06|Sector Design

6.1 Introduction

This section of the ULDF describes the way in which the Expressway urban and landscape design has considered and responded to the design implications (identified in the Policy and Context section).

The tables below identify and discuss the design implications for each of the four sectors of the Expressway.

Plans for each of the sectors are also provided which show bridge locations, planting strategies, noise barrier designs, cycle and walking routes and connections and the Expressway itself.

Detailed design responses are also described in relation to Poplar and Leinster Avenue, Kāpiti Road Interchange and the Te Moana Road Interchange. These more detailed responses have been been developed for these locations because they are places where the relationship between the existing land uses, landform, ecology, hydrology, vegetation and the Expressway effects are more complex.

In considering each of the sector design implications, reference will need to be made to the Corridor Design section which describes the specific design approach proposed to different elements of the Expressway. Typically the corridor design aspects will be either recognised in the sector design already, or will be aspects of the design that need to be further developed as the Project design progresses through to implementation.

Policy and Context Headings section 2 and 3

Design implications under each of the headings in sections 2 and 3 specifically as they apply to each sector

How the Project design in its current form responds to these design implication

DESIGN IMPLICATIONS	SPECIFIC DESIGN IMPLICATION POINTS	URBAN AND LANDSCAPE DESIGN RESPONSE
policy		
landform		
hydrology		
vegetation		
ecology		
built environment and land uses		
movement networks		
heritage		

6.2 Sector 1 MacKays to Raumati

DESIGN IMPLICATIONS	SECTOR 1	URBAN AND LANDSCAPE DESIGN RESPONSE
policy	• Aim to protect outstanding landscapes (Waikanae River, dunes and foredunes) and ecological areas. • Aim to minimise visual, landscape, noise, land take and other potentially adverse effects on Queen Elizabeth Park.	The design considered an route option through Queen Elizabeth Park - this would have affected the park dunes and those behind Leinster Ave that route would have taken park land that could have recreational or amenity benefits in the future. The proposed route avoids these landforms and land take.
landform	• Recognise, as a first principle, the dune landscape by guiding the Expressway alignment to avoid dunes, or by positioning the Expressway above and within or between large dunes rather than removing them. • Re-creating new dune forms as context for the Expressway if the context enables the forms to reflect natural shapes and patterns. The prevailing alignment of the dunes runs roughly parallel to the coast therefore the design or modification of landforms should acknowledge and reflect this pattern. Introducing “dunes” as uniform bunds along the whole route will appear unnatural and contrived and should be avoided. • Retain or enhance views from the Expressway to features such as the coast, Kāpiti Island and Tararuas, although this should not be at the expense of causing adverse effects on the local communities. • Recognise that the sand will be vulnerable to wind and water erosion if not managed, and that peat ground or extracted peat will require conditioning before planting.	The alignment options considered a route through Queen Elizabeth Park and across the Western Link Road designation which would have significantly modified the dunes in the area behind Leinster Ave - the proposed route avoids these landforms. Earth bunds will be developed between the Leinster Ave area and Raumati Road to provide visual and noise separation to adjacent residential properties - the cycleway will sit along this in part. There are no views out to Kāpiti Island from Sector 1. However, views toward the coastal dunes may be possible from the elevated Expressway at the Poplar Avenue interchange. The construction methodology recognises that the sand areas will be vulnerable to erosion and this will be managed by limiting the extent of open areas and mixing in other materials and watering to stabilise sand.
hydrology	• Maintain and enhance the watercourses that remain with a view to reduced channelisation and more natural forms which can enhance the natural habitat for fish and other animals as well as improved visual amenity. • Consider the multiple stream and other watercourse crossings as places that can incorporate additional east-west walking and cycle Expressway crossing links. • Integrate planning and design for flood storage associated with the Expressway in conjunction with other urban development needs, such as at the Paraparaumu Town Centre and other places as appropriate. • Protect and supplement the few remaining wetlands with new wetland areas that have the dual role of flood storage and stormwater filtration required for the Expressway displacement and runoff.	There are no significant watercourses in this sector that are affected - Drain 7 will be culverted to allow continued fish passage exist. There is no large enough watercourse bridge in Sector 1 that could be used to gain access beneath for walking or cycling east-west connections. A flood storage area in the land to the east of the Expressway north of Leinster Avenue will provide flood storage and the two existing wetland areas retained to the west of the Expressway. Further urbanisation of the residual land in this location will need to consider additional flood storage needs. The existing wetlands behind Leinster Ave will be retained with the exception of a small area. The proposed stormwater management areas adjacent to the wetland will be planted with appropriate wetland species.
vegetation	• Recognise the value of all woody vegetation in terms of integration of the Expressway into the landscape; retention of existing amenity trees and shelter belts can assist with landscape integration and mitigation. • Reflect existing vegetation patterns and species mix in mitigation planting, using both exotic and native plant species, but with a predominance of native species. • Avoid the same vegetation treatment along the whole route and use site specific plant options and layouts that reflect the varying contexts. • Carefully select plant species that will be sustainable within the corridor and recognise the climatic conditions, soil types and that require minimal maintenance after establishment.	The existing vegetation to remain has been identified and will be protected during construction. Mass planting of indigenous species are proposed for this sector, along the route and surrounding the large wetland and stormwater areas. The species selection will reflect the existing manuka/wetland environment as well as the vegetation on the Raumati escarpment.
ecology	• Protect and supplement the few remaining wetlands with new wetland areas that have the dual role of flood storage and stormwater filtration required for the Expressway displacement and runoff. • Expand and extend the wetland network utilising the Expressway corridor to link between the numerous water bodies and existing wet areas within the design for stormwater management associated with the Expressway and adjacent land uses as appropriate. • Utilise and enhance existing wet depressions as components in a linked network of through good stormwater run-off design. • Utilise east west hydrological connections as habitat corridors across the Expressway in suitable locations. • Develop planting and stormwater treatment wetlands to reflect existing vegetation patterns and provide additional habitat to freshwater fish and bird species. • Ensure stormwater is sufficiently treated within filtration areas such as swales and wetland areas prior to entering water bodies.	The existing wetland behind Leinster Ave will be retained. The additional riparian planting proposed in association with the new stormwater management areas will enhance the riparian biodiversity of the existing wetland. Swale treatment areas will be accommodated along the sides of the Expressway. These will be grassed or vegetated to read as part of the general landscape planting programme - these swales will feed filtered stormwater to existing watercourses and wetlands.

6.2 Sector 1 MacKays to Raumati

built environment and land uses	• Maintaining wide corridors within the designation extent will be important to buffer the Expressway from adjacent residential uses. • Options for the Expressway should be designed to avoid effects on schools and to encourage the safety and directness for walking and cycling access. • Beach community residents and visitors will need to pass across the Expressway regularly and this movement needs to be visually, functionally and safely provided for. This includes interchange design to facilitate local road movements by pedestrians and cyclists. • The future development of residual areas of the Expressway designation (such as at Raumati) and at planned growth areas needs to be considered in the design especially in terms of connections, to, from and within these areas, as well as the protection of recognised features.	At the area around Leinster Ave the landscape design is utilising the corridor width created by the designation to manage adjacency with landforms and planting. The alignment option selection preferred allows continued access from the Leinster Ave area (some 100 households) to Raumati South School, and avoids the Te Ra School. The local road connection at Poplar Ave includes a separated walking and cycle path and will include on-road cycle lanes. Marked off ramp crossing points for the on-road cycle paths will be designed to best practice and accepted standards providing clear lines of sight and thresholds. The area (currently designated land or NZTA/KCDC owned) to the rear of Leinster Ave and Main Road properties could be residential in the future if KCDC allows it to be rezoned. Natural features including wetlands and dunes should be retained and also connections made from the Leinster Ave service road through to a connection into Matai Road. A new bridge over the Expressway may also be warranted depending on the extent of development and additional households. Provision has been made for a pedestrian bridge.
movement networks	• The Expressway crosses a number of east west oriented local roads linking the beach communities on the coastal side with those inland. These connections need to be maintained to provide for the interaction between these communities. This includes through the construction period. • The Expressway is to provide a consistent highway speed (100kmh) route through the district. The local road crossings will accordingly be grade separated and take the form of a bridge over or road under the Expressway. Walking and cycling movements will be most sensitive to the condition and quality of the crossing - be that having to move under a bridge or on an over-bridge. • The existing SH1 is part of the regional cycle network. Consideration needs to be given to either maintaining this route along its current alignment and/or providing a new commuter cycle route along the Expressway, as well as how this connects at either end to the wide network. In either case, the safety, convenience and amenity of cycling must be a primary consideration to satisfy transport policy and project objectives. • The Expressway enables the existing SH1 to take on a new character including revitalised town centres at Waikanae and Paraparaumu. The design for the condition of the existing SH1 is of interest to KCDC and the community generally, given that it will pass to KCDC once the Expressway is operational as the new SH1. • There will be an interaction between the existing SH1 and Expressway at the points where interchanges are provided for. The implications for the design of the local roads that connect the two need to be considered in terms of impacts on existing land uses and the quality of the road as a walking and cycling route. • The location of interchanges and the level of connectivity these provide will influence the use of land around them. Where there is good connectivity to the local network there is likely to be pressure for land development by urban land uses. Although this connectivity can be positive, KCDC's objectives are to limit urban growth outside of the existing towns and nominated growth areas. • The interaction between the existing SH1 and future land uses along its length will need to be considered to ensure that KCDC's urban growth objectives are not put at risk as a result of the change from the current limited access status. • There is the possibility of a future Raumati railway station - the Expressway design should not preclude this possibility.	The local road connection at Poplar Ave will be retained and at grade - the roundabout arrangement connection to the existing SH1 will facilitate safer connections from Poplar Ave for drivers heading south on SH1 and the off ramp from the existing SH1 to Poplar Ave will provide immediate connectivity for Raumati residents. The local road connection at Poplar Ave includes a separated walking and cycle path and will include on road marked cycle lanes. Off ramp crossing points for the on-road cycle paths will be designed to best practice and accepted standards providing clear lines of sight and thresholds. A cycleway/walking path will connect from Raumati through Queen Elizabeth Park to Paekākāriki to provide an alternative route to the use of the SH1 Raumati Straight. This path will give direct connectivity between the two settlements and the services and amenities they provide as well as being used for sub-regional cycling movements. This section of the cycle/walkway will be provided by agreement between NZTA, KCDC and GWRC and is not part of the designation for the Expressway. The link at the south end to the Transmission Gully cyclepath will need to be considered and provided for. A parallel cycle/walkway will connect from the Poplar Ave/SH1 intersection along the Expressway to Raumati Road (this continues north all the way to Peka Peka). Connections at Harry Shaw Way will connect the path back to Matai Road. A new bridge over the Expressway will connect Leinster area to existing SH1. Cyclepath connections at Poplar Ave and the end of Leinster Ave will give access to Leinster residents to this facility. The loss of a vehicle access connection for Leinster Avenue to the existing SH1 will reduce the connectivity for the existing residents. If future development of the land at the rear of Leinster Avenue does occur provision of a new street connection back towards Raumati or Matai Road should be considered. Remediation of the existing SH1 north of Poplar Ave may include reduced road width surface and lane numbers and the use of this width for amenity planting and walking and cycle paths. There is little risk that at the intersection of the Expressway off-ramp and Poplar Ave new land uses will establish around it that would be contrary to the KCDC Development Management Strategy given the constrained nature of this area. The constraints include the Park, road infrastructure and railway line. A future Raumati railway station and its associated parking facilities could be accommodated on the residual SH1 land and on the east side of that area adjacent to the rail corridor. There is also potential for land where the Expressway tracks west from the existing SH1 to become available for park and ride parking.
heritage	• Engage with iwi in the Project design to identify how the route alignment options and the landscape of the Expressway can best be designed to provided for Māori cultural values. • Consider the known sites, identify the significance of these, and aim to avoid these as far as possible. However, recognise the avoidance of all sites will not be likely given the many known and still unknown sites. • Consider the opportunities to enhance the awareness of the heritage in the way the Expressway and associated structures, pathways and other elements are designed.	There has been engagement with iwi throughout the design process to ensure cultural values are understood and the design has responded to this as best it can. A protocol arrangement with iwi has been developed to provide a process for managing sites uncovered in the course of construction. There are opportunities for cultural heritage to be recognised in the developed design process.

