Appendix 3: BRIDGE SUMMARY- WHAREMAUKU

Site Specific Management Plan 003 - [SectorS 360-370-380] MacKays to Peka Peka Expressway

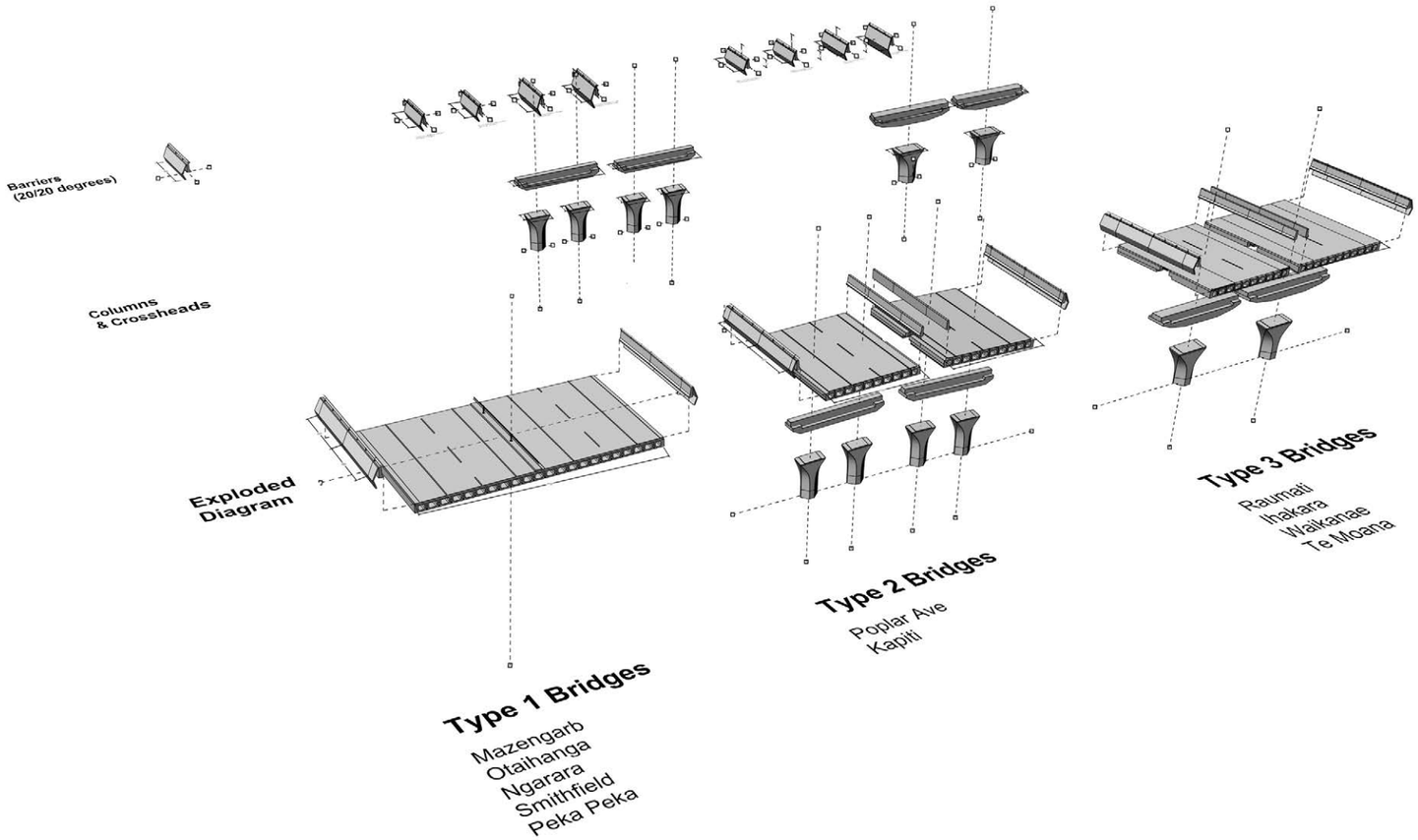
01 SEPTEMBER 2014 - CERTIFIED ISSUE - REV C

