Memorandum

To	Otago Regional Council
Copy	
From	Kos Maas
Office	Wellington
Date	20/12/2019
File	6-CT012.00
Subject	New Beaumont Bridge – Flooding and Engineering Hazard Section 92 Request

1 Introduction

This memo presents additional information regarding the engineering and natural hazards of the New Beaumont Bridge in response to the request for Further Information received from Otago Regional Council on the 2 December 2019. Requests for further information are reproduced in bold text below with responses immediately after:

i. Future Management of Existing Bridge: Provide clarification on future management arrangements for the existing bridge to ensure the potentially adverse effects of a bridge collapse on public safety, the waterway and the new bridge structure are appropriately mitigated

We note the following with regards to the existing bridge:

- Bridge soffit level (to permanent structure and not scaffolding) is RL48.68m which provides around 1.51m freeboard to the 1% AEP flood event reducing to around 0.42m freeboard when climate effects to year 2120 are considered
- The existing bridge is currently being monitored for fatigue issues from repetitive heavy vehicle axle loading (state highway traffic). This structural concern is eliminated with the removal of traffic from the existing bridge.

The New Bridge has been designed in accordance with the NZ Transport Agency Bridge Manual including for hydrodynamic loading for the ULS flood event (1 in 1,000 year ARI with design flood level of RL 49.91m). Under this flood event the design flood level is above the bridge soffit level. The flood loading on the new bridge consists of a 3m deep x 20m wide debris raft applied near the water surface. On the critical pier, this equates to a lateral force in the order of 800kN and pier column moment in the order of 7000kNm.

In the unlikely event that the existing bridge is swept against the base of the new bridge piers (assumes that the bridge sinks) with the timber deck perpendicular to the flow (i.e. presenting the largest area on which water pressure will act), the lateral force acting on the critical pier is in the order of 2700kN. However, the column moment is in the order of 7000kNm as it is applied close to the base of the column. To meet the confinement and anti-buckling requirements for seismic design, the columns will have a shear capacity in excess of 3000kN under flood conditions.

As such, the effects of the existing bridge collapsing and impacting the new bridge are likely to be adequately accounted for by the current flood and structural design provisions and public

safety considerations can be readily managed through existing Transport Agency emergency management processes.

ii. <u>Flood Levels:</u> Clarify whether the design flood levels given in the main report and in the Appendix 5C report are affected by flow super-elevation and, if so, by how much

The proposed bridge will be located on a relatively straight section of the Clutha River downstream of a river bend (refer Figure 1 and Design Drawings attached to consent application). At the bridge location, superelevation effects are not considered significant noting that the New Bridge is downstream of the existing bridge as well as the other uncertainties in the modelling (e.g. climate effects, return periods, modelling limitations/coarseness).

Figure 1 Aerial photo showing the river alignment in the vicinity of the bridge (the proposed bridge is positioned immediately downstream of the existing bridge)

iii. Backwater Profiles and Bridge Afflux Effects:

a. The piers on both the existing and new bridges act to reduce the effective channel width and thereby cause an afflux effect which is superimposed on each backwater profile. There is no discussion in Appendix 5C report of this afflux effect. Provide comment on the afflux effect.

Afflux effects have been accounted for in the HEC-RAS model and effects are reported in Table 3-4 of the Hydraulic Assessment Report.

As per the Hydraulic Assessment Report, the results show that the effect of the proposed SH8 Bridge across the Clutha River will have a less than minor effect on the flood risk upstream of the existing SH8 Bridge. The maximum increase in flood level for the scenarios considered is 0.10m, which is within the model error range.

b. The site is likely to give rise to a large woody debris load conveyed by the river under flood conditions. The potential for debris raft formation on the piers of both the existing and new bridges is therefore fairly high. While the bridge afflux due to the piers alone may not be significant, the afflux due to debris raft formation on each bridge pier is potentially very significant. Provide an assessment on this.

The New Bridge has been designed with the bridge piers aligned downstream of the existing bridge piers to minimise restriction of the waterway and enable founding on the prominent rock outcrop which runs in the direction of the river flow (refer Design Drawings submitted with consent application). The New Bridge piers also offer a much smaller restriction to the waterway compared to the existing bridge. Therefore, the flood effects due to debris raft formation on the New bridge won't have a significant effect on flood flows which will be controlled by debris formations on the existing bridge piers which provide a much greater impediment to woody debris.

iv. Freeboard:

a. The estimated freeboard for the Serviceability Limit State (SLS) flood at the critical location on the soffit of the new bridge (on the downstream side of the deck at the left abutment) appears to be less than the minimum freeboard allowance of 1.2 m recommended in the NZTA Bridge Manual where there is a possibility of large trees being conveyed down the waterway by flood flows. There is no indication in the supporting technical reports that the bridge designer has sought a departure from the design freeboard standard from NZTA and that this non-compliance is acceptable. Provide discussion on this.

A departure has been accepted by the Transport Agency for reduced freeboard to the bridge soffit. The design provides 1.2m freeboard at pier E on the true left bank, reducing to 0.9m at abutment F (i.e. at least 1.2m freeboard is provided except for the eastern most land span).

b. It is noted that a permanent maintenance/ inspection platform has been constructed on the underside of the deck on the existing bridge (Figure 21 and 28 in Appendix 5E). it is also not clear in the Appendix 5C report whether the freeboard value for the SLS flood given in Section 3.5 is to the soffit of the actual bridge deck or to the soffit of maintenance/ inspection platform. Provide clarification of this and an assessment on the effects on the new bridge.

The existing bridge soffit level of RL48.68m is to the permanent structure and not the scaffolding. The scaffolding is required to provide inspection access to monitor fatigue issues associated with heavy vehicle use (state highway traffic) of the structure.

The temporary scaffolding will be removed from the existing bridge once the New Bridge is opened and any final maintenance activities have been completed to the existing structure.

Should a significant flood occur prior to the scaffolding being removed then it is expected that either:

- The scaffolding will constrain flood flows through the existing bridge and reduce flood levels for the new bridge
- Should the scaffolding and/or existing bridge collapse, the risk of damage to the New Bridge is very low given the hydrodynamic load cases that the New Bridge has been designed for

v. Floodplain Effects:

a. Provide discussion on whether the river banks confine the flood flows upstream of the new and existing bridges or whether the flood flows spill over the top of the banks and onto the floodplains. Extending the figure illustrating the backwater profiles for the SLS and Upper Limit State (ULS) floods to show the line of the top of the bank on each side of the river may assist with this.

The flood extents based on the HEC-RAS model results for the SLS design event are shown in Figure 2 below (reproduced from the hydraulic assessment report) which extends to the limits of accurate survey data available (accurate topographic survey is confined to the road corridor and immediately adjacent land).

The only level data that is available is that from the cross-sections of the river, consequently there is limited data available of the potential flood plains on both banks. These cross-sections do not extend far enough from the river banks on either side to show constraining topographical features. What limited information that is available from 20m contours shows that the river upstream of the bridges is constrained by steep hillside on the left (east) bank of the river. It is likely that the river terrace on the right (west) bank may also constrain the flow there, though we do not have any ground levels on it. Hence, we have assumed that all flow remains within the surveyed cross-sections. This is conservative as this will predict higher water levels than what is likely to occur. However, this will not show any overland flows that may presently occur across the road to the west of the existing bridge.

The HEC-RAS model results indicate that the water levels at the existing bridge do not overtop the approach embankments in the immediate vicinity of the bridge even during the ULS design event (Figure 3). This is also true for the New Bridge (Figure 4) and hence it is likely that all (if not the majority) of the flow will pass under the bridges during the design event(s) considered.

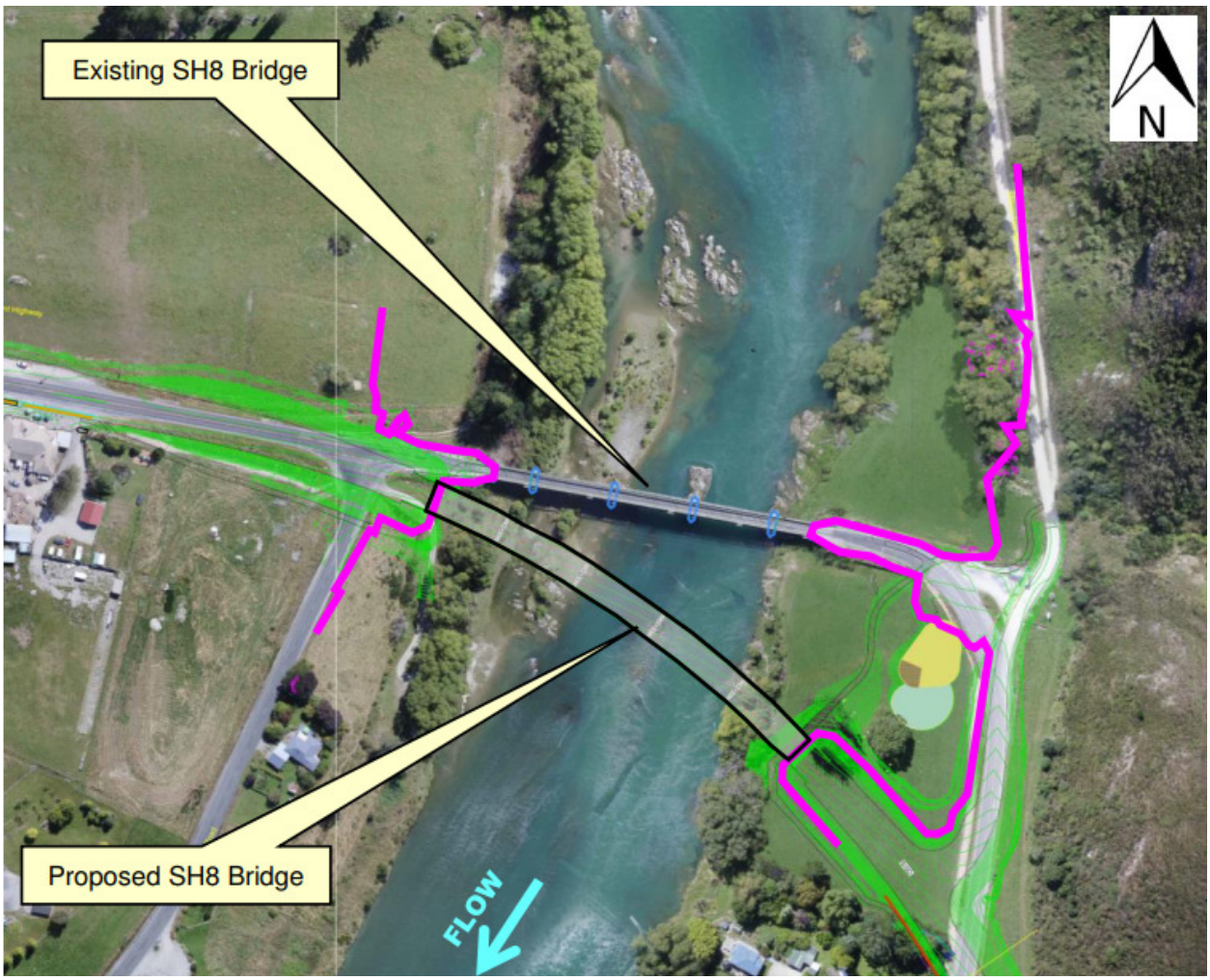


Figure 2 Existing and proposed SH8 bridges showing channel alignment and flood extents near the bridges.

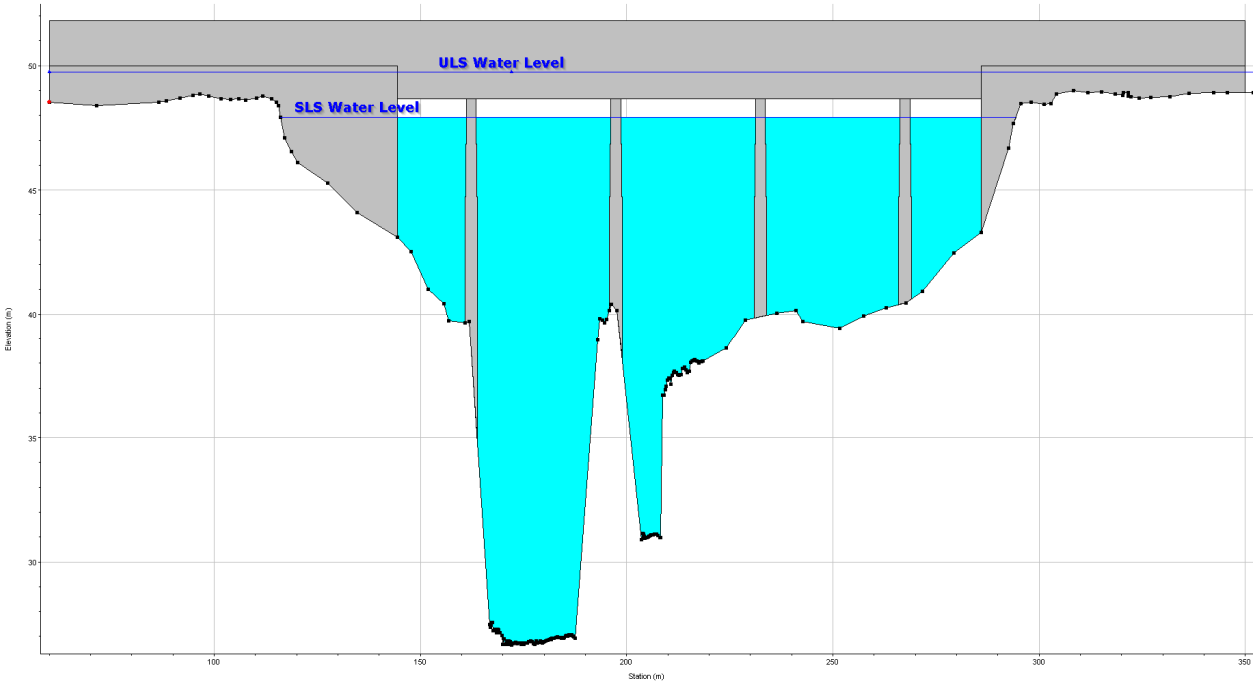


Figure 3 HEC-RAS model cross-section of the existing bridge viewed downstream with design event peak water levels.

