clayey sandy SILT; brown mottled orange and grey. Moist; low plasticity.		0.4 – 1.6		3, 3, 3, 3, 3, 4, 4, 4, 4		88 13	◁
Clayey silty SAND; brown mottled grey and orange. Saturated.		1.6 – 2.0		16, 16, 16			
SAND; blackish grey. Dense; saturated; sand, fine. EOH: 2.00m		2.0 – 3.8		25 >>, 25 >>, 11, 11, 9, 9, 9, 17, 14, 17			

PHOTO(S)

REMARKS

WATER
- Standing Water Level
- Out flow
- In flow

INVESTIGATION TYPE
- ☑ Hand Auger
- ☐ Test Pit

INVESTIGATION LOG

TAIAO
BE PART OF THE SOLUTION

HOLE NO.: 7.2B BH2

CLIENT: Cheal Consultants
PROJECT: Te Ara Mangawhero Trail

JOB NO.: 24-0242

SITE LOCATION: Mount Ruapehu - Te Ara Mangawhero Trail Bridge 7.2 - Refer Cross Section
CO-ORDINATES:

START DATE 02/07/2024
END DATE: 02/07/2024
LOGGED BY: NW

MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	GEOLOGY	DEPTH (m)	LEGEND	SCALA PENETROMETER (Blows / 100mm)	VANE SHEAR STRENGTH (kPa) Vane: SV1 Cheal	WATER
TOPSOIL.		0.0 – 0.4	TS			
Clayey sandy SILT; brown mottled orange grey. Wet; low plasticity.		0.4 – 1.2		1, 1, 1, 1, 3, 3, 3, 3, 3, 3, 3, 3, 3	61, 10	
Clayey SILT, with some sand; brown. Saturated; unable to retrieve at 2.2m.		1.2 – 2.2		4, 4, 5, 8, 12, 8, 8, 9, 8, 9, 11, 10, 12		
EOH: 2.20m		2.2 – 3.0		25 >>		

Scala penetrometer axis: 2 4 6 8 10 12 14 16 18
Vane shear strength axis: 50 100 150 200 Values
Depth axis: 0.2 0.4 0.6 0.8 1.0 1.2 1.4 1.6 1.8 2.0 2.2 2.4 2.6 2.8 3.0 3.2 3.4 3.6 3.8

PHOTO(S)

REMARKS

WATER
- Standing Water Level
- Out flow
- In flow

INVESTIGATION TYPE
- [x] Hand Auger
- [ ] Test Pit

TAIAO
BE PART OF THE SOLUTION

INVESTIGATION LOG

HOLE NO.: 8.3B BH3

CLIENT: Cheal Consultants
PROJECT: Te Ara Mangawhero Trail

JOB NO.: 24-0242

SITE LOCATION: Mount Ruapehu - Te Ara Mangawhero Trail Bridge 8.3 - Refer Cross Section
CO-ORDINATES:

START DATE02/07/2024
END DATE: 02/07/2024
LOGGED BY: NW

MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	GEOLOGY	DEPTH (m)	LEGEND	SCALA PENETROMETER (Blows / 100mm)	VANE SHEAR STRENGTH (kPa) Vane: SV1 Cheal	WATER
TOPSOIL.		0.0	TS	2 4 6 8 10 12 14 16 18	50 100 150 200 Values	Groundwater Not Encountered
SAND (SP); blackish grey. Moist; poorly graded; sand, fine.		0.2				
Sandy SILT; greyish brown. Moist; non-plastic.		0.4				
Sandy SILT, with some gravel; brown. Moist; low plasticity; at 1m depth U.T.P Rock ?? - SCALA Bouncing .		0.6				
		0.8	1 1		61 19	
EOH: 1.00m		1.0				
		1.2				
		1.4				
		1.6				
		1.8				

PHOTO(S)

REMARKS

WATER
- Standing Water Level
- Out flow
- In flow

INVESTIGATION TYPE
- [x] Hand Auger
- [ ] Test Pit

INVESTIGATION LOG

TAIAO
BE PART OF THE SOLUTION

HOLE NO.: 8.3B BH4

CLIENT: Cheal Consultants
PROJECT: Te Ara Mangawhero Trail

JOB NO.: 24-0242

SITE LOCATION: Mount Ruapehu - Te Ara Mangawhero Trail Bridge 8.3 - Refer Cross Section
CO-ORDINATES:

START DATE: 02/07/2024
END DATE: 02/07/2024
LOGGED BY: NW

MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	GEOLOGY	DEPTH (m)	LEGEND	SCALA PENETROMETER (Blows / 100mm)	VANE SHEAR STRENGTH (kPa) Vane: SV1 Cheal	WATER
TOPSOIL.		0.0	TS			
Sandy SILT; greyish brown. Moist.		0.4		1	115 40	
Sandy SILT, with trace gravel; brown. Moist; low plasticity;		0.6		1		
at 900mm depth gravel content increasing.		0.8		7		
EOH: 1.00m		1.0		7		Groundwater Not Encountered
		1.2		5		
		1.4		5		
		1.6		5		
		1.8		10		
		2.0		6		
		2.2		6		
		2.4		6		
		2.6		6		
		2.8		6		
				6		
				5		
				5		
				6		
				5		
				5		
				5		
				18		

Scala Penetrometer scale: 2 4 6 8 10 12 14 16 18
Vane Shear Strength scale: 50 100 150 200 Values

PHOTO(S)

REMARKS

WATER
- Standing Water Level
- Out flow
- In flow

INVESTIGATION TYPE
- [x] Hand Auger
- [ ] Test Pit

INVESTIGATION LOG

TAIAO
BE PART OF THE SOLUTION

HOLE NO.: 5.8B BH5

CLIENT: Cheal Consultants
PROJECT: Te Ara Mangawhero Trail

JOB NO.: 24-0242

SITE LOCATION: Mount Ruapehu - Te Ara Mangawhero Trail Bridge 5.8 - Refer Cross Section
CO-ORDINATES:

START DATE: 03/07/2024
END DATE: 03/07/2024
LOGGED BY: NW

MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	GEOLOGY	DEPTH (m)	LEGEND	SCALA PENETROMETER (Blows / 100mm)	VANE SHEAR STRENGTH (kPa) Vane: SV1 Cheal	Values	WATER
TOPSOIL.		0.0		1			Groundwater Not Encountered
SAND (SP); grey/black with some brown and orange. Loose; moist; poorly graded; sand, fine to medium.		0.2		1			
		0.4		1			
		0.6		1			
Clayey SILT, with some sand; brown. Soft to firm; moist; low plasticity.		0.8		1			
		1.0		5		106 19	
		1.2		5			
SAND, with some clay; brownish grey. Medium dense to dense; wet.		1.4		5		141 26	
		1.6		5			
Sandy SILT, with some clay; brown mottled orange and grey. Wet; low plasticity.		1.8		5			
Silty sandy gravelly bouldery COBBLES. UTP - Boulder ?.		2.0		4			
EOH: 2.00m		2.2		4			
		2.4		10			
		2.6					
		2.8					
		3.0					
		3.2					
		3.4					
		3.6					
		3.8					

PHOTO(S)

REMARKS

WATER
- Standing Water Level
- Out flow
- In flow

INVESTIGATION TYPE
- [x] Hand Auger
- [ ] Test Pit

INVESTIGATION LOG

TAIAO
BE PART OF THE SOLUTION

HOLE NO.: 5.8B BH6

CLIENT: Cheal Consultants
PROJECT: Te Ara Mangawhero Trail

JOB NO.: 24-0242

SITE LOCATION: Mount Ruapehu - Te Ara Mangawhero Trail Bridge 5.8 - Refer Cross Section
CO-ORDINATES:

START DATE: 03/07/2024
END DATE: 03/07/2024
LOGGED BY: NW

MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	GEOLOGY	DEPTH (m)	LEGEND	SCALA PENETROMETER (Blows / 100mm)	VANE SHEAR STRENGTH (kPa) Vane: SV1 Cheal	WATER
TOPSOIL.		0.0	TS			
SAND (SP); blackish grey with some brown. Loose to medium dense; wet; poorly graded; sand, fine to medium.		0.4		1, 1, 3, 3, 3, 3, 3		Groundwater Not Encountered
Clayey sandy SILT; brown mottled grey and orange. Soft to firm; moist; low plasticity.		0.8		13	86 22	
EOH: 1.40m		1.4		40 >>		

Scala Penetrometer: 2 4 6 8 10 12 14 16 18
Vane Shear Strength (kPa): 50 100 150 200 Values

PHOTO(S)

REMARKS

WATER
- Standing Water Level
- Out flow
- In flow

INVESTIGATION TYPE
- [x] Hand Auger
- [ ] Test Pit

TAIAO
BE PART OF THE SOLUTION

INVESTIGATION LOG

HOLE NO.: 5.8B BH7

CLIENT: Cheal Consultants
PROJECT: Te Ara Mangawhero Trail

JOB NO.: 24-0242

SITE LOCATION: Mount Ruapehu - Te Ara Mangawhero Trail Bridge 5.8 - Refer Cross Section
CO-ORDINATES:

START DATE: 03/07/2024
END DATE: 03/07/2024
LOGGED BY: NW

MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	GEOLOGY	DEPTH (m)	LEGEND	SCALA PENETROMETER (Blows / 100mm)	VANE SHEAR STRENGTH (kPa) Vane:	WATER
TOPSOIL.		0.0	TS	2 4 6 8 10 12 14 16 18	50 100 150 200 Values	Groundwater Not Encountered
SAND (SP); brown. Loose; moist; poorly graded; sand, fine; (U.T.P @1.1m gravels?).		0.2 0.4 0.6 0.8 1.0				
EOH: 1.10m		1.2 1.4 1.6 1.8 2.0 2.2 2.4 2.6 2.8 3.0 3.2 3.4 3.6 3.8		3 5 12		

PHOTO(S)

REMARKS

WATER

- Standing Water Level
- Out flow
- In flow

INVESTIGATION TYPE

- [x] Hand Auger
- [ ] Test Pit

INVESTIGATION LOG

TAIAO
BE PART OF THE SOLUTION

HOLE NO.: 5.8B BH8

CLIENT: Cheal Consultants
PROJECT: Te Ara Mangawhero Trail

JOB NO.: 24-0242

SITE LOCATION: Mount Ruapehu - Te Ara Mangawhero Trail Bridge 5.8 - Refer Cross Section
CO-ORDINATES:

START DATE 03/07/2024
END DATE: 03/07/2024
LOGGED BY: NW

MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	GEOLOGY	DEPTH (m)	LEGEND	SCALA PENETROMETER (Blows / 100mm)	VANE SHEAR STRENGTH (kPa) Vane:	WATER
[SET A COMPOSITION].						
SAND (SP); brown. Moist; poorly graded; sand, fine.		0.0 – 1.2	TS	1, 1, 1.5, 1.5, 1.5, 1.5, 1.5, 1.5, 1.5, 1.5		Groundwater Not Encountered
SAND, with some gravel; blackish grey (sand) with some brown/orange gravels. Loose to medium dense; moist.		1.2 – 1.4				
SAND, with some clay and gravel; greyish brown. Loose to medium dense; moist.		1.4 – 1.8		10, 35 >>		
EOH: 1.80m		1.8				

Scala Penetrometer (Blows / 100mm): 2 4 6 8 10 12 14 16 18
Vane Shear Strength (kPa): 50 100 150 200 Values

PHOTO(S)

REMARKS

WATER
- Standing Water Level
- Out flow
- In flow

INVESTIGATION TYPE
- [x] Hand Auger
- [ ] Test Pit

INVESTIGATION LOG

TAIAO — BE PART OF THE SOLUTION

HOLE NO.: 6.27B BH9

CLIENT: Cheal Consultants
PROJECT: Te Ara Mangawhero Trail

JOB NO.: 24-0242

SITE LOCATION: Mount Ruapehu - Te Ara Mangawhero Trail Bridge 6.27 - Refer Cross Section
CO-ORDINATES:

START DATE: 02/07/2024
END DATE: 02/07/2024
LOGGED BY: JS

MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	GEOLOGY	DEPTH (m)	LEGEND	SCALA PENETROMETER (Blows / 100mm)	VANE SHEAR STRENGTH (kPa) Vane: SV2 Cheal	Values	WATER
SILT, with some sand; orangish brown. Soft to firm; moist; low plasticity.		0.0 – 0.8		1, 1, 1, 2, 2, 2		26 6	Groundwater Not Encountered
Silty SAND; brown (with black sand). Medium dense; moist.		0.8 – 1.4		3, 2, 3, 2, 6, 3		70 16	
EOH: 1.50m		1.4 – 1.8		12, 10			

Scala penetrometer axis: 2 4 6 8 10 12 14 16 18
Vane shear strength axis: 50 100 150 200

PHOTO(S)

REMARKS

WATER
- Standing Water Level
- Out flow
- In flow

INVESTIGATION TYPE
- [x] Hand Auger
- [ ] Test Pit

TAIAO
BE PART OF THE SOLUTION

INVESTIGATION LOG

HOLE NO.: 6.27B BH10

CLIENT: Cheal Consultants
PROJECT: Te Ara Mangawhero Trail

JOB NO.: 24-0242

SITE LOCATION: Mount Ruapehu - Te Ara Mangawhero Trail Bridge 6.27 - Refer Cross Section
CO-ORDINATES:

START DATE: 02/07/2024
END DATE: 02/07/2024
LOGGED BY: JS

MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	GEOLOGY	DEPTH (m)	LEGEND	SCALA PENETROMETER (Blows / 100mm)	VANE SHEAR STRENGTH (kPa) Vane: SV2 Cheal	Values	WATER
SILT, with minor sand; black/dark grey. Soft; saturated; non-plastic.		0.0 – 0.4		1, 1, 1		26 16	Groundwater Not Encountered
SILT, with some sand; brown. Soft; saturated; non-plastic.		0.4 – 0.8		10		54 51	
EOH: 0.80m		0.8					

0.2, 0.6, 1.0, 1.2, 1.4, 1.6, 1.8

SCALA PENETROMETER: 2 4 6 8 10 12 14 16 18
VANE SHEAR STRENGTH (kPa): 50 100 150 200

PHOTO(S)

REMARKS

WATER
- Standing Water Level
- Out flow
- In flow

INVESTIGATION TYPE
- [x] Hand Auger
- [ ] Test Pit

TAIAO
BE PART OF THE SOLUTION

INVESTIGATION LOG

HOLE NO.: 6.29B BH11

CLIENT: Cheal Consultants
PROJECT: Te Ara Mangawhero Trail

JOB NO.: 24-0242

SITE LOCATION: Mount Ruapehu - Te Ara Mangawhero Trail Bridge 6.29 - Refer Cross Section
CO-ORDINATES:

START DATE: 02/07/2024
END DATE: 02/07/2024
LOGGED BY: JS

MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	GEOLOGY	DEPTH (m)	LEGEND	SCALA PENETROMETER (Blows / 100mm)	VANE SHEAR STRENGTH (kPa) Vane: SV2 Cheal	Values	WATER
TOPSOIL.		0.0 – 0.4	TS	1, 1, 1			
SILT, with some sand; orangish brown. Soft; moist; non-plastic.		0.4 – 1.0		1, 2, 1, 1, 2		42, 16	
SAND, with minor silt; blackish grey. Medium dense to dense; saturated.		1.0 – 1.8		2, 3, 3, 4, 5, 5, 6		19, 10	◁
EOH: 1.80m		1.8 – 2.8		6, 6, 5, 3, 4, 5, 5, 8, 10			

PHOTO(S)

REMARKS

WATER
- Standing Water Level
- Out flow
- In flow

INVESTIGATION TYPE
- [x] Hand Auger
- [ ] Test Pit

TAIAO
BE PART OF THE SOLUTION

INVESTIGATION LOG

HOLE NO.: 6.29B BH12

CLIENT: Cheal Consultants
PROJECT: Te Ara Mangawhero Trail

JOB NO.: 24-0242

SITE LOCATION: Mount Ruapehu - Te Ara Mangawhero Trail Bridge 6.29 - Refer Section
CO-ORDINATES:

START DATE: 02/07/2024
END DATE: 02/07/2024
LOGGED BY: JS

MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	GEOLOGY	DEPTH (m)	LEGEND	SCALA PENETROMETER (Blows / 100mm)	VANE SHEAR STRENGTH (kPa) Vane:	Values	WATER
TOPSOIL.		0.0 – 0.2	TS	2, 2			
SILT, with some sand; orangish brown. Soft; moist; non-plastic.		0.2 – 1.6		1, 2, 3, 3, 3, 4, 4, 3		22, 13	◁
Silty SAND; blackish grey. Medium dense; saturated; well graded.		1.6 – 2.2		4, 4, 5, 4, 5, 9, 7		26, 16	
EOH: 2.30m		2.2 – 2.8		5, 8, 5, 6, 11			

PHOTO(S)

REMARKS

WATER
- Standing Water Level
- Out flow
- In flow

INVESTIGATION TYPE
- [x] Hand Auger
- [ ] Test Pit

INVESTIGATION LOG

TAIAO — BE PART OF THE SOLUTION

HOLE NO.: 6.31B BH13

CLIENT: Cheal Consultants
PROJECT: Te Ara Mangawhero Trail

JOB NO.: 24-0242

SITE LOCATION: Mount Ruapehu - Te Ara Mangawhero Trail Bridge 6.31 - Refer Cross Section
CO-ORDINATES:

START DATE 02/07/2024
END DATE: 02/07/2024
LOGGED BY: JS

MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	GEOLOGY	DEPTH (m)	LEGEND	SCALA PENETROMETER (Blows / 100mm)	VANE SHEAR STRENGTH (kPa) Vane: SV2 Cheal	Values	WATER
Sandy SILT, with minor gravel; orangish brown, mottled orange and grey. Moist; no recovery at 1.4m. EOH: 1.40m		0.0 – 1.4		1, 2, 2, 3, 3, 5, 7, 6, 10, 13, 20	19, 13		Groundwater Not Encountered

PHOTO(S)

REMARKS

WATER
- Standing Water Level
- Out flow
- In flow

INVESTIGATION TYPE
- [x] Hand Auger
- [ ] Test Pit

INVESTIGATION LOG

TAIAO — BE PART OF THE SOLUTION

HOLE NO.: 6.31B BH14

CLIENT: Cheal Consultants
PROJECT: Te Ara Mangawhero Trail

JOB NO.: 24-0242

SITE LOCATION: Mount Ruapehu - Te Ara Mangawhero Trail Bridge 6.31 - Refer Cross Section
CO-ORDINATES:

START DATE: 02/07/2024
END DATE: 02/07/2024
LOGGED BY: JS

MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	GEOLOGY	DEPTH (m)	LEGEND	SCALA PENETROMETER (Blows / 100mm)	VANE SHEAR STRENGTH (kPa) Vane: SV2 Cheal	WATER
SILT, with some sand; orangish brown mottled orange and grey. Moist; non-plastic.		0.0		3	26	Groundwater Not Encountered
		0.2		1	13	
EOH: 0.50m		0.4		15		
		0.6				
		0.8				
		1.0				
		1.2				
		1.4				
		1.6				
		1.8				
		2.0				
		2.2				
		2.4				
		2.6				
		2.8				

Scala penetrometer scale: 2 4 6 8 10 12 14 16 18
Vane shear strength scale: 50 100 150 200 Values

PHOTO(S)

REMARKS

WATER
- Standing Water Level
- Out flow
- In flow

INVESTIGATION TYPE
- [x] Hand Auger
- [ ] Test Pit

TAIAO
BE PART OF THE SOLUTION

INVESTIGATION LOG

HOLE NO.: 9.1B BH15

CLIENT: Cheal Consultants
PROJECT: Te Ara Mangawhero Trail

JOB NO.: 24-0242

SITE LOCATION: Mount Ruapehu - Te Ara Mangawhero Trail Bridge 9.1 - Refer Cross Section
CO-ORDINATES:

START DATE: 03/07/2024
END DATE: 03/07/2024
LOGGED BY: JS

MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	GEOLOGY	DEPTH (m)	LEGEND	SCALA PENETROMETER (Blows / 100mm) 2 4 6 8 10 12 14 16 18	VANE SHEAR STRENGTH (kPa) Vane: 50 100 150 200 Values	WATER
Roading Chip on surface underlain by cobbles/boulders above rock lava flow @ likely 1-2m depth Scala refused at 0.1m depth. EOH: 0.00m				3		

PHOTO(S)

REMARKS

WATER
- Standing Water Level
- Out flow
- In flow

INVESTIGATION TYPE
- Hand Auger
- Test Pit

INVESTIGATION LOG

TAIAO
BE PART OF THE SOLUTION

HOLE NO.: 9.1B BH16

CLIENT: Cheal Consultants
PROJECT: Te Ara Mangawhero Trail

JOB NO.: 24-0242

SITE LOCATION: Mount Ruapehu - Te Ara Mangawhero Trail Bridge 9.1 - Refer Cross Section
CO-ORDINATES:

START DATE: 03/07/2024
END DATE: 03/07/2024
LOGGED BY: JS

MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	GEOLOGY	DEPTH (m)	LEGEND	SCALA PENETROMETER (Blows / 100mm)	VANE SHEAR STRENGTH (kPa) Vane:	WATER
TOPSOIL.		0.0	TS	1		Groundwater Not Encountered
		0.2	TS	1		
			TS	1		
Silty SAND, with trace gravel; blackish grey. Saturated; no recovery.		0.4		2		
EOH: 0.40m				15		
		0.6		11		
				12		
		0.8		9		
				18		
		1.0		21 >>		
		1.2				
		1.4				
		1.6				
		1.8				

Scala Penetrometer (Blows / 100mm): 2 4 6 8 10 12 14 16 18
Vane Shear Strength (kPa): 50 100 150 200 Values

PHOTO(S)

REMARKS

WATER
- Standing Water Level
- Out flow
- In flow

INVESTIGATION TYPE
- [x] Hand Auger
- [ ] Test Pit

INVESTIGATION LOG

TAIAO
BE PART OF THE SOLUTION

HOLE NO.: 9.3B BH17

CLIENT: Cheal Consultants
PROJECT: Te Ara Mangawhero Trail

JOB NO.: 24-0242

SITE LOCATION: Mount Ruapehu - Te Ara Mangawhero Trail Bridge 9.3 - Refer Cross Section
CO-ORDINATES:

START DATE: 03/07/2024
END DATE: 03/07/2024
LOGGED BY: JS

MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	GEOLOGY	DEPTH (m)	LEGEND	SCALA PENETROMETER (Blows / 100mm)	VANE SHEAR STRENGTH (kPa) Vane:	WATER
TOPSOIL.		0.0	TS			Groundwater Not Encountered
SILT; orange. Dry.		0.2		2, 2, 5		
SAND, with minor silt, with trace gravel; dark brown. Dense; dry; well graded.		0.4		11, 11		
EOH: 0.70m		0.6				
		0.8				
		1.0				
		1.2				
		1.4				
		1.6				
		1.8				

Scala Penetrometer: 2 4 6 8 10 12 14 16 18
Vane Shear Strength: 50 100 150 200 Values

PHOTO(S)

REMARKS

WATER
- Standing Water Level
- Out flow
- In flow

INVESTIGATION TYPE
- [x] Hand Auger
- [ ] Test Pit

INVESTIGATION LOG

TAIAO
BE PART OF THE SOLUTION

HOLE NO.: 9.3B BH18

CLIENT: Cheal Consultants
PROJECT: Te Ara Mangawhero Trail

JOB NO.: 24-0242

SITE LOCATION: Mount Ruapehu - Te Ara Mangawhero Trail Bridge 9.3 - Refer Cross Section
CO-ORDINATES:

START DATE: 03/07/2024
END DATE: 03/07/2024
LOGGED BY: JS

MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	GEOLOGY	DEPTH (m)	LEGEND	SCALA PENETROMETER (Blows / 100mm)	VANE SHEAR STRENGTH (kPa) Vane:	WATER
TOPSOIL.						
SAND (SW); blackish grey. Moist; well graded; sand, medium.						
Silty SAND, with trace gravel; dark brown. Medium dense; saturated;		0.2				
Scala refused at 0.8m depth.		0.4		1		
		0.6		1		
				1		
				2		
EOH: 0.80m		0.8		4		
		1.0				
		1.2				
		1.4				
		1.6				
		1.8				

Scala Penetrometer (Blows / 100mm): 2 4 6 8 10 12 14 16 18
Vane Shear Strength (kPa): 50 100 150 200 Values

Groundwater Not Encountered

PHOTO(S)

REMARKS

WATER
- Standing Water Level
- Out flow
- In flow

INVESTIGATION TYPE
- [x] Hand Auger
- [ ] Test Pit

INVESTIGATION LOG

TAIAO
BE PART OF THE SOLUTION

HOLE NO.: 9.13B BH19

CLIENT: Cheal Consultants
PROJECT: Te Ara Mangawhero Trail

JOB NO.: 24-0242

SITE LOCATION: Mount Ruapehu - Te Ara Mangawhero Trail - Bridge 9.13 - Refer Cross Section
CO-ORDINATES:

START DATE: 03/07/2024
END DATE: 03/07/2024
LOGGED BY: NW

MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	GEOLOGY	DEPTH (m)	LEGEND	SCALA PENETROMETER (Blows / 100mm) 2 4 6 8 10 12 14 16 18	VANE SHEAR STRENGTH (kPa) Vane: 50 100 150 200 Values	WATER
TOPSOIL, with some gravel. Gravel, fine.		0.0	TS S TS 1			dwater Not Encou
Rock (Lava flow), Scala refusal at 0.1m depth.						
EOH: 0.20m		0.2				
		0.4				
		0.6				
		0.8				
		1.0				
		1.2				
		1.4				
		1.6				
		1.8				

PHOTO(S)

REMARKS

WATER
- Standing Water Level
- Out flow
- In flow

INVESTIGATION TYPE
- Hand Auger
- Test Pit

TAIAO
BE PART OF THE SOLUTION

INVESTIGATION LOG

HOLE NO.: 9.13B BH20

CLIENT: Cheal Consultants
PROJECT: Te Ara Mangawhero Trail

JOB NO.: 24-0242

SITE LOCATION: Mount Ruapehu - Te Ara Mangawhero Trail Bridge 9.13 - Refer Cross Section
CO-ORDINATES:

START DATE: 03/07/2024
END DATE: 03/07/2024
LOGGED BY: JS

MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	GEOLOGY	DEPTH (m)	LEGEND	SCALA PENETROMETER (Blows / 100mm)	VANE SHEAR STRENGTH (kPa) Vane: SV2 Cheal	WATER
SAND (SW), with some silt; dark brown. Moist; well graded; sand, fine to medium; Rootlets present.		0.0		1, 1		Groundwater Not Encountered
Sandy SILT; dark brown. Moist; Scala refusal at 0.9m depth.		0.2		1, 1, 1	70	
EOH: 0.40m		0.4		1, 1, 1, 1, 1, 2	29	
		0.6				
		0.8				
		1.0				
		1.2				
		1.4				
		1.6				
		1.8				

Scala Penetrometer (Blows / 100mm): 2 4 6 8 10 12 14 16 18
Vane Shear Strength (kPa): 50 100 150 200 Values

PHOTO(S)

REMARKS

WATER
- Standing Water Level
- Out flow
- In flow

INVESTIGATION TYPE
- [x] Hand Auger
- [ ] Test Pit

TAIAO
BE PART OF THE SOLUTION

INVESTIGATION LOG

HOLE NO.: 9.17BW SB

CLIENT: Cheal Consultants
PROJECT: Te Ara Mangawhero Trail

JOB NO.: 24-0242

SITE LOCATION: Mount Ruapehu - Te Ara Mangawhero Trail - Boardwalk 9.17 Switch Back
CO-ORDINATES:

START DATE: 03/07/2024
END DATE: 03/07/2024
LOGGED BY: NW

MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	GEOLOGY	DEPTH (m)	LEGEND	SCALA PENETROMETER (Blows / 0mm)	VANE SHEAR STRENGTH (kPa) Vane:	Values	WATER
Clayey SILT; brown/grey. Moist; low plasticity; Shear vane reading on surface soils exposed by slumps. EOH: 0.40m		0.2 0.4 0.6 0.8 1.0 1.2 1.4 1.6 1.8		2 4 6 8 10 12 14 16 18	50 100 150 200	16 3	Groundwater Not Encountered

PHOTO(S)

REMARKS

WATER
- Standing Water Level
- Out flow
- In flow

INVESTIGATION TYPE
- Hand Auger
- Test Pit

TAIAO
BE PART OF THE SOLUTION

INVESTIGATION LOG

HOLE NO.: Slip BHA

CLIENT: Cheal Consultants
PROJECT: Te Ara Mangawhero Trail

JOB NO.: 24-0242

SITE LOCATION: Mount Ruapehu
CO-ORDINATES: 1816854mE, 5645270mN

START DATE: 03/07/2024
END DATE: 03/07/2024
LOGGED BY: NW

MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	GEOLOGY	DEPTH (m)	LEGEND	SCALA PENETROMETER (Blows / 100mm)	VANE SHEAR STRENGTH (kPa) Vane: SV2 Cheal	WATER
Sandy SILT; brown. Moist; with rootlets.		0.0 – 0.6		1, 2, 3	Values: 80, 32	Groundwater Not Encountered
SAND; blackish grey. Wet; sand, fine to medium; U.T.P at 700mm depth Gravels ??. EOH: 0.70m		0.6 – 1.8		4, 1, 2, 5, 12, 12, 20, 9, 7, 6, 12, 10		

Scala Penetrometer scale: 2 4 6 8 10 12 14 16 18
Vane Shear Strength scale: 50 100 150 200

PHOTO(S)



REMARKS

WATER

- Standing Water Level
- Out flow
- In flow

INVESTIGATION TYPE

- [x] Hand Auger
- [ ] Test Pit

INVESTIGATION LOG

TAIAO — BE PART OF THE SOLUTION

HOLE NO.: Slip BHB

CLIENT: Cheal Consultants
PROJECT: Te Ara Mangawhero Trail

JOB NO.: 24-0242

SITE LOCATION: Mount Ruapehu
CO-ORDINATES: 1816844mE, 5645284mN

START DATE: 03/07/2024
END DATE: 03/07/2024
LOGGED BY: NW

MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	GEOLOGY	DEPTH (m)	LEGEND	SCALA PENETROMETER (Blows / 100mm)	VANE SHEAR STRENGTH (kPa) Vane: SV2 Cheal	Values	WATER
Sandy SILT; brown. Moist; with rootlets U.T.P at 1m depth Gravels ???. EOH: 1.00m		0.0 – 1.0		1, 2, 3		42 26 68 26	Groundwater Not Encountered
		1.0 – 2.8		11, 7, 6, 5, 6, 6, 9, 9, 7, 6, 12, 10, 12, 10, 10, 26 >>, 25 >>			

PHOTO(S)



REMARKS

WATER
- Standing Water Level
- Out flow
- In flow

INVESTIGATION TYPE
- [x] Hand Auger
- [ ] Test Pit

INVESTIGATION LOG

TAIAO — BE PART OF THE SOLUTION

HOLE NO.: Slip BHC

CLIENT: Cheal Consultants
PROJECT: Te Ara Mangawhero Trail

JOB NO.: 24-0242

SITE LOCATION: Mount Ruapehu
CO-ORDINATES: 1816833mE, 5645301mN

START DATE: 03/07/2024
END DATE: 03/07/2024
LOGGED BY: NW

MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	GEOLOGY	DEPTH (m)	LEGEND	SCALA PENETROMETER (Blows / 100mm)	VANE SHEAR STRENGTH (kPa) Vane:	WATER
Sandy SILT, with some clay, with trace gravel; brownish grey. Moist; U.T.P at 200mm depth Gravels ??.		0.0		1		dwater Not Encou
EOH: 0.20m		0.2		10		
		0.4		20		
		0.6				
		0.8				
		1.0				
		1.2				
		1.4				
		1.6				
		1.8				

Scala Penetrometer (Blows / 100mm): 2 4 6 8 10 12 14 16 18

Vane Shear Strength (kPa) Vane: 50 100 150 200 Values

PHOTO(S)



REMARKS

WATER

- Standing Water Level
- Out flow
- In flow

INVESTIGATION TYPE

- [x] Hand Auger
- [ ] Test Pit

INVESTIGATION LOG

TAIAO — BE PART OF THE SOLUTION

HOLE NO.: Slip BHD

CLIENT: Cheal Consultants
PROJECT: Te Ara Mangawhero Trail

JOB NO.: 24-0242

SITE LOCATION: Mount Ruapehu
CO-ORDINATES: 1816827mE, 5645255mN

START DATE: 03/07/2024
END DATE: 03/07/2024
LOGGED BY: NW

MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	GEOLOGY	DEPTH (m)	LEGEND	SCALA PENETROMETER (Blows / 0mm)	VANE SHEAR STRENGTH (kPa) Vane: SV2 Cheal	Values	WATER
TOPSOIL.		0.0 – 0.4	TS	1, 2, 2, 2, 2, 2			
Sandy SILT; brownish grey. Moist; with rootlets U.T.P at 2m depth Gravels/Cobbles/Boulders ???.		0.4 – 1.2		4, 4, 4, 5, 5	101, 90	101 90	
		1.2 – 1.8		4, 4, 3, 3, 3	68, 26	68 26	◁
EOH: 2.00m		1.8 – 2.0		7	168, 123	168 123	
		2.0 – 2.4		8, 9, 10, 17			
		2.6 – 2.8					

PHOTO(S)



REMARKS

WATER

- ▼ Standing Water Level
- ▷ Out flow
- ◁ In flow

INVESTIGATION TYPE

- ☑ Hand Auger
- ☐ Test Pit

INVESTIGATION LOG

TAIAO — BE PART OF THE SOLUTION

HOLE NO.: Slip BHE

CLIENT: Cheal Consultants
PROJECT: Te Ara Mangawhero Trail

JOB NO.: 24-0242

SITE LOCATION: Mount Ruapehu
CO-ORDINATES: 1816812mE, 5645280mN

START DATE: 03/07/2024
END DATE: 03/07/2024
LOGGED BY: NW

MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	GEOLOGY	DEPTH (m)	LEGEND	SCALA PENETROMETER (Blows / 100mm)	VANE SHEAR STRENGTH (kPa) Vane: SV2 Cheal	Values	WATER
Sandy SILT, with some clay; blackish grey. Moist; rootlets.		0.0–0.6		1, 2, 1, 3, 3			
SAND, with some silt; blackish grey. Moist; sand, fine to medium.		0.6–0.8					
Clayey sandy SILT; greyish brown mottled orange. Moist to wet; low plasticity.		0.8–2.0		2, 2, 4, 4, 4, 5, 4, 4, 4, 5, 4, 4, 4, 4	196, 141	196 141	Groundwater Not Encountered
Clayey gravelly SILT (GP), with some sand; brown with orange/red gravels. Saturated; low plasticity; U.T.P at 2.5m depth Gravels ?? Scala refusal. EOH: 2.70m		2.0–2.7		6, 6, 6	154, 125	154 125	