6.2 Sector 1 MacKays to Raumati

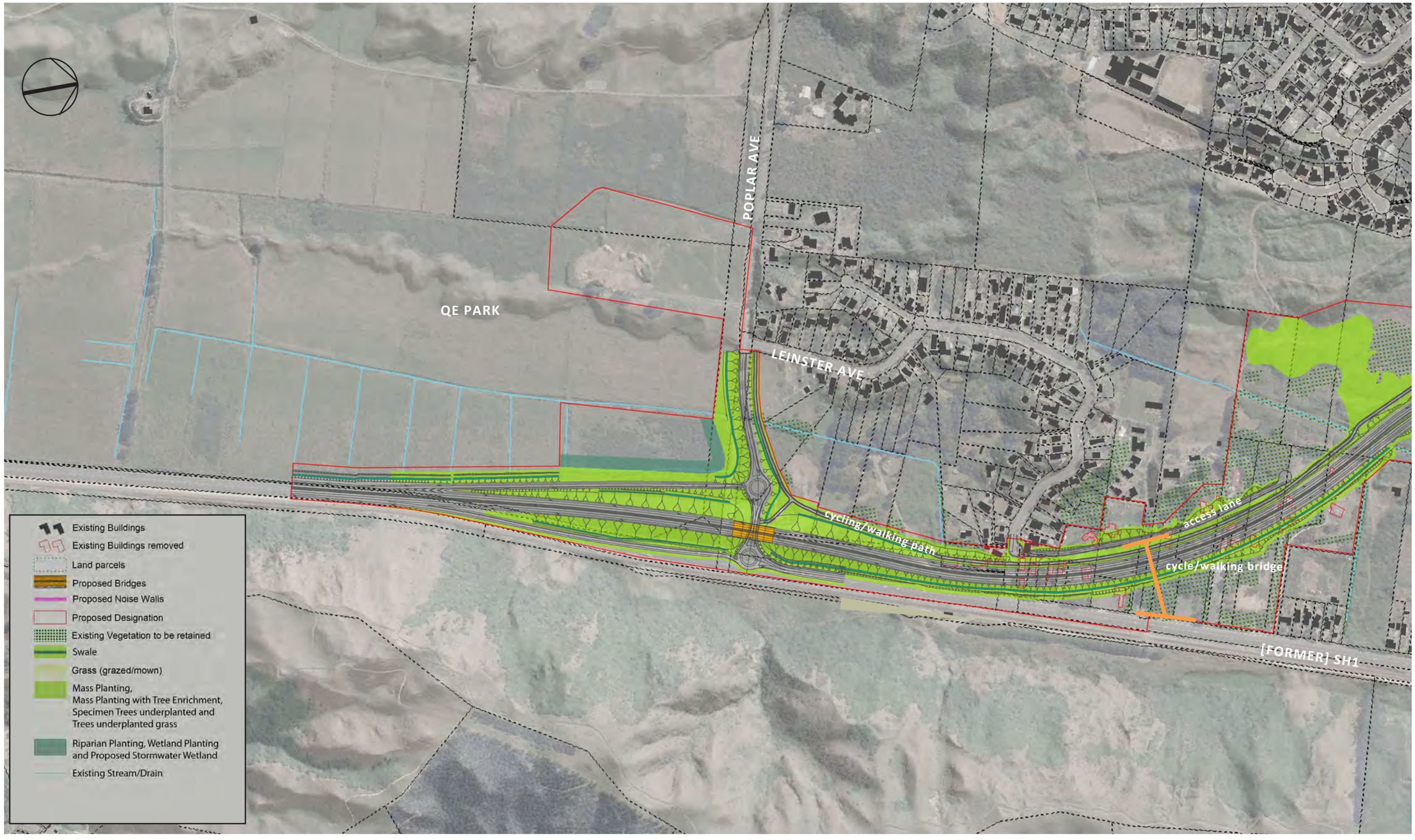


Figure 124

0 100 200 400m

6.2 Sector 1 MacKays to Raumati

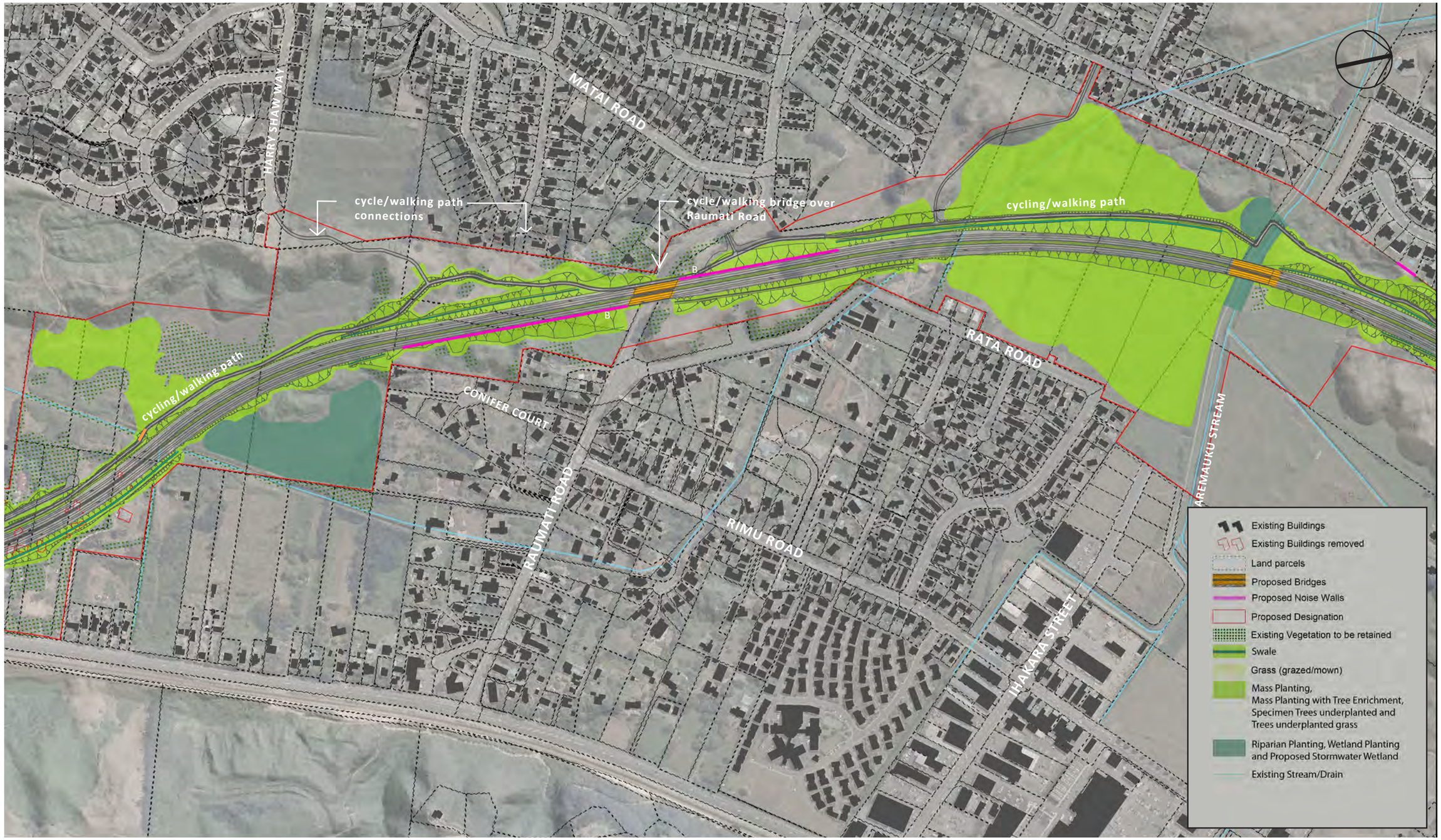


Figure 125

0 100 200 400m

6.2 Sector 1 MacKays to Raumati

A cycle and walking path
B private lane vehicular property access
C stormwater swale
D drain
E existing wetland retained
F potential Raumati rail station car park locations

Figure 125 Indicative view south to QE Park with Raumati Rd crossing in foreground

Figure 126 Indicative view down Poplar Ave to Expressway over bridge

Figure 127 Indicative view down (closed) Leinster Ave to turn area

Figure 128 At the Leinster Ave area showing landscape integration proposals and below sections describe the landform manipulation to provide visual and noise separation

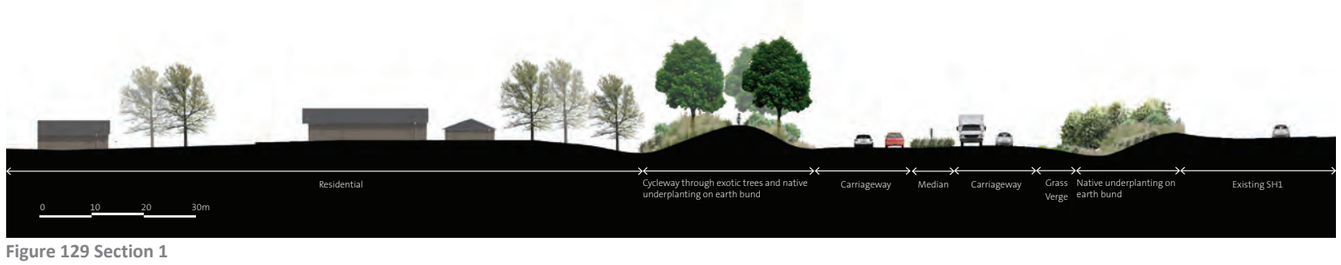


Figure 129 Section 1

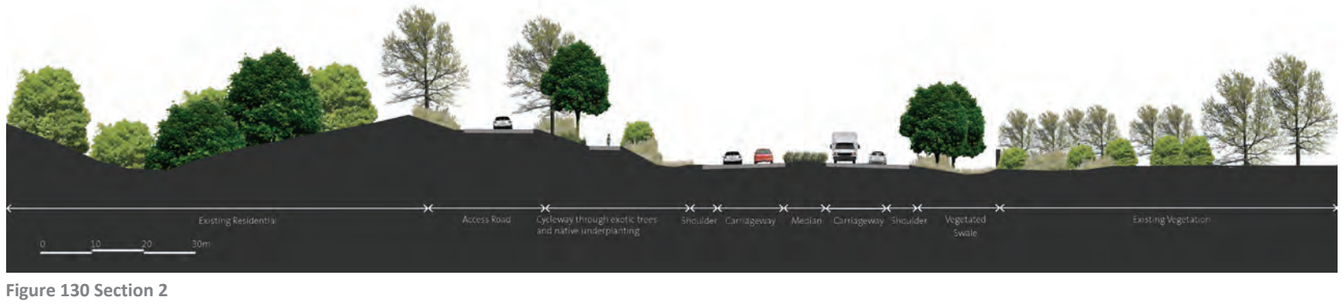


Figure 130 Section 2

6.3 Sector 2 Raumati/Paraparaumu

DESIGN IMPLICATIONS	SECTOR 2	URBAN AND LANDSCAPE DESIGN RESPONSE
policy	• Aim to ensure the location and design of any interchange at Kāpiti Road enables continued growth in this 'change area'. • Aim to integrate land use and transportation to achieve good urban form. The location and design of interchanges will be particularly relevant to such integration. • Aim to facilitate intensification and improved urban form at Paraparaumu. • Aim to provide for increasing road freight movement and likely increase in peak traffic congestion. The location of Expressway interchanges has the potential to help relieve traffic congestion and remove freight vehicles from the existing State Highway. • Aim to incorporate strategy actions in the Expressway design which includes linkages to important amenities and services and access across and along the Expressway corridor. • Aim for the design to enhance linkages within and across the Expressway corridor to provide connections for people moving between communities and for the ecological benefits.	The design includes an interchange at Paraparaumu (and Waikanae) which at its location on Kāpiti Road provides direct access to the proposed town centre growth area and the now developing airport area. The interchange will facilitate movement of freight and people to and from the highway network to the town centre and thus can contribute positively to its growth as an employment as well as amenity and services location. The design of the interchange to provide for local road movements by drives as well as walkers and cyclists will require careful attention to facilitate the access by the community to facilities which are located on either side of the Expressway. A new pedestrian bridge is proposed midway on the block between Kāpiti Road and Mazengarb Road which will assist this movement across the Expressway corridor. The Wharemauku Stream will continue to operate as an east-west corridor that can be enhanced to have higher ecological benefits with planting in balance with its function within the flood plain. The cycle and walking path within the Expressway corridor will enhance north-south linkages within the District.
landform	• Guide the design of the Expressway within the nominated corridor with the aim of minimising earthworks by: forming an alignment that runs between large dunes rather than removing them and forming its vertical and horizontal extent in response to natural levels • Recognise that some dune loss or modification will be inevitable given the confined corridor and consider approaches to address this such as: minimising the vertical profile of the Expressway to recognise that the coastal plain is relatively flat (even with the dune forms) - aim for an Expressway 'in' the landscape rather than 'on' the landscape. • Carry out earthworks so that final landforms reflect natural shapes and patterns of the existing dunes. The prevailing alignment of the dunes runs roughly parallel to the coast therefore the design or modification of landforms should acknowledge and reflect this pattern. • Avoid creating and reshaping "dunes" as uniform bunds as they will appear unnatural and contrived. • Recognise the views to the Tararua Ranges and Kāpiti Island as prominent and important landforms and features in the design of east/west local road crossings. • Recognise that the sand will be vulnerable to wind and water erosion if not managed, and that peat ground or extracted peat will require conditioning before planting.	