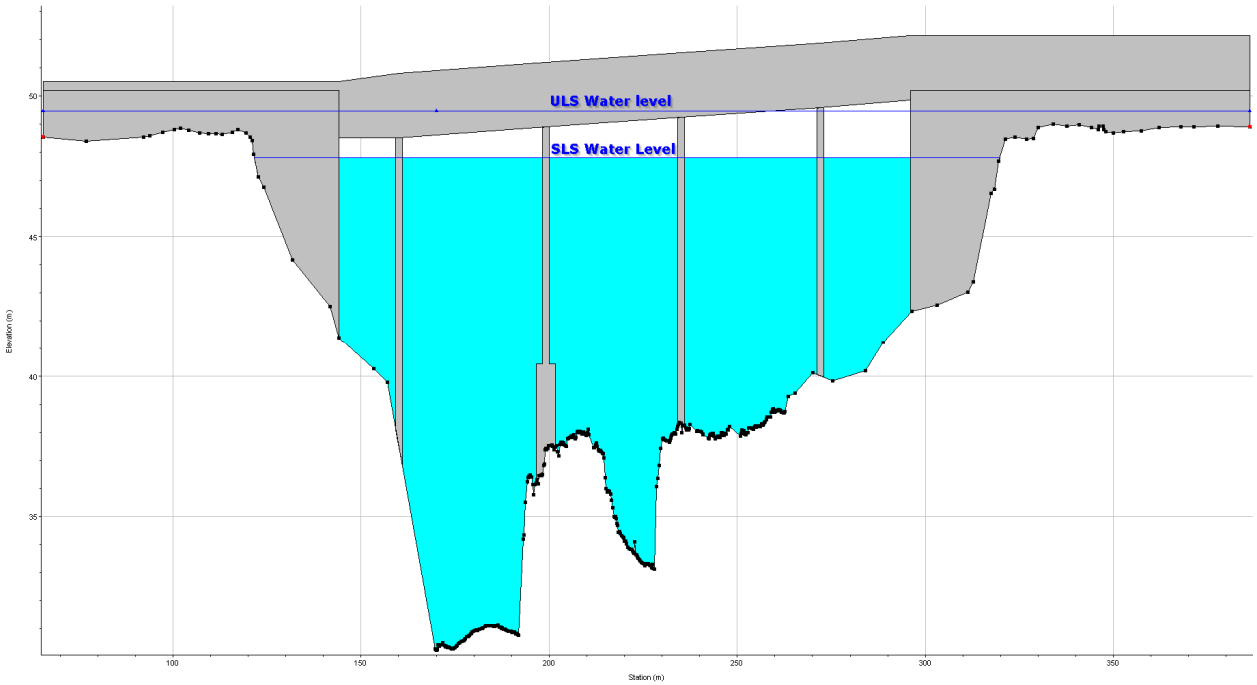


Figure 4 HEC-RAS model cross-section of the New Bridge viewed downstream with design event peak water levels.

b. Provide details on the extent of overbank flows and their likely flow path for the SLS and ULS flood with and without the new bridge. Provide a statement on whether the new bridge exacerbates the extent of overbank flows.

The hillside on the east (left) bank constrains the overland flow and hence it is unlikely that the New bridge will have a significant effect on the overland flows on this bank.

There is insufficient survey data available to accurately predict the magnitude and location of the overland flow on the west (right) bank. Ground levels adjacent the hotel exceed the design flood levels for both ULS and SLS events. Hence, it is likely that the river terrace that the hotel stands on constrains the overland flow in that vicinity and the effect on the overland flow paths is likely to be negligible.

Hence, we believe that the bridge is unlikely to exacerbate the extent of the overland flows.

c. Clarify the potential effects of the proposed approach embankments on any overbank flows resulting from the SLS and ULS floods.

Refer responses above.

d. Confirm if the approach abutments to the new bridge are likely to be overtopped by the overbank flow resulting from the SLS and ULS floods. If so, detail whether any erosion protection measures are proposed for the approach embankments.

The longitudinal profile of the road centreline on the approaches to the New Bridge is presented on Drawing Sheet C03.

On the western approach, the road alignment remains above both ULS and SLS flood levels and is not overtopped.

On the eastern approach, the proposed road alignment falls to a low point at the Stonewall Street intersection which is above the SLS flood level but below the ULS flood level.

Approximately 350m of the state highway approach in the vicinity of Stonewall Street is below the ULS flood level and is likely to be overtopped.

Erosion protection for the New Bridge is focused on protecting the immediate bridge abutment and erosion protection to embankments and approaches away from the bridge abutment is not proposed under ULS scenarios.

vi. Turbulent Wake from Piers on Existing Bridge: **Provide comment on the potential for wake vortices shed off the piers on the existing bridge to impact the new bridge piers and exacerbate the scour risk to them.**

The proposed bridge structure is to be founded on single reinforced concrete bored piles at the pier locations. To meet structural design requirements, the piles are to be socketed into the schist bedrock with around 8m embedment at Piers B, and C where competent bedrock is encountered at surface; and around 12 to 17m embedment into the schist at Piers D and E where the proximity to the main river channel requires deeper founding (refer attached geological long-section for indicative founding depths).

With the piles socketed into competent bedrock, scour, including for any potential vortex effects, is not considered to be a risk.

vii. Bridge Stability in Flood Events:

a. Provide a statement noting that the formation of debris rafts around the piers on the new bridge will increase the lateral hydrodynamic load on the bridge has been considered.

Debris raft formation and associated hydrodynamic loading has been assessed in accordance with the NZ Transport Agency Bridge Manual as part of the structural design.

b. Provide comment that the structure is stable under a ULS flood with a debris raft on each pier in accordance with the requirements of Section 3.4.8 of the NZTA Bridge Manual (3rd edition, 2018).

We confirm the structure is stable under the ULS flood loads with a debris raft on each pier in accordance with the requirements of Section 3.4.8 of the NZTA Bridge Manual (3rd edition, 2018)

c. Provide comment on whether the stability of the new bridge under the hydrodynamic loads imposed on the bridge by floodwaters and debris raft formation at this level is affected.

We confirm stability of the bridge is not affected.

viii. Effects on River Morphology:

Provide comment on how the proposed new bridge will impact on the morphology of the river.

The river bed is comprised of bedrock (schist), with shallow (less than 1m to bedrock) gravel shoals within the deeper channel and on the western side of the river (refer to the attached Geological long-section). Piers B, D and E are all positioned directly onto prominent rock outcrops while Pier C is located with around 0.5m of overburden before the bedrock is encountered. Piers are also aligned directly downstream of the existing bridge piers which are

positioned on the prominent rock outcrops which align with the river flow direction. As such, there is negligible effect on river morphology.

ix. Construction Issues:

a. Confirm the effects of any temporary work platforms on the flood capacity of the waterway and the upstream backwater influence these platforms.

For temporary staging, 600mm freeboard to the 1 in 25 year ARI flood (excluding climate effects) is to be provided. Staging will be required on the western side of the river to provide access to Pier D and the main river channel between Piers D and E will remain unobstructed. As such, the effect on flood conveyance is considered to be less than minor.

b. Describe how the temporary work platforms will be founded on the river bed.

Temporary works design will be completed by the Contractor but it is anticipated that work platforms will comprise steel columns socketed into the near surface rock. Hydrodynamic load effects will be considered in the design.

c. Confirm the proposed source of the gravel material for the construction of the gravel bund work platforms including the methodology of extraction and the approximate quantity of material required.

There is an existing gravel bund at the site (refer photo below) which provides access to Pier C from the western river bank. The bund is partially inundated under the daily river level fluctuations from power generation and is fully inundated under any high flows. It is expected that gravel will be sourced from local quarries to raise the bund and enable access to Pier C under normal daily fluctuations. Estimated material volumes are in the order of 200 cubic metres of gravel.

Figure 3 – existing gravel bund providing access to Pier C from the western river bank

d. Confirm the potential impact on the downstream river channel in the event that the temporary gravel work platforms are washed away in a flood event.

Given the size of the river and scale of bund proposed there will be no significant effects if the bund is washed downstream.

e. Confirm how the risk of flood transported woody debris snagging on any temporary steel platforms will be managed during construction.

The Contractor will be required to prepare a Management Plan to identify how they will manage access to the temporary platform during potential flood effects. It is expected that personnel and equipment will be removed from the platform if major events are forecast. Following each flood event, any substantial accumulation of debris will be removed from piers.

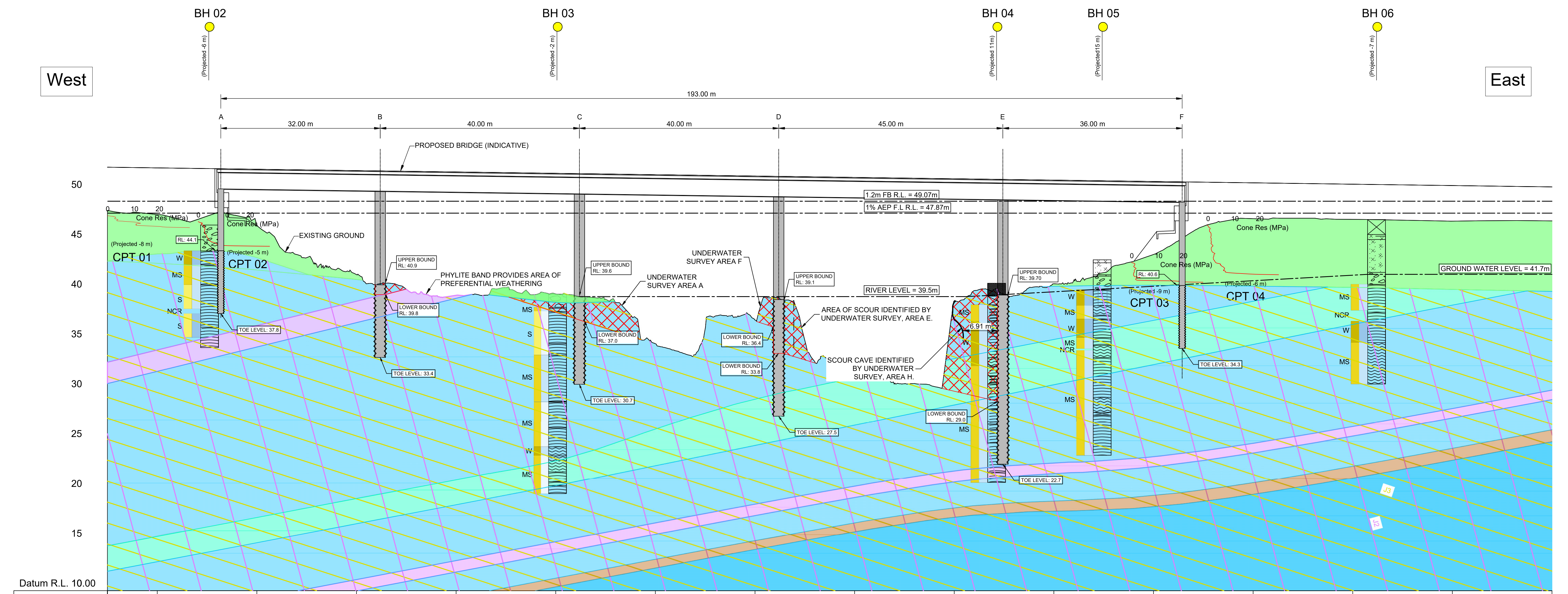
f. Provide a statement about how safety on the construction site is proposed to be managed with respect to flood risk.

The Contractor will be required to prepare a Management Plan to identify how they will manage safety on the construction site with respect to flood risks.

g. Provide a statement about how fine sediment plumes which could be released by construction activities into the Clutha River/ Mata-Au are proposed to be managed and mitigated.

The potential for fine sediment plumes has been considered in the Assessment of Environmental Effects and associated Assessment of Ecological Affects.

Attachment 1: Geological Long-section



PROPOSED LEVEL	52.48	52.41	52.28	52.14	52.00	51.87	51.73	51.59	51.46	51.32	51.18	51.05	50.91	50.78	50.64	50.50
EXISTING LEVEL	48.14	47.73	46.59	41.71	39.63	39.76	34.77	37.15	31.68	39.07	40.78	43.72	47.32	47.25	47.07	47.09
CUT/FILL		4.68	5.69	10.42	12.37	12.11	16.96	14.45	19.78	12.25	10.40	7.33	3.59	3.53	3.57	3.41
VERTICAL GEOMETRY	-0.68% 298.50m															
HORIZONTAL ALIGNMENT																
STATION		6180.00	6200.00	6220.00	6240.00	6260.00	6280.00	6300.00	6320.00	6340.00	6360.00	6380.00	6400.00	6420.00	6440.00	6460.00

Legend:

Rock Strength

ES	Extremely Strong (> 250 MPa)
VS	Very Strong (100 - 250 MPa)
S	Strong (50 - 100 MPa)
MS	Moderately Strong (25 - 50 MPa)
W	Weak (5 - 25 MPa)
VW	Very Weak (1 - 5 MPa)
EW	Extremely Weak (0.25 - 1 MPa)

Rock Weathering

U	Unweathered
SW	Slightly Weathered
MW	Moderately Weathered
HW	Highly Weathered
CW	Completely Weathered
RS	Residual Soil

Key

- Overburden
- Metasandstone
- Phylite 1
- Phylite 2
- Phylite 3
- Phylite 4

Selected Lithological Graphics

- BSI Sandy Gravel
- Zone of no core recovery
- BSI Silty Sand
- Coarse-grained Metamorphic Rock
- Medium grained Metamorphic Rock
- Fine grained Metamorphic Rock
- BSI Clayey Silt
- Fill (made ground)
- BSI Silt
- BSI Gravel

	Extent of potential kinematic failure
	J2 Approximate orientation and spacing 5 - 10m
	J3 Approximate orientation and spacing 1 - 5m
Upper bound	Upper bound level of competent rock for structural design of pile
Lower bound	Rock with potential to fail, lower bound level. Competent rock for structural design of piles.