Scala Penetrometer scale: 2 4 6 8 10 12 14 16 18
Vane Shear Strength scale: 50 100 150 200

PHOTO(S)



REMARKS

WATER
- Standing Water Level
- Out flow
- In flow

INVESTIGATION TYPE
- [x] Hand Auger
- [ ] Test Pit

Appendix 8. Hydrological Assessment

Ngā Waihua o Paerangi Trust, Ohakune

Te Ara Mangawhero Trail, Tongariro National Park, Ohakune

Stream Crossings Assessment

210700

1 October 2024

Ngā Waihua o Paerangi Trust, Ohakune

Te Ara Mangawhero Trail, Tongariro National Park, Ohakune

Stream Crossings Assessment

Prepared by:



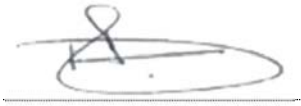
Tenisia Chidzurira
Civil Engineer
Qualifications BE (Civil Engineering) (Hons), CMEngNZ (Eng. Technologist)

Reviewed by:



Jake Saathof
Bay of Plenty Regional Manager
Qualifications BE(Forest)(Hons), CMEngNZ, CPEng

Approved for release by:



Dean Sherrit
Principal | Ruapehu Regional Manager
Registered Professional Surveyor

Date:	1 October 2024
Reference:	210700
Status:	Final
Revision:	NA
Previous Revision Date:	NA

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1. Cheal Consultants Drawings - Ruapehu WorX Limited Te Ara Mangawhero Trail
2. Site photography
3. Calculations

1. INTRODUCTION

1.1. Background

Cheal Consultants Limited (Cheal) has been engaged by Ngā Waihua o Paerangi Trust, Ohakune (the Client) to provide a stream crossing assessment of several bridge sites on the proposed Te Ara Mangawhero Trail, part of the Mountains to Sea – Ngā Ara Tūhono cycleway located on the Southern side of Mt Ruapehu. These bridge sites are numbered as follows, 5.8, 6.29, 6.31, 7.2, 8.3, 9.1 and 9.3. The locations of bridge sites are detailed on Cheal Consultants drawings numbers: 210700-200 to 206 Rev B contained within Appendix A.

The proposed Te Ara Mangawhero Trail is part of the Mountains to Sea – Ngā Ara Tūhono cycle trail. This section of trail is located in Tongariro National Park, on the southern flank of Mt Ruapehu, above Ohakune. The bridge sites subject to this report cross the Mangawhero Stream in several locations and a number of small tributaries.

1.2. Scope

Cheal was engaged to undertake the following for each bridge crossing:

- Site walk over & scour assessment
- Hydrological assessment
- Hydraulic analysis

A site walk over was undertaken 2 – 4 July 2024, during which stream crossing cross sections were surveyed with a clinometer and tape, a visual inspection was undertaken and shallow ground geotechnical investigation (subject of Taiao, Geotechnical Factual Report dated 18 September 2024).

1.3. Performance Standards

The following performance standards were used in setting the proposed bridge soffit levels:

- Rainfall data – HIRDSv4 RCP8.5 2081-2100 (NZTA Bridge Manual v3).
- Gauging data – Existing flow data increased by 16% to allow for climate change (8% increase per 1°C of warming, Preparing for Climate Change, A guide for local government in New Zealand).
- Design flood event – 1% AEP (NZTA Bridge Manual v3).
- Freeboard – 0.5m from flood level to bridge soffit.

2. SITE DESCRIPTION

2.1. Overview

Traversing in a north south direction, the Te Ara Mangawhero Trail, located in Tongariro National Park, Ohakune crosses numerous points of Mangawhero River which is flowing off Mt Ruapehu's southern flank, eventually joining the Whangaehu River. Each crossing site will be described, an assessment of any observed scour given, and the proposed bridge span included below. Additional site photography is included in Appendix 2.

2.2. Bridge 5.8

Bridge site 5.8 is the lowest in the catchment, proposed crossing of the Mangawhero River described in this report. The sides and base of the river consist of mature trees and low grasses around the proposed crossing point. The stream bed consists of well graded gravel to cobbles with small boulders showing in the stream bank. The crossing site appeared to be stable with no active erosion observed. A swing bridge span of approximately 34m is proposed to span the stream. A photo of the proposed crossing and swing bridge span is shown below.



Photo 1 – Bridge site 5.8

2.3. Bridges 6.27, 6.29 and 6.31

Bridge sites 6.27, 6.29 and 6.31 are located within 100m of each other on the existing Blyth Track. Small single span bridges are located at each site. It is proposed to replace these bridges for wider single span bridges suitable for a cycle trail.

Each site is similar is character with an incised stream channel cascading steeply down the hill in a series of small rapids. Each channel was overhung by ferns, dead branches and trees. Sites 6.27 and 6.31 had small cobbles in their beds with channel gradients of 19% and 34% respectively. Bridge site 6.29 had a slick bed and sides with a gradient of 68%.

No active erosion was observed at each site, and each existing bridge appeared to be stable. However, due to the incised nature of each channel, and to increase bridge resilience, it is recommended that new bridge piles extend to depth at least equal to the height of the adjacent stream bank.

Minimum bridge spans of 5m, 4m and 6m are recommended for sites 6.27, 6.29 and 6.31 respectively. Photos 2 to 4 below show each site.



Photo 2 – Bridge site 6.27



Photo 3 – Bridge site 6.29



Photo 4 - Bridge site 6.31

2.4. Bridge 7.2

Proposed bridge site 7.2 is located a short distance off the Blyth track from sites 6.29, 6.27 and 6.31. The site is characterised by mature trees flanking a shallow channel with moderately sloped sides. The waterway was unobstructed at normal flows and had bed material consisting of cobbles. Vegetation overhung the sides.

A bridge span of 8m is proposed for this site.

2.5. Bridge 8.3

Bridge site 8.3 is located in the upper Mangawhero Stream catchment area. The stream sides consist of bedrock and large boulders, bordered by small shrubs and alpine forest further up. The stream channel cascades through a series of bedrock rapids and pools with well graded gravel and cobbles located on small beaches. The stream channel appeared to be well confined and bedrock banks stable.

A swing bridge span of 20m is proposed for this site.



Photo 5 – Bridge site 8.3

2.6. Bridge 9.1

Proposed bridge site 9.1 crosses the Mangawhero Stream approximately 1.5km above proposed bridge site 8.3. The proposed crossing is located adjacent to Ohakune Mountain Road. At this location the stream flows at an average gradient of 5%, dropping through riffles and pools as it winds around bedrock, large boulders and gravel bed material. The annual flood level (height of clean bank sides) was observed to be 0.6m above the stream bed. Stream banks were moderately steep and appeared to be stable and no active erosion was observed.

A bridge span of 14m is proposed for this site. Photo 5 below shows the proposed site, looking upstream.



Photo 6 – Proposed bridge site 9.1

2.7. Bridge 9.3

Proposed bridge site 9.3 is located on the Mangawhero Stream approximately 150m upstream from proposed site 9.1. The stream channel had an average grade of 7%, and like site 9.1, had bed material of bedrock, boulders and gravel. The stream dropped through a series of rapids and pools.

The right-hand side stream bank (looking downstream) has a beach at its toe and gentle slope covered in small boulders and alpine grasses. The left-hand side was characterised by a large boulder near nominal flow level and steep bank thereafter. Both banks appeared stable at time of inspection. The annual flood level was observed to be approximately 0.7m above the bed level. A

swing bridge span of 18m is recommended for this site. Photo 6 below, looking upstream shows the proposed crossing site.



Photo 7 – Proposed site 9.3

3. FLOOD FLOW MODELLING

3.1. Methodology

The following methodology was used to estimate flood flow runoff for each catchment and calculate flooding depth for each site.

Time of concentration was estimated using Ramser-Kirpich, Bransby Williams and U.S Soil Conservation Service. Time of concentration aligning with the two converging results was used.

Flood flow modelling was estimated using TM61, Rational Method, Modified Rational Method and Flood Frequency in New Zealand (FFINZ). Rational Method C was calculated using Tables 4.2 and 4.3 included in Appendix 3. Adjacent gauging stations were used for FFINZ estimates. Estimated peak flows were taken from The Rational Method for catchments <3km^2, and Modified Rational Method for catchments >3km^2, which were compared with FFINZ and gauging station records.

Manning's n was assigned using the 'visual comparison' approach outlined in Hicks and Mason, Roughness Characteristics of New Zealand Rivers[1].

3.2. Catchment Hydrology

Results are included below in Table 1; calculations are contained in Appendix 3.

Table 1 – Hydrological analysis summary

Proposed bridge	Catchment (km2)	Time of concentration (minutes)	Estimation method	1% AEP Peak flow (m3/sec)
5.8	20.40	70	Modified Rational Method	89.7
6.27	0.10	10	Rational Method	2.1
6.29	0.20	10	Rational Method	1.9
6.31	0.20	12.4	Rational Method	2.0
7.2	0.10	13	Rational Method	1.1
8.3	3.20	24	Rational Method	43.9
9.1	1.60	21	Rational Method	22.8
9.3	1.60	21	Rational Method	22.8

Rational Method was used for hydrological analysis for all the bridges except for bridge 5.8. The catchment for bridge 5.8 has many tributaries contributing to it, yielding very high peak flow estimates when using the Rational Method. A comparative gauge lower in the catchment of the MaNgawhero River was used as a comparison in FFNZ. This gave an estimated 1% AEP peak flow of 41m^3/sec, on the lower end of estimated flows. As such the peak flow given by the Modified Rational Method was selected for this catchment, the estimated flow laying between the FFNZ estimate and the Rational Method.

[1] D M Hicks and P D Mason. (1998). Roughness Characteristics of New Zealand Rivers. NIWA. Pg 258 – 261.

3.3. Hydraulic analysis

Flooding depth and required bridge soffit level above the stream bed for each site is summarised in Table 2 below. Calculations are included in Appendix 3 and cross sections of each proposed bridge are included in Appendix 4.

Table 2 – Flood flow hydraulic analysis

Proposed Bridge	Manning's 'n'	Peak Flow Depth (m)	Minimum Bridge Soffit Height* (m)	Recommended Bridge Span (m)	Avg. Velocity (m/sec)
5.8	0.066	2.0	2.5	34	3.3
6.27	0.070	0.8	1.3	5	2.9
6.29	0.070	0.3	0.8	4	4.4
6.31	0.058	0.2	0.7	6	3.3
7.2	0.058	0.3	0.8	8	1.8
8.3	0.065	1.8	2.3	20	3.3
9.1	0.070	1.3	1.8	14	2.9
9.3	0.070	1.5	2.0	19	2.7

* Height above stream bed, includes 0.5m Freeboard

4. CONCLUSION

A stream crossing assessment was undertaken for eight proposed bridge sites located on the proposed Te Ara Mangawhero Trail. At time of inspection each proposed bridge site appeared to be relatively stable with minimal erosion risk. Hydrological and hydraulic analysis for a climate change adjusted 1% AEP peak flow event yielded the following recommended minimum bridge soffit heights above stream and recommended bridge spans as indicated in Table 2 above.

5. DISCLAIMER

This Report has been prepared solely for the use of our client with respect to the particular brief given to Cheal Consultants Limited (Cheal).

No liability is accepted in respect of its use for any other purpose or by any other person or entity.

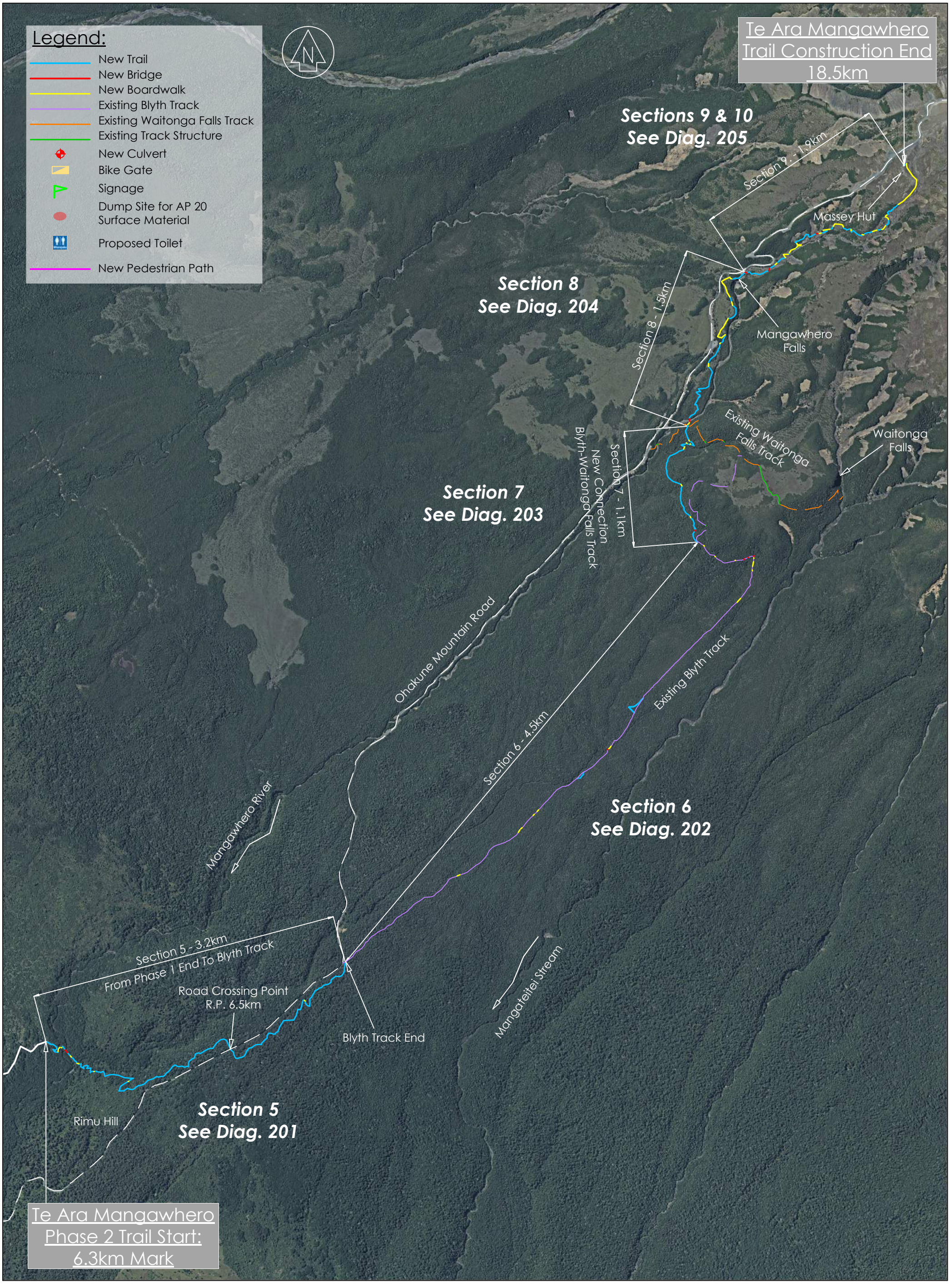
The opinions, recommendations and comments given in this Report are the result from the application of accepted industry methods of site investigations.