Along most of this sector the Expressway will be cut into the top of the dunes. At numerous locations earth bunds will be constructed for noise and visual mitigation, and these landforms will be integrated with the natural dune landforms. Between Kāpiti and Mazengarb Roads, integration of the remaining dune landforms and mitigation bunding will require special consideration, given the limited space available, and need for near continuous bunding, due to the adjoining residential development. Views to Kāpiti Island and the Ranges are likely to be possible from several of the elevated points within this sector including the over bridges at Wharemauku Stream, Kāpiti Road and Mazengarb Road. The construction methodology recognises that the sand areas will be vulnerable to erosion and this will be managed by limiting the extent of open areas and mixing in other materials and watering to stabilise sand.
hydrology	• Maintain and enhance the watercourses that remain with a view to reduced channelisation and more natural forms which can enhance the natural habitat for fish and other animals as well as improved visual amenity. • Consider the multiple stream and other watercourse crossings as places that can incorporate additional east-west walking and cycle Expressway crossing links. • Integrate planning and design for flood storage associated with the Expressway in conjunction with other urban development needs, such as at the Paraparaumu Town Centre and other places as appropriate. • Protect and supplement the few remaining wetlands with new wetland areas that have the dual role of flood storage and stormwater filtration required for the Expressway displacement and runoff.	Drain 7 will be bridged and culverted to allow fish passage. Wharemauku Stream is a modified channel and the Expressway will bridge it to the west of the town centre. There will be no change to habitat values and bridge piers will be located away from the stream to prevent stream obstruction. Some stream edge protection maybe required to prevent the stream moving to undercut piers in heavy water flows. Access under the Wharemauku bridge will be maintained for the existing walking and cycle path and will also allow for future local road extension of Ihakara Street towards the airport. A flood storage area in the land to the south of Wharemauku Stream will offset loss of storage by the Expressway footprint. It can link to other flood storage areas provide by KCDC or other developers of town centre land in the future and provide an enhanced ecological appearance and setting for the town centre. A stormwater treatment wetland is also provided for managing the runoff from the Expressway prior to its discharge to the stream.
vegetation	• Recognise the value of all woody vegetation in terms of integration of the Expressway into the landscape; retention of existing amenity trees and shelter belts can assist with landscape integration and mitigation. • Reflect existing vegetation patterns and species mix in mitigation planting, using both exotic and native plant species, but with a predominance of native species. • Avoid the same vegetation treatment along the whole route and use site specific plant options and layouts that reflect the varying contexts. • Carefully select plant species that will be sustainable within the corridor and recognise the climatic conditions, soil types and that require minimal maintenance after establishment.	The existing vegetation to remain has been identified and will be protected. The future Kāpiti town centre is located in this sector. The vegetation framework will be designed to enhance the amenity of the town centre, with visual screening, shade, shelter and the opportunity to develop a local identity, where vegetation will consist of a combination of indigenous and exotic species. South of Wharemaku stream the large flood storage area will be planted with indigenous vegetation.