Hz. -1:400 0 4 8 12 16 20 24 28 32 36 40 m (A1)

Vt. - 1:800 0 10 20 30 40 50 60 70 80 m (A1)

Revision	Amendment	Approved	Revision Date

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Project
NEW ZEALAND TRANSPORT AGENCY
REGION SH8 RS
SH8 BEAUMONT BRIDGE REPLACEMENT

Sheet
BRIDGE CENTRELINE GEOLOGICAL SECTION
WITH BOREHOLE AND CPT DATA

Project No.	Sheet. No.	Revision
6-CT012.00	C209	B

Original Sheet Size A1 [841x594] Plot Date 2019-08-15 at 3:03:51 PM Path \\opus\s\Proj\NZ\6C\6-CT012.00 Beaumont Bridge Replacement\Home\500 Technical\520 Geotech\05110 - Geotech Testing Mgnt\4. Drawings\6-CT012.00_C209-C210(B) -GEOLOGICAL SECTIONS ON BRIDGE CENTRELINE.dwg C209(A)

SH 8 NEW BEAUMONT BRIDGE

URBAN AND LANDSCAPE DESIGN FRAMEWORK

October 2019

NZ TRANSPORT AGENCY WAKA KOTAHI

WSP | OPUS

DOCUMENT HISTORY AND STATUS

REVISION	DATE	AUTHOR	REVIEWED BY	APPROVED BY	STATUS
1	31/10/2018	D McKenzie	S Steyn	M Davies	First Issue
2	11/01/2019	M Back	D McKenzie	M Davies	Updated
3	06/09 /2019	M Back	D McKenzie	M Davies	Updated
4	17/10/2019	M Back	D McKenzie	M Davies	Updated

REVISION	DETAILS
1	First Issue of the document
2	Updated for NZTA comments
3	Updated for NZTA comments & project changes
4	Updated for NZTA comments & project changes

CONTENTS

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1. INTRODUCTION

1.1 Background

The existing State Highway 8 (SH8) Beaumont Bridge is a single lane, five-span, wrought iron truss bridge constructed in 1884 in the township of Beaumont in Otago, approximately 110 km west of Dunedin. The bridge carries SH8 over the Clutha Mata-au River and provides the only connection between the two parts of Beaumont located on either side of the river (Figure 1). SH8 is a key arterial route between Central Otago and Coastal Otago being the most direct route between Queenstown and Dunedin. State Highway 8 is also an important freight route and is the only High Productivity Motor Vehicle (HPMV) route between the Dunedin and Queenstown.

Age related structural integrity issues have been identified, resulting in a susceptibility to fatigue and subsequent reduction in the remaining economic life of the existing bridge. A Detailed Business case completed by WSP Opus in 2017 demonstrated the need for a replacement bridge and confirmed a preferred option comprising a new two-lane structure on a curved alignment downstream of the existing bridge. It also identified opportunity for adaptive re-use of the existing structure for cycling and walking.

In May 2018, WSP Opus was engaged by the NZ Transport Agency (Transport Agency) to complete the pre-implementation phase for the replacement bridge. This Urban and Landscape Design Framework (ULDF) develops concepts for the Beaumont Bridge replacement to ensure that urban and landscape design components of the project are appropriately defined, developed and implemented. It provides a forum to capture and integrate the various elements of the project, and to ensure the urban and landscape design concepts and objectives are well defined, to enable them to be designed and implemented.

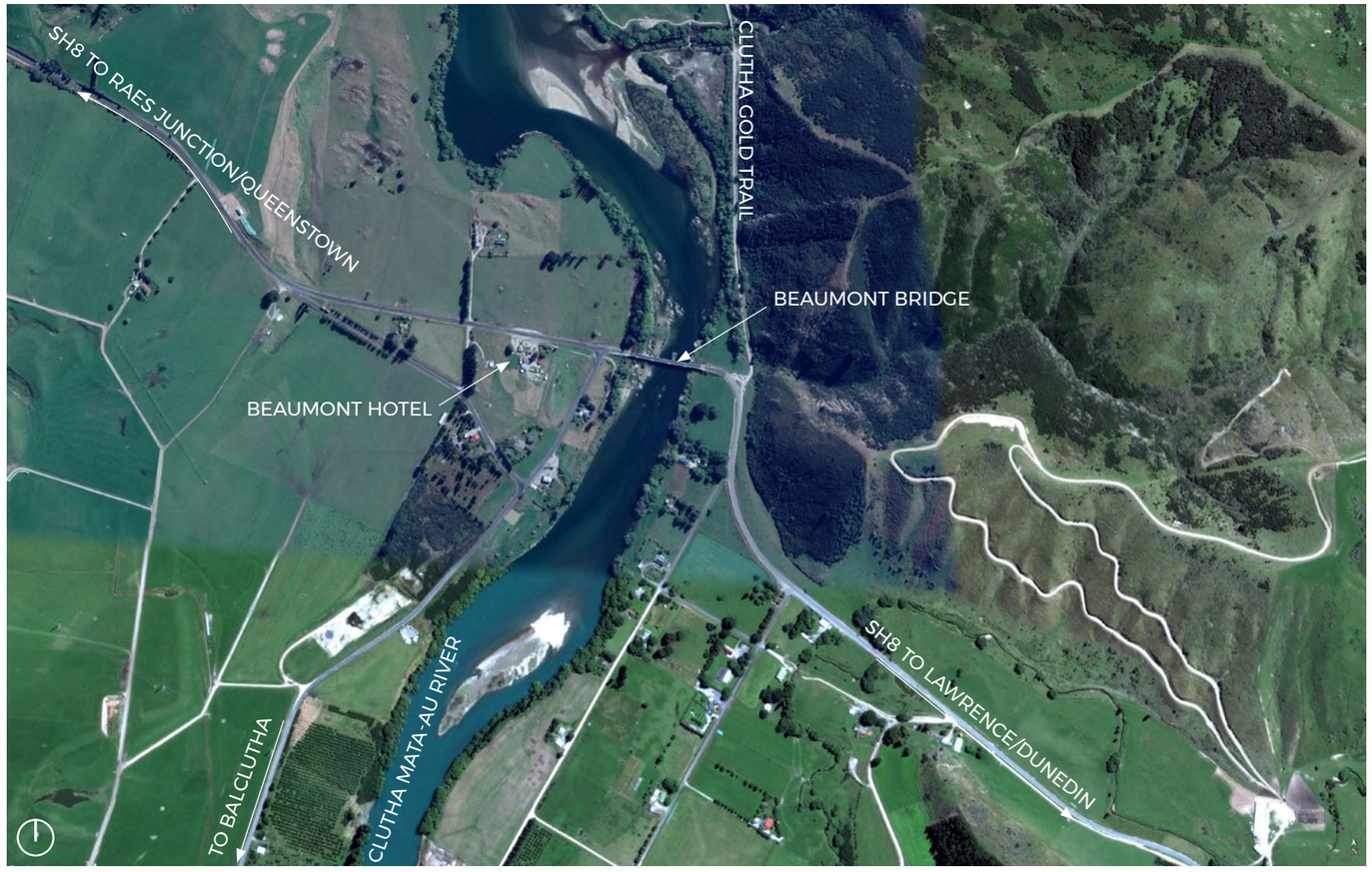


FIGURE 1: LOCATION MAP (SOURCE: GOOGLE EARTH, SCALE AS SHOWN)

1.2 Project Objectives

The primary objective of the Project is to achieve route security for SH8 across the Clutha Mata-au River at Beaumont. Through the Detailed Business Case, a number of consequential/ancillary objectives have also been identified, which include:

- Maintaining the highway function and standard in context with the adjacent state highway environment.
- Minimising social impact on the Beaumont community.
- Optimising environmental and heritage opportunities, where directly associated with the highway works.
- Ensuring the existing structure provides an attractive facility for ongoing use as a pedestrian and cycle linkage between the Clutha Gold Trail and wider Beaumont township and its services.

Through the Detailed Business Case, a number of consequential/ancillary objectives have also been identified, which include:

- Providing a safe and effective connectivity between the highway and the local road and street network.
- Providing safe connectedness for pedestrians and cyclists, both within the Beaumont community and across to the Clutha Gold Trail, in so far as this relates to the highway, or may be enabled through the highway corridor.

1.3 Purpose of the Framework

The purpose of the Urban and ULDF is to ensure the urban and landscape design concepts and objectives are well defined to enable them to be designed and implemented. The ULDF is a guiding document which sets out the urban and landscape design principles for the Project and is intended to be used as a supporting document for the Detailed Design phases of the Project[1].

The ULDF also considers the high level urban design issues, where the broader context and aspirations are considered while encompassing the Transport Agency's objectives and requirements. Additionally, the ULDF co-ordinates the technical inputs to ensure all elements of the Project are well integrated, while allowing innovation and design development to be added throughout the design process.

1.4 Report Structure

The ULDF utilises background documentation and contextual analysis to inform the design principles and objectives. Underlying the process is the co-ordination of multi- discipline specialists to ensure an integrated approach is achieved for all elements of the Project.

The following outlines the structure of this report:

SECTION 1: INTRODUCTION

Outlines report structure, background material and aims of the ULDF.

SECTION 2: POLICY CONTEXT

Background information in relation to the Transport Agency's protocols and other statutory expectations.

SECTION 3: PROJECT CONTEXT

Briefly comments on the context of the proposed bridge and its approaches and considers the contextual relationship of landform, hydrology, land uses, existing vegetation, character areas, historic heritage, Tangata Whenua, community facilities, ecology, movement networks and community consultation.

SECTION 4: CORRIDOR DESIGN PRINCIPLES

Describes urban and landscape design principles for the proposed bridge to ensure the Project is assimilated within the context of the surrounding environment.

SECTION 5: CONCEPT PLAN

Application of ULDF philosophies and principles to the Project. Specific approaches will demonstrate the intent to ensure a context sensitive and fully integrated design approach is achieved.

1.5 Project References and Background Information

An extensive review of background documentation has been undertaken to identify relevant landscape and urban influences on the bridge replacement, and design standards that should be integrated into the project.

The background documents include the following:

- Transport Agency's Urban Design Policy, 2004
- NZ Urban Design Protocol, March 2005
- NZ Transport Strategy, 2008
- Transport Agency's Urban Design Guidelines 'Bridging the Gap', 2013
- Transport Agency's Landscape Guidelines, 2014
- Transport Agency's P39 Landscape Specification for Highway Landscape Treatments, 2013
- NZTA Cycling Network guidance
- NZTA Pedestrian Planning and Design Guide, 2009
- Resource Management Act (RMA), 1991
- Heritage New Zealand Pouhere Taonga Act 2014.

1 refer appendix 2: https://www.nzta.govt.nz/assets/resources/bridging-the-gap/docs/bridging-the-gap.pdf

2. POLICY CONTEXT

2.1 Planning Policy

The following provides the relevant RMA context that will be integrated into the Project.

CLUTHA DISTRICT PLAN

Land surrounding the site is zoned a mixture of Rural and Rural Settlement in the Operative Clutha District Plan (planning maps 8 and 9). Surrounding land use is predominantly residential and agriculture, with some commercial activity such as the Beaumont Hotel and Beaumont Jet.

The project objectives align with objectives in the plan regarding efficiency and continual development and upgrading of the transport network, maintaining amenity values in the rural environment.

2.2 Transport Policy

NEW ZEALAND TRANSPORT STRATEGY 2008

The New Zealand Government developed the New Zealand Transport Strategy (NZTS) to provide a plan until 2040 for the whole transport sector, and although the document is not a statutory document, it is given statutory weight in other documents.

The vision of the NZTS is to provide people and freight in New Zealand access to an affordable, integrated, safe, responsive and sustainable transport system. Additionally, the document has specific objectives which include:

- Ensuring environmental sustainability
- Assisting economic development
- Assisting safety and personal security
- Improving access and mobility
- Protecting and promoting public health.

GOVERNMENT POLICY STATEMENT ON LAND TRANSPORT

The Government Policy Statement on land transport 2018 reflects a new approach to transport through four clear priorities: a safer transport network free of death and injury, accessible and affordable transport, reduced emissions, and value for money.

OTAGO SOUTHLAND REGIONAL LAND TRANSPORT PLANS 2015 – 2021

Beaumont Bridge replacement has a regional priority of '2' in the Otago Southland Regional Land Transport Plan (RLTP) 2015-2021. The reason for the priority is given as:

This is an aging bridge, which is close to the end of its economic life. The objective of the project is to ensure a resilient and secure transport network and reduce delays. Benefits network performance and capability, and safety and regional development.

SAFER JOURNEYS

The government's long-term goal for road safety in New Zealand is a road system increasingly free of death and serious injury based on the international 'Safe System' approach.

The Safe System approach works across safe roads and roadsides, safe speeds, safe vehicles and safe road use. Of particular reference to landscape outcomes is that Safe Systems applies to all parts of the system including highway margins, to improve safety overall.

Safe Systems in relation to the highway landscape includes the following matters:

- Design of landscape treatments which encourage safe travel speeds and behaviours.
- Planting designs that integrate sight lines and safety setbacks from structures, barriers and signage.
- Frangible planting.
- Provision for safe access and landscape maintenance as part of maintenance operations requirements for high landscape assets.
- Provide for attractive and safe stopping places and rest areas with good visibility.
- Make walking and cycling safer.