TENISIA CHIDIZURIRA
CHEAL CONSULTANTS LIMITED
1 October 2024

Appendix 1

Cheal Consultants
Drawings - Ruapehu WorX Limited Te Ara Mangawhero Trail



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Rev	Date	Amendment	By	Chk	App
A	12/08/24	First Issue	AJW	DS	DS

Project Title
Ruapehu WorX Limited:
Te Ara Mangawhero Trail

Drawing Title
Phase Two Construction Trail Sections Overview

Surveyed	D.Sherrit	Sept-Nov 23	DS
Designed	C.J.Olmi	01/12/23	CJO
Drawn	A.White	12/08/24	AJW
Checked	D.Sherrit	12/08/24	DS
Approved	D.Sherrit	12/08/24	DS

Status **INFORMATION**

Scale A3 1:22500 | A3

Drawing Number 210700-200 | Rev A

Legend:

- New Pedestrian Path
- New Trail
- New Bridge
- New Boardwalk
- Existing Blyth Track
- Existing Waitonga Falls Track
- Existing Track Structure
- New Culvert
- Bike Gate
- Signage
- Dump Site for AP 20
- Surface Material
- Proposed Toilet

Section 9
Diag. 205

Section 8
Diag. 204

Section 7
Diag. 203

Section 6
Diag. 202

Section 5
Diag. 201

Waitonga Falls

Road

Mountain

Mangawhero River

Ohakune

Mangateitei Stream

A

B

Locality Plan

Scale 1:50000

Section 5/6 Transition

POWER

Existing Blyth Track Carpark

Turoa Ski Field Power Cable (Ground)

Wharepaku

5.20.W
Boardwalk
8m

5.21

Ohakune Mountain Road

5.18
Ohakune Mountain Road
R.P. 6.5km existing sealed road
New 2 x 300Ø culverts in existing table drains

5.19

225m min. Sight Distance

5.17

250m min. Sight Distance

Turoa Ski Field Power Cable (Ground)

Diag. 201 B

Phase 1
Last Segment
(4.4)

5.4.W
Boardwalk
11m

5.8.B
Mangawhero Bridge
24m

5.5

5.3

5.6.W
Boardwalk
3m

5.7

5.1

5.10.W
Boardwalk
10m

5.9

5.12.W
Boardwalk
12m

5.11

5.2.W
Boardwalk
14m

5.13

5.15

5.14.W
Boardwalk
3m

Mangawhero River

5.16.W
Boardwalk
5m
(Tree roots)

5.17

Ohakune Mountain Road

Rimu Hill

Phase 2
Trail Construction Start:
6.3km Mark

Diag. 201 A

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Rev	Date	Amendment	By	Chk	App
A	12/08/24	First Issue	AJW	DS	DS

Project Title
Ruapehu WorX Limited:
Te Ara Mangawhero Trail

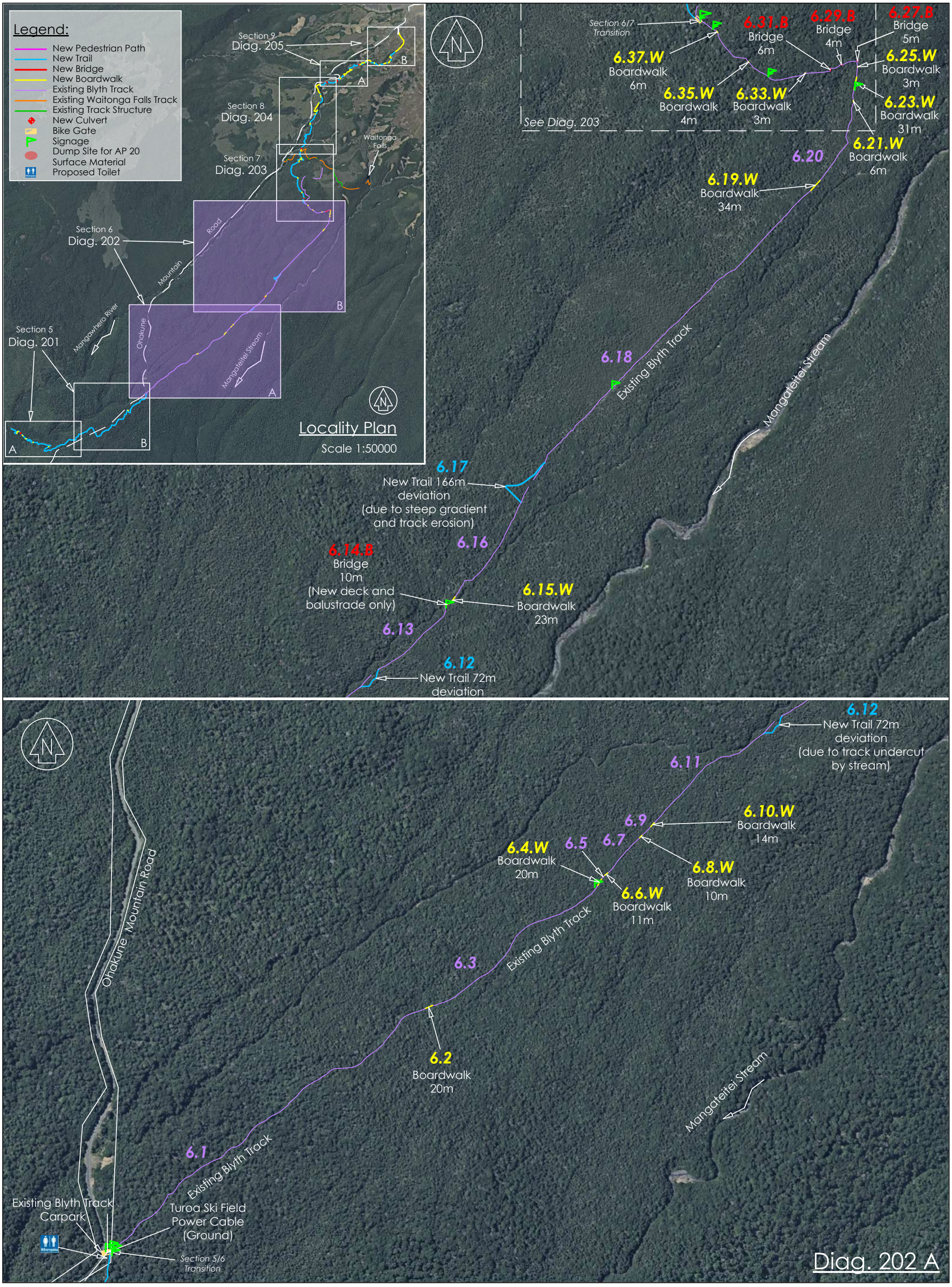
Drawing Title
Phase Two Construction
Trail Section Detail

Surveyed	D.Sherrit	Sept-Nov 23	DS
Designed	C.J.Olmi	01/12/23	CJO
Drawn	A.White	12/08/24	AJW
Checked	D.Sherrit	12/08/24	DS
Approved	D.Sherrit	12/08/24	DS

Status **INFORMATION**

Scale A3 1:4000 | A3

Drawing Number 210700-201 | Rev A



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Rev	Date	Amendment	By	Chk	App
A	12/08/24	First Issue	AJW	DS	DS

Project Title
Ruapehu WorX Limited:
Te Ara Mangawhero Trail

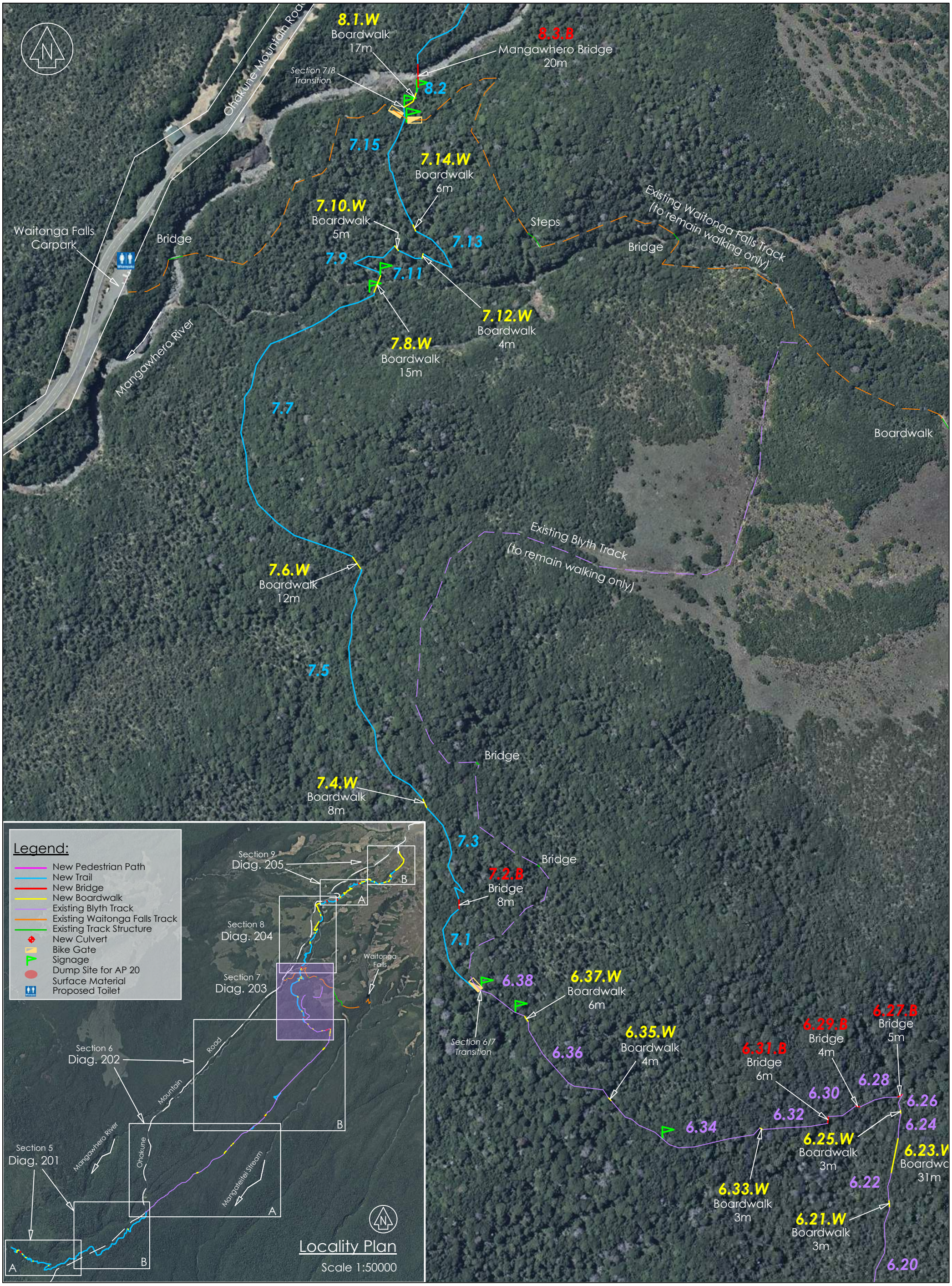
Drawing Title
Phase Two Construction
Trail Section Detail

Surveyed	D.Sherrit	Sept-Nov 23	DS
Designed	C.J.Olmi	01/12/23	CJO
Drawn	A.White	12/08/24	AJW
Checked	D.Sherrit	12/08/24	DS
Approved	D.Sherrit	12/08/24	DS

Status **INFORMATION**

Scale A3 1:8000 | A3

Drawing Number 210700-202 | Rev A



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Rev	Date	Amendment	By	Chk	App
A	12/08/24	First Issue	AJW	DS	DS

Project Title
Ruapehu WorX Limited:
Te Ara Mangawhero Trail

Drawing Title
Phase Two Construction
Trail Section Detail

Surveyed	D.Sherrit	Sept-Nov 23	DS
Designed	C.J.Olmi	01/12/23	CJO
Drawn	A.White	12/08/24	AJW
Checked	D.Sherrit	12/08/24	DS
Approved	D.Sherrit	12/08/24	DS

Status INFORMATION

Scale A3 1:3000 | A3

Drawing Number 210700-203 | Rev A

Legend:

- New Pedestrian Path
- New Trail
- New Bridge
- New Boardwalk
- Existing Blyth Track
- Existing Waitonga Falls Track
- Existing Track Structure
- New Culvert
- Bike Gate
- Signage
- Dump Site for AP 20
- Surface Material
- Proposed Toilet

Section 9
Diag. 205

Section 8
Diag. 204

Section 7
Diag. 203

Section 6
Diag. 202

Section 5
Diag. 201

Waitonga Falls

Road

Mountain

Ohakune

Mangawhero River

Mangateitei Stream

A

B

Locality Plan

Scale 1:50000

Section 8/9 Transition

Existing steps to be ramped

8.15

9.2

9.1.B
Mangawhero Bridge
14m

8.14.W
Boardwalk
195m

Mangawhero Falls

8.13

8.12.W
Boardwalk
25m

8.11

8.10.W
Boardwalk
174m

Barrier
15m

8.9.W
Elevated Boardwalk
and Barrier
25m

8.8

8.7.W
Boardwalk
7m

8.6

Mangawhero River

Ohakune Mountain Road

8.5.W
Boardwalk
20m

8.4

8.1.W
Boardwalk
17m

8.3.B
Mangawhero Bridge
20m

Section 7/8 Transition

8.2

Existing Waitonga Falls Track

7.15

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Rev	Date	Amendment	By	Chk	App
A	12/08/24	First Issue	AJW	DS	DS

Project Title
Ruapehu WorX Limited:
Te Ara Mangawhero Trail

Drawing Title
Phase Two Construction
Trail Section Detail

Surveyed	D.Sherrit	Sept-Nov 23	DS
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Drawn	A.White	12/08/24	AJW
Checked	D.Sherrit	12/08/24	DS
Approved	D.Sherrit	12/08/24	DS

Status **INFORMATION**

Scale A3 1:3000 | A3

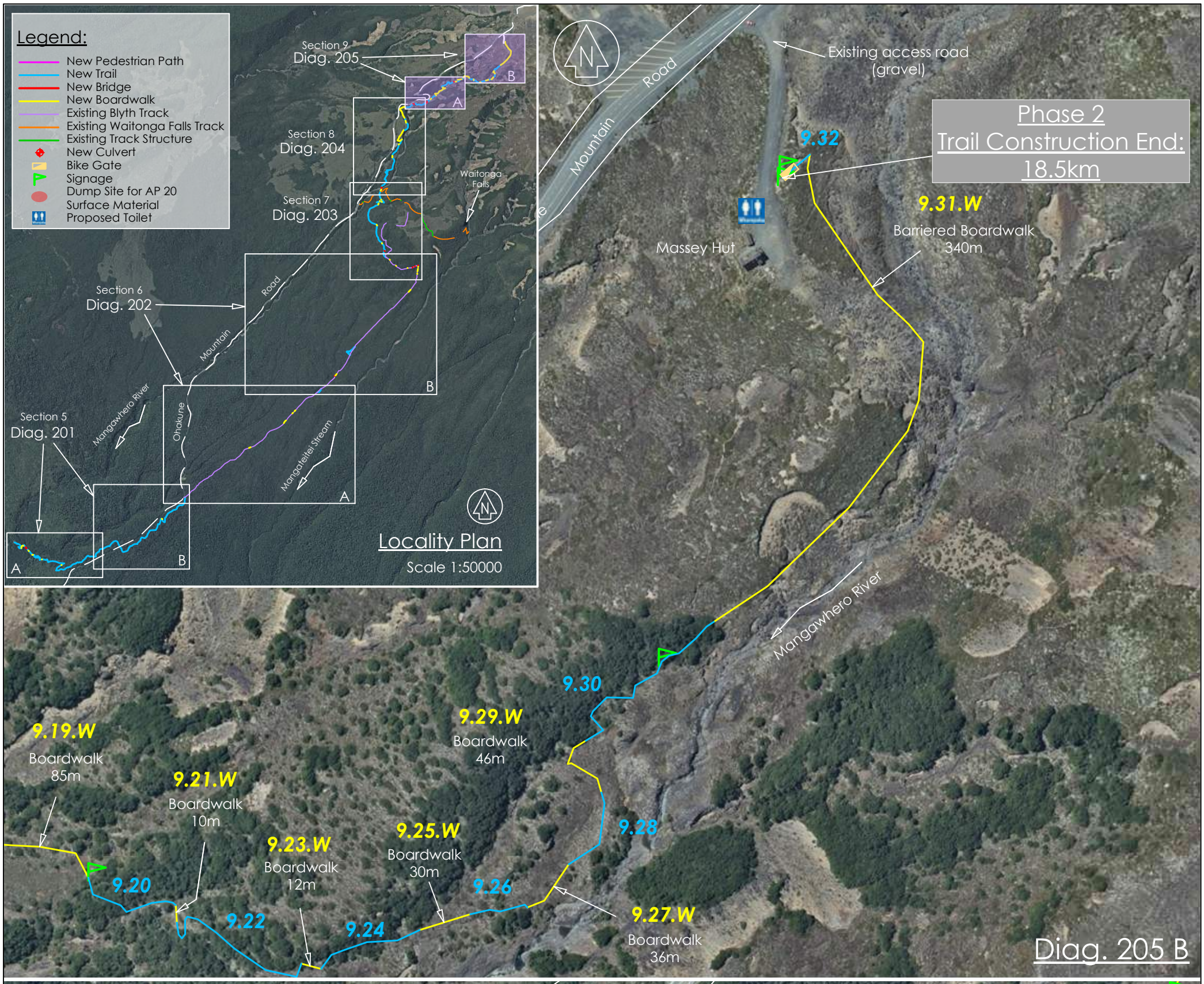
Drawing Number 210700-204 | Rev A

Legend:

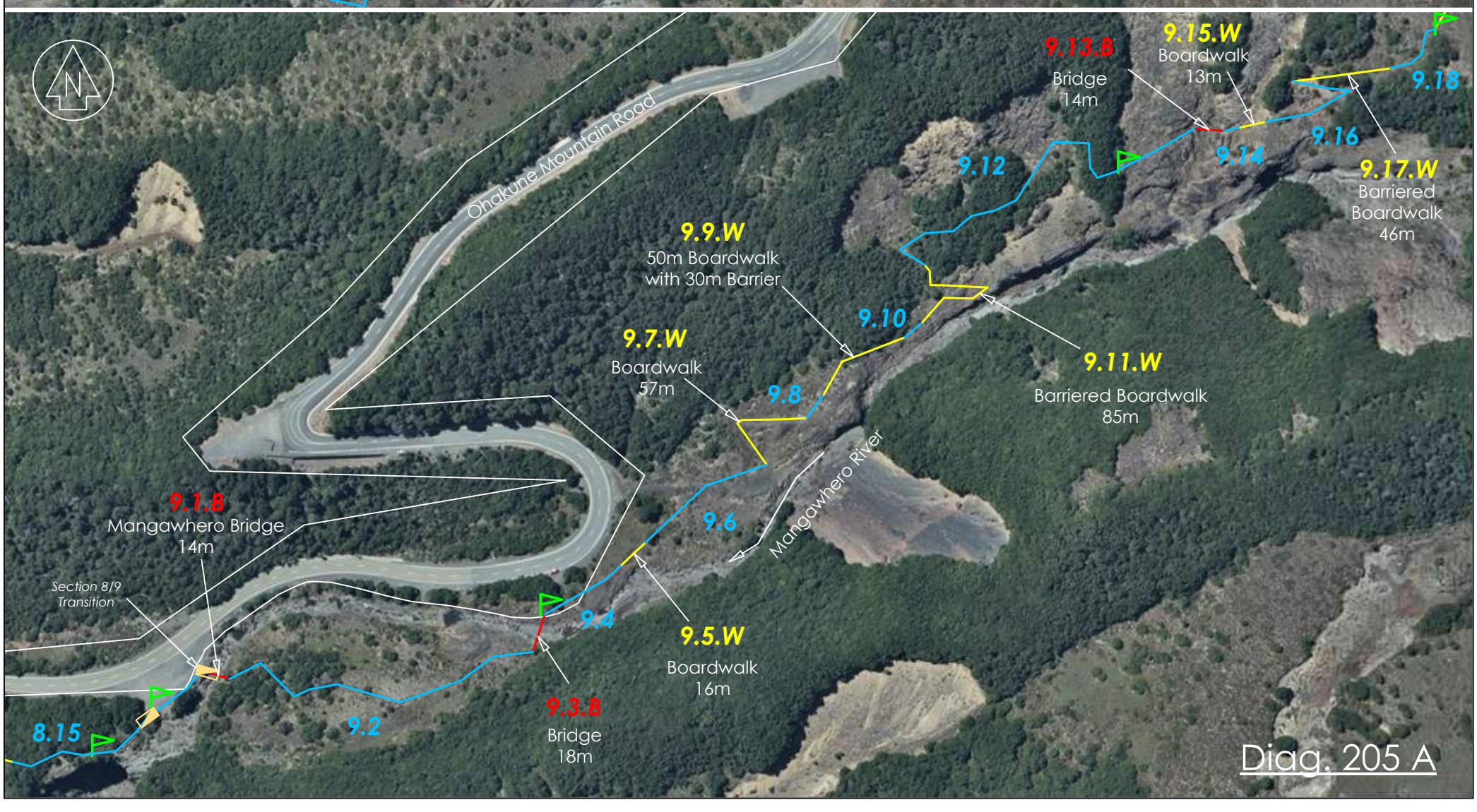
- New Pedestrian Path
- New Trail
- New Bridge
- New Boardwalk
- Existing Blyth Track
- Existing Waitonga Falls Track
- Existing Track Structure
- New Culvert
- Bike Gate
- Signage
- Dump Site for AP 20
- Surface Material
- Proposed Toilet

Locality Plan

Scale 1:50000



Diag. 205 B



Diag. 205 A

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Rev	Date	Amendment	By	Chk	App
A	12/08/24	First Issue	AJW	DS	DS

Project Title

Ruapehu WorX Limited:
Te Ara Mangawhero Trail

Drawing Title

Phase Two Construction
Trail Section Detail

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Designed	C.J.Olmi	01/12/23	CJO
Drawn	A.White	12/08/24	AJW
Checked	D.Sherrit	12/08/24	DS
Approved	D.Sherrit	12/08/24	DS

Status **INFORMATION**

Scale A3 1:2500 | A3

Drawing Number 210700-205 | Rev A



Trail Section Details

Section	Segment	Name	Length (m)	Start Chainage (m)	End Chainage (m)	Description
5	5.1	New Trail	171	6358	6529	
	5.2.W	Boardwalk	14	6529	6543	New
	5.3	New Trail	7	6543	6550	
	5.4.W	Boardwalk	11	6550	6561	New
	5.5	New Trail	10	6561	6571	
	5.6.W	Boardwalk	3	6571	6574	New
	5.7	New Trail	53	6574	6627	
	5.8.B	Bridge	24	6627	6651	New over Mangawhero River
	5.9	New Trail	28	6651	6679	
	5.10.W	Boardwalk	10	6679	6689	New
	5.11	New Trail	60	6689	6749	
	5.12.W	Boardwalk	12	6749	6761	New
	5.13	New Trail	221	6761	6982	
	5.14.W	Boardwalk	3	6982	6985	New
	5.15	New Trail	326	6985	7311	
	5.16.W	Boardwalk	5	7311	7316	New
	5.17	New Trail	1022	7316	8338	
	5.18	New Trail	9	8338	8347	Ohakune Mountain Road intersection
	5.19	New Trail	756	8347	9103	
	5.20.W	Boardwalk	8	9103	9111	New
	5.21	New Trail	474	9111	9585	
6	6.1	Existing formed trail	973	9585	10558	Existing Blyth Track
	6.2	Boardwalk	20	10558	10578	New
	6.3	Existing formed trail	486	10578	11064	Existing Blyth Track
	6.4.W	Boardwalk	20	11064	11084	New
	6.5	Existing formed trail	9	11084	11093	Existing Blyth Track
	6.6.W	Boardwalk	11	11093	11104	New
	6.7	Existing formed trail	108	11104	11212	Existing Blyth Track
	6.8.W	Boardwalk	10	11212	11222	New
	6.9	Existing formed trail	27	11222	11249	Existing Blyth Track
	6.10.W	Boardwalk	14	11249	11263	New
	6.11	Existing formed trail	333	11263	11596	Existing Blyth Track
	6.12	New Trail	72	11596	11668	Deviation
	6.13	Existing formed trail	220	11668	11888	Existing Blyth Track
	6.14.B	Bridge	10	11888	11898	New Deck Only
	6.15.W	Boardwalk	23	11898	11921	New
	6.16	Existing formed trail	277	11921	12198	Existing Blyth Track
	6.17	New Trail	166	12198	12364	Deviation
	6.18	Existing formed trail	890	12364	13254	Existing Blyth Track
	6.19.W	Boardwalk	34	13254	13288	New
	6.2	Existing formed trail	207	13288	13495	Existing Blyth Track
	6.21.W	Boardwalk	3	13495	13498	New
	6.22	Existing formed trail	24	13498	13522	Existing Blyth Track
	6.23.W	Boardwalk	31	13522	13553	New
	6.24	Existing formed trail	22	13553	13575	Existing Blyth Track
	6.25.W	Boardwalk	3	13575	13578	New
	6.26	Existing formed trail	14	13578	13592	Existing Blyth Track
	6.27.B	Bridge	5	13592	13597	New
	6.28	Existing formed trail	34	13597	13631	Existing Blyth Track
	6.29.B	Bridge	4	13631	13635	New
	6.3	Existing formed trail	26	13635	13661	Existing Blyth Track
	6.31.B	Bridge	6	13661	13667	New
	6.32	Existing formed trail	57	13667	13724	Existing Blyth Track
	6.33.W	Boardwalk	3	13724	13727	New
	6.34	Existing formed trail	148	13727	13875	Existing Blyth Track
	6.35.W	Boardwalk	4	13875	13879	New
	6.36	Existing formed trail	104	13879	13983	Existing Blyth Track
	6.37.W	Boardwalk	6	13983	13989	New
	6.38	Existing formed trail	45	13989	14034	Existing Blyth Track
7	7.1	New Trail	90	14034	14124	
	7.2.B	Bridge	8	14124	14132	New
	7.3	New Trail	106	14132	14238	
	7.4.W	Boardwalk	8	14238	14246	New
	7.5	New Trail	227	14246	14473	
	7.6.W	Boardwalk	12	14473	14485	New
	7.7	New Trail	346	14485	14831	
	7.8.B	Bridge	15	14831	14846	New
	7.9	New Trail	67	14846	14913	
	7.10.W	Boardwalk	5	14913	14918	New
	7.11	New Trail	22	14918	14940	
	7.12.W	Boardwalk	4	14940	14944	New
	7.13	New Trail	74	14944	15018	
	7.14.W	Boardwalk	6	15018	15024	New
	7.15	New Trail	110	15024	15134	Intersection with Waitonga Falls Track
8	8.1.W	Boardwalk	17	15134	15151	New
	8.2	New Trail	5	15151	15156	
	8.3.B	Bridge	20	15156	15176	New over Mangawhero River
	8.4	New Trail	509	15176	15685	
	8.5.W	Boardwalk	20	15685	15705	New
	8.6	New Trail	154	15705	15859	
	8.7.W	Boardwalk	7	15859	15866	New
	8.8	New Trail	69	15866	15935	
	8.9.W	Boardwalk	25	15935	15960	New elevated and barriered
	8.10.W	Boardwalk	174	15960	16134	New, 15m barrier
	8.11	New Trail	127	16134	16261	
	8.12.W	Boardwalk	25	16261	16286	New
	8.13	New Trail	34	16286	16320	
	8.14.W	Boardwalk	195	16320	16515	New
	8.15	New Trail	105	16515	16620	
9	9.1.B	Bridge	14	16620	16634	New over Mangawhero River
	9.2	New Trail	158	16634	16792	
	9.3.B	Bridge	19	16792	16811	New over Mangawhero River
	9.4	New Trail	42	16811	16853	
	9.5.W	Boardwalk	16	16853	16869	New
	9.6	New Trail	69	16869	16938	
	9.7.W	Boardwalk	57	16938	16995	New
	9.8	New Trail	13	16995	17008	
	9.9.W	Boardwalk	50	17008	17058	New with 30m barrier
	9.1	New Trail	10	17058	17068	
	9.11.W	Boardwalk	85	17068	17153	New barriered
	9.12	New Trail	191	17153	17344	
	9.13.B	Bridge	14	17344	17358	New
	9.14	New Trail	7	17358	17365	
	9.15.W	Boardwalk	13	17365	17378	New
	9.16	New Trail	70	17378	17448	
	9.17.W	Boardwalk	46	17448	17494	New barriered
	9.18	New Trail	31	17494	17525	
	9.19.W	Boardwalk	85	17525	17610	New
	9.2	New Trail	62	17610	17672	
	9.21.W	Boardwalk	10	17672	17682	New
	9.22	New Trail	105	17682	17787	
	9.23.W	Boardwalk	12	17787	17799	New
	9.24	New Trail	63	17799	17862	
	9.25.W	Boardwalk	30	17862	17892	New
	9.26	New Trail	34	17892	17926	
	9.27.W	Boardwalk	36	17926	17962	New
	9.28	New Trail	51	17962	18013	
	9.29.W	Boardwalk	46	18013	18059	New
	9.3	New Trail	119	18059	18178	
	9.31.W	Boardwalk	340	18178	18518	New barriered
	9.32	New Trail	21	18518	18539	Massey Hut - Trail End 18.5km

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Rev	Date	Amendment	By	Chk	App
A	12/08/24	First Issue	AJW	DS	DS

Project Title

Ruapehu WorX Limited:
Te Ara Mangawhero Trail

Drawing Title

Phase Two Construction
Engineering Table

Surveyed	D.Sherrit	Sept-Nov 23	DS
Designed	C.J.Olmi	01/12/23	CJO
Drawn	A.White	12/08/24	AJW
Checked	D.Sherrit	12/08/24	DS
Approved	D.Sherrit	12/08/24	DS

Status **INFORMATION**

Scale A3 Not To Scale | A3

Drawing Number 210700-206 | Rev A

Appendix 2

Site Photography


Bridge 6.27


Bridge 6.27


Bridge 6.27


Bridge 6.28


Bridge 6.28


Bridge 6.28


Bridge 6.31


Bridge 6.31


Bridge 9.1


Bridge 9.1


Bridge 9.3


Bridge 9.3


Bridge 9.3

Appendix 3

Calculations

3.2 sq km

Bridge 8.3

Bridge 8.3 Catchment Area

Grid squares: 1 × 1 km Map series: Topo50 NZTM

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NZ Topo Map www.topomap.co.nz

bivouac/outdoor COMMITTED TO ADVENTURE

20.4 sq km

Bridge 5.8 Catchment Area

Bridge 5.8

Grid squares: 1 × 1 km Map series: Topo50 NZTM

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NZ Topo Map www.topomap.co.nz

bivouac/outdoor COMMITTED TO ADVENTURE

2.2 sq km

9.3

9.1

Bridges 9.1 and 9.3 Catchment Area's

Grid squares: 1 × 1 km Map series: Topo50 NZTM

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NZ Topo Map www.topomap.co.nz

bivouac/outdoor COMMITTED TO ADVENTURE

Bridges 6.27, 6.29, 6.31 and 7.2 Catchment Area's

6.27

6.29

2

6.31

5.8

Grid squares: 1 × 1 km Map series: Topo50 NZTM

NZTopo sourced from LINZ - Crown Copyright Reserved

NZ Topo Map www.topomap.co.nz

bivouac/outdoor COMMITTED TO ADVENTURE

HIRDS V4 Depth-Duration-Frequency Results
Sitename: Custom Location
Coordinate system: WGS84
Longitude: 175.3899
Latitude: -39.287
DDF Model

Parameter:	c	d	e	f	g	h	i
Values:	-0.00909	0.435441	0.004617	-0.00136	0.250452	-0.00778	2.881716

Example:	Duration (h	ARI (yrs)	x	y	Rainfall Depth (mm)
	24	100	3.178054	4.600149	167.8677

Rainfall depths (mm) :: Historical Data

ARI	AEP	10m	20m	30m	1h	2h	6h	12h	24h	48h	72h	96h	120h
1.58	0.633	8.36	11.1	13.2	17.8	24.2	39.2	53	71.4	95.3	112	126	137
2	0.5	9.22	12.2	14.5	19.5	26.4	42.7	57.6	77.4	103	121	136	148
5	0.2	12.3	16.2	19.1	25.5	34.3	54.7	73.4	97.9	129	152	169	184
10	0.1	14.7	19.2	22.7	30.1	40.3	63.8	85.2	113	149	174	194	211
20	0.05	17.2	22.5	26.5	35.1	46.6	73.4	97.5	129	169	197	219	237
30	0.033	18.9	24.6	28.9	38.1	50.5	79.2	105	138	181	210	234	253
40	0.025	20.1	26.1	30.6	40.3	53.4	83.5	110	145	189	220	245	265
50	0.02	21	27.3	32	42.1	55.7	86.8	115	151	196	228	253	274
60	0.017	21.8	28.4	33.2	43.6	57.6	89.6	118	155	202	234	260	281
80	0.013	23.2	30	35.1	46	60.6	94.1	124	162	211	244	271	293
100	0.01	24.2	31.3	36.6	47.9	63	97.7	128	168	218	252	280	302
250	0.004	28.8	37	43.1	56.1	73.4	113	147	191	247	285	315	340

Rainfall depths (mm) :: RCP6.0 for the period 2081-2100

ARI	**AEP**	**10m**	**20m**	**30m**	**1h**	**2h**	**6h**	**12h**	**24h**	**48h**	**72h**	**96h**	**120h**
1.58	**0.633**	**9.98**	**13.3**	**15.8**	**21.3**	**28.6**	**45.2**	**60**	**79.5**	**104**	**122**	**136**	**147**
2	**0.5**	**11**	**14.7**	**17.4**	**23.4**	**31.4**	**49.5**	**65.6**	**86.5**	**113**	**132**	**147**	**160**
5	**0.2**	**14.8**	**19.6**	**23.1**	**30.9**	**41.1**	**64.1**	**84.4**	**110**	**144**	**167**	**185**	**200**
10	**0.1**	**17.8**	**23.4**	**27.5**	**36.6**	**48.5**	**75.1**	**98.4**	**128**	**166**	**192**	**213**	**230**
20	**0.05**	**21**	**27.4**	**32.2**	**42.7**	**56.3**	**86.7**	**113**	**146**	**189**	**218**	**241**	**260**
30	**0.033**	**23**	**30**	**35.2**	**46.4**	**61.1**	**93.7**	**122**	**157**	**202**	**233**	**258**	**278**
40	**0.025**	**24.5**	**31.8**	**37.3**	**49.1**	**64.6**	**98.9**	**128**	**165**	**212**	**245**	**270**	**291**
50	**0.02**	**25.7**	**33.4**	**39**	**51.4**	**67.5**	**103**	**133**	**171**	**220**	**253**	**279**	**301**
60	**0.017**	**26.7**	**34.6**	**40.5**	**53.2**	**69.8**	**106**	**137**	**177**	**226**	**261**	**287**	**309**
80	**0.013**	**28.3**	**36.7**	**42.8**	**56.2**	**73.6**	**112**	**144**	**185**	**237**	**272**	**299**	**322**
100	**0.01**	**29.6**	**38.3**	**44.7**	**58.5**	**76.5**	**116**	**150**	**191**	**244**	**281**	**309**	**332**
250	**0.004**	**35.1**	**45.2**	**52.6**	**68.5**	**89.1**	**134**	**171**	**218**	**277**	**317**	**348**	**374**