6.2 Sector 2 Raumati/Paraparaumu

built environment and land uses	• Maintaining wide corridors within the designation extent will be important to buffer the Expressway from adjacent residential uses. • Destination activities - eg airport, town centres and schools - will benefit from connections to the interchanges provided those connections are readily accessible from local road networks. • Freeing up the existing SH1 from highway traffic enables the design of the town centres to be designed to function more positively and with higher amenity, including better connections between the centres and railway stations. • Options for the Expressway should be designed to avoid effects on schools and to encourage the safety and directness for walking and cycling access. • Beach community residents and visitors will need to pass across the Expressway regularly and this movement needs to be visually, functionally and safely provided for. This includes interchange design to facilitate local road movements by pedestrians and cyclists. • The opportunity should be taken with the Expressway interchange design at Paraparaumu to set a positive precedent for the quality of the of whole of Kāpiti Road.	In the section between Kāpiti Road and Mazengarb Road the Expressway is in a confined corridor with residential properties built up to its edge. The width of the corridor is approximately 100m metres and allows for the separation space between the road itself (25m wide) and the edges of the corridor to be used to form bunds and for the areas to be planted to provide some visual and noise buffering. Noise barriers are required in places and these will be integrated using the design approaches described earlier in the ULDF. The Paraparaumu town centre will benefit from the interchange location at Kāpiti Road. The removal of traffic from the current highway will allow for Paraparaumu town centre to better connect across to the east and to facilities including employment and the railway station. It will also enable people living on the eastern side of the existing SH1 access to the facilities and amenity at the town centre. The design of the interchange and Kāpiti Road will need to provide for local movements by walkers and cyclists. The use of free left hand turns to on and off ramps should be avoided and pedestrian crossing facilities provided by traffic lights. A new pedestrian bridge is proposed midway on the block between Kāpiti Road and Mazengarb Road which will assist this movent across the Expressway corridor.
ecology	• Expand and extend the wetland network utilising the Expressway corridor to link between the numerous water bodies and existing wet areas within the design for stormwater management associated with the Expressway and adjacent land uses as appropriate. • Utilise and enhance existing wet depressions as components in a linked network of through good stormwater run-off design. • Develop planting and stormwater treatment wetlands to reflect existing vegetation patterns and provide additional habitat to freshwater fish and bird species.	The low lying areas behind the Paraparaumu town centre area will be utilised as flood storage and wetland areas that will also provide some stormwater filtration functions to intercept runoff from the Expressway prior to discharge to the Wharemauku Stream. The opportunities have been considered in the design of the wetland areas associated with the Expressway to link to future town centre wetland/flood storage provision which will need to be designed when the wider town centre planning is undertaken. The Wharemauku Stream will continue to operate as an east-west corridor that can be enhanced to have higher ecological benefits with planting in balance with its function within the flood plain.
movement networks	• The Expressway crosses a number of east west oriented local roads linking the beach communities on the coastal side with those inland. These connections need to be maintained to provide for the interaction between these communities. This includes through the construction period. • The Expressway is to provide a consistent highway speed (100kmh) route through the district. The local road crossings will accordingly be grade separated and take the form of a bridge over or road under the Expressway. Walking and cycling movements will be most sensitive to the condition and quality of the crossing - be that having to move under a bridge or on an over-bridge. • The existing SH1 is part of the regional cycle network. Consideration needs to be given to either maintaining this route along its current alignment and/or providing a new commuter cycle route along the Expressway, as well as how this connects at either end to the wide network. In either case, the safety, convenience and amenity of cycling must be a primary consideration to satisfy transport policy and project objectives. • The Expressway enables the existing SH1 to take on a new character including revitalised town centres at Waikanae and Paraparaumu. The design for the condition of the existing SH1 is of interest to KCDC and the community generally, given that it will pass to KCDC once the Expressway is operational as the new SH1. • The Waikanae River and Wharemauku Streams provide highly used corridors for recreation and commuting movements. They also have other amenity values. The sensitivity with which the Expressway crosses these waterways will be important to the continuance of the movements and enjoyment of these places. • There will be an interaction between the existing SH1 and Expressway at the points where interchanges are provided for. The implications for the design of the local roads that connect the two need to be considered in terms of impacts on existing land uses and the quality of the road as a walking and cycling route. • The interaction between the existing SH1 and future land uses along its length will need to be considered to ensure that KCDC's urban growth objectives are not put at risk as a result of the change from the current limited access status.	Local road crossings at Raumati Road, potentially Ihakara Street, Kāpiti Road, and Mazengarb Road all occur in this section. The approach has to been to provide for these local roads to remain at grade and for the Expressway to go over the top on a bridge. This means walking and cycling activities do not have to go up and over the Expressway, and maintains existing road configurations and patterns. Provision has also been made through this urban section for bridges to be split to allow light down to the local road. The level of Mazengarb Road in the section which currently forms a hump at the position of the Expressway alignment to allow the over bridge to be lower on the dunes. The design of the interchange and Kāpiti Road will need to provide for local movements by walkers and cyclists. The use of free left hand turns to on and off ramps should be avoided and pedestrian crossing facilities provided by traffic lights. A new pedestrian bridge is proposed midway on the block between Kāpiti Road and Mazengarb Road which will assist this movement across the Expressway corridor. The existing use of the Wharemauku Stream corridors for cycling walking and horses will continue to be provided for and the recreational as well as commuting purposes. The removal of traffic from the current highway will allow for Paraparaumu town centre to better connect across to the east and to facilities including employment and the railway station. It will also enable people living on the eastern side of the existing SH1 access to the facilities and amenity at the town centre. The provision of the interchange at Kāpiti Road is consistent with KCDC growth objectives as expressed in the Development Management Strategy and District Plan to encourage development at the town centre.
heritage	• Engage with iwi in the Project design to identify how the route alignment options and the landscape of the Expressway can best be designed to provided for Māori cultural values. • Consider the opportunities to enhance the awareness of the heritage in the way the Expressway and associated structures, pathways and other elements are designed.	There has been engagement with iwi throughout the design process to ensure cultural values are understood and the design has responded to this as best it can. A protocol arrangement with iwi has been developed to provide a process for managing sites uncovered in the course of construction. There are opportunities for cultural heritage to be recognised in the developed design process.