NZ TRANSPORT AGENCY WAKA KOTAHI

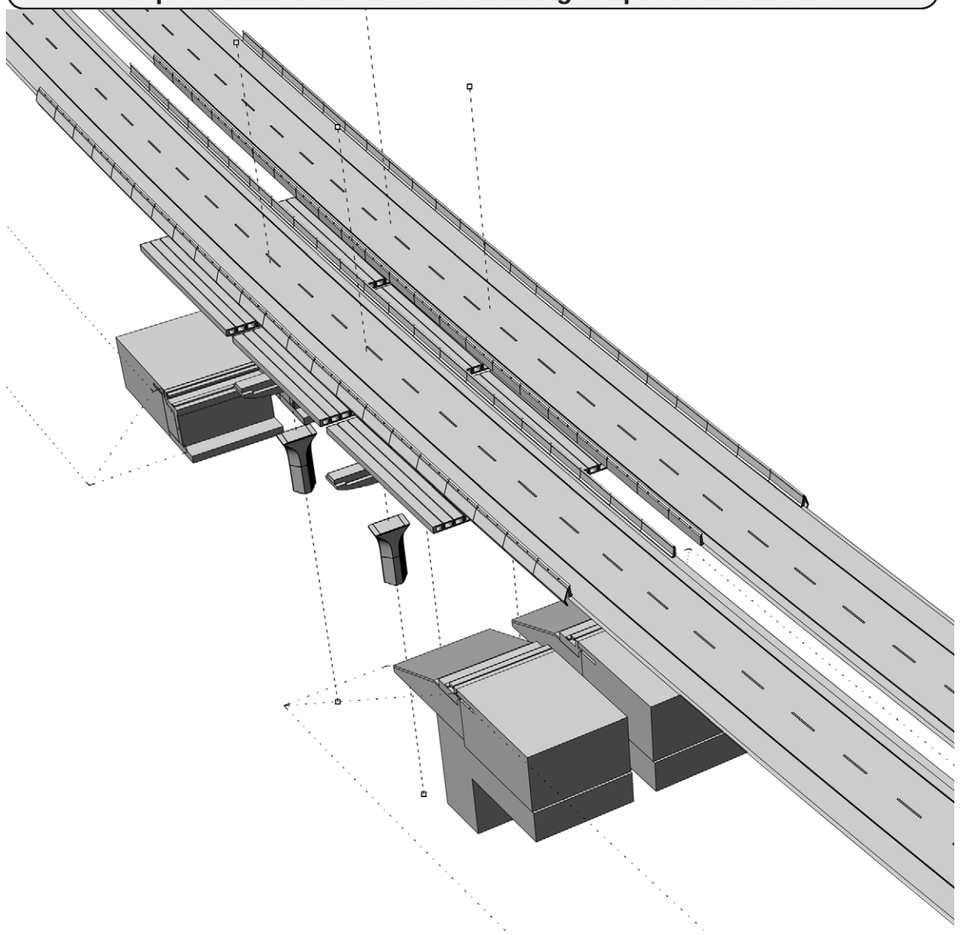
MacKays to Peka Peka
Wellington Northern Corridor

M2PP Bridge Design Objectives

Bridges as a series of components



Proposed Wharemauku Stream Bridge exploded isometric



Design Objectives

With reference to the Urban and Landscape Design Framework (Technical Report 5) (ULDF) there are four design objectives for the bridges and their respective contexts. These four objectives are overarching aims for the project and have been extracted from the Design Concept statements in two sections of the ULDF: Local Road Interface Design (section 5.7) and Bridge Design (section 5.8).

The purpose of extracting these objectives is to enable any changes to bridge structures and their context made through the concept and detailed design process to be considered at the highest level of the design intent. There are design principles in each of the sections as noted above and these too form a basis for considering the development of the designs for the bridges and their context.

As is typical in a design evaluation process, any aspects of design that do not align with the design principles would be elevated to consideration against the design objectives.

Design Objectives:

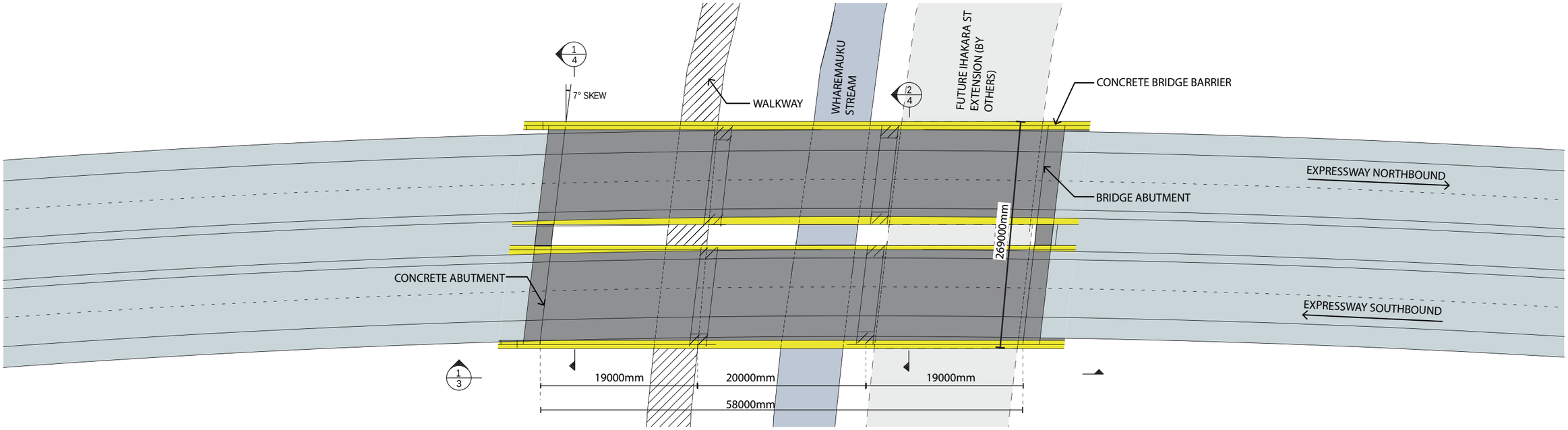
1. The public spaces of the roads and streets take primacy over the experience of the Expressway users. Local people will be making slower movements and as a consequence the bridges will be more visually apparent to them than to people travelling along the Expressway.