2.3 Non-Statutory Documents

NZ TRANSPORT AGENCY URBAN DESIGN GUIDELINES 'BRIDGING THE GAP', 2013

Bridging the Gap sets out ten fundamental urban design principles. These principles reflect the Transport Agency's expectation for the integration of urban design in all phases of transport projects and the desired inter-disciplinary approach to addressing urban design issues. The document also incorporates the New Zealand Urban Design Protocol (2005), Crime Prevention Through Environmental Design (CPTED) requirements and provides ULDF guidelines amongst other things.

NZ TRANSPORT AGENCY LANDSCAPE GUIDELINES (FINAL DRAFT), 2014

The Transport Agency Landscape Guidelines recognise the important contribution landscape thinking, landscape planting, landscape design, implementation and management provides in the delivery of quality infrastructure. The guidelines outline the key considerations and critical steps to be followed when assessing, designing, constructing and maintaining highway landscape assets.

NZ TRANSPORT AGENCY P39 STANDARD SPECIFICATIONS FOR HIGHWAY LANDSCAPE TREATMENTS, 2013

The Transport Agency P39 Standard Specifications for Highway Landscape Treatments set out the minimum performance, quality and workmanship standards for all Transport Agency landscape projects.

NZ TRANSPORT AGENCY BRIDGE MANUAL, 2016

The Transport Agency's 'Bridge Manual' sets out the criteria for the design and evaluation of bridges, culverts, stock underpasses and subways, the design of earthworks and retaining structures. The manual is a companion document to the overarching Highway Structures Design Guide which provides general and specific design criteria for all highway structures.

Consideration was given to this manual and in particular Section 2.6 Urban Design when preparing the ULDF.

2. PROJECT CONTEXT

This section describes the main features of the locality and its related landscape opportunities and constraints, and provides an overview of the bridge replacement and associated works.

3.1 Site Description

A map showing the Beaumont township and roading network is provided in Figure 2.

From east to west, the existing state highway passes over the Low Burn bridge (small watercourse) then curves north as it passes Stonewall Street and Weardale Street which come off to the left (south side) of the highway via priority controlled tee-intersections. These streets provide access to residential properties on the eastern side of the river. As the curve of SH8 reverses back towards the west, Craig Flat Road comes off to the north, continuing up the true left (east) bank of the Clutha / Mata-au River (refer Figure 6). This intersection also provides a parking area with parking and interpretation signage.

At Weardale Street, the Clutha Gold (cycle) trail joins SH8 again after traversing across farmland from Chinaman Flat road to Eastferry street and then down Weardale Street (refer Figure 2). It runs down the south side of SH 8 as the curve reverses back westwards towards the existing Beaumont bridge. The trail then crosses SH8 to Craig Flat Road, which it continues along towards Roxburgh.

Heading westward, SH 8 arrives at the existing single lane, traffic signal controlled, bridge over the Clutha Mata-au River (refer Figure 5). Immediately after the bridge, the Rongahere Road priority-controlled tee-intersection provides a route along the true right of the Clutha Mata-au River to Clydevale and Balclutha. Access to the river below the bridge is via a metal track at the northern end of Rongahere Road.

After the intersection with Rongahere Road, SH8 then proceeds over a small rise in front of the Beaumont Hotel (refer Figure 4), and past the Dee Street priority controlled cross-road. Westferry Road is the next street to intersect with SH8, joining it at an intersection on the outside of the bend as the state highway turns north. It provides the most direct access from the state highway to Rongahere Road for traffic going to Clydevale or Balclutha from the west (Roxburgh / Queenstown (refer Figure 3). Westferry Road, when viewed by travellers heading from east to west, presents as a acute, almost hairpin corner.

From the curve to the north, SH8 continues up a relatively steep hill towards Roxburgh / Queenstown.

FIGURE 2: MAP OF BEAUMONT WITH THE CLUTHA GOLD TRAIL SHOWN AS A DASHED ORANGE LINE

FIGURE 3: SH8 / WESTFERRY STREET INTERSECTION ON THE WESTERN OUTSKIRTS OF THE TOWNSHIP

FIGURE 4: VIEW FROM THE FRONT OF THE BEAUMONT HOTEL LOOKING EAST TOWARDS THE EXISTING BRIDGE

FIGURE 5: VIEW ALONG THE EXISTING BRIDGE LOOKING WEST TOWARDS THE BEAUMONT HOTEL

(IMAGE ON RIGHT)
FIGURE 6: VIEW OF THE PARKING AREA AT THE CRAIG FLAT ROAD INTERSECTION PROVIDING ACCESS TO THE CLUTHA GOLD TRAIL (SOURCE: GOOGLE STREET VIEW)

3.2 Landscape Description

The broader landscape context of the Project is that of the broad river valley of the Clutha Mata-au River where the river flows out of the relatively short Island Block-Beaumont Gorge, through the local Beaumont Flats and south into the Beaumont-Tuapeka Mouth Gorge area. In general, the landscape is characterised by river flats and terraces and undulating to steep hill country, representative of an underlying geology of blocky to weathered schist. Landforms within the area include flat to undulating terraces and the river channel itself. The local topography is contained by hill country on all sides.

The Project site is central to the Beaumont Flats and the only other notable topographic feature is the Low Burn Valley through which SH8 traverses from the east.

The area is highly modified, with vegetation comprising grazed pasture, evergreen shelterbelts, clumps of well-established exotic trees around scattered dwellings, especially on the east side of the river and willow along both riverbanks. The local hills have a scrappy cover of gorse and broom with some pockets of native vegetation, such as mānuka, flax and cabbage tree within the gullies. On the more distant slopes of the Blue Mountains to the west and south is a dense cover of beech forest and pine plantation.

3.3 Significant Trees

Within the Project area there are seven trees listed in Clutha District Council's register of significant trees as having scenic and landscape significance. Three of these trees - English oak - are located on the north boundary of the Healey property on the eastern side (true left) of the river as shown in Figure 7

FIGURE 7: ENGLISH OAK TREES LISTED IN CLUTHA DISTRICT COUNCIL'S REGISTER OF SIGNIFICANT TREES

3.4 Reserves/ Open Space

Reserves or distinctive areas of open space within the Project site include:

- The existing node of the Clutha Gold Trail on the eastern side of the existing bridge adjacent Craig Flat Road which incorporates information panels and a picnicking area.
- The Clutha Mata-au River and its banks including a defined marginal strip on the western bank (administered by the Department of Conservation).
- The property on the eastern bank immediately south of the existing bridge is subject to Part 4A of the Conservation Act, meaning there is a movable 20 m marginal strip adjacent to the river (undefined).
- The local roads and streets form linear 'open space' network within the township of which the Clutha Gold Trail is an obvious part.

3.5 Movement Networks – Roads, Cycle, Pedestrian Routes

The section of SH8 running across the Beaumont Flats and the Clutha Mata-au River is the dominant roading link in the area, with various 'streets' within the township and local roads branching off it. The main local road – Rongahere Road – runs south along the west bank of the Clutha Mata-au River ~35 km to Clydevale where the next downstream road crossing of the river is located. There is also a historic punt ~25 km downstream of Beaumont at Tuapeka Mouth that operates on set hours and is funded by the Transport Agency.

On the east side of the river, the highway was once paralleled by a railway line that ran from Clarkville to Roxburgh and much of this old railway formation now carries the Clutha Gold Trail. There are no footpaths as such within the township as traffic volumes are very low. For the most part, the cycle trail also utilises the road formation through the eastern part of the township having been on Craig Flat Road and the old railway formation upstream of the township, rejoining the latter to the east of the township.

3.6 Heritage

Opened for use in 1887, the Beaumont Bridge consists of three wrought iron truss spans supported on concrete piers; refer Figure 8. It was the first of four iron truss bridges made entirely from ironwork assembled in New Zealand. The bridge now forms part of SH8 through Central Otago. It is listed as a historic structure in Clutha District Council's Register of Heritage Buildings, item no. H61; but is not on the New Zealand Heritage List/Rārangi Kōrero.

The settlement of Beaumont also has high cultural, archaeological, historic and social value with the Beaumont Hotel; being a focal point of the town on the western side of the river (refer Figure 9).

A Heritage Significance Assessment[1], was completed as part of the Detailed Business Case for the Project and made the following recommendations with regards to re-purposing of the existing bridge and design of the replacement bridge which are relevant to this ULDF:

- The existing bridge should be retained with a new use found, taking advantage of existing opportunities such as the cycle trail.
- Repair works necessary to make the bridge suitable for the selected alternative use should be carried out.
- Replacement bridge options should consider the heritage significance of both the existing bridge and the Beaumont settlement.

FIGURE 9: BEAUMONT HOTEL FRONTING THE STATE HIGHWAY ON THE WESTERN APPROACH TO THE BRIDGE

1 Beaumont Bridge, Clutha, Otago: Heritage Significance Assessment – Opus, October 2016

a) Beaumont Bridge c1890 with Hotel in the background (source: Hocken Collection Asset ID 6264)

b) Elevation of existing bridge showing buttressing to piers and geometry of wrought iron trusses

FIGURE 8: EXISTING BRIDGE PHOTOS

3.7 Environmental and Social Responsibility Screen

The Environmental and Social Responsibility Screen completed during the Detailed Business Case identified the following for the Project:

- The Clutha Mata-au River is the predominant natural feature and is a Statutory Acknowledgment under the Ngāi Tahu Claims Settlement Act. There is limited indigenous vegetation on the river margins.
- Heritage status of the existing bridge.
- Seven listed trees on the Healey property.
- Identified HAIL site at the former railway station and yards.
- Presence of boat ramp/river access on true left bank downstream of the bridge.
- Integration of the Clutha Gold Trail will be an important urban and landscape design element.

3.8 Description of Proposed Bridge and Approach Alignment

A preliminary alignment has been developed for the proposed new bridge and approaches as shown in Figure 10. This is based on the Detailed Business Case alignment with minor refinement to position the central bridge pier on the prominent rock outcrop within the main river channel.

As part of the Project, the existing state highway intersections with Weardale Street, Rongahere Road and Westferry Street will be closed.

Proposed pedestrian and cycle linkages will create a pedestrian path and route a 'side path' of the Clutha Gold Trail across the existing bridge and under the west abutment of the new bridge to link to the Beaumont Hotel and camp ground. The proposed new bridge will also have a 2.0 m shared pedestrian/cyclist path to provide future resilience (for example if an event led to the loss of the existing bridge).

The existing stormwater management of the area is a combination of roadside swales and overland flow paths into the Clutha Mata-au River. Stormwater design will be completed in accordance with the NZTA Stormwater Treatment Standard for State Highway Infrastructure and will incorporate a mixture of grassed roadside swales, piped conveyance and a planted stormwater basin on the eastern approach to provide treatment of runoff prior to discharge into the Clutha Mata-au River.

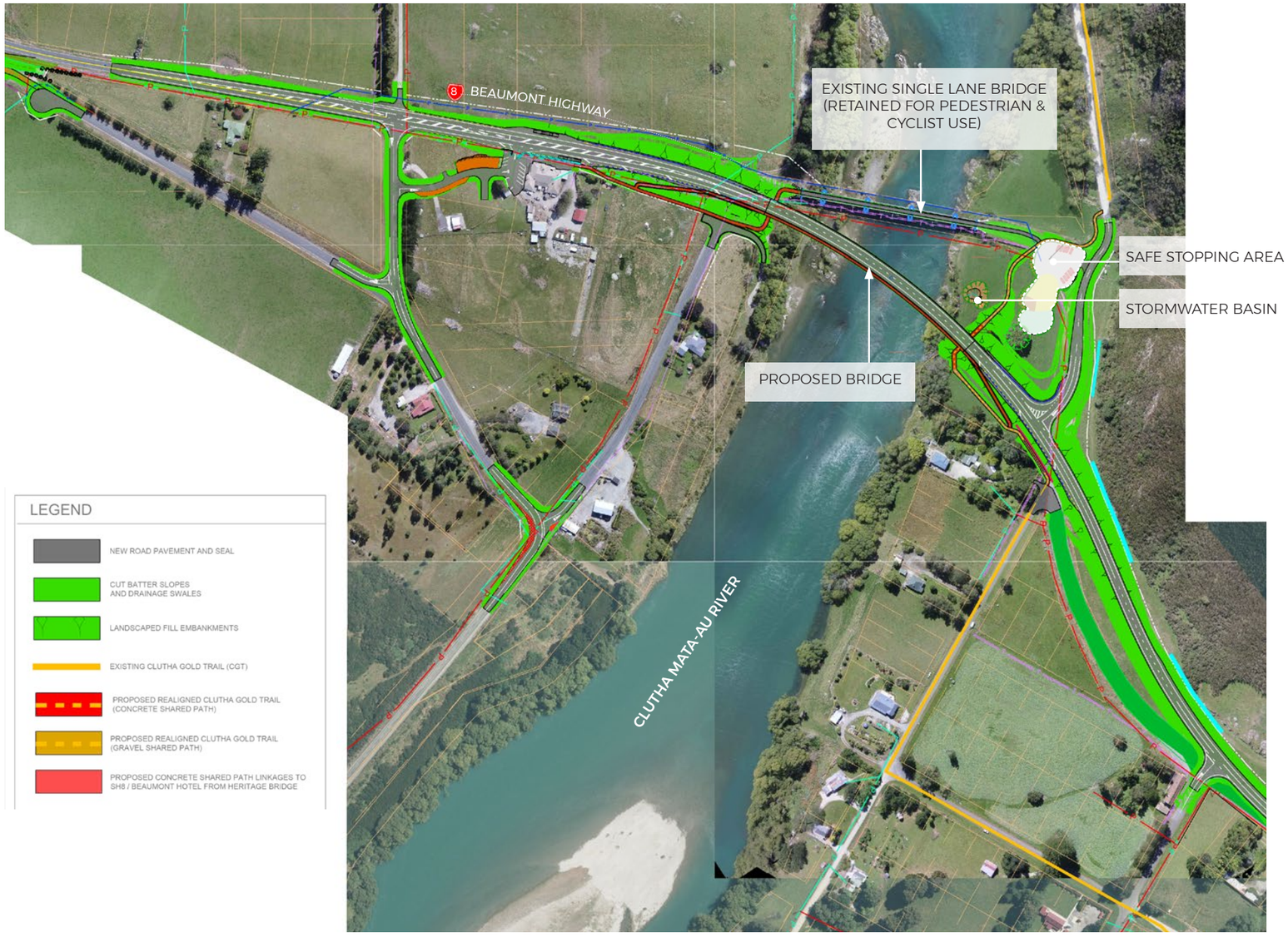


FIGURE 10: PROPOSED ALIGNMENT FOR THE NEW BRIDGE AND APPROACHES 1:4000@ A3

3.9 Proposed Bridge Structure

Preliminary alignment design has progressed on the basis of a 193 m long curved bridge, with span lengths (from east to west) of 36 m- 45m- 40 m- 40 m- 32 m (west to east) to enable founding on prominent rock outcrops within the river channel and river banks (refer Figure 12). It is expected the span lengths will be refined/optimised as the design progresses and geotechnical and topographical constraints are better understood.