6.3 Sector 2 Raumati/Paraparaumu

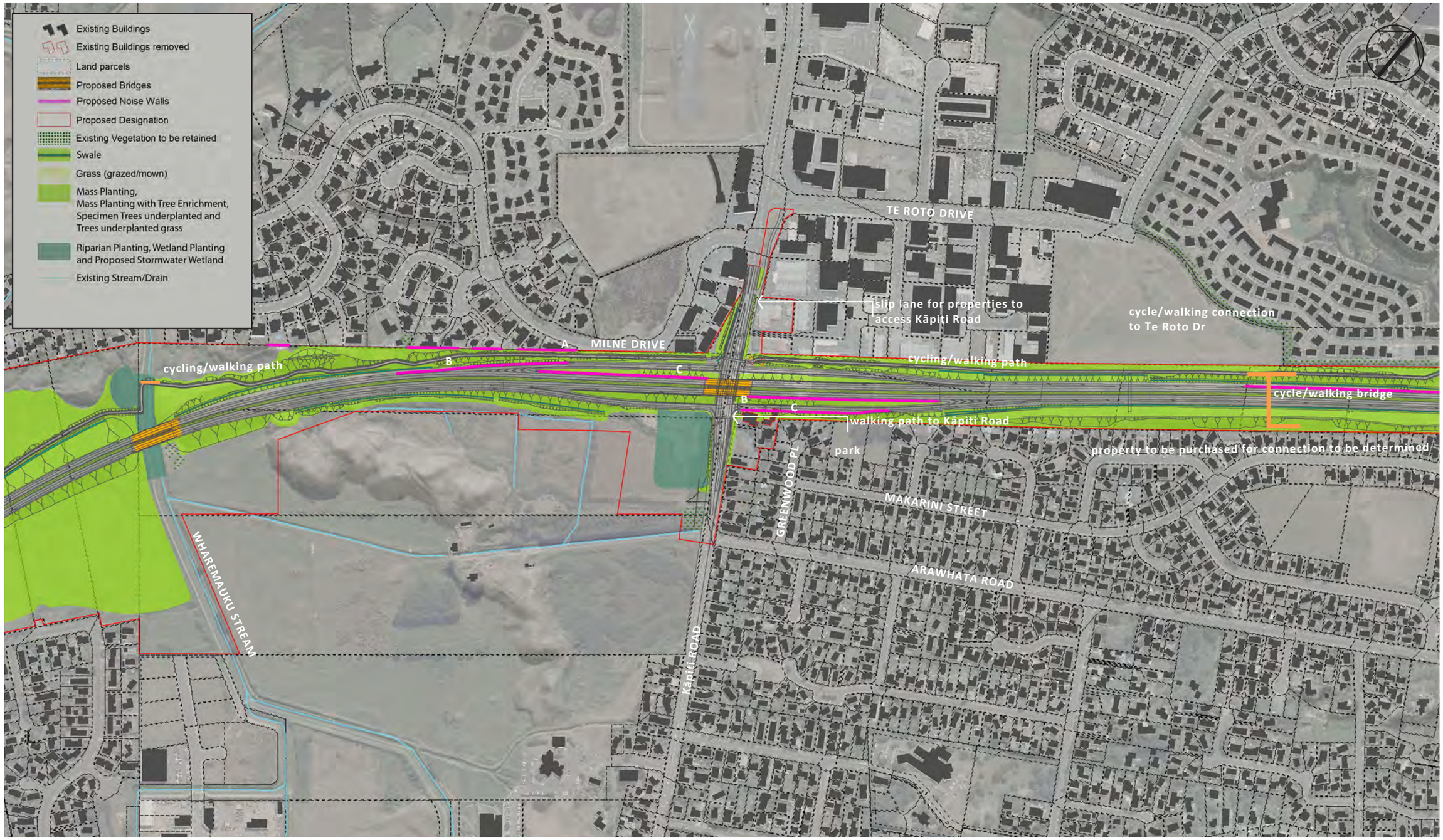


Figure 131

6.3 Sector 2 Raumati/Paraparaumu

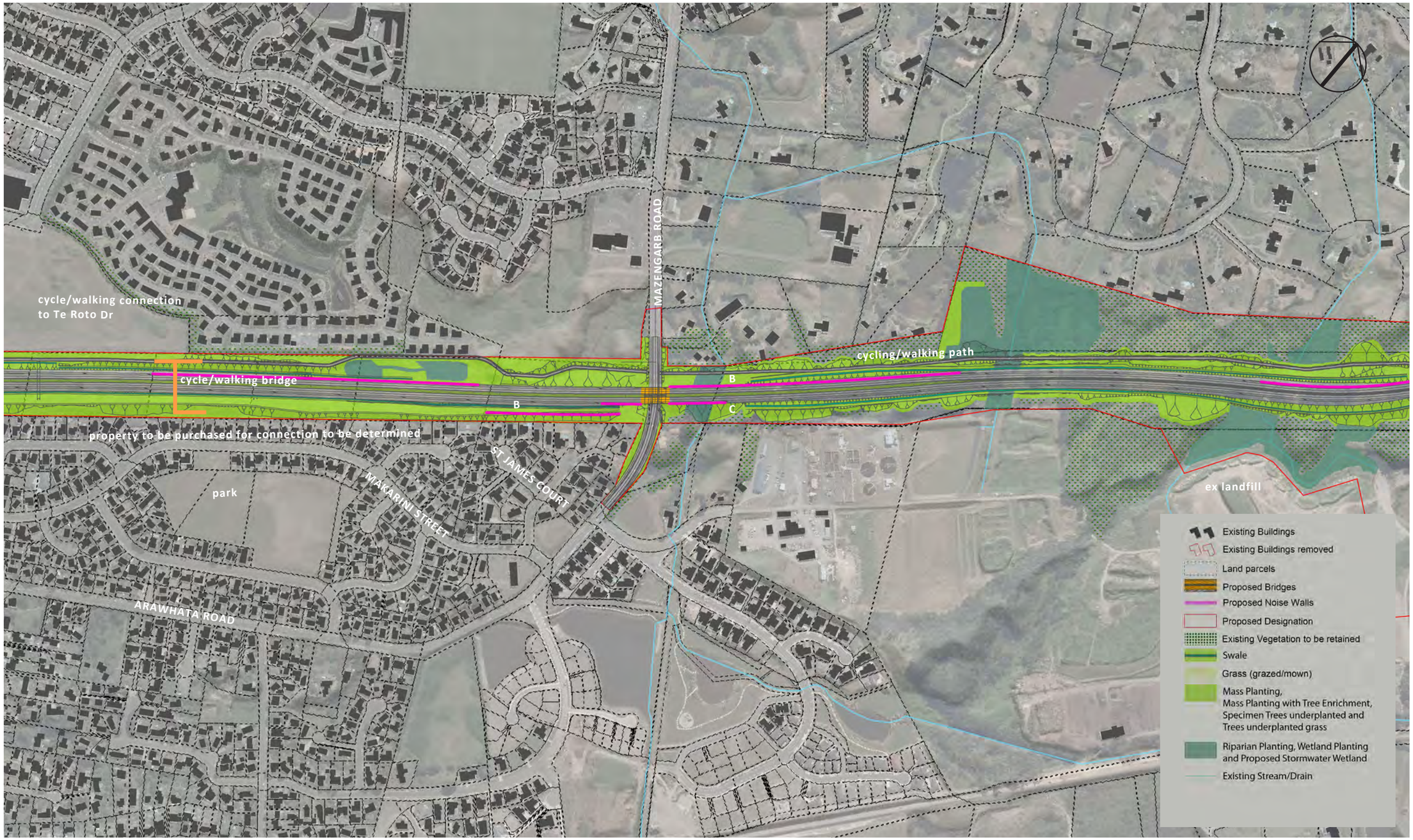


Figure 132

6.3 Sector 2 Raumati/Paraparaumu

A	wetland stormwater area
B	traffic signals
C	dense planting
D	open grassed areas
E	shared cycle/walking path
F	upright native trees
G	noise barrier
H	pathway to Kāpiti Road

Figure 133 Indicative view west along Kāpiti Road - tree planting not shown

Figure 134 Indicative view east along Kāpiti Road with Te Roto Rd crossing in foreground -tree planting not shown

Figure 135 At Kāpiti Road showing proposed landscape integration by utilising clear stemmed native specimen trees in conjunction with dense planting under. Walls can also be greened with climbers