2. As a new element in the landscape, the bridges respect the surrounding landscape and are expressed in terms of their horizontality, fluidity and simplicity because the landscape is relatively low key and low in scale; having several ‘feature’ bridges would become both visually complex and overwhelming in scale.

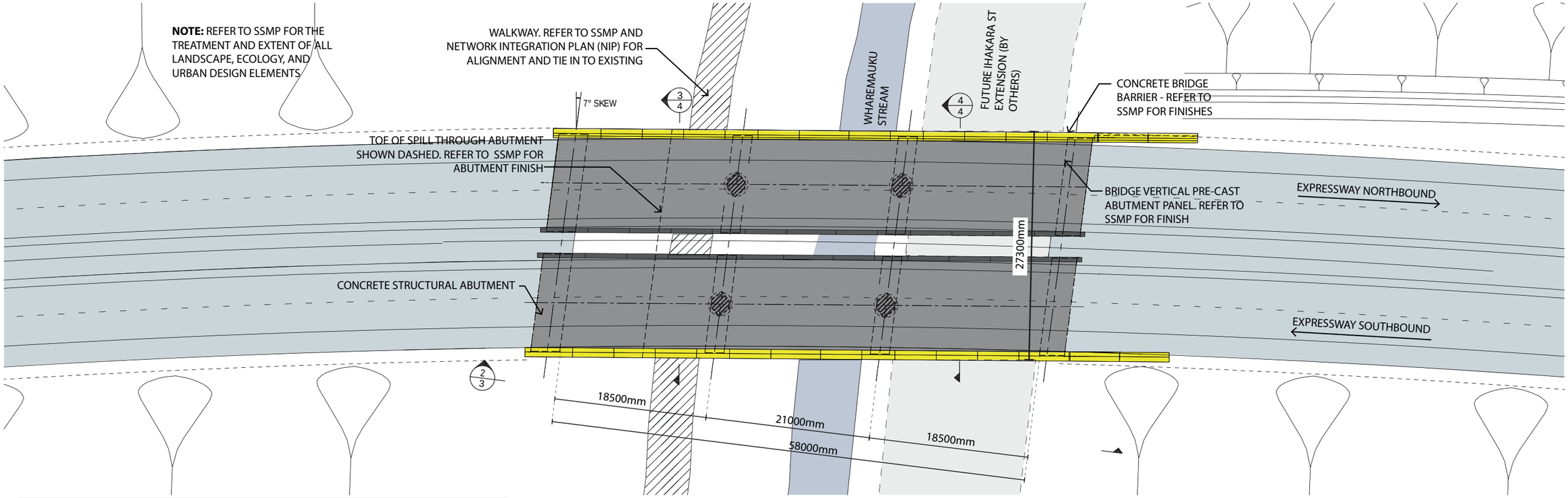
3. Bridges are formed as a whole from a single kit of parts, which allows the components to be repeated and a similar approach used at the multiple crossings to register as a ‘family’ of bridges because people will have multiple interactions day to day with the Expressway and this approach promotes simplicity and visual continuity

4. Utilise concrete prefabricated parts because this allows fine levels of quality control, cost benefits and significant improvements in construction time at the crossings and reduces disturbance to the area.