Rainfall depths (mm) :: RCP8.5 for the period 2081-2100

ARI	AEP	10m	20m	30m	1h	2h	6h	12h	24h	48h	72h	96h	120h
1.58	0.633	10.9	14.6	17.3	23.3	31.1	48.7	64	84.3	110	127	141	153
2	0.5	12.1	16.1	19.1	25.7	34.4	53.5	70.3	91.8	119	139	154	167
5	0.2	16.3	21.5	25.4	34	45.1	69.6	90.8	118	152	176	194	210
10	0.1	19.6	25.8	30.3	40.3	53.3	81.6	106	137	176	203	224	242
20	0.05	23.2	30.3	35.6	47.1	62	94.4	122	156	200	230	254	273
30	0.033	25.4	33.1	38.8	51.3	67.3	102	131	168	215	247	272	292
40	0.025	27	35.2	41.2	54.3	71.2	108	139	177	225	259	284	306
50	0.02	28.4	36.9	43.2	56.8	74.3	112	144	183	234	268	295	316
60	0.017	29.5	38.2	44.7	58.8	76.9	116	149	189	240	276	303	325
80	0.013	31.3	40.5	47.4	62.1	81.1	122	156	198	252	288	316	339
100	0.01	32.7	42.3	49.4	64.7	84.3	127	162	205	260	297	326	350
250	0.004	38.9	50	58.2	75.8	98.2	146	186	234	295	336	368	393

Catchment Characteristics	Runoff-Producing Characteristics			
Rainfall Intensity	(0.15) 50 - 25mm per hour	(0.10) 25 - 13 mm per hour	(0.05) 13 mm per hour	(0) Below 13 mm per hour
Relief	(0.10) Steep rugged country with average slopes above 20%	(0.05) Hilly with average slopes of 10 - 20%	(0) Rolling with average slopes of 5 - 10%	(0) Relatively flat with average slope 0 - 5%
Surface retention, stream and surface storage	(0.25) Negligible; few surface depressions; watercourses steep with thin film of overland flow	(0.15) Well defined system of small watercourses	(0.10) Considerable surface depressions; overland flow is significant; some farm ponds and swamps; some contour banks and furrows	(0.05) Poorly defined & meandering stream course; large surface storage
Infiltration	(0.25) No effective soil cover; either solid rock or thin mantel of negligible infiltration capacity	(0.20) Slow water infiltration; e.g. solodic soils when surface sealed or saturated	(0.15) Loam soils or well structured clay soils; e.g. rendzinas	(0.10) Deep sands or well aggregated soil, e.g. organic/peaty soils
Cover	(0.30) No effective plant cover	(0.20) Sheet eroded native pasture; less than 10% of area under good native or improved pasture; clean cultivated crops	(0.15) About 50% of area with Improved cover; not more than 50% cultivation; open scrub	(0.05) About 90% of area with Improved pastures; very leafy bushy vegetation

Notes: The procedure for estimating C is:

1.
(a) for each of the 5 listed catchment characteristics, select or interpolate a value representative of the catchment from the values in brackets;
(b) sum the five values

2. Reduce C by 10% to allow for Interception in dense forest (i.e. rain forest).
3. Taken from Turner[14] (1960) and modified.

Table 4.3 Estimation of the Runoff Coefficient C for Use with the Rational Formula for Catchments from 2.5 to 25 km²

AEP 1% storm event.

0.15 + 0.05 + 0.15 + 0.15 + 0.05 = 0.55 less 10%
= 0.5

Catchment Characteristics	Runoff-Producing Characteristics			
Rainfall Intensity	(0.30) 75 - 100 mm per hour	(0.25) 50 - 75 mm per hour	(0.15) 25 - 50 mm per hour	(0.05) 25 mm per hour
Relief	(0.10) Steep rugged country with ave. slope above 20%	(0.05) Hilly with average slopes of 10% - 20%	(0) Rolling with average slopes of 5 - 10%	(0) Relatively flat land with average slope 0 - 5%
Surface retention stream and surface storage	(0.10) Negligible; few surface depressions; watercourses steep with thin film of overland flow	(0.05÷) Well defined system of small watercourses	(0.05) Considerable surface depressions; overland flow is significant; some farm ponds and swamps; some contour banks and furrows	(0) Poorly defined & meandering stream courses; large surface storage
Infiltration	(0.25) No effective soil cover; either solid rock or thin mantle of negligible infiltration capacity	(0.20) Slow water infiltration; e.g. solodic soils when surface sealed or saturated	(0.10) Loam soils or well structured clay soils; e.g. rendzinas	(0.05) Deep sands or well aggregated soil e.g.organic/peaty soils
Cover	(0.25) No effective plant cover	(0.20) Sheet eroded native pasture; less than 10% of area under good native or Improved pasture; clean cultivated crops	(0.10) About 50% of area with Improved cover; not more than 50% cultivation; open scrub	(0.05) About 90% of area with Improved pasture; very leafy bushy vegetation

Notes: The procedure for estimating C is:

1.
(a) for each of the 5 listed catchment characteristics, select or interpolate a value representative of the catchment from the values in brackets;
(b) sum the five values

2. Reduce C by 10% to allow for Interception in dense forest (i.e. rain forest).
3. Taken from Turner[14] (1960) and modified.

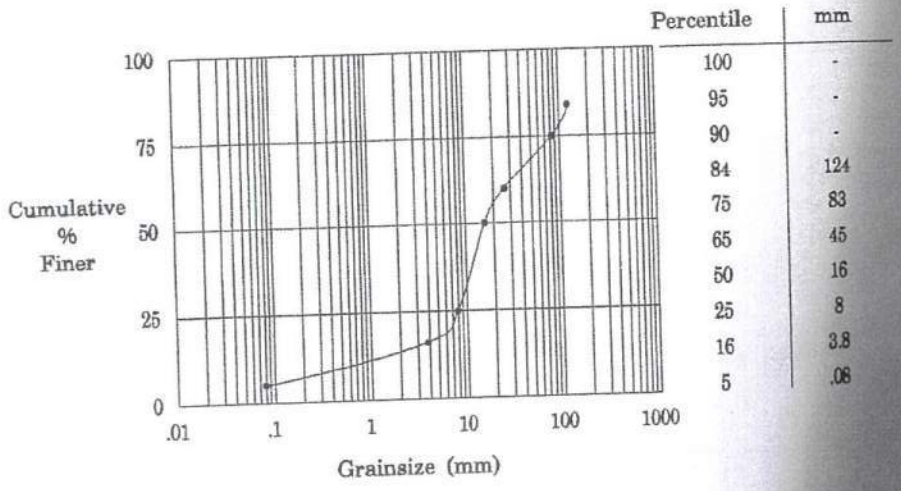
Table 4.2 Estimation of the Runoff Coefficient C for Use with the Rational Formula for Catchments less than 2.5 km²

33347: Wanganui at TePorere.

Map reference:- T19:344368 (Metric); N112:087944 (Yard).
Catchment area:- 28.2 km^2.
Period of record:- January 1966 - Present.
Mean annual flood:- 29.8 m^3/s.
Mean flow:- 1.3 m^3/s.

Surveyed reach:-
Cross-sections:- 2 along a 85 m reach.
Manning's n range:- 0.059-0.18
Channel description:- Bed consists of cobbles and small boulders. Banks are lined with native flaxes and bushes.

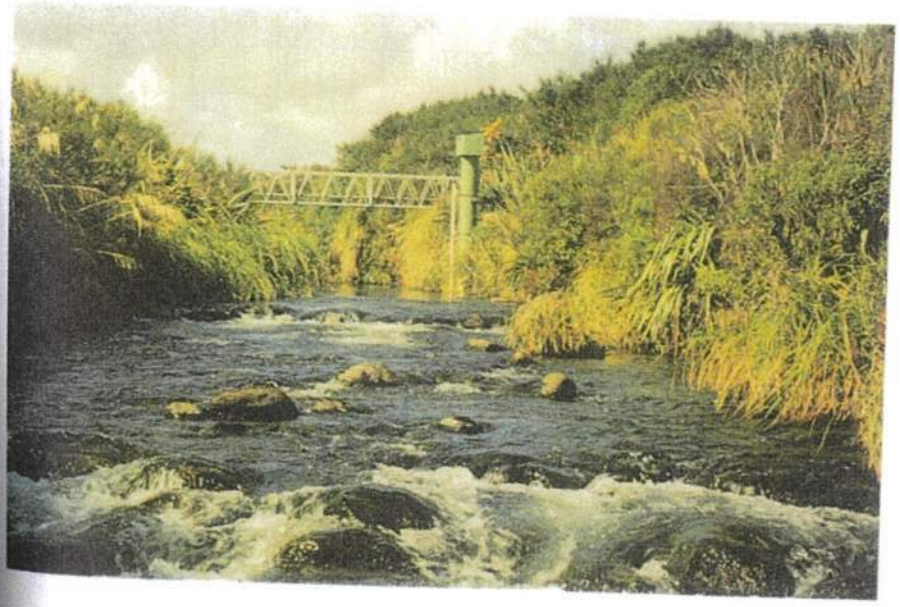
Bed Surface Material



Percentile	mm
100	-
95	-
90	-
84	124
75	83
65	45
50	16
25	8
16	3.8
5	.08



View downstream from middle of reach.



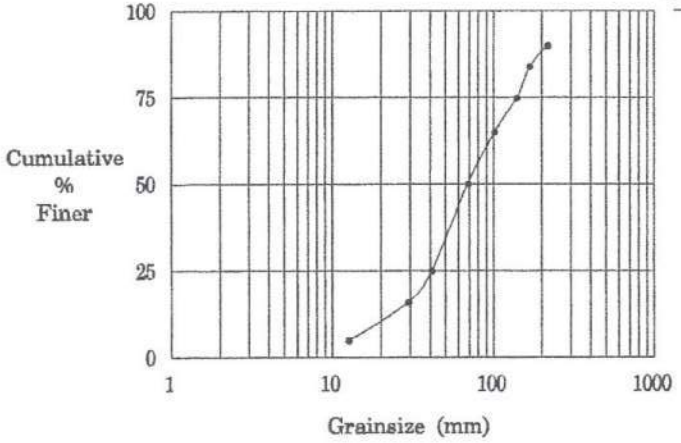
View upstream from middle of reach.

90605: Butchers Creek at Lake Kaniere Road.

Map reference:- J33:534242 (Metric); S058:630487 (Yard).
Catchment area:- 3.9 km².
Period of record:- July 1971 - Present.
Mean annual flood:- 25.3 m³/s.
Mean flow:- 0.35 m³/s.

Surveyed reach:-
Cross-sections:- 5 along a 103 m reach.
Manning's n range:- 0.032-0.31
Channel description:- Bed material ranges from pebbles to large cobbles. Banks are thickly bushed, with trees overhanging channel.

Bed Surface Material



Percentile	mm
100	-
95	-
90	218
84	168
75	140
65	101
50	69.3
25	41
16	29.4
5	12.6



View upstream at top cross-section.



View upstream from bottom cross-section.

Hydrological Catchment Analysis

Stream Name: **Mangawhero River**
Reference: Bridge 5.8
Location: **Date:** 13-Aug-24
Calculated: Tenisia Chidzurira

Technical Memorandum 61

Catchment Data

Catchment Area	A	km^2	20.40
Direct length	L_d	km	11.90
Stream length	L	km	13.32
Average slope	S_a	m/m	0.150
Height difference	H	m	1000

Calculation of Av. Channel Slope
Equal Area Method

Distance (metres)	Elevation (metres)	Area
0	780	
420	800	331800
1853	860	1189390
2900	940	942300
4000	1000	1067000
5887	1100	1981350
6869	1200	1129300
7830	1300	1201250
8682	1400	1150200
9680	1500	1447100
10636	1600	1481800
11244	1700	1003200
11647	1800	705250
12027	1900	703000
12450	2000	824850
12777	2100	670350
13058	2200	604150
13315	2300	578250
Average slope (S_a)		0.075
S_a as %		7.47

Time of Concentration

Ramser-Kirpich Eq.	Tc_1	min	60.7	3.66	m/s
Bransby Williams Eq.	Tc_2	min	237.4	0.93	m/s
U.S. Soil Con. Servic	Tc_3	min	79.2	2.80	m/s
	Ave.	min	125.7	1.76	m/s
	Use	min	70.0	1.31	m/s

TM61 Catchment Characteristics

Surface Characteristic	W_{ic}		0.6
Slope Factor	W_s		96.3
$W_s \times W_{ic}$	W		57.8
Discharge coefficient	C		1370
Standard rainfal depth		mm	76.9
A/L_d^2	K		0.144
Shape factor	S		0.47

Absorbant soil, 100% of area in long grass, scrub or bush

Rainfall data

Interpolation of HIRDS V4
RCP8.5

Duration	2 year	5 year	10 year	20 year	50 year	100 year
	Design Rainfall Depth (mm)					
60 minutes	25.7	34	40.3	47.1	56.8	64.7
70 minutes	27	36	42	50	60	68
120 minutes	34.4	45.1	53	62	74.3	84.3

Run-off Calculation

		2 year	5 year	10 year	20 year	50 year	100 year
Rainfall Factor	R	0.35	0.47	0.55	0.64	0.78	0.88
Peak Flow	$Q_{p\ m^3/s}$	**30.3**	**40.0**	**47.4**	**55.4**	**66.7**	**75.9**

Rational Method

Run-off Calculation

		2 year	5 year	10 year	20 year	50 year	100 year
Area	A ($km^{2)}$	20.4	20.4	20.4	20.4	20.4	20.4
Runoff Coefficient	C	0.45	0.5	0.5	0.5	0.5	0.5
Rainfall Intensity	I (mm/h)	23	31	36	43	51	58
Peak Flow	**Q**p m^3/s	**59.3**	**87.1**	**103.1**	**120.4**	**145.0**	**165.1**

Modified Rational Method

Run-off Calculation

		2 year	5 year	10 year	20 year	50 year	100 year
Shape Factor	S	0.60	0.60	0.60	0.60	0.60	0.60
Area Factor	F	0.91	0.91	0.91	0.91	0.91	0.91
Peak Flow	**Q**p m^3/s	**32.3**	**47.3**	**56.1**	**65.5**	**78.8**	**89.7**

Flood Frequency in New Zealand

National Contour Map

Area	A	km^2	20.4
$Q/A^{0.8}$ Contour			3
Mean Annual Flood	Q_1	m^3/s	33.5
Q_{100} Flood Contour			2.0
Peak Discharge	Q_{100}	m^3/s	**67.0**

Local Gauge Data

Gauge name	Mangawhero River @ Hagley's		
Climate change adjustment	8.5	RCP	16%
Catchment	A	km^2	70.2

		2 year	5 year	10 year	20 year	50 year	100 year
Gauge data	**Q**gauge m^3/s	46.6	57.7	66.7	75.4	86.6	94.9
Climate change adjusted gauge flow	Qc m^3/s	54.1	66.9	77.4	87.5	100.4	110.1
Peak Flow	**Q**p m^3/s	**20.1**	**24.9**	**28.8**	**32.5**	**37.4**	**41.0**

Selected Run-off Estimation:

		2 year	5 year	10 year	20 year	50 year	100 year
Modified Rational Method	**Q**p m^3/s	**32.3**	**47.3**	**56.1**	**65.5**	**78.8**	**89.7**

Hydrological Catchment Analysis

Stream Name: **Tributary to Mangawhero River**
Reference: Bridge 6.27
Location: **Date:** 13-Aug-24
Calculated: Tenisia Chidzurira

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Catchment Data

Catchment Area	A	km^2	0.10
Direct length	L_d	km	0.50
Stream length	L	km	0.60
Average slope	S_a	m/m	0.117
Height difference	H	m	100

Calculation of Av. Channel Slope
Equal Area Method

Distance (metres)	Elevation (metres)	Area
0	1160	
200	1180	234000
400	1200	238000
500	1220	121000
600	1260	124000
Average slope (S_a)		0.117
S_a as %		11.67

Time of Concentration

Ramser-Kirpich Eq.	Tc_1	min	6.1	1.63	m/s
Bransby Williams Eq.	Tc_2	min	15.5	0.64	m/s
U.S. Soil Con. Servic	Tc_3	min	5.4	1.87	m/s
Ave.		min	9.0	1.11	m/s
Use		min	10.0	1.00	m/s

TM61 Catchment Characteristics

Surface Characteristi	W_{ic}		0.6
Slope Factor	W_s		34.7
W_s x W_{ic}	W		20.8
Discharge coefficient	C		180
Standard rainfal depth		mm	76.9
A/L_d^2	K		0.400
Shape factor	S		0.47

Absorbant soil, 100% of area in long grass, scrub or bush

Rainfall data

Interpolation of HIRDS V4
RCP8.5

Duration	2 year	5 year	10 year	20 year	50 year	100 year
	Design Rainfall Depth (mm)					
10 minutes	9.1	12.3	14.9	17.7	21.9	25.4
10 minutes	9	12	15	18	22	25
20 minutes	12.2	16.5	20	23.4	28.8	33.3

Run-off Calculation

		2 year	5 year	10 year	20 year	50 year	100 year
Rainfall Factor	R	0.12	0.16	0.19	0.23	0.28	0.33
Peak Flow	$Q_{p\ m^3/s}$	**0.0**	**0.0**	**0.0**	**0.0**	**0.1**	**0.1**