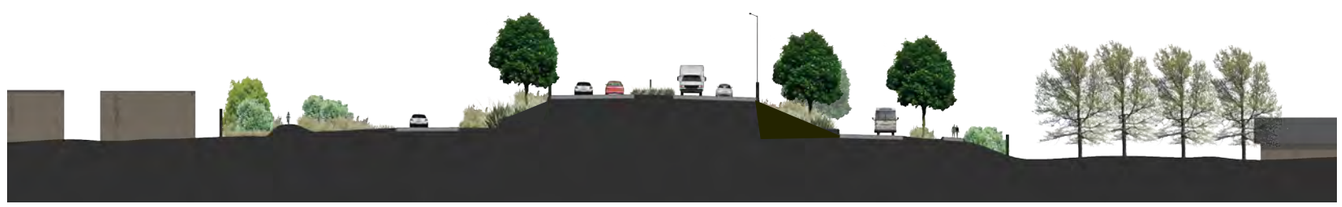


Figure 136 Cross section at Kāpiti Road Interchange

Figure 137 Simulation of Wharemauku Stream with Expressway over

6.4 Sector 3 Otaihanga/Waikanae

DESIGN IMPLICATIONS	SECTOR 3	URBAN AND LANDSCAPE DESIGN RESPONSE
policy	• Aim for the design of the bridge over the Waikanae River to provide good amenity for pedestrians below. • Aim to protect outstanding landscapes (Waikanae River, dunes and foredunes) and ecological areas. • Aim to facilitate employment and residential developments growth in targeted areas. The design of the Expressway needs to take into consideration the vehicular access and amenity levels of these sites. • Aim to provide an additional river crossing. The location and design of interchanges for in Paraparaumu and Waikanae should improve connectivity between the two communities. • Aim to integrate land use and transportation to achieve good urban form. The location and design of interchanges will be particularly relevant to such integration. • Aim for safe commuter cycling links between communities. The Expressway offers opportunities for improved commuter cycle route(s). • Aim for the design to enhance linkages within and across the Expressway corridor to provide connections for people moving between communities and for the ecological benefits.	The Waikanae River is an outstanding landscape and modification to it will occur from the addition of a bridge as well as realignment of a section of the river. The approach to the bridge design has been to down play its significance so it appears as a simple structure and similar to the other bridges across the route. With the river channel realignment design work needs to focus on the way in which any channel edge 'hardening' with riprap can be managed to enable re-vegetation. Beneath the bridge it will be important to consider the limitation for vegetation growth, and the amenity of people that move along the river corridor for recreation activity. The Expressway provides an interchange at Te Moana Road which will facilitate access to the growth areas to the north and will join the Waikanae community to Paraparaumu. There will be cycleway provision along the route and in this north section this will also allow space for horse riding alongside. The new bridge at Waikanae River will significantly improve the north-south connectivity within the district and for people moving throughout the lower North Island on SH1.
landform	• Guide the design of the Expressway within the nominated corridor with the aim of minimising earthworks by: forming an alignment that runs between large dunes rather than removing them and forming its vertical and horizontal extent in response to natural levels. • Recognise that some dune loss or modification will be inevitable given the confined corridor and consider approaches to address this such as: minimising the vertical profile of the Expressway to recognise that the coastal plain is relatively flat (even with the dune forms) - aim for an Expressway 'in' the landscape rather than 'on' the landscape. • Carry out earthworks so that final landforms reflect natural shapes and patterns of the existing dunes. The prevailing alignment of the dunes runs roughly parallel to the coast therefore the design or modification of landforms should acknowledge and reflect this pattern. • Avoid creating and reshaping "dunes" as uniform bunds as they will appear unnatural and contrived.	Most of this sector traverses dunes. Between Otaihanga Road and the Waikanae River the Expressway cuts through a series of relatively large dunes; with consequentially large cut faces (at 1:3 slope) it is intended that these faces and edges will be finished to avoid a 'tunnel' like effect and reflect the original form of the dunes. Between Waikanae River and Te Moana Road a more easterly alignment was considered that would have avoided the large crescent shaped dune near Pururi Road. However, this would have affected a larger number of residential properties. Consequently a large cut is proposed through the dune. Apart from the elevated posiitions on Otaihanga over bridge and Waikanae River bridge, views to Kāpiti Island are limited from this sector.
hydrology	• Maintain and enhance the watercourses that remain with a view to reduced channelisation and more natural forms which can enhance the natural habitat for fish and other animals as well as improved visual amenity. • Consider the multiple stream and other watercourse crossings as places that can incorporate additional east-west walking and cycle expressway crossing links. • Recognise in the design of the bridge structure the significance of the Waikanae River corridor as a 'mountains to sea' physical, ecological, landscape and recreational link.	Waikanae River channel and Maupoko Stream realignment design needs to focus on how any channel edge 'hardening' with riprap can be managed to enable revegetation. This will also influence the habitat values for fish. Beneath the Waikanae River bridge it will be important to consider the limitation for vegetation growth, and the amenity of people that move along the river corridor for recreation activity. The hydrological performance of the overland flow path from the Waikanae River towards the Waimeha Stream needs to be reflected in the landscape design.
vegetation	• Reinforce and supplement existing forest remnants where they can be extended into the Expressway corridor. • Recognise the value of all woody vegetation in terms of integration of the Expressway into the landscape; retention of existing amenity trees and shelter belts can assist with landscape integration and mitigation. • Reflect existing vegetation patterns and species mix in mitigation planting, using both exotic and native plant species. • Avoid same vegetation treatment along the route and use site specific plant options and layouts that reflect the varying contexts • Carefully select plant species that will be sustainable within the corridor and recognise the climatic conditions, soil types and that require minimal maintenance after establishment.	The existing vegetation to remain has been identified and will be protected. The Te Moana interchange occurs in this sector- the vegetation framework will be designed to enhance the amenity of the area, with visual screening, shade, shelter and the opportunity to develop a local identity.The planting will predominantly consist of indigenous species. Through the rural duneland south of the Waikanae River planting will consist primarily of grass and small groups of trees to reflect the open nature of the area. Elsewhere, native vegetation will dominate including riparian planting in the Waikanae river corridor and around stormwater wetlands.
ecology	• Replace any existing natural wetland area losses with new contiguous or linked wetland areas. Add new wetland areas that have the dual role of flood storage and stormwater filtration required for the Expressway displacement and runoff. • Expand and extend the wetland network utilising the Expressway corridor to link water bodies utilising the high water table. • Design any new wetlands with an appropriate maintenance regime that recognises its function as either natural, or for some form of stormwater management or flood detention. • Utilise and enhance existing wet depressions as components in the stormwater and flood detention design. • Utilise east west hydrological connections as habitat corridors across the Expressway in suitable locations. • Develop planting and stormwater treatment wetlands to reflect existing vegetation patterns and provide additional habitat to freshwater fish and bird species.	The wetland area at El Rancho will be affected to a small extent, but new wetland areas created on the east side of the Expressway to replace the area lost. The corridor of the Waikanae River and the ecologies within that area are being recognised and provided for with proposals to revegetate disturbed areas and provide riparian planting that will benefit in-stream habitat. The river edge treatment and the management of the land around the interchange and Waimeha Stream will require both riparian as well as wetland ecological design inputs. The design provides for the development of wetland areas in residual areas around Kauri Road and the riparian re vegetation at Waimeha Stream. Consideration should be given to the on and off ramp bridges design and also the cycleway bridge being connected to the off ramp to limit visual clutter, in-stream impacts and overhead shadowing where possible.

built environment and land uses	• Maintaining wide corridors within the designation extent will be important to buffer the Expressway from adjacent residential uses. • Freeing up the existing SH1 from highway traffic enables the design of the town centres to be designed to function more positively and with higher amenity, including better connections between the centres and railway stations. • Options for the Expressway should be designed to avoid effects on schools and to encourage the safety and directness for walking and cycling access. • Beach community residents and visitors will need to pass across the Expressway regularly and this movement needs to be visually, functionally and safely provided for. This includes interchange design to facilitate local road movements by pedestrians and cyclists. • Design approaches should discourage urban growth at Otaihanga, Te Moana Road and Peka Peka. • The future development of residual areas of the Expressway designation (such as at Raumati) and at planned growth areas needs to be considered in the design especially in terms of connections, to, from and within these areas, as well as the protection of recognised features.	At the area around Puriri and Kauri Road a separation distance within the Expressway corridor allows for landscape mitigation in the form of bunds and planting. The mitigation will be designed to integrate within the existing context. The Development Management Strategy seeks to direct urban development away from Otaihanga and towards existing urban areas. The Expressway will assist with preventing urban growth at Otaihanga by not providing an interchange there. The Te Moana Road interchange is relatively well located to the Ngarara growth area and provision has been made to allow a new road connection to Te Moana Road for access to it. The removal of traffic from the current highway will allow for Waikanae town centre to better connect across to the east and to facilities including employment and the railway station. It will also enable people living on the eastern side of the existing SH1 access to the facilities and amenity at the town centre.
movement networks	• The Expressway crosses a number of east west oriented local roads linking the beach communities on the coastal side with those inland. These connections need to be maintained to provide for the interaction between these communities. This includes through the construction period. • The Expressway is to provide a consistent highway speed (100kmh) route through the district. The local road crossings will accordingly be grade separated and take the form of a bridge over or road under the Expressway. Walking and cycling movements will be most sensitive to the condition and quality of the crossing - be that having to move under a bridge or on an over-bridge. • SH1 is part of the regional cycle network. Consideration needs to be given to either maintaining this route along its current alignment and/or providing a new commuter cycle route along the Expressway, as well as how this connects at either end to the wide network. In either case, the safety, convenience and amenity of cycling must be a primary consideration to satisfy transport policy and project objectives. • The Expressway enables the former SH1 to take on a new character including revitalised town centres at Waikanae and Paraparaumu. The design for the condition of the former SH1 is of interest to KCDC and the community generally, given that it will pass to KCDC once the Expressway is operational as the new SH1. • There will be an interaction between the former SH1 and Expressway at the points where interchanges are provided for. The implications for the design of the local roads that connect the two need to be considered in terms of impacts on existing land uses and the quality of the road as a walking and cycling route. • The interaction between the former SH1 and future land uses along its length will need to be considered to ensure that KCDC's urban growth objectives are not put at risk as a result of the change from the current limited access status. • The Waikanae River and Wharemauku Streams provide highly used corridors for recreation and commuting movements. They also have other amenity values. The sensitivity with which the Expressway crosses these waterways will be important to the continuance of the movements and enjoyment of these places.	The local road crossing at Te Moana Road is a significant east west connector. The approach has to been to provide for these local roads to remain at grade and for the Expressway to go over the top on a bridge. This means walking and cycling activities do not have to go up and over the Expressway, and maintains existing road configurations and patterns. The bridge at Te Moana Road will not be split width-wise like those in the urban areas, but its length will maintain some sense of space beneath. The design of the interchange and Te Moana Road needs to provide for local road movements by drivers, as well as walkers and cyclists and will require careful attention to enable access by the community to facilities on either side of the Expressway. The large roundabouts at this interchange should be reconsidered. The removal of traffic from the current highway will allow for Waikanae town centre to better connect across to the east and to facilities including employment and the railway station. It will also enable people living on the eastern side of SH1 access to the facilities and amenity at the town centre. The interchange at Te Moana Road will give improved connectivity and access to the regional centre at Paraparaumu. The KCDC Development Management Strategy objective is to prevent urban growth in Otaihanga. The Expressway will assist with preventing urban growth at Otaihanga by not providing an interchange there. The Te Moana Road interchange is relatively well located to the Ngarara growth area and provision has been made to allow a new road connection to Te Moana Road for its access. The Waikanae River bridge and the treatment of the space beneath and around it will need to be carefully designed to enable the amenity and recreational benefits currently enjoyed by a large number of people. In particular designs will need to be developed to address the quality of walking surfaces, the surfaces that cannot be planted due to a lack of light, and safety of the space beneath.
heritage	• Engage with iwi in the Project design to identify how the route alignment options and the landscape of the Expressway can best be designed to provided for Māori cultural values. • Consider the known sites, identify the significance of these, and aim to avoid these as far as possible. However, recognise the avoidance of all sites will not be likely given the many known and still unknown sites. • Consider the opportunities to enhance the awareness of the heritage in the way the Expressway and associated structures, pathways and other elements are designed.	There has been engagement with iwi throughout the design process to ensure cultural values are understood and the design has responded to this as best it can. The sites have been identified including through the use of ground penetrating radar to identify if burial sites exist beyond the known Takamore urupa. A protocol arrangement with iwi has been developed to provide a process for managing sites uncovered in the course of construction. There are opportunities for cultural heritage to be recognised in the developed design process.