AEE Consented to DET Proposed Graphic Comparison



AEE PLAN- WHAREMAUKU STREAM BRIDGE - 1:500@A3



PROPOSED PLAN- WHAREMAUKU STREAM BRIDGE - 1:500@A3

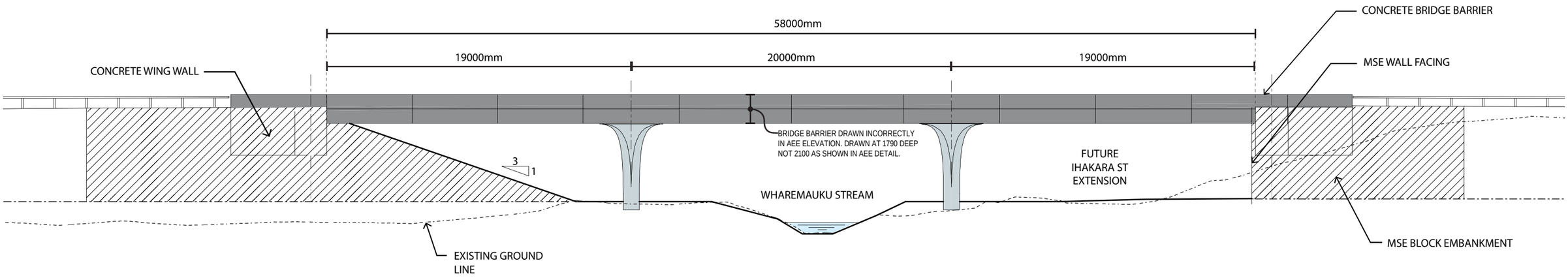
Design development

1. Column shape and location changed, abutment details refined

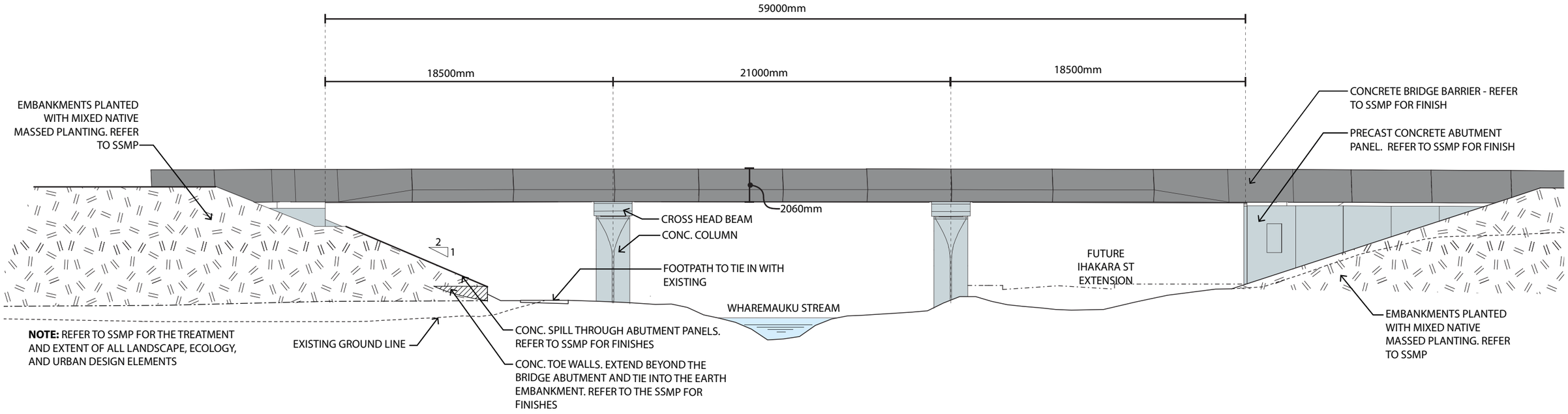
Rationale

1. Reduced number of columns (8 to 4) Due to bridge skew will appear more open beneath

AEE Consented to DET Proposed Graphic Comparison



1. AEE ELEVATION - WHAREMAUKU STREAM EAST ELEVATION (LOOKING WEST) - 1:250@A3



2. PROPOSED ELEVATION - WHAREMAUKU STREAM EAST ELEVATION (LOOKING WEST) - 1:250@A3