It is also expected that a continuous steel multi-girder superstructure, with composite concrete deck, founded on reinforced concrete hammerhead piers (i.e. single pile) will provide a cost-effective solution relative to the site constraints. Abutment and pier form will be shaped to complement the existing bridge, while overall form will also feature angular shapes to reference but not imitate the existing bridge (refer Figure 13).

The proposed bridge cross section has been developed in accordance with the NZTA Bridge Manual (refer Figure 11). This allows for two traffic lanes, 1.5m wide shoulder on the upstream side and 2.5m wide sealed shoulder with a 2.0m shared path on the downstream side. The wide shoulder and shared path combined with 1.2m height pedestrian safety barrier on the downstream side provides for the appropriate level of stopping sight distance on the inside of the curve.

Performance Level 5 rigid concrete “HT” barriers comprising a steel top rail are proposed for vehicle containment on the outside edges of the bridge deck. A pedestrian / cycle safety barrier is to be installed on the downstream side of the bridge.

3.10 Proposals for Existing Bridge

The existing bridge is to be re-purposed to cater for pedestrians and cyclists and also to ensure the structure is in a suitable condition for potential handover to another party. This is expected to comprise modifications to the deck, handrails/parapets and maintenance of the structure and abutments. All works will need to be cognisant of the heritage status of the bridge.

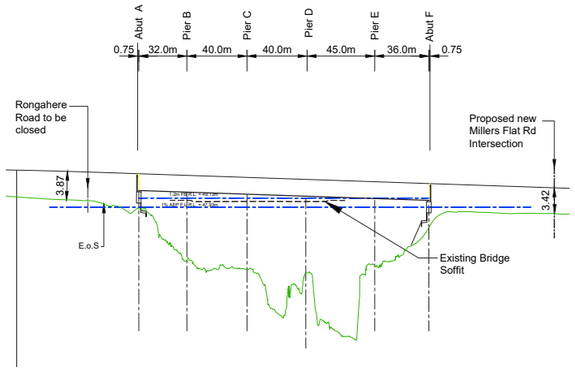


FIGURE 12: PROPOSED BRIDGE LONG SECTION (HZ 1:4000 VT 1:800 @A3)

FIGURE 13: PROPOSED BRIDGE PIER & BARRIER (UPSTREAM SIDE)

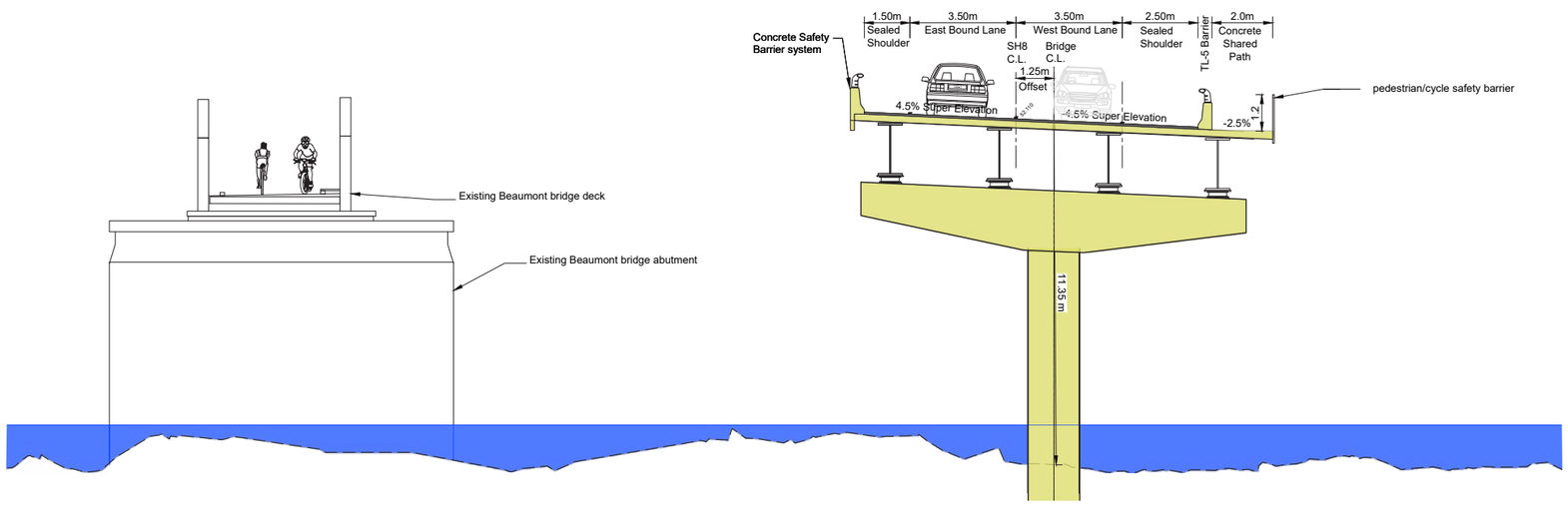


FIGURE 11: PROPOSED BRIDGE CROSS-SECTION (1:200 @A3)

4. CORRIDOR DESIGN PRINCIPLES

This section of the ULDF sets out the vision and specific urban and landscape design principles and objectives that will be applied to the Project.

4.1 Urban and Landscape Design Vision

The urban and landscape design vision for the Project is to design a highway bridge which forms a distinct and attractive 'connection' between the existing bridge, the wider landscape and between Beaumont township and the Clutha Gold Trail. It will also providing a safe multi-modal transport corridor that:

- Upholds the spirit of the Otago Southland RLTP.
- Balances the need for long term connectivity for local community with the need to deliver a safe and effective operating highway.
- Delivers a robust and integrated design that is attractive, coherent and durable.

4.2 Project Wide Principles

The following principles and objectives set out the approach and design intent for the Project:

- Ensure the proposed bridge is context sensitive in terms of acknowledging local cultural aspects, heritage, landforms, land use, views and rural environment.
- Ensure good urban design outcomes are achieved, utilising creative and innovative measures to integrate sustainable design measures including structures, street and highway furniture, drainage and ecology.
- Ensure that the Project relates to the future growth of the township, the cycle trail and a range of connections to the wider landscape.
- Ensure the design is environmentally sensitive.
- Ensure the design is aligned with Transport Agency's and Council's policies and objectives.
- Ensure the design collaborates with local community and interest groups.

4.3 Key Design Objectives and Outcomes

Project objectives provide more specific design responses that will be incorporated into the Project as follows:

- Consider the design quality of the proposed bridge in terms of amenity, aesthetics of the experience, accessibility, safety and landscape context.
- Create a connection via the proposed and existing bridges that is sympathetic to the wider landscape and integrates with the surrounding environment and land uses.
- Relate to the future development of the area including tourism.
- Connect and retain access to the existing built environment, future development and links between the Clutha Mata-au River, its recreational use and wider land uses.
- Integrate stormwater design and ecological planting as part of the Project's stormwater management.
- Provide quality open space for cyclists and pedestrians 'passing through' on the Clutha Gold Trail.
- Provide a robust and integrated design that is attractive, coherent, durable and innovative.
- Ensure secondary elements and detailing are part of the integrated design.

4.4 Bridge Design Expectations

A major bridge design 'driver' for this Project is to ensure that the relationship between the proposed bridge and the existing bridge works. That is, the design and aesthetic appearance of the proposed bridge acknowledges, but does not compromise the existing bridge and, in particular, its heritage aspects.

When considering the design of a new bridge that is going to be in close proximity to and approximately parallel to an existing bridge, one response is to duplicate the existing bridge in many, if not all, of its structural aspects. The wrought iron truss form of the existing bridge is both relatively uncommon and very distinctive, so replicating its form, albeit in a modern idiom, would definitely acknowledge the existing bridge. However, aside from this approach not having favour from a heritage point of view, the constructibility of a 'replica' negates this approach. This is due to a range of reasons such as geotechnical conditions, flood capacity relative to pier placement, cost and safety in design.

The converse approach, and that which will be followed in this case, is to develop a new design that complements, but does not compete, with that of the existing bridge. In this case the sweeping or changing alignment of the proposed bridge will provide continuity via an approach that does not dominate the existing bridge. Additionally the increased height of the new bridge is balanced by the (less dominant) single pier structure, which maintains a visual balance with the lower, but more 'solid' existing bridge with its combination of buttressed piers and wrought iron trusses.

Another major bridge design 'driver' is to create a bridge that acknowledges the history of the distinctive forms of the range of heritage bridges in the Central Otago region. It is noted that within the broader Clutha Mata-au River catchment, which includes the Kawarau and Shotover Rivers, there are many existing bridge types from historic bridges. The include suspension bridges such as the Kawarau Bridge Bungy bridge, the steel through tress Luggate 'Grandview Bridge' and Clyde - Earnscleugh Bridge, the steel tress arch SH8 Alexandra Bridge, the concrete, bowstring SH1 Balclutha Bridge as well as the more conventional concrete bridges such as the SH6 Shotover Bridge and the Clydevale Bridge .

All of these bridges are distinctive due to their form, location and their contribution to the local landscape character as well as that of the Clutha Mata-au catchment. The 'place' of the proposed SH8 Beaumont Bridge, both locally and regionally, is an important consideration going forward. While a large embellished structure may detract from the historic bridge, a plain concrete structure would conversely be out of place in its utilitarianism.

Consideration has been given to a number of modern bridge types or designs as the Project developed. The selection of the actual bridge form that will be progressed to detail design will be strongly influenced by the landscape and urban design drivers of having least effect on the existing bridge, while becoming a memorable structure when traveling on SH8 and being an asset in both form and function for the local and wider community.

5. CONCEPT PLAN

5.1 Landscape Concept Plan

The Project's Landscape Concept Plan at Appendix A acknowledges a number of recreational and amenity opportunities that can be developed as part of the Project. One of which is to provide an interesting safe stopping area that is also a positive and memorable feature of Beaumont township, acknowledging history, especially the historic bridge; while linking cyclists on the trail, to the township. This relies on creating an appealing setting for the proposed bridge that visually and physically links to the surrounding landscape.

The integration of the local section of the Clutha Gold Trail for both cyclists and pedestrians will encourage greater recreational use of the area. The 're-purposing' of the existing bridge provides the opportunity for a safe and interesting link from the cycle trail to the Beaumont Hotel and Holiday Park and to the highway and local roads on the west bank of the Clutha Mata-au River. It also allows the opportunity for an 'off-highway' safe stopping area to be created that is focused on an existing 'node' on the cycle way. This area, in turn, leads to the existing bridge and the opportunity to view and appreciate the river and both existing and proposed bridges.

It is intended that the Landscape Concept Plan will be further developed and implemented as part of the Project.

5.2 Urban and Landscape Treatment

Simple and bold landscape treatments will be key in providing a cohesive environment that creates a strong 'gateway' to Central Otago. Key elements and focus areas for the route are outlined below:

EASTERN APPROACH

Approaching from Lawrence, the highway will have a more flowing alignment than the current situation which has curves that 'tighten' and then the required halt at the traffic lights before proceeding across the existing single lane bridge. Depending on traffic safety advice, it may be necessary provide highway threshold treatment in the area of Low Burn Bridge to assist in 'signaling' the approach to Beaumont township and the proposed bridge.

Local road intersections will be improved at Stonewall Street and Craig Flat Road, with Weardale Street intersection being closed. As part of the latter, sycamore trees and associated exotic shrubbery will be removed from the near corner of the adjoining Healey property, but the large oak trees with significant tree status within the property will not be affected. The large macrocarpa tree in the adjacent paddock will be impacted by the proposed eastern approach embankment and will be removed while the prominent walnut tree in this paddock will be retained. There is the possibility to retain the macrocarpa tree in the landscape treatment as slabs of timber used in seating or decking or as sculpture / art.

Detail design will define the placement and alignment of the cycle trail in this area, along with incorporating screen planting to visually 'close-off' the end of Weardale Street as seen when approaching from the south along the street. A stormwater detention basin serving the proposed bridge and its eastern approaches will be created within this paddock. This basin will be planted with wetland species that will rise into the native species planting of the bridge approach embankment.

The local section of the cycle trail will be realigned from the proposed cul-de-sac head on Weardale Street along the toe of the eastern approach batter, then under the proposed bridge, past the proposed stormwater basin to the proposed safe stopping area. A pedestrian pathway will rise from this route at the approaches to the bridge to join the shared path on the downstream side of the proposed bridge. In all areas fall protection fencing will be added, as necessary.