Rational Method

Run-off Calculation

		2 year	5 year	10 year	20 year	50 year	100 year
Area	A (km^2)	0.1	0.1	0.1	0.1	0.1	0.1
Runoff Coefficient	C	0.45	0.45	0.45	0.5	0.5	0.5
Rainfall Intensity	I (mm/h)	55	74	89	106	131	152
Peak Flow	**Q**p m^3/s	**0.7**	**0.9**	**1.1**	**1.5**	**1.8**	**2.1**

Modified Rational Method

Run-off Calculation

		2 year	5 year	10 year	20 year	50 year	100 year
Shape Factor	S	0.43	0.43	0.43	0.43	0.43	0.43
Area Factor	F	1.00	1.00	1.00	1.00	1.00	1.00
Peak Flow	**Q**p m^3/s	**0.3**	**0.4**	**0.5**	**0.6**	**0.8**	**0.9**

Flood Frequency in New Zealand

National Contour Map

Area: A = 0.1 km^2

Local Gauge Data

Gauge name: Mangawhero River
Climate change adjustment: 8.5 RCP 16%
Catchment: A = 70.2 km^2

		2 year	5 year	10 year	20 year	50 year	100 year
Gauge data	**Q**gauge m^3/s	6.7	7.5	9.0	10.5	13.1	15.3
Climate change adjusted gauge flow	Qc m^3/s	7.7	8.7	10.4	12.2	15.1	17.8
Peak Flow	**Q**p m^3/s	**0.0**	**0.0**	**0.1**	**0.1**	**0.1**	**0.1**

Selected Run-off Estimation:

		2 year	5 year	10 year	20 year	50 year	100 year
Rational Method	**Q**p m^3/s	**0.7**	**0.9**	**1.1**	**1.5**	**1.8**	**2.1**

Hydrological Catchment Analysis

Stream Name: **Tributary to Mangawhero River**
Reference: Bridge 6.29
Location: **Date:** 13-Aug-24
Calculated: Tenisia Chidzurira

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Catchment Data

Catchment Area	A	km^2	0.10
Direct length	L_d	km	0.60
Stream length	L	km	0.70
Average slope	S_a	m/m	0.131
Height difference	H	m	80

Calculation of Av. Channel Slope
Equal Area Method

Distance (metres)	Elevation (metres)	Area
0	1160	
200	1180	234000
400	1220	240000
600	1240	246000
700	1240	124000

Hydrological Catchment Analysis

Stream Name: **Tributary to Mangawhero River**
Reference: Bridge 6.31
Location: **Date:** 15-Aug-24
Calculated: Tenisia Chidzurira

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Catchment Data

Catchment Area	A	km^2	0.10
Direct length	L_d	km	0.60
Stream length	L	km	0.80
Average slope	S_a	m/m	0.106
Height difference	H	m	70

Calculation of Av. Channel Slope
Equal Area Method

Distance (metres)	Elevation (metres)	Area
0	1170	
200	1210	238000
400	1215	242500
600	1220	243500
800	1240	246000
Average slope (S_a)		0.106
S_a as %		10.63

Time of Concentration

Ramser-Kirpich Eq.	Tc_1	min	7.9	1.68	m/s
Bransby Williams Eq.	Tc_2	min	23.5	0.57	m/s
U.S. Soil Con. Servic	Tc_3	min	8.6	1.56	m/s
	Ave.	min	13.4	1.00	m/s
	Use	min	14.0	0.95	m/s

TM61 Catchment Characteristics

Surface Characteristic	W_{ic}		0.6
Slope Factor	W_s		37.5
W_s x W_{ic}	W		22.5
Discharge coefficient	C		210
Standard rainfal depth		mm	76.9
A/L_d^2	K		0.278
Shape factor	S		0.47

Absorbant soil, 100% of area in long grass, scrub or bush

Rainfall data

Interpolation of HIRDS V4
RCP8.5

Duration	2 year	5 year	10 year	20 year	50 year	100 year
	Design Rainfall Depth (mm)					
10 minutes	12.1	16.3	19.6	23.2	28.4	32.7
14 minutes	14	18	22	26	32	37
20 minutes	16.1	21.5	26	30.3	36.9	42.3

Run-off Calculation

		2 year	5 year	10 year	20 year	50 year	100 year
Rainfall Factor	R	0.18	0.24	0.29	0.34	0.41	0.48
Peak Flow	**Q_p m^3/s**	**0.0**	**0.1**	**0.1**	**0.1**	**0.1**	**0.1**

Rational Method

Run-off Calculation

		2 year	5 year	10 year	20 year	50 year	100 year
Area	A (km^2)	0.1	0.1	0.1	0.1	0.1	0.1
Runoff Coefficient	C	0.32	0.32	0.41	0.41	0.45	0.45
Rainfall Intensity	I (mm/h)	59	79	95	112	136	157
Peak Flow	**Q**p m^3/s	**0.5**	**0.7**	**1.1**	**1.3**	**1.7**	**2.0**

Modified Rational Method

Run-off Calculation

		2 year	5 year	10 year	20 year	50 year	100 year
Shape Factor	S	0.43	0.43	0.43	0.43	0.43	0.43
Area Factor	F	1.00	1.00	1.00	1.00	1.00	1.00
Peak Flow	**Q**p m^3/s	**0.2**	**0.3**	**0.5**	**0.5**	**0.7**	**0.8**

Flood Frequency in New Zealand

National Contour Map

Gauge name	Mangawhero River		
Climate change adjustment	8.5	RCP	16%
Catchment	A	km^2	70.2

		2 year	5 year	10 year	20 year	50 year	100 year
Gauge data	**Q**gauge m^3/s	6.7	7.5	9.0	10.5	13.1	15.3
Climate change adjusted gauge flow	Qc m^3/s	7.7	8.7	10.4	12.2	15.1	17.8
Peak Flow	**Q**p m^3/s	**0.0**	**0.0**	**0.1**	**0.1**	**0.1**	**0.1**

Selected Run-off Estimation:

		2 year	5 year	10 year	20 year	50 year	100 year
Rational Method	**Q**p m^3/s	**0.5**	**0.7**	**1.1**	**1.3**	**1.7**	**2.0**

Hydrological Catchment Analysis

Stream Name: **Tributary to Mangawhero River**
Reference: Bridge 7.2
Location: **Date:** 15-Aug-24
Calculated: Tenisia Chidzurira

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Catchment Data

Catchment Area	A	km^2	0.10
Direct length	L_d	km	0.60
Stream length	L	km	0.70
Average slope	S_a	m/m	0.082
Height difference	H	m	40

Calculation of Av. Channel Slope
Equal Area Method

Distance (metres)	Elevation (metres)	Area
0	1190	
200	1210	240000
300	1220	121500
400	1230	122500
500	1230	123000
600	1230	123000
700	1230	123000
Average slope (S_a)		0.082
S_a as %		8.16

Time of Concentration

Ramser-Kirpich Eq.	Tc_1	min	7.9	1.47	m/s
Bransby Williams Eq.	Tc_2	min	22.4	0.52	m/s
U.S. Soil Con. Service.	Tc_3	min	9.1	1.28	m/s
	Ave.	min	13.2	0.89	m/s
	Use	min	10.0	1.17	m/s

TM61 Catchment Characteristics

Surface Characteristic	W_{ic}		0.6
Slope Factor	W_s		32.6
W_s x W_{ic}	W		19.6
Discharge coefficient	C		159
Standard rainfall depth		mm	76.9
A/L_d^2	K		0.278
Shape factor	S		0.47

Absorbant soil, 100% of area in long grass, scrub or bush

Rainfall data

Interpolation of HIRDS V4
RCP6.0

Duration	2 year	5 year	10 year	20 year	50 year	100 year
	Design Rainfall Depth (mm)					
10 minutes	12.1	16.3	19.6	23.2	28.4	32.7
10 minutes	12	16	20	23	28	33
20 minutes	16.1	21.5	26	30.3	36.9	42.3

Run-off Calculation

		2 year	5 year	10 year	20 year	50 year	100 year
Rainfall Factor	R	0.16	0.21	0.25	0.30	0.37	0.43
Peak Flow	Q_p m^3/s	**0.0**	**0.0**	**0.0**	**0.1**	**0.1**	**0.1**

Rational Method

Run-off Calculation

		2 year	5 year	10 year	20 year	50 year	100 year
Area	A (km^2)	0.1	0.1	0.1	0.1	0.1	0.1
Runoff Coefficient	C	0.32	0.32	0.41	0.41	0.45	0.45
Rainfall Intensity	I (mm/h)	73	98	118	139	170	196
Peak Flow	**Q**p m^3/s	**0.3**	**0.4**	**0.6**	**0.7**	**0.9**	**1.1**

Flood Frequency in New Zealand

Local Gauge Data

Gauge name	Mangawhero River		
Climate change adjustment	8.5	RCP	16%
Catchment	A	km^2	70.2

		2 year	5 year	10 year	20 year	50 year	100 year
Gauge data	**Q**gauge m^3/s	6.7	7.5	9.0	10.5	13.1	15.3
Climate change adjusted gauge flow	Qc m^3/s	7.7	8.7	10.4	12.2	15.1	17.8
Peak Flow	**Q**p m^3/s	**0.0**	**0.0**	**0.1**	**0.1**	**0.1**	**0.1**

Selected Run-off Estimation:

		2 year	5 year	10 year	20 year	50 year	100 year
Rational Method	**Q**p m^3/s	**0.3**	**0.4**	**0.6**	**0.7**	**0.9**	**1.1**

Hydrological Catchment Analysis

Stream Name: **Mangawhero River**
Reference: Bridge 8.3
Location: **Date:** 15-Aug-24
Calculated: Tenisia Chidzurira

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Catchment Data

Catchment Area	A	km^2	3.20
Direct length	L_d	km	6.70
Stream length	L	km	7.50
Average slope	S_a	m/m	0.339
Height difference	H	m	1710

Calculation of Av. Channel Slope
Equal Area Method

Distance (metres)	Elevation (metres)	Area
0	1190	
200	1200	239000
400	1220	-2164185
1200	1300	1008000
1700	1340	660000
1900	1360	270000
2100	1380	274000
2300	1400	278000
2500	1420	282000
3400	1500	1314000
4200	1700	1280000
4900	1800	1225000
5500	1900	1110000
6000	2000	975000
7000	2300	2150000
7300	2400	705000
7500	2500	490000
Average slope (S_a)		0.339
S_a as %		33.87

Time of Concentration

Ramser-Kirpich Eq.	Tc_1	min	28.5	4.39	m/s
Bransby Williams Eq.	Tc_2	min	128.9	0.97	m/s
U.S. Soil Con. Service.	Tc_3	min	33.2	3.77	m/s
	Ave.	min	63.5	1.97	m/s
	Use	min	30.0	4.17	m/s

TM61 Catchment Characteristics

Surface Characteristic	W_{ic}		0.7
Slope Factor	W_s		129.4
W_s x W_{ic}	W		90.6
Discharge coefficient	C		3349
Standard rainfal depth		mm	57.4
A/L_d^2	K		0.071
Shape factor	S		0.29

Absorbant soil, 100% of area in long grass, scrub or bush

Rainfall data

Interpolation of HIRDS V4
RCP 8.5

Duration	2 year	5 year	10 year	20 year	50 year	100 year
	Design Rainfall Depth (mm)					
20 minutes	12.2	16.5	19.8	23.4	28.8	33.3
30.0 minutes	19	25	30	36	43	49
30 minutes	19.1	25.4	30	36	43.2	49.4

Run-off Calculation

		2 year	5 year	10 year	20 year	50 year	100 year
Rainfall Factor	R	0.33	0.44	0.53	0.63	0.75	0.86
Peak Flow	**$Q_{p\ m^3/s}$**	**10.6**	**14.0**	**16.7**	**19.9**	**23.9**	**27.3**

Rational Method

Run-off Calculation

		2 year	5 year	10 year	20 year	50 year	100 year
Area	A (km^2)	3.2	3.2	3.2	3.2	3.2	3.2
Runoff Coefficient	C	0.45	0.45	0.45	0.5	0.5	0.5
Rainfall Intensity	I (mm/h)	38	51	61	72	86	99
Peak Flow	**Q**p m^3/s	**15.3**	**20.3**	**24.2**	**32.0**	**38.4**	**43.9**

Modified Rational Method

Run-off Calculation

		2 year	5 year	10 year	20 year	50 year	100 year
Shape Factor	S	0.51	0.51	0.51	0.51	0.51	0.51
Area Factor	F	0.98	0.98	0.98	0.98	0.98	0.98
Peak Flow	**Q**p m^3/s	**7.7**	**10.3**	**12.2**	**16.2**	**19.4**	**22.2**

Flood Frequency in New Zealand

Local Gauge Data

Gauge name	Mangawhero River		
Climate change adjustment	8.5	RCP	16%
Catchment	A	km^2	70.2

		2 year	5 year	10 year	20 year	50 year	100 year
Gauge data	**Q**gauge m^3/s	15.9	17.8	20.9	24.4	29.8	34.6
Climate change adjusted gauge flow	Qc m^3/s	18.5	20.7	24.3	28.3	34.5	40.2
Peak Flow	**Q**p m^3/s	**1.6**	**1.7**	**2.1**	**2.4**	**2.9**	**3.4**

Selected Run-off Estimation:

		2 year	5 year	10 year	20 year	50 year	100 year
Rational Method	**Q**p m^3/s	**15.3**	**20.3**	**24.2**	**32.0**	**38.4**	**43.9**

Hydrological Catchment Analysis

Stream Name: **Mangawhero River**
Reference: Bridge 9.1
Location: **Date:** 14-Aug-24
Calculated: Tenisia Chidzurira

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Catchment Data

Catchment Area	A	km^2	1.60
Direct length	L_d	km	5.60
Stream length	L	km	6.30
Average slope	S_a	m/m	0.339
Height difference	H	m	1120

Calculation of Av. Channel Slope
Equal Area Method

Distance (metres)	Elevation (metres)	Area
0	1260	
200	1280	254000
400	1300	258000
1500	1400	1485000
1700	1420	282000
2700	1500	1460000
3000	1520	453000
3800	1600	1248000
4600	1700	1320000
5000	1800	700000
5500	1960	940000
6300	2380	1736000

Hydrological Catchment Analysis

Stream Name: **Mangawhero River**
Reference: Bridge 9.3
Location: **Date:** 14-Aug-24
Calculated: Tenisia Chidzurira

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Catchment Data

Catchment Area	A	km^2	1.60
Direct length	L_d	km	5.60
Stream length	L	km	6.30
Average slope	S_a	m/m	0.339
Height difference	H	m	1120

Calculation of Av. Channel Slope
Equal Area Method

Distance (metres)	Elevation (metres)	Area
0	1260	
200	1280	254000
400	1300	258000
1500	1400	1485000
1700	1420	282000
2700	1500	1460000
3000	1520	453000
3800	1600	1248000
4600	1700	1320000
5000	1800	700000
5500	1960	940000
6300	2380	1736000

Channel Capacity Analysis

Stream Name: **Mangawhero River**

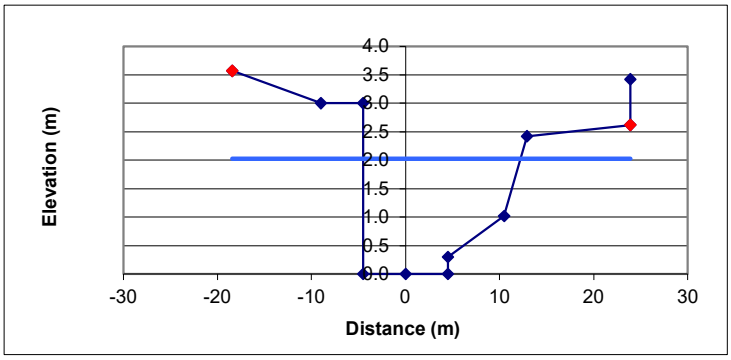
Reference:

Location: Bridge 5.8 **Date:** 15-Aug-24

Calculated: Tenisia Chidzurira

Remark: Mannings n ref: 33347: Wanganui TePorere

Slope (m/m)	0.0300
Mannings n LB	0.0660
Mannings n MC	0.0660
Mannings n RB	0.0660
Divider LB (m)	-18.43
Divider RB (m)	23.88
Water Level (m)	2.03



Coordinates		Left Bank		Main Channel		Right Bank	
Distance	Elevation	Area	Perimeter	Area	Perimeter	Area	Perimeter
(m)	(m)	(m^2)	(m)	(m^2)	(m)	(m^2)	(m)
-18.43	3.57			Above WL			
-9.00	3.00			Above WL			
-4.50	3.00			0.00	2.03		
-4.50	0.00			9.12	4.50		
0.00	0.00			9.12	4.50		
4.50	0.00			0.00	0.30		
4.50	0.30			8.15	6.00		
10.46	1.02			0.88	2.01		
12.88	2.42			Above WL			
23.88	2.62					Above WL	
23.88	3.42						
				0.00	0.00		
				0.00	0.00		
				0.00	0.00		
				0.00	0.00		
				0.00	0.00		
				0.00	0.00		
				0.00	0.00		
				0.00	0.00		
				0.00	0.00		
				0.00	0.00		
				0.00	0.00		
				0.00	0.00		
				0.00	0.00		
				0.00	0.00		
				0.00	0.00		
				0.00	0.00		
Totals		0.00	0.00	27.27	19.34	0.00	0.00
Hydraulic Radius (m)				1.41			
Velocity (m/s)				3.30			
Flow (m^3/s)		0.00		89.99		0.00	