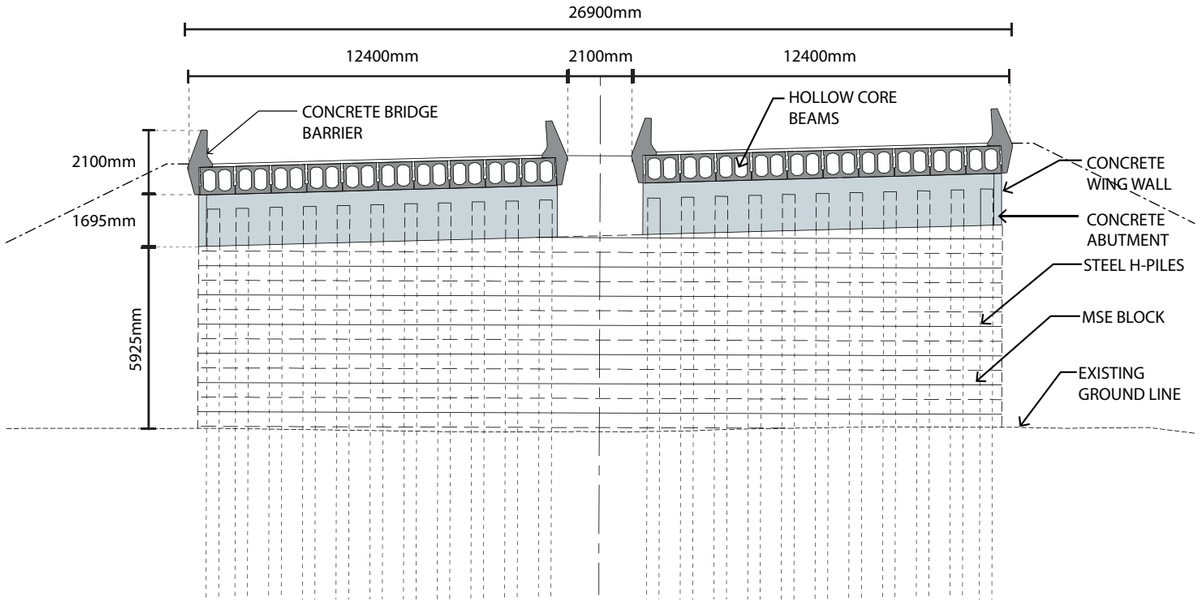
Design development

1. Bridge barrier drawn correctly
2. Bridge abutment grade has increased
3. Column profile developed

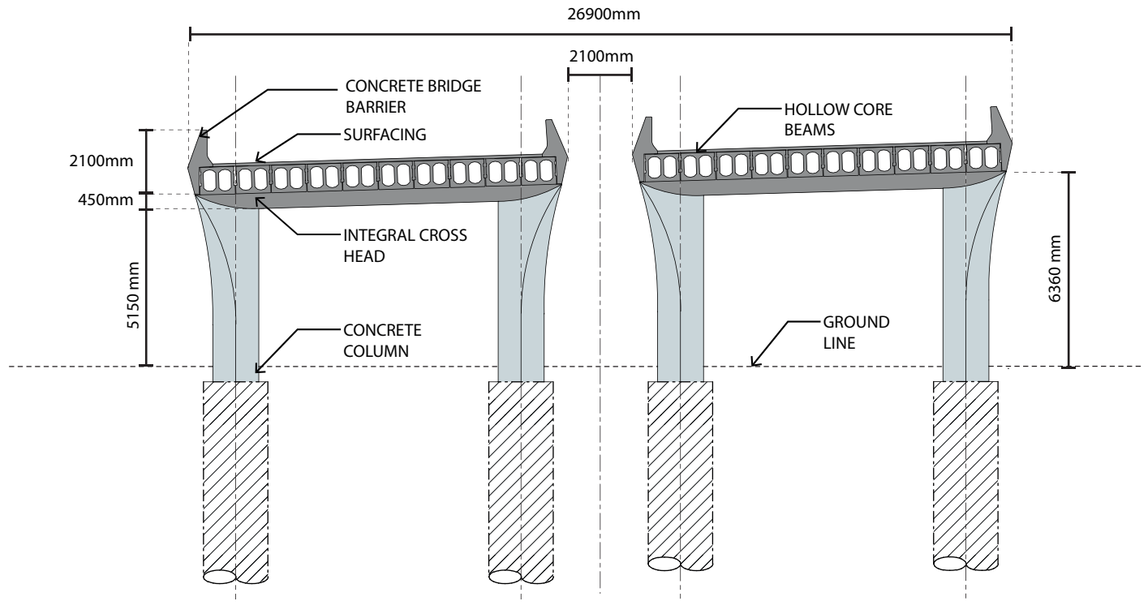
Rationale

1. Barrier drawn incorrectly in AEE elevation, Actual barrier depth unchanged from AEE simulations
2. Geotechnical and flood modelling developments since the NOR/AEE submission
3. Increased structural core based on geotech investigations carried out post AEE, while still providing the sculptural outer.

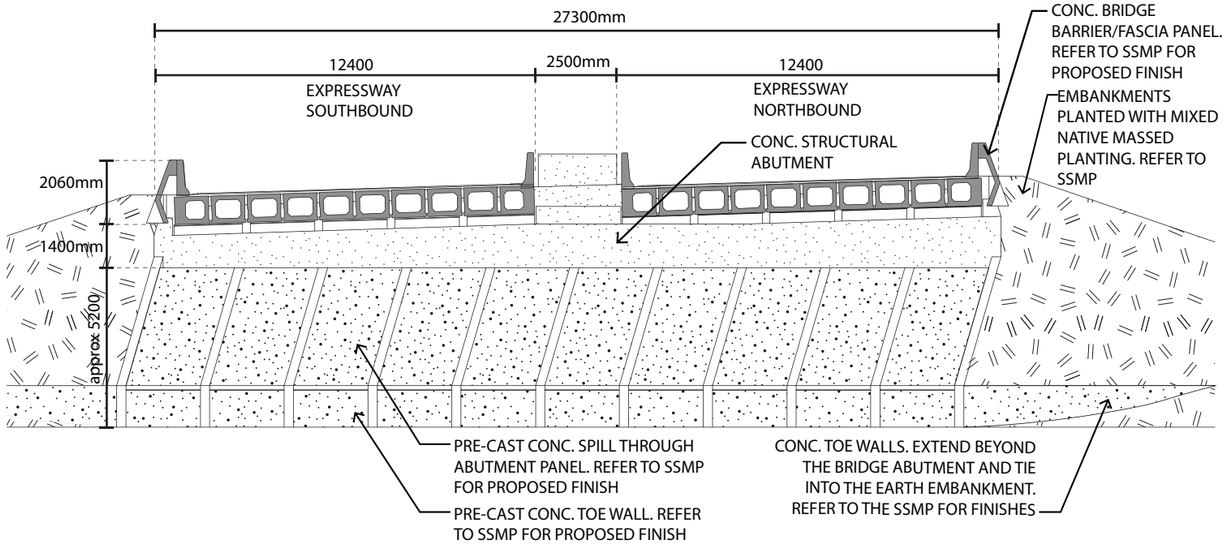
AEE Consented to DET Proposed Graphic Comparison