BEAUMONT BRIDGE SAFE STOPPING AREA

As previously mentioned, the defunct section of highway at the sharp approach bend to the existing bridge provides an opportunity. This would be to create a safe stopping place/rest area that incorporates the existing information node on the Clutha Gold Trail. This would then provide cycle and pedestrian access to the existing bridge, once it has been de-commissioned as a traffic bridge.

The existing open area of the Craig Flat Road intersection with the highway affords a broad area that can be shaped and re-surfaced for parking, while maintaining a link and a node in the Clutha Gold Trail. The surfacing will need to take into account the shared use of the space and prioritise safe cycle and pedestrian crossing.

There is the potential for the installation of seating, picnic tables and cycle stand; this could also tie-in with the existing cycle trail information/ interpretation signage. Re-used asphalt, concrete, schist and hardwood such as old railway sleepers would be materials that reference the history of the area. Inclusion of the retained walnut tree as a feature in the design of the safe stopping area will also build on the heritage themes.

An objective of the Clutha Gold Trail project is to re-establish glades of large native trees along the length of the trail. This would be combined with the opportunity to provide shade and a backdrop to the proposed safe stopping area. Tōtara would a suitable tree species as it was once common to the local river banks and was used in the construction of the original bridge across the Clutha Mata-au River at this point.

EXISTING BRIDGE 'LINKAGE'

The defunct highway bridge will become a 'viewing platform' for both the river and the proposed bridge. This will also allow the opportunity to observe the form, structure and materials of the historic bridge at close hand. It is anticipated that scaffolding that is currently in place for the frequent maintenance that the traffic bridge requires will be removed and the uncluttered form of the bridge will become visible again.

At the western end of the existing bridge, the combined cycle and pedestrian path would lead under the proposed bridge and to the south side of the highway to the hotel and holiday park. A path from the end of shared path crossing the proposed bridge will lead down to join this path. Design solutions will prioritise safety and accessibility, with appropriate gradients allowing cyclists and pedestrians to enjoy the riverside experience as they travel towards the hotel and holiday park.

Detail landscape design would develop the connection to the river edge and also create a visual screen and physical barrier to block taking a direct and unsafe route across the highway to the hotel. This screen would also reinforce the 'closing-off' of the west approach to the existing bridge relative to passing traffic. Similar landscape treatment would also aid in visually 'closing-off' Rongahere Road to local traffic heading north on this section of road. This planting on both sides of the highway would also help define the western approaches to the proposed bridge.

WEST APPROACH

The main local feature on the west bank of Clutha Mata-au River is the Beaumont Hotel, which fronts directly on to the highway. With an improved highway alignment, traffic speeds in this area are likely to increase and some form of separation between hotel and highway is required. Given the space constraints, the detail design of this area will have a single vehicle entrance to the hotel and holiday park, traffic barriers and a physical and planted landscape screen. Traffic would exit the area via a new link to Dee Street, the local road on the property's western boundary; refer Appendix B for concept plan.

To the immediate west of the hotel frontage, Dee Street intersection will be improved as it will become the one link from the highway south to Rongahere Road and to Tuapeka Mouth-Clydevale area. Any landscape treatment would be kept to the minimum in this area ensuring clear sightlines.

Further to the west, the Westferry Road intersection would be closed with landscape planting reinforcing the visual closure of this road relative to highway traffic approaching from Roxburgh and the west.

PROPOSED BRIDGE

The current Beaumont Bridge is one of New Zealand's oldest landmarks, with its structural form being unique and characteristic of the Central Otago Region. The proposed new two lane bridge located downstream presents an unique opportunity to pay homage to this icon; tying in with the character whilst being sympathetic to the history yet maintaining it's own distinct and elegant form.

As noted in Section 3.9, a continuous steel multi-girder superstructure, with composite concrete deck, founded on reinforced concrete hammerhead piers (i.e. single pile) will provide a cost-effective solution for the site constraints..

Opportunities for urban design features of the bridge that can be developed to 'embellish' the design include:

Piers – concrete columns (circular or simple geometric shapes such as octagonal) provide a contemporary solution to support the bridge. Careful consideration for integrating the pier with any pile cap or larger diameter cylinder forming the piled foundation will be required to avoid a disconnect and ensure the bridge is visually well 'grounded'.

Abutments - Due to the retention of the historic bridge as a part of the cycle trail, pedestrians and cyclists will pass under the new bridge at both ends (refer Figure 14). Important consideration has been given to this experience and vantage angle, to both engage and promote a secure and inviting passage and journey for all parties. The two abutments present the opportunity for patterning signifying elements of area during passage under the bridge adjacent to the Clutha Mata-au River at what is a historic and long used crossing area.

FIGURE 14: ARTISTS IMPRESSION OF TRAIL LEADING UNDER ABUTMENTS, SHOWING OPPORTUNITY FOR ART APPLICATION TO ABUTMENTS & INCLUSION OF ANGULAR FORMS ON SIDE BARRIERS

Superstructure – There is the potential to incorporate some degree of contrast in the steel bridge beams which will be visible below the side barriers. The use of weathering steel provides a low maintenance option and bold contrast with the concrete of the edge barriers and is recommended for further consideration (refer Figure 15 and Figure 16). Careful detailing will need to be adopted to ensure staining of substructure elements is avoided.

The connection between the steel bridge beams and hammer head piers will need to be well considered and a simple treatment without end upstands is proposed similar to the Waitaki River Bridge. Utilisation of a hammer head pier structure allows the pier shapes to pay homage to the existing bridge.

Side barriers; outside face – The standard TL-5 HT barrier provides opportunities for incorporation of textures and patterns. This 'infill' line work would be visible from the cycle and pedestrian path on the existing bridge and on the riverbanks immediately below the proposed bridge (refer Figure 14 and Figure 15).

Side barriers; inside face – There is the opportunity to embellish the inside faces of the side barriers as seen from the traffic lanes. This embellishment could take the form of exposed aggregate or embossed lines that reflect the external 'panel' elements. While there is an urban design preference for embellishment on the inside face of the barriers, the actual texture used will be guided by the practicality of 'installing' such.

Side barriers; top rail – An unpainted, hot dip galvanised (HDG) or thermal metal spray finish is proposed for exposed steel elements such as the barrier top rails. However, the top rail of the side barriers is an element where colour can be introduced with relative ease and limited cost. Given that weathering steel is proposed for the superstructure, this 'rust' colour could be carried through to the top rails. Alternatively a simple HDG finish could reference the grey tones of the existing bridge. In terms of 'whole-of-life' considerations, it is expected that the colour will need to be a lighter shade so it does not readily fade, but has enough 'weight' so that the top rail 'reads' as a distinct line.

Pedestrian / cycle side barriers between path and river can also feature similar colour and angular forms to complement the rest of the bridge design.

The appropriate combination of design features will allow the new structure to tie in with the existing landscape and be appropriately "of place" (refer Figure 18).

FIGURE 17: INDICATIVE PATTERNS SHOWING POTENTIAL TO USE ELEMENTS FROM THE ENVIRONMENT TO FORM PATTERN ON ELEMENTS OF THE BRIDGE.

FIGURE 15: EXAMPLE OF WEATHERING STEEL USED FOR BRIDGE GIRDERS AT KAWARAU FALLS BRIDGE NEAR QUEENSTOWN. THE KAWARAU FALLS BRIDGE ALSO INCORPORATES TEXTURES IN THE OUTSIDE FACE OF "HT" CONCRETE BARRIERS.

FIGURE 16: EXAMPLE OF WEATHERING STEEL USED FOR BRIDGE GIRDERS ON THE WAITAKI RIVER BRIDGE, KUROW.

FIGURE 18: ARTIST'S IMPRESSION OF PROPOSED BRIDGE & SAFE STOPPING AREA

5.3 Crime Prevention Through Environmental Design

Consideration will be given to limit any potential CPTED/personal security risks relative to the detailed design of the proposed safe stopping area, the sections of path passing under the proposed bridge (refer Figure 19). This consideration will also guide the actual placement and massing of plant species so as to not create unintended screened-off areas and the opportunities for undesirable behaviour.

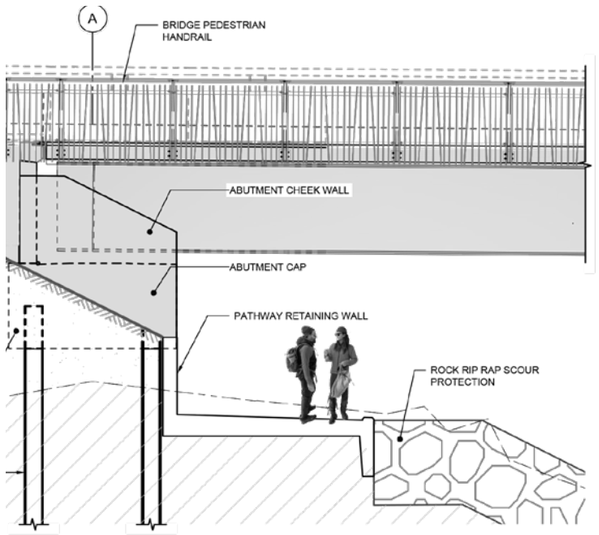


FIGURE 19: CONSIDERATION OF ABUTMENT FORM TO AVOID CREATION OF UNDUE PERSONAL SAFETY RISK

5.4 Landscape Maintenance

The long-term maintenance consideration of the proposed landscape treatment is fundamental to the design of an appropriate, practical and sustainable design solution and will be applied to the design.

Landscape design should establish long-term aims and objectives for landscape and feature management (as a continuous process).This is to optimise the life and value of the vegetation, while maintaining, managing and improving safety. Further to this, biodiversity, visual quality, stormwater runoff, pest, local air quality considerations and Transport Agency business practices are foremost. Maintenance consideration will cover the following:

- Design of core areas with hard surfaces at the narrow parts, to avoid plant establishment and maintenance issues
- Co-ordinated street furniture
- Plant selection to deliver whole of life value
- Maintenance needs being coordinated with the design
- Space created for practical mowing operations as part of the design, if such are required
- Safety margin to mowing operators.

6. CONCLUSION

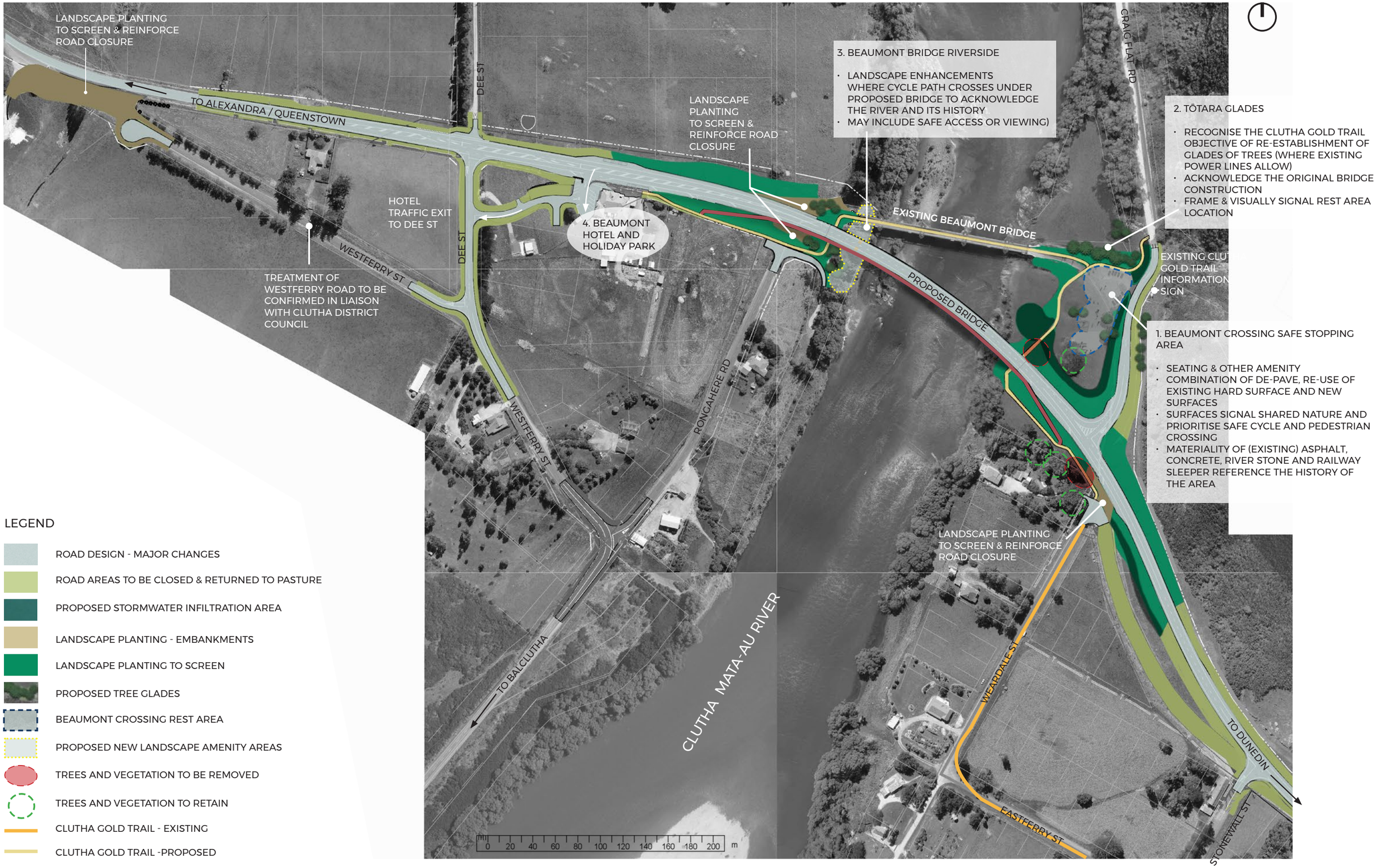
The Urban and Landscape Design Framework outlines the guiding principles to be incorporated from concept through to detailed design of the replacement bridge and associated approach works. The ULDF has drawn on the high level urban design issues, where the broader context and aspirations are considered, while encompassing the Transport Agency's objectives and requirements to develop an integrated Landscape Concept Plan for the highway corridor and river crossing.