Total Flow (m^3/s) 89.99

Channel Capacity Analysis

Stream Name: **Mangawhero Tributary**

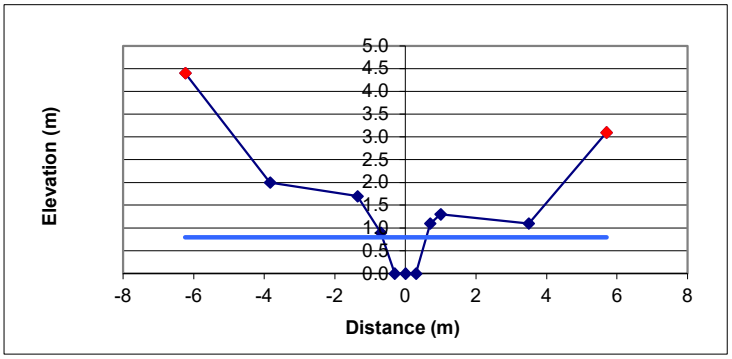
Reference:

Location: Bridge 6.27 **Date:** 15-Aug-24

Calculated: Tenisia Chidzurira

Remark: Ref: 90605: Butchers Creek at Lake Kaniere Road for Mannings

Slope (m/m)	0.1900
Mannings n LB	0.0700
Mannings n MC	0.0700
Mannings n RB	0.0700
Divider LB (m)	-6.24
Divider RB (m)	5.70
Water Level (m)	0.79



Coordinates		Left Bank		Main Channel		Right Bank	
Distance	Elevation	Area	Perimeter	Area	Perimeter	Area	Perimeter
(m)	(m)	(m^2)	(m)	(m^2)	(m)	(m^2)	(m)
-6.24	4.40						
-3.84	2.00			Above WL			
-1.36	1.70			Above WL			
-0.70	0.90			Above WL			
-0.30	0.00			0.14	0.87		
0.00	0.00			0.24	0.30		
0.30	0.00			0.24	0.30		
0.70	1.10			0.11	0.84		
1.00	1.30			Above WL			
3.50	1.10			Above WL			
5.70	3.10			Above WL			
				0.00	0.00		
				0.00	0.00		
				0.00	0.00		
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				0.00	0.00		
				0.00	0.00		
				0.00	0.00		
				0.00	0.00		
Totals		0.00	0.00	0.73	2.31	0.00	0.00
Hydraulic Radius (m)				0.32			
Velocity (m/s)				2.89			
Flow (m^3/s)		0.00		2.11		0.00	
Total Flow (m^3/s)		2.11					

Channel Capacity Analysis

Stream Name: **Mangawhero Tributary**

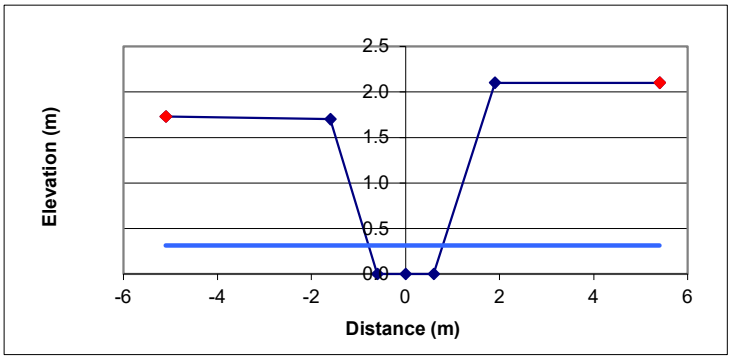
Reference:

Location: Bridge 6.29 **Date:** 15-Aug-24

Calculated: Tenisia Chidzuirra

Remark: Mannings n ref: Ref: 90605: Butchers Creek at Lake Kaniere Road for Manning

Slope (m/m)	0.6800
Mannings n LB	0.0700
Mannings n MC	0.0700
Mannings n RB	0.0700
Divider LB (m)	-5.10
Divider RB (m)	5.40
Water Level (m)	0.31



Coordinates		Left Bank		Main Channel		Right Bank	
Distance	Elevation	Area	Perimeter	Area	Perimeter	Area	Perimeter
(m)	(m)	(m^2)	(m)	(m^2)	(m)	(m^2)	(m)
-5.10	1.73			Above WL			
-1.60	1.70			0.03	0.36		
-0.60	0.00			0.19	0.60		
0.00	0.00			0.19	0.60		
0.60	0.00			0.03	0.37		
1.90	2.10			Above WL			
5.40	2.10						
				0.00	0.00		
				0.00	0.00		
				0.00	0.00		
				0.00	0.00		
				0.00	0.00		
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				0.00	0.00		
				0.00	0.00		
				0.00	0.00		
				0.00	0.00		
Totals		0.00	0.00	0.44	1.93	0.00	0.00
Hydraulic Radius (m)				0.23			
Velocity (m/s)				4.36			
Flow (m^3/s)		0.00		1.90		0.00	
Total Flow (m^3/s)		1.90					

Channel Capacity Analysis

Stream Name: **Mangawhero Tributary**

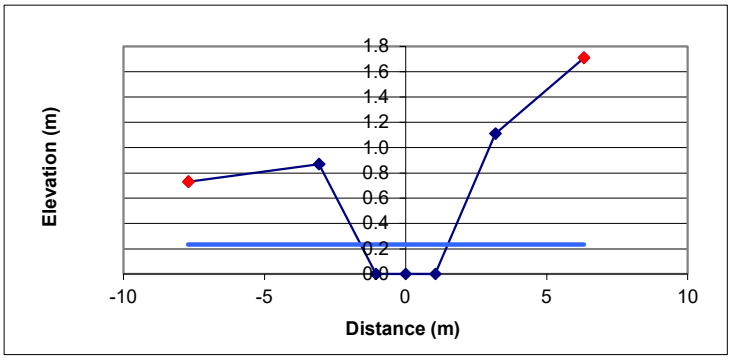
Reference:

Location: Bridge 6.31 **Date:** 15-Aug-24

Calculated: Tenisia Chidzurira

Remark: Mannings n ref: Ref: 90605: Butchers Creek at Lake Kaniere Road for Manning

Slope (m/m)	0.3400
Mannings n LB	0.0580
Mannings n MC	0.0580
Mannings n RB	0.0580
Divider LB (m)	-7.70
Divider RB (m)	6.32
Water Level (m)	0.23



Coordinates		Left Bank		Main Channel		Right Bank	
Distance	Elevation	Area	Perimeter	Area	Perimeter	Area	Perimeter
(m)	(m)	(m^2)	(m)	(m^2)	(m)	(m^2)	(m)
-7.70	0.73			Above WL			
-3.07	0.87			0.06	0.59		
-1.05	0.00			0.24	1.05		
0.00	0.00			0.24	1.05		
1.05	0.00			0.05	0.50		
3.18	1.11			Above WL			
6.32	1.71						
				0.00	0.00		
				0.00	0.00		
				0.00	0.00		
				0.00	0.00		
				0.00	0.00		
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				0.00	0.00		
				0.00	0.00		
				0.00	0.00		
				0.00	0.00		
Totals		0.00	0.00	0.60	3.19	0.00	0.00
Hydraulic Radius (m)				0.19			
Velocity (m/s)				3.31			
Flow (m^3/s)		0.00		2.00		0.00	
Total Flow (m^3/s)		2.00					

Channel Capacity Analysis

Stream Name: **Mangawhero Tributary**

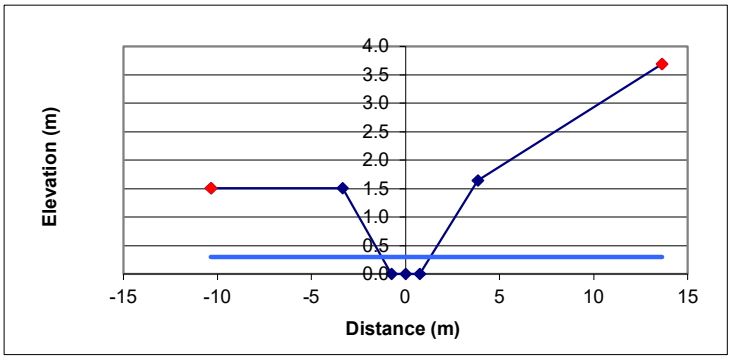
Reference:

Location: Bridge 7.2 **Date:** 16-Aug-24

Calculated: Tenisia Chidzurira

Remark: Mannings n ref: Ref: 90605: Butchers Creek at Lake Kaniere Road for Manning

Slope (m/m)	0.0820
Mannings n LB	0.0580
Mannings n MC	0.0580
Mannings n RB	0.0580
Divider LB (m)	-10.35
Divider RB (m)	13.63
Water Level (m)	0.30



Coordinates		Left Bank		Main Channel		Right Bank	
Distance	Elevation	Area	Perimeter	Area	Perimeter	Area	Perimeter
(m)	(m)	(m^2)	(m)	(m^2)	(m)	(m^2)	(m)
-10.35	1.51			Above WL			
-3.35	1.51			0.08	0.59		
-0.75	0.00			0.22	0.75		
0.00	0.00			0.22	0.75		
0.75	0.00			0.08	0.64		
3.84	1.64			Above WL			
13.63	3.69						
				0.00	0.00		
				0.00	0.00		
				0.00	0.00		
				0.00	0.00		
				0.00	0.00		
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				0.00	0.00		
				0.00	0.00		
				0.00	0.00		
Totals		0.00	0.00	0.61	2.73	0.00	0.00
Hydraulic Radius (m)				0.22			
Velocity (m/s)				1.81			
Flow (m^3/s)		0.00		1.10		0.00	
Total Flow (m^3/s)		1.10					

Channel Capacity Analysis

Stream Name: **Mangawhero River**

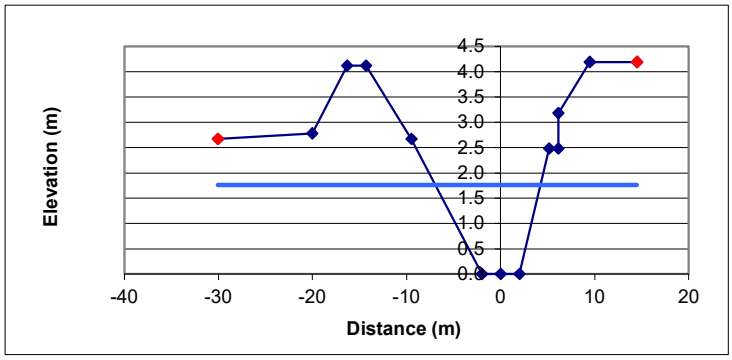
Reference:

Location: Bridge 8.3 **Date:** 16-Aug-24

Calculated: Tensia Chidzurira

Remark: Mannings n ref: 90605: Butchers Creek at Lake Kaniere Road

Slope (m/m)	0.0400
Mannings n LB	0.0650
Mannings n MC	0.0650
Mannings n RB	0.0650
Divider LB (m)	-30.04
Divider RB (m)	14.49
Water Level (m)	1.76



Coordinates		Left Bank		Main Channel		Right Bank	
Distance	Elevation	Area	Perimeter	Area	Perimeter	Area	Perimeter
(m)	(m)	(m^2)	(m)	(m^2)	(m)	(m^2)	(m)
-30.04	2.67						
-20.04	2.78			Above WL			
-16.32	4.12			Above WL			
-14.32	4.12			Above WL			
-9.50	2.67			Above WL			
-2.00	0.00			4.36	5.25		
0.00	0.00			3.52	2.00		
2.00	0.00			3.52	2.00		
5.14	2.48			1.96	2.84		
6.14	2.48			Above WL			
6.14	3.18			Above WL			
9.49	4.19			Above WL			
14.49	4.19			Above WL			
				0.00	0.00		
				0.00	0.00		
				0.00	0.00		
				0.00	0.00		
				0.00	0.00		
				0.00	0.00		
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				0.00	0.00		
				0.00	0.00		
				0.00	0.00		
				0.00	0.00		
Totals		0.00	0.00	13.37	12.09	0.00	0.00
Hydraulic Radius (m)				1.11			
Velocity (m/s)				3.29			
Flow (m^3/s)		0.00		43.97		0.00	

Total Flow (m^3/s) 43.97

Channel Capacity Analysis

Stream Name: **Mangawhero River**

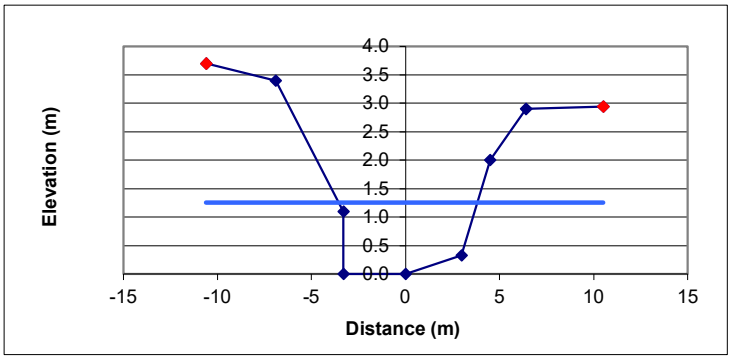
Reference:

Location: Bridge 9.1 **Date:** 16-Aug-24

Calculated: Tenisia Chidzurira

Remark: Mannings n ref: 90605: Butchers Creek at Lake Kaniere Road

Slope (m/m)	0.0500
Mannings n LB	0.0700
Mannings n MC	0.0700
Mannings n RB	0.0700
Divider LB (m)	-10.60
Divider RB (m)	10.50
Water Level (m)	1.26



Coordinates		Left Bank		Main Channel		Right Bank	
Distance	Elevation	Area	Perimeter	Area	Perimeter	Area	Perimeter
(m)	(m)	(m^2)	(m)	(m^2)	(m)	(m^2)	(m)
-10.60	3.70			Above WL			
-6.90	3.40			0.02	0.29		
-3.30	1.10			0.00	1.10		
-3.30	0.00			4.14	3.30		
0.00	0.00			3.25	3.00		
2.98	0.33			0.39	1.25		
4.50	2.00			Above WL			
6.40	2.90			Above WL			
10.50	2.94						
				0.00	0.00		
				0.00	0.00		
				0.00	0.00		
				0.00	0.00		
				0.00	0.00		
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				0.00	0.00		
				0.00	0.00		
				0.00	0.00		
				0.00	0.00		
Totals		0.00	0.00	7.80	8.94	0.00	0.00
Hydraulic Radius (m)				0.87			
Velocity (m/s)				2.92			
Flow (m^3/s)		0.00		22.77		0.00	
Total Flow (m^3/s)		22.77					

Channel Capacity Analysis

Stream Name: **Mangawhero River**

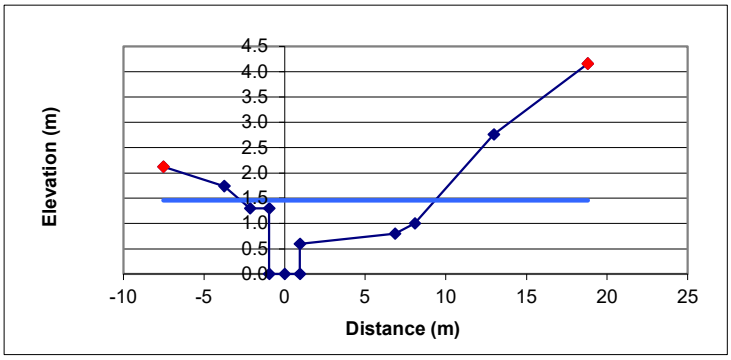
Reference:

Location: Bridge 9.3 **Date:** 16-Aug-24

Calculated: Tenisia Chidzurira

Remark: Mannings n ref.: 90605: Butchers Creek at Lake Kaniere Road

Slope (m/m)	0.0700
Mannings n LB	0.0700
Mannings n MC	0.0700
Mannings n RB	0.0700
Divider LB (m)	-7.52
Divider RB (m)	18.80
Water Level (m)	1.46



Coordinates		Left Bank		Main Channel		Right Bank	
Distance	Elevation	Area	Perimeter	Area	Perimeter	Area	Perimeter
(m)	(m)	(m^2)	(m)	(m^2)	(m)	(m^2)	(m)
-7.52	2.12			Above WL			
-3.74	1.74			0.05	0.59		
-2.15	1.30			0.19	1.20		
-0.95	1.30			0.00	1.30		
-0.95	0.00			1.39	0.95		
0.00	0.00			1.39	0.95		
0.95	0.00			0.00	0.60		
0.95	0.60			4.47	5.90		
6.85	0.80			0.68	1.24		
8.07	1.00			0.29	1.36		
12.97	2.76			Above WL			
18.80	4.16						
				0.00	0.00		
				0.00	0.00		
				0.00	0.00		
				0.00	0.00		
				0.00	0.00		
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				0.00	0.00		
				0.00	0.00		
				0.00	0.00		
Totals		0.00	0.00	8.45	14.09	0.00	0.00
Hydraulic Radius (m)				0.60			
Velocity (m/s)				2.69			
Flow (m^3/s)		0.00		22.73		0.00	
Total Flow (m^3/s)		22.73					