1. AEE SECTIONAL ELEVATION - WHAREMAUKU STREAM BRIDGE SOUTHERN ABUTMENT - 1:200@A3



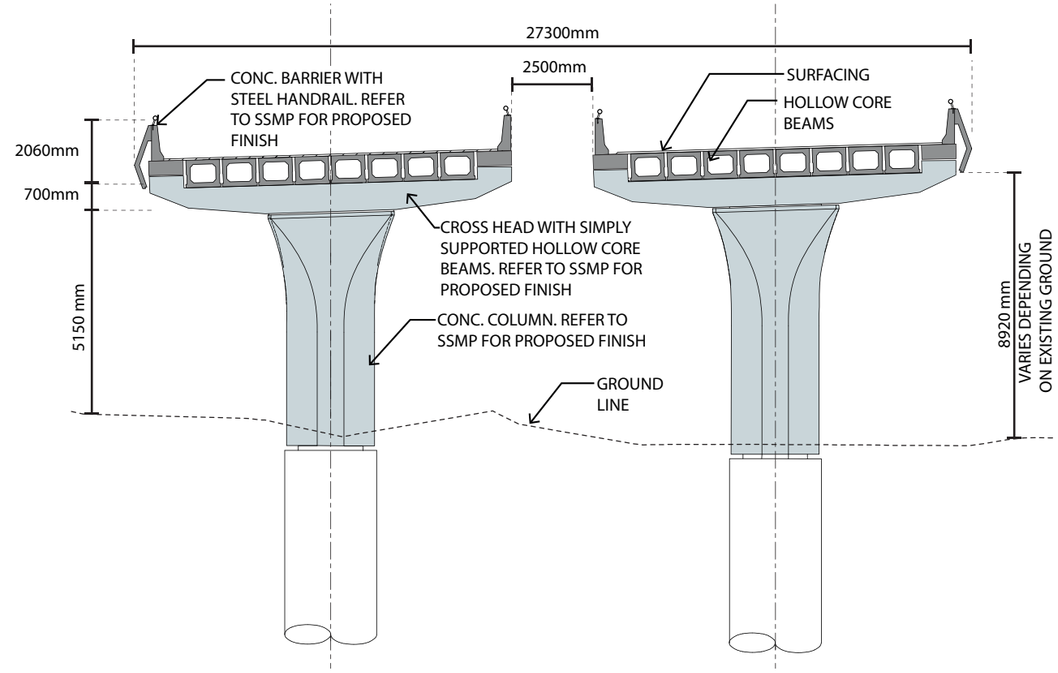
2. AEE SECTIONAL ELEVATION - WHAREMAUKU STREAM BRIDGE (LOOKING SOUTH) - 1:200@A3



NOTE:
THERE IS A SKEW BETWEEN THE EXPRESSWAY AND WHAREMAUKU SREAM. THE SPILL THROUGH ABUTMENTS ARE DESIGNED PERPENDICULAR TO THE STREAM.

REFER TO SSMP FOR THE TREATMENT AND EXTENT OF ALL LANDSCAPE, ECOLOGY, AND URBAN DESIGN ELEMENTS

3. PROPOSED SECTIONAL ELEVATION - WHAREMAUKU STREAM BRIDGE SOUTHERN ABUTMENT - 1:200@A3



4. PROPOSED SECTIONAL ELEVATION - WHAREMAUKU STREAM BRIDGE (LOOKING SOUTH) - 1:200@A3

Design development

1. Reduced number of columns; 2 columns to 1 column each cross head
2. More detail provided for abutment treatment
3. Cross head form changed
4. Column profile developed
5. Simply supported structure

Rationale

1. Improved visual permeability when considering bridge skew. Total column width when combined is reduced
2. Lack of resolution in AEE Abutment design developed
3. Simply supported structure requires platform to seat beams
4. Increased structural core based on geotech investigations
5. carried out post AEE, while still providing the sculptural outer. Constructability issues because of seismic requirements. Integral connections difficult to build without increasing structural element sizes further.