A contemporary modern structure incorporating circular columns, hammer head piers and weathering steel bridge beams below concrete deck and concrete edge barriers, it is proposed this bridge will acknowledge but not compete with the distinctive form of the existing wrought iron truss bridge. Careful detailing and provision of texture to edge barriers and colour to barrier top rails will further embellish the structure.

This bridge structure is accompanied with cohesive landscape strategy which forms a safe stopping area for motorists, a distinctive crossing area and rest for cyclists and pedestrians, and cohesive pedestrian and cycle links to the both sides of the bridge. This will be accompanied with planting to form necessary screening chosen from palettes particular to the area in terms of both original ecosystem, and other locally valued species.

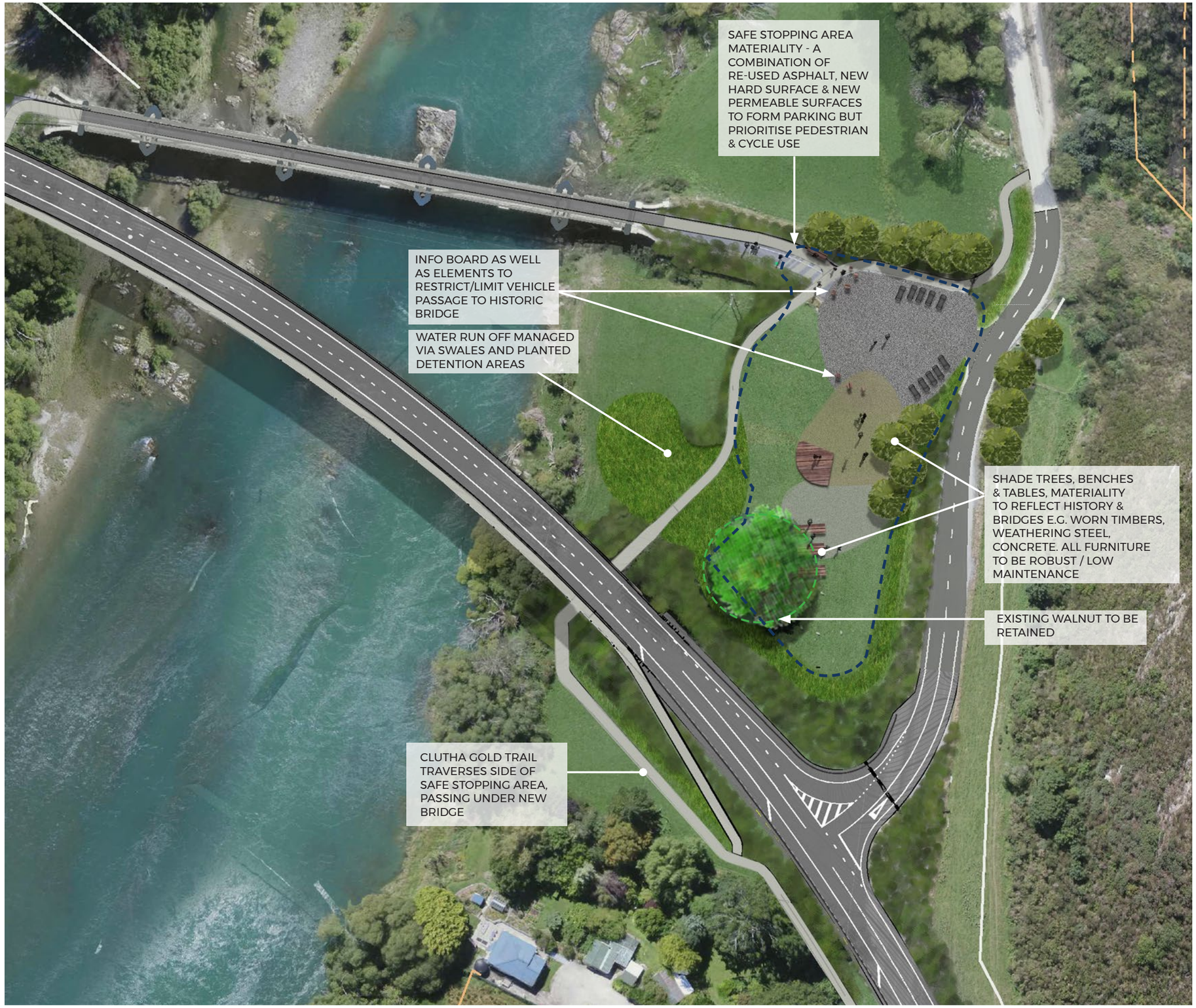
The safe stopping area and associated paths and amenity also provide opportunity to experience the historic Beaumont Bridge. The Beaumont Hotel's place in the area is maintained, with sympathetic landscape development around the new bridge maintaining clear, safe access and an attractive frontage. Access to the river will also be redeveloped, maintaining both pedestrian and recreational vehicular access.

APPENDIX A - LANDSCAPE CONCEPT PLAN



LEGEND

- ROAD DESIGN - MAJOR CHANGES
- ROAD AREAS TO BE CLOSED & RETURNED TO PASTURE
- PROPOSED STORMWATER INFILTRATION AREA
- LANDSCAPE PLANTING - EMBANKMENTS
- LANDSCAPE PLANTING TO SCREEN
- PROPOSED TREE GLADES
- BEAUMONT CROSSING REST AREA
- PROPOSED NEW LANDSCAPE AMENITY AREAS
- TREES AND VEGETATION TO BE REMOVED
- TREES AND VEGETATION TO RETAIN
- CLUTHA GOLD TRAIL - EXISTING
- CLUTHA GOLD TRAIL -PROPOSED
- PEDESTRIAN ACCESS ACROSS BRIDGE



LEGEND

- WAYFINDING SCULPTURE - SLEEPERS OR SIMILAR
- PROPOSED STORMWATER INFILTRATION AREA
- LANDSCAPE PLANTING - EMBANKMENTS
- PROPOSED TREE GLADES
- BEAUMONT CROSSING REST AREA
- EXISTING TREE TO RETAIN
- CLUTHA GOLD TRAIL -PROPOSED NEW ROUTE

SAFE STOPPING AREA DETAIL SCALE: 1:1000@A3

1 BEAUMONT BRIDGE SAFE STOPPING AREA

- create rest area with safe access to existing bridge, walnut tree, cycle way and vista to river
- tell the story of the crossing - traditional crossing area for both Tangata Whenua and European settlers, by punt and bridge
- allow for parking, but overall provide a safe pedestrian and cycle area with lower priority given to vehicles
- robust cycle parking systems to allow safe parking
- use materiality of ground plane to help signal cycle and pedestrian priority
- re-use asphalt via retention and/or de-pave and re-use
- use combination of permeable and non permeable materials such as asphalt, concrete and crusher dust
- provide amenity which reflects the materiality of the bridges - hardwood sleepers, weathering steel or powdercoated steel in heritage colours, concrete, with forms that also complement bridge architecture
- provide clear wayfinding cues and signs & interpretation signage
- provide native ecology and soften edges via planting which complements the roadside planting and adjacent stormwater infiltration area
- CPTED principles adhered to

2 TOTARA GLADES:

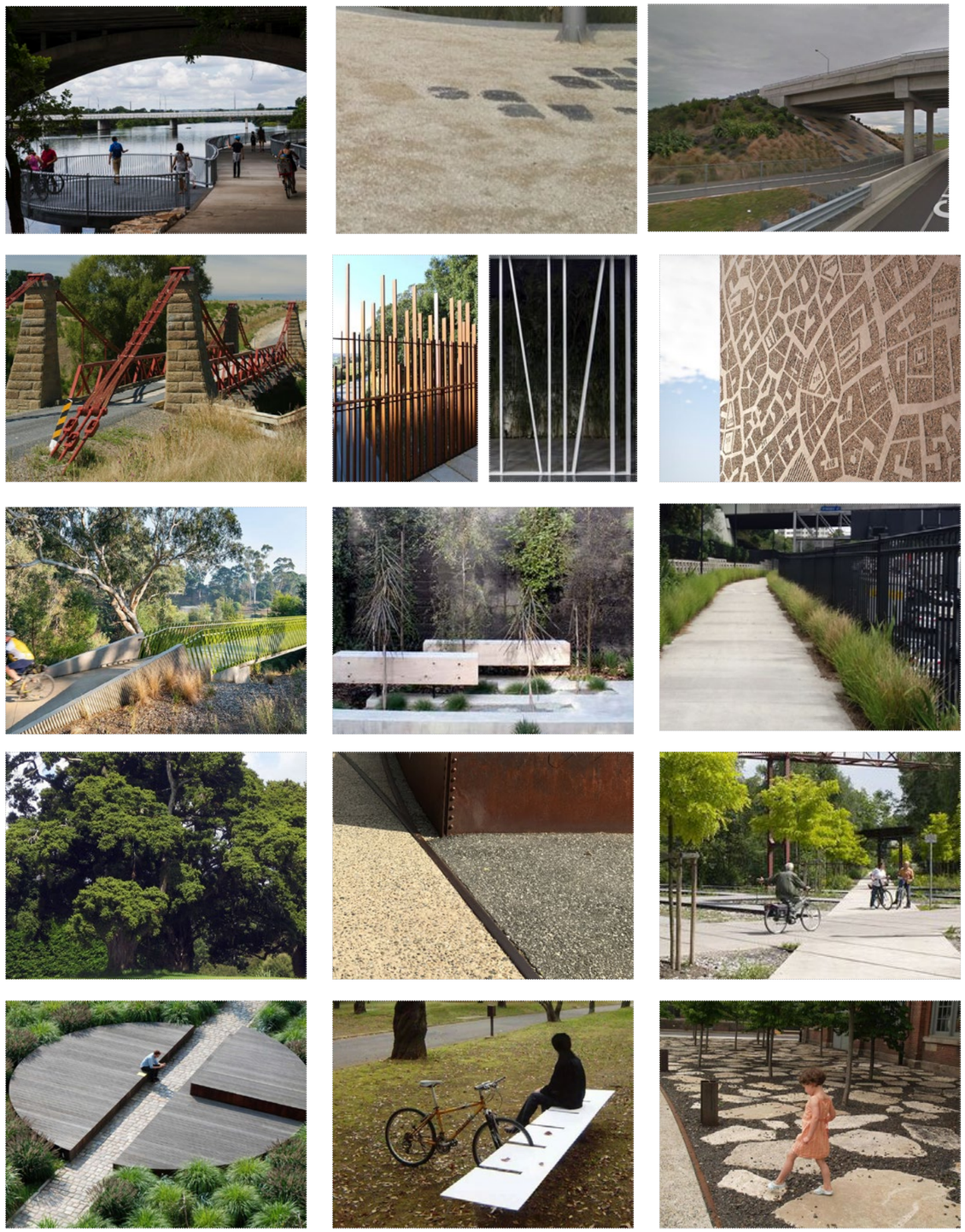
- incorporate Clutha Gold Trail objective to re-establish glades of large native trees
- reflect the original construction materials of the Beaumont Bridge
- planning for eventual shade and shelter for cyclists and other users
- visually signpost the rest area and bridge from multiple directions of approach aiding wayfinding
- aid in visual and physical screening of closed road areas
- provide native ecology.

3 BEAUMONT BRIDGE RIVERSIDE - SHARED CYCLE/WALKING PATH:

- shared cycle walking path provides safe viewing of river, potential access to river
- abutment's featuring natural stones and element of surprise/interest
- abutment materials referencing geography and history
- CPTED principles adhered to
- materiality includes natural stones, concrete, patterned concrete, weathering steel, railway sleepers to reference bridge and railway history
- Any pedestrian/cycle fencing needed combines materiality which references the bridge (i.e. weathering steel) with timber palisade with a nod to the mānuka "hill stick" typically used by shepherds in the region
- riparian planting with high amenity value planted in open spaces
- rip rap adjacent to abutments for flood protection
- planting reflects original ecosystems
- inclusion of river boulders into the track surrounds to blend into riverside
- gradients managed to eliminate risk of serious fall from track. Where not possible, track has appropriate barrier fencing or railing with similar materiality to rest of area
- interpretation to reflect history of this section of the river.

4 BEAUMONT HOTEL:

- landscape treatment highlights Beaumont Hotel including signalling of new entranceway.
- cycle and pedestrian paths provide pleasant and safe linkage to hotel from safe stopping area and cycleway via both bridges.



PRECEDENT IMAGES

APPENDIX B - HOLIDAY PARK ENTRY LAYOUT

NOTE:
All Signage is shown as Indicative.To be confirmed.