6.4 Sector 3 Otaihanga/Waikanae

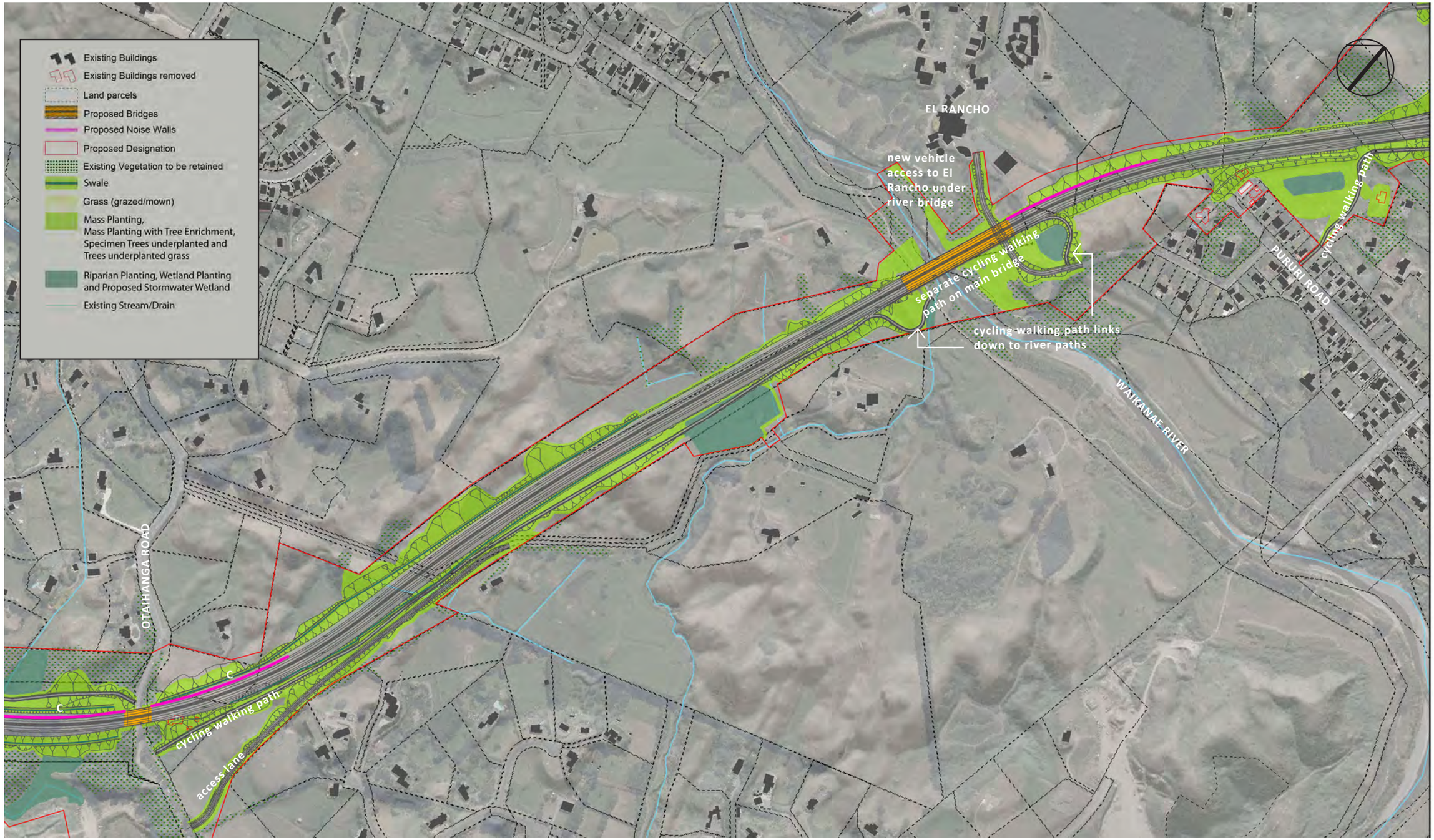


Figure 138

6.4 Sector 3 Otaihanga/Waikanae

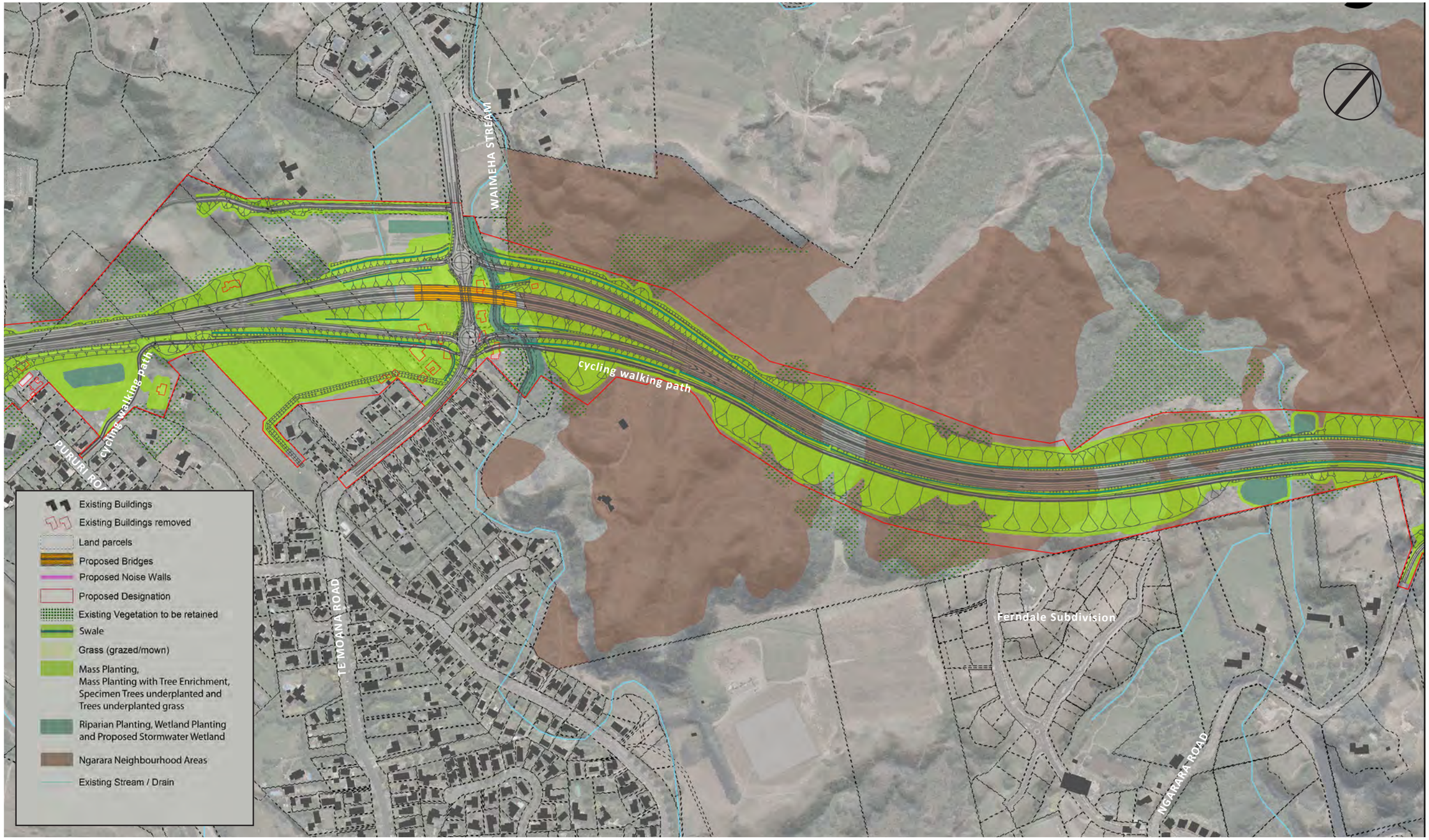


Figure 139

6.4 Sector 3 Otaihanga/Waikanae

A wetland stormwater area
B stream planting
C dense planting
D dense planting on bund
E open grassed areas
F shared cycle/walking path
G exotic tree rows
H bridge
I swale
J floodway

Figure 140 View of Waikanae River bridge looking east

Figure 141 View of Te Moana Road interchange bridge

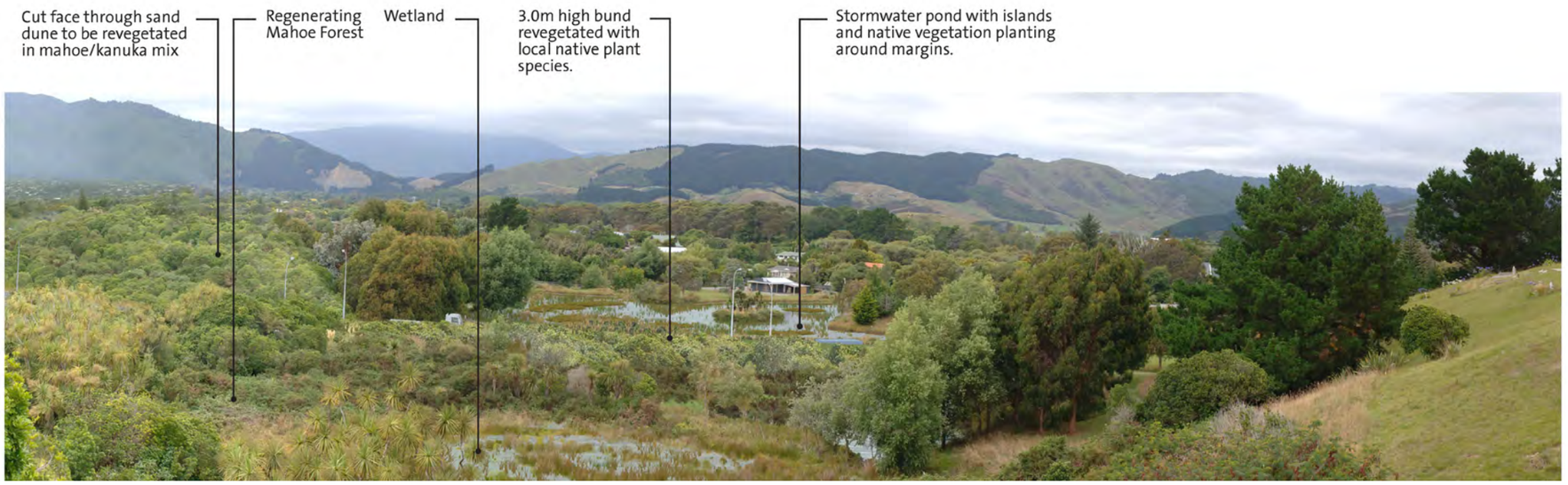
Figure 142 Plan view of Te Moana Road interchange