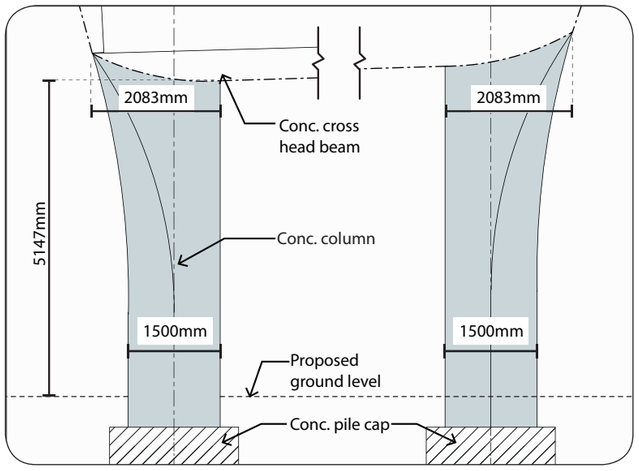
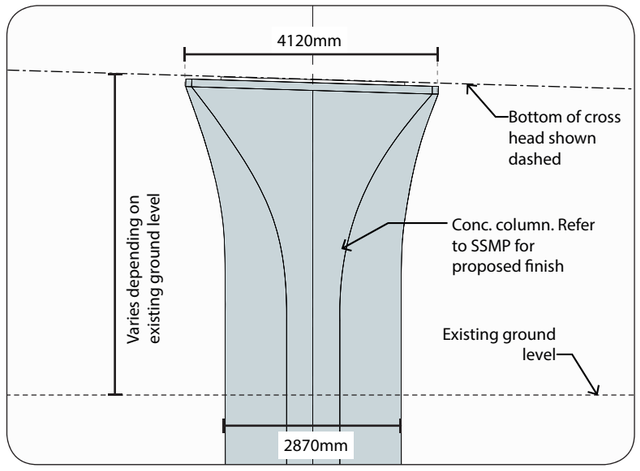
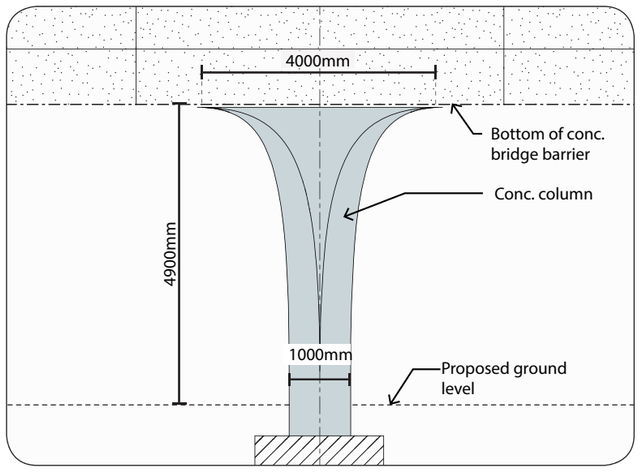
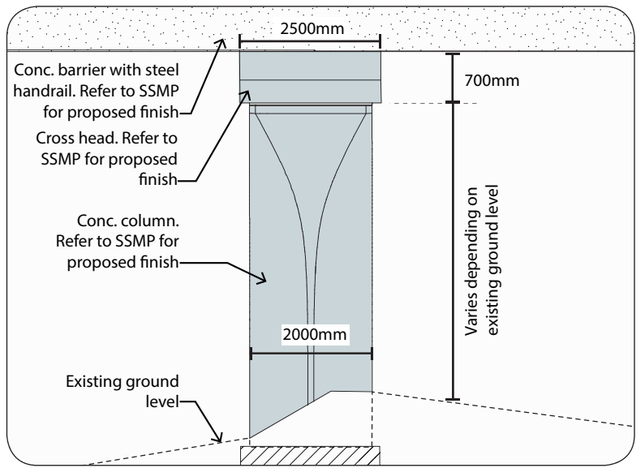
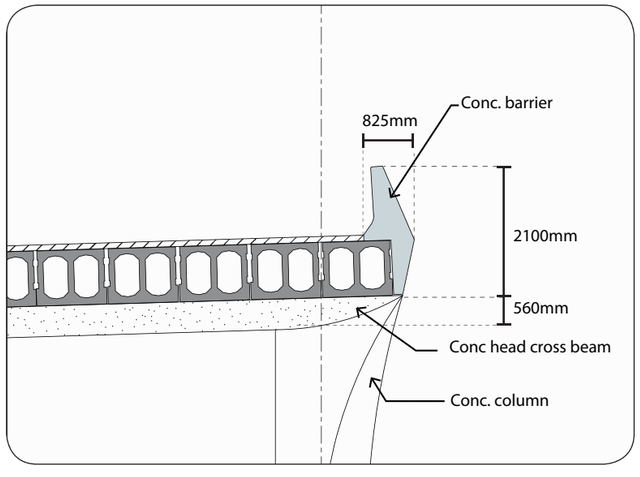
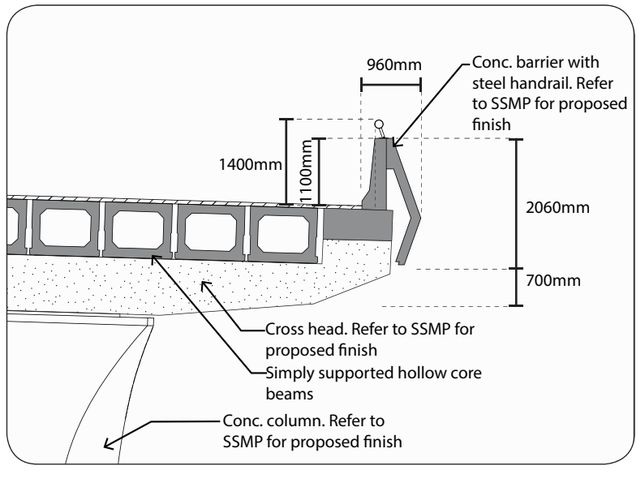
AEE Consented to DET Proposed Graphic Comparison

AEE VISUALISATION - WHAREMAUKU STREAM BRIDGE (SOUTH EAST SIDE OF THE WHAREMAUKU STREAM LOOKING WEST)

PROPOSED VISUALISATION - WHAREMAUKU STREAM BRIDGE (SOUTH EAST SIDE OF THE WHAREMAUKU STREAM LOOKING WEST)

NOTE: TO BETTER REPRESENT THE BRIDGE, THE PROPOSED VISUALISATION HAS BEEN DRAWN FROM A VANTAGE POINT THAT IS CLOSER TO THE BRIDGE THAN THE ORIGINAL AEE RENDER