Queenstown
Dunedin
HOLIDAY PARK
350m ON RIGHT
SH8 Widening for Right Turn Bay
NO EXIT
S2
SID-5
HOLIDAY PARK
500m ON LEFT
8 - Beaumont Highway
DEE STREET
SH8 Entry only access
Gravel Parking area
Parking area
3m wide gravel access to overflow area
EXIT
BEAUMONT HOTEL
Raised island with screen planting
Proposed Shared Path link to Clutha Gold Trail
Queenstown
Dunedin
Balclutha
Gravel Parking area
5.5m wide two way Entry-Egress.
PRELIMINARY

BEAUMONT BRIDGE REPLACEMENT

BEAUMONT HOTEL & HOLIDAY PARK ENTRY - EGRESS PRELIMINARY DESIGN LAYOUT PLAN

WSP OPUS

NZ TRANSPORT AGENCY WAKA KOTAHI

DATE: 21/05/2019 PROJECT NUMBER 6-CT012.00 -PRELIMDESIGN SHEET-10(C)

1:500 0 5 10 15 20 m

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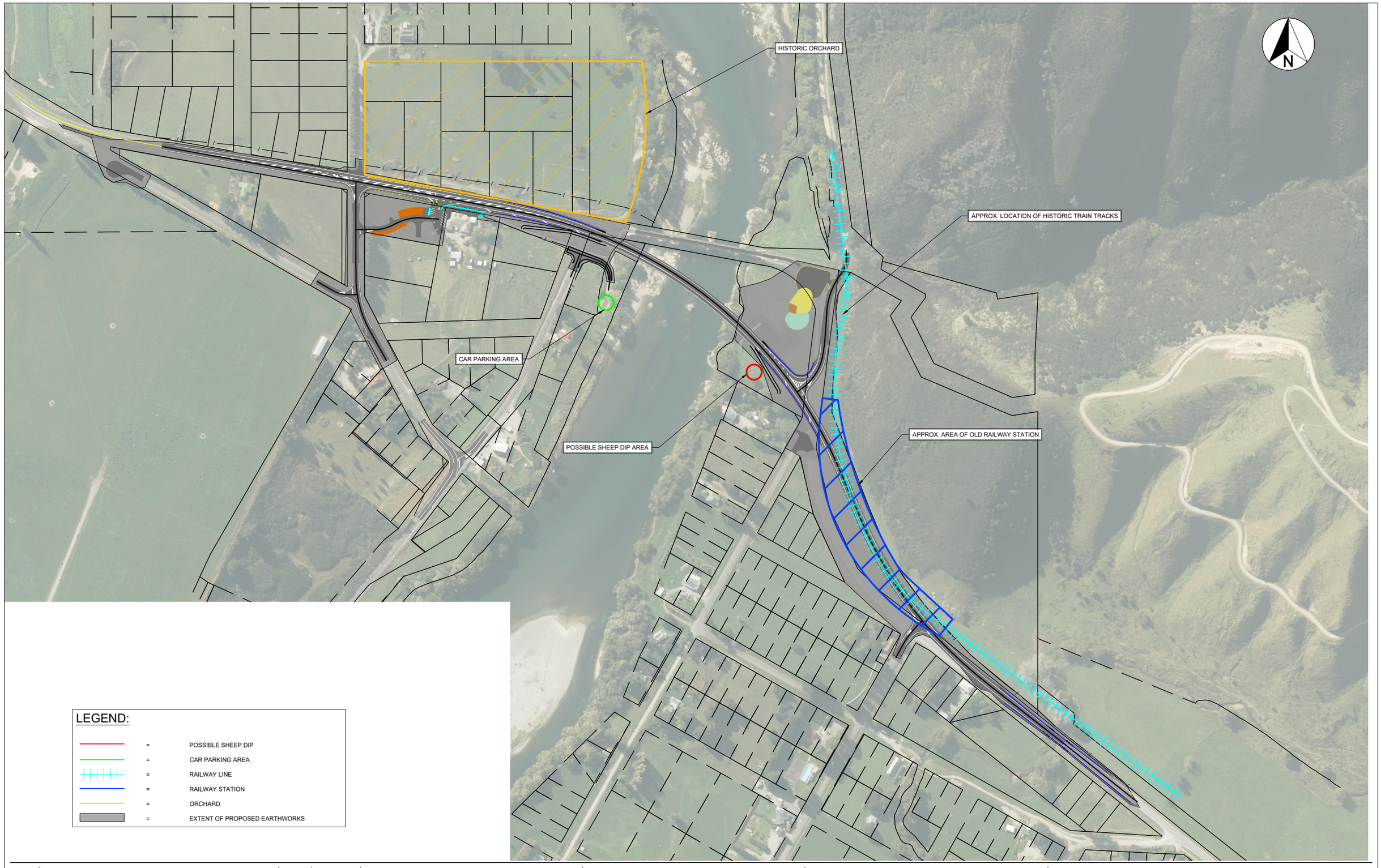

REVISION	AMENDMENT	APPROVED	DATE
A	FOR CONSENT		

WAKA KOTAHI NZ TRANSPORT AGENCY

wsp
Dunedin Office
+64 3 471 5500
Private Bag 1913
Dunedin 9016
New Zealand

PLANNING

SCALES		ORIGINAL SIZE
1:2000 @ A1, 1:4000 @ A3		A1
DRAWN	DESIGNED	APPROVED
E. GEORGE	S. ROBERTS	M. DAVIES
DRAWING VERIFIED	DESIGN VERIFIED	APPROVED DATE
VERIFIER	VERIFIER	YYYY-MM-DD

FOR CONSENT

PROJECT
NEW ZEALAND TRANSPORT AGENCY
BEAUMONT, OTAGO
SH8 BEAUMONT BRIDGE REPLACEMENT

TITLE
POTENTIALLY CONTAMINATED SITES

WSP PROJECT NO. (SUB-PROJECT)	SHEET NO.	REVISION
6-CT012.00 (00024)	X1001	A

Original sheet size A1 (841x594) Plot Date 2019-12-19 at 2:08:04 PM B:\800 Drawings\(P) Planning\6-CT012.01_DRAFT.dwg X1001

20 December 2019

Otago Regional Council
PO Box 5245
DUNEDIN 9058

Attention: Rebecca Jackson

Consent RM19.387 - Response to Request for Further Information

Dear Rebecca

With regards to your request for further information dated 2 December 2019 attached are:

- A drawing showing the location of potentially contaminated sites in relation to the project 'footprint' (In relation to item 2.0)
- A memo from Ryder consultants dated 18 December 2019 (in relation to item 3.0)
- A report entitled 'Urban and Landscape Design Framework' (in relation to item 4.0)
- A memo from WSP 20 December 2019 (in relation to item 5.0).

In addition to the attached please also refer to the below responses:

1.0 Consent Application

(i) With regards to the need for discharge permits, please consider the following:

Stormwater: We consider we can comply with the relevant provisions of the Regional Water Plan (RWP) (Rules 12.B.1.8 and 12.B.1.9). As such the reference to a discharge permit for stormwater in the application is incorrect.

Other discharges: I note that Rule 13.5.A.1 of the RWP states of: *"Discharges of bed material arising from the alteration of the bed of a lake or river, or a Regionally Significant Wetland, are addressed only through rules in section 13.5."* Discharges of this nature are the only other discharges we consider of relevance to this project.

Turning to Rule 13.5.1.1 which is relevant to the project in terms of the construction activity, it covers: *"The disturbance of the bed of any lake or river, or any Regionally Significant Wetland, and any resulting discharge or deposition of bed material associated with: …the erection…of any structure…"*. As the application cannot comply with (f) we require consent in terms of Rule 13.5.3.1. The bed disturbance regulated by (f) will include an element of discharge, that we consider can comply with (g). What is not entirely clear from our reading of the plan is if non-compliance with (f) triggers both a land use consent (s13) and discharge permit. We would appreciate Council's guidance on this – however we do consider the effects and scope of activities have been fully explained in the application to enable an assessment of the activity in terms of Rule 13.5.3.1.

(ii) We are no longer proposing to apply to extract any gravel from the bed as part of this project. Any gravel needed for construction activities will be bought to the site.

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Dunedin 9016
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wsp.com/

2.0 Contaminated Site

We note the request for further information has essentially provided two options in terms of a response. Our preference is for the second option (a staged approach).

(i) An updated site plan is attached.

(ii) We wish to reiterate that any risk from contaminants in soil at the site have been assessed as being low. Given this we consider the appropriate mechanism to deal with this is for Council to require, as a condition of consent, the Construction Environmental Management Plan to address how the potentially contaminated sites within the project footprint will be dealt with during the ground disturbance phase of the project. We do not consider any testing is necessary.

3.0 Ecological Assessment

(i) (iv)Refer to attached report. With respect to item (iii) this is addressed on page 19 of the application as lodged.

4.0 Visual Assessment

Please refer to the attached report (ULDF R4)

(i) I also note for completeness the applications as lodged feature a thorough Statutory Analysis in relation to all aspects of the proposal.

(ii) Refer to attached report.

(iii) Refer to attached report.

(iv) Refer to attached report.

(v) Refer to attached report.

(vi) Refer to attached report.

(vii) We do not intend producing any visual simulations beyond those already produced in the attached report.

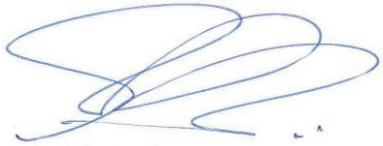
(viii) We are not proposing any replanting that would require consent from the Otago Regional Council. Please note detailed planting plans would be required to be included in any Outline Plan submitted to the Clutha District Council in accordance with section 176A of the Act.

5.0 Engineering / Natural Hazards Assessment

(i)– (ix) Please refer to the attached memo.

We consider that we have responded to your request with sufficient information for the application to be publicly notified, as we have already requested. We would appreciate it if you could work with Clutha District Council to have the application notified by the end of January 2020, and preferably the week of 20 January.

Regards



Shane Roberts
Work Group Manager - Planning & Property

Copy:

Clutha District Council

Ryder Environmental Ltd
195 Rattray Street
Dunedin
03 477 2119

To: Shane Roberts, Work Group Manager - Planning & Property, WSP
From: Dean Olsen, Environmental Scientist & Associate Director, Ryder Environmental
Date: 18 December 2019
Subject: Beaumont Bridge Ecological Assessment – response to request for further information

---

Dear Shane,

I have now had a chance to consider the s.92 request for further information provided by the Otago Regional Council (ORC), dated 2 December 2019, regarding the Beaumont Bridge ecological assessment (Olsen & Stowe 2019[1]). This request outlines four queries relating to the ecological assessment:

i. Fish spawning
ii. Mussels and crayfish
iii. Concrete discharge
iv. On-site requirements

I address each of these matters below.

Fish spawning

The Clutha River/Mata-Au is identified in Schedule 1A of the ORC Regional Plan: Water as being a significant spawning habitat for trout and salmon (see Table 1 of Olsen & Stowe 2019). While the extent of spawning within the mainstem of the Clutha River/Mata-Au in the vicinity of the proposed works is unknown, the large size (mean flow of 614 m^3/s), depth and high water velocities in the vicinity of the works indicate that the area is unlikely to be suitable for salmonid spawning. Despite this, it was suggested in our original assessment that any potential adverse effects on spawning could be avoided by not undertaking works during the trout spawning and incubation season (April-September). Salmon may also spawn in the mainstem of the Clutha/Mata-Au and their spawning is expected to take place at a similar time to trout spawning and rearing (March-September). It is expected that most salmon spawning in the mainstem Clutha/Mata-Au will take place upstream of the proposed works.

It was also assessed that the potential for adverse effects on instream values, including fish spawning, could be minimized by following good sediment management practices (Leersnyder *et al.* 2018) and the potential for adverse effects arising from the proposed works were low given the very large size (mean flow of 614 m^3/s) and swiftness in the vicinity of the works meaning that the river has a very high capacity to dilute and disperse any contaminants (particularly sediment) that may enter it. Therefore, the risks of localized sedimentation adversely affecting instream values (including spawning) are deemed to be low.

---

[1] Olsen D & Stowe C 2019. Beaumont Bridge Replacement: Assessment of Ecological Effects. Prepared for WSP Opus by Ryder Environmental Limited and Urtica Ecology. Ryder Environmental Ltd, Dunedin. 2 May 2019.

Mussels and crayfish

There are no records of kōura (crayfish) or kākahi (mussels)in the mainstem of the Clutha River/Mata-Au in the vicinity of the proposed works in the NZ Freshwater Fish Database, although there are records of kōura in a number of nearby tributaries (e.g. Talla Burn, Beaumont River, Carson's Creek). The apparent absence of kōura from the mainstem of the Clutha River/Mata-Au likely reflects the extreme challenge associated with sampling a river of this size, as well as the low suitability of the habitat in the mainstem of the Clutha River/Mata-Au in the vicinity of the works. The depth and swiftness (resulting in mobilitisation of fine sediments, even at low flows) of the Clutha River/Mata-Au, along with the flow fluctuations resulting from the operation of the Clyde and Roxburgh Dams, are likely to make the mainstem unsuitable for long-lived species such as kōura or kākahi. Kōura favour small, forested streams with high inputs of organic matter and coarse, stable substrate, rather than the large, unstable channel of the Clutha/Mata-Au. Similarly, kākahi

Concrete discharges

The risks associated with concrete discharges were clearly set out in Olsen & Stowe (2019), which was attached to the application. Given the toxicity of uncured concrete and concrete water on aquatic life, it was recommended that "*…all steps should be taken to avoid concrete or concrete wastewater from entering water and any water that seeps from the boxing during curing of the concrete should be disposed of onto a grassy area away from waterbodies or pumped into storage containers and removed from the site and disposed of appropriately elsewhere away from watercourses."*

The approaches proposed to prevent discharges of concrete/concrete water will be outlined in construction plans for the project.

On-site requirements

Ryder Environmental staff will be available to provide ecological advice, undertake site visits, fish salvage etc. during construction.

Fish salvage

It is expected that construction of the coffer dams required for works on the channel margins will be undertaken at low flows when these areas are dry. Therefore, it is anticipated that fish salvage will not be required for these stages of construction. Fish salvage may be required during the construction of any coffer dams around the piling in the bedrock in mid-channel. It is uncertain what species will be present in the immediate vicinity of the works, but Ryder Environmental staff will be available to assist in the removal of fish from the immediate vicinity of these works should it be necessary. Removal methods would depend on the particular circumstances, but could involve electric fishing or netting (minnow traps, hand-netting), as appropriate. Ryder Environmental holds the appropriate permits for fish sampling, handling and recovery.