Figure 143 Cross section of Te Moana interchange

6.4 Sector 3 Otaihanga/Waikanae

Figure 144 Existing view looking east from the urupa

Figures 145 and 146 Simulated view looking east from the urupa with the Expressway - without mitigation above and with mitigation below



6.5 Sector 4 Waikanae North

DESIGN IMPLICATIONS	SECTOR 4	URBAN AND LANDSCAPE DESIGN RESPONSE
policy	• Aim to minimise disruption to planned growth areas and maintain or enhance current levels of access to these sites from Te Moana and Ngarara Roads. • Aim to facilitate employment and residential developments growth in targeted areas. The design of the Expressway needs to take into consideration the vehicular access and amenity levels of these sites. • Aim to supplement walking, cycling and horse riding routes. • Aim to facilitate employment and residential developments growth in targeted areas. The design of the Expressway needs to take into consideration the vehicular access and amenity levels of these sites. • Aim to integrate land use and transportation to achieve good urban form. The location and design of interchanges will be particularly relevant to such integration. • Aim for safe commuter cycling links between communities. The Expressway offers opportunities for improved commuter cycle route(s). • Aim for the design to enhance linkages within and across the Expressway corridor to provide connections for people moving between communities and for the ecological benefits.	The Expressway provides an interchange at Te Moana Road which will facilitate access to the north and will assist connectivity between Waikanae and Paraparaumu. The shared cycle and walking path will connect to Peka Peka Road and will facilitate the circuit down to the beach - this will also allow use by horse riders. The Te Moana Road interchange is relatively well located to the Ngarara growth area and provision has been made to allow a new road connection to Te Moana Road for access to it. The Expressway does cut through the Ngarara growth area and it will require new planning work to determine an appropriate new form for this area whilst recognising the objectives for the design. A substantial component of urban growth in the Ngarara can still be provided for. Connectivity across the Expressway to allow movement between Waikanae township and the growth area has been considered and will be sufficinetly provided for by the proposed bridges across Ngarara and Smithfeild Roads in conjuction with the other village and hamlet connections proposed within the Ngarara structure plan. The design of the Peka Peka connection to SH1 will be important to discourage urban growth at this location as this would be counter to the KCDC Development Management Strategy objectives and District Plan. The design proposes only north direction ramps that will allow existing Peka Peka residents to travel directly north, and north bound Expressway users are to connect to the local roads here. However, there will be no direct provision for Peka Peka residents to travel south on the Expressway at this point which will assist to achieve the desired inhibition to urban growth here. It is noted that Hadfeild Road residents will have less connectivity across to Peka Peka Road given the currently direct link will be severed.
landform	• Guide the design of the Expressway within the nominated corridor with the aim of minimising earthworks by: forming an alignment that runs between large dunes rather than removing them and forming its vertical and horizontal extent in response to natural levels • Recognise that some dune loss or modification will be inevitable given the confined corridor and consider approaches to address this such as: minimising the vertical profile of the Expressway to recognise that the coastal plain is relatively flat (even with the dune forms) - aim for an Expressway 'in' the landscape rather than 'on' the landscape. • Carry out earthworks so that final landforms reflect natural shapes and patterns of the existing dunes. The prevailing alignment of the dunes runs roughly parallel to the coast therefore the design or modification of landforms should acknowledge and reflect this pattern. • Recognise the views to the Tararua Ranges and Kāpiti Island as prominent and important landforms and features in the design of east/west local road crossings. • Recognise that the sand will be vulnerable to wind and water erosion if not managed, and that peat ground or extracted peat will require conditioning before planting.	Some of the largest dunes along the route occur in this sector, between Te Moana Road and Smithfield Road. The large cut faces (at 1:3 slope) are intended to be finished in such a way to avoid a 'tunnel' like effect and reflect, to some degree, the original form of the dunes. Views to Kāpiti Island and the Ranges are likely to be possible from several of the elevated points within this sector including the over bridges at the Peka Peka interchange. The construction methodology recognises that the sand areas will be vulnerable to erosion and this will be managed by limiting the extent of open areas and mixing in other materials and watering to stabilise sand.
hydrology	• Maintain and enhance the watercourses that remain with a view to reduced channelisation and more natural forms which can enhance the natural habitat for fish and other animals as well as improved visual amenity • Consider the multiple stream and other watercourse crossings as places that can incorporate additional east-west walking and cycle Expressway crossing links. • Integrate planning and design for flood storage associated with the Expressway in conjunction with other urban development needs, such as at the Paraparaumu Town Centre and other places as appropriate. • Protect and supplement the few remaining wetlands with new wetland areas that have the dual role of flood storage and stormwater filtration required for the Expressway displacement and runoff.	There are many smaller watercourses through this section of the route that are crossed by the Expressway. These are maintained and in some locations it is proposed to enhance these where there is an opportunity for offsetting some of the loss of open water due to bridges and culvert extensions. There is no large enough watercourse bridge in Sector 4 that could be used to gain access beneath for walking or cycling east-west connections. There are important wetland areas in this section of the route and these have largely been avoided by the Expressway alignment design. There are locations where these can be supplemented and also stormwater wetland areas and some flood detention areas are to be developed that will enable some ecological benefits to accrue.
vegetation	• Recognise the value of all woody vegetation in terms of integration of the Expressway into the landscape; retention of existing amenity trees and shelter belts can assist with landscape integration and mitigation. • Reflect existing vegetation patterns and species mix in mitigation planting, using both exotic and native plant species, but with a predominance of native species. • Avoid the same vegetation treatment along the whole route and use site specific plant options and layouts that reflect the varying contexts. • Carefully select plant species that will be sustainable within the corridor and recognise the climatic conditions, soil types and that require minimal maintenance after establishment.	Cues from the existing vegetation will guide the selection of species, and pattern of planting. Through the open rural land south of Peka Peka planting will consist primarily of grass and small groups of trees to reflect the open nature of the area. Elsewhere, native vegetation will dominate, particularly to enhance riparian areas of the realigned stream and stormwater wetlands. The Ngarara area is part of an east-west ecological corridorr that links the mountains with the coast, consequently the indigenous planing in the Expressway corridor will also be enriched with canopy species to enhance the biodiversity of the ecological corridor.

6.5 Sector 4 Waikanae North

ecology	• Replace any existing natural wetland area losses with new contiguous or linked wetland areas. • Add new wetland areas that have the dual role of flood storage and stormwater filtration required for the Expressway displacement and runoff. • Design any new wetlands with an appropriate maintenance regime that recognises its function as either natural, or for some form of stormwater management or flood detention. • Utilise and enhance existing wet depressions as components in the stormwater and flood detention design. • Utilise east west hydrological connections as habitat corridors across the Expressway in suitable locations. • Develop planting and stormwater treatment wetlands to reflect existing vegetation patterns and provide additional habitat to freshwater fish and bird species.	There are significant wetland areas in this sector. These have been avoided as far as practicable and supplementary wetland areas will also be created. Maintenance strategies will be required for these areas, particularly during the establishment phase. The need for flood storage areas in this sector will also require large areas of land to be managed to allow for detention in period of high rainfall. The habitat connections in this sector are import to recognise the movement from the hills to the coast by bird life. This will be provided for by the revegetation treatment within the Expressway corridor.
built environment and land uses	• Destination activities - eg airport, town centres and schools - will benefit from connections to the interchanges provided those connections are readily accessible from local road networks. • Freeing up the current SH1 from highway traffic enables the design of the town centres to be designed to function more positively and with higher amenity, including better connections between the centres and railway stations. • Options for the Expressway should be designed to avoid effects on schools and to encourage the safety and directness for walking and cycling access. • Beach community residents and visitors will need to pass across the Expressway regularly and this movement needs to be visually, functionally and safely provided for. This includes interchange design to facilitate local road movements by pedestrians and cyclists. • The opportunity should be taken with the Expressway interchange design at Paraparaumu to set a positive precedent for the quality of the of whole of Kāpiti Road. • Design approaches should discourage urban growth at Otaihanga, Te Moana Road and Peka Peka. • The future development of residual areas of the Expressway designation (such as at Raumati) and at planned growth areas needs to be considered in the design especially in terms of connections, to, from and within these areas, as well as the protection of recognised features.	The Peka Peka Beach community will