Bridge Development Matrix

Elements	AEE Design	Current Design	Developments	Why?	ULDF Principles
Column Front elevation 1:100@A3			1. Column base width increase hexagonal column rather than flattened diamond 2. Reduced number of columns 3. Columns moved in board 4. Column height varies	1. To provide increased structural core to the column based on geotech investigations carried out post AEE, while still providing the sculptural outer. 2. The total width of columns when combined is reduced for 1 column vs 2 column solution 3. Resolves issues with bridge skew. 4. To allow for the changes to the cross head. Integration with existing ground level.	1. Please refer to ULDF principles summary on sheet; 7 of this document. With particular reference to principle number; 1, 2, 3, 5, 8, 11 and 13
Column Side elevation 1:100@A3			1. Column base width increase hexagonal column rather than flattened diamond at base of column 2. Column moved in-board. Cross head lower (approx 200mm) 3. Column height varies	1. To provide increased structural core to the column based on geotech investigations carried out post AEE, while still providing the sculptural outer. 2. Simply supported structure requires platform to seat beam, and new arrangement helps resolve issues with bridge skew 3. To allow for the changes to the cross head. Integration with existing ground level.	1. Please refer to ULDF principles summary on sheet; 7 of this document. With particular reference to principle number 1, 2, 3, 5, 8, 11 and 13
Cross Head & barrier junction 1:100@A3			1. Addition of handrail 2. Columns moved in-board 3. Simply supported rather than integral cross head	1. Safety requirement 2. Reduced number of columns from two columns per crosshead to one centrally placed column. Helps resolve issues with bridge skew. 3. Constructability issues because of seismic requirements. Integral connections difficult to build without increasing structural element sizes further.	1. Please refer to ULDF principles summary on sheet; 7 of this document. With particular reference to principle number 1, 2, 3, 4, 8 and 13

ULDF PRINCIPLES SUMMARY

Uldf principle	Assessment of ULDF principles
1. Make the bridges generally consistent in their form so they register as a 'family' and provide some visual continuity within the local environment	Proposed Ihakara/Wharemauku Stream bridge is different from the AEE bridge, but the form remains consistent with other proposed bridges. The consistency across the bridges overall has become even more consistent as there is less variation in types from that shown in AEE. Accordingly this improves visual continuity.
2. Express the bridges as simple forms that sit across the changes in landscape and are not seen as strong statement in their own right	Proposed bridge form remains a visually simple structure and sits across the landscape as an horizontal element. The bridge is not seen as making a statement in its own right. The bridge appears 'heavier' in that the piers have doubled in width. However, it is noted that the number of piers has been halved, albeit that they are larger in width.
3. Unite the bridge elements of pier, cross head, deck and barrier as one sculptural form and ensure services are concealed from view	Proposed bridge form is different than the AEE in that the piers have been repositioned to sit beneath the bridge deck. However, the principle of united piers, cross head, deck and barrier remains upheld, albeit in a new pier configuration. The profile from the crease of the barrier to the sloping cross head end to the shaped pier continues to show the bridge as a united single form.
4. Ensure the form of the bridges from the underside is visually appealing to recognise the primacy of the local roads user's experience in design consideration.	The space beneath the bridge will be no less visually appealing than the AEE bridge and maybe perceived as better given there is now proposed to be a reduced number of piers (albeit that those being proposed are larger in size). The openness of the spill through abutment on the CWB side remains.
5. Design the intersection of the piers with the ground in concert with the local road interface design of abutment forms and materials (refer to local road interface design principles)	Proposed bridge piers are located to provide good clearance for local road movements and the abutment to the south where the CWB path is located continues to be set at a slope that provides for light penetration. The reduced number of piers (albeit that they are larger) increases the openness of the space beneath. The abutments remain as 'spill through' slopes and these will be treated in a consistent way with the other local road abutments.
6. Light the spaces beneath local road over bridges to enhance the quality of the space including the use of natural light penetration where the local road has a higher frequency of pedestrian cycling and other non-vehicular users	Not relevant
7. Use architectural lighting to emphasise the sculptural forms of the bridges and light units that are readily serviceable from the ground	Not relevant
8. Utilise the opportunity provided by multiple bridges to make a system of parts that can be repeated at each location and improve efficiency of construction	Proposed bridge, as in the AEE, remains of the same systematic approach to allow repetition of parts at other locations and improves the efficiency of construction.
9. Use textured finishes within the bridge elements surfaces' to provide a crafted finish – avoid printed forms	The proposed finish on the Ihakara/Wharemauku Bridge barriers will be fair faced concrete with a white wash, applied concrete coating to ensure colour and tonal uniformity between panels. The bridge abutment will be constructed with precast concrete panels with an inlaid Otaki pebble finish. The other elements – columns, cross head and deck will be simple, fair faced concrete without the applied white wash coating to help make these elements visually recessive relative to the barrier. Matt graffiti protection to be applied to all bridge elements surfaces. Refer to the SSMP for further detail on the proposed finishes.
10. Repeat the bridge design concepts within the design of pedestrians bridges recognising that these may be able to utilise lighter weight materials	Not relevant
11. Develop each bridge crossing design considering the piers types best suited to the location	The piers are located out of the stream and do not require armouring to the stream edge.
12. Locate bridge piers associated with bridge watercourse crossings away from riparian edges to prevent need to armour stream edges	Proposed bridge form at Wharemauku Stream has addressed all the contributing factors of visual amenity, safe CWB crossing, structural design in high seismic zone, and constructability. Rip-rap required under the footprint of the bridge/Wharemauku stream edges irrespective of the location of the pier location.
13. Ensure that the integrity and significance of the bridge forms as important to the amenity of the community is not accorded any less priority than the other design requirements of the project	The design of the bridge forms at Ihakara/Wharemauku River has addressed all the contributing factors of visual amenity, CWB crossing, structural design in high seismic zone, river hydrology and constructabilty

WHAREMAUKU STREAM CROSSING - VISUALISATION

NZ TRANSPORT AGENCY
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MacKays to Peka Peka
Wellington Northern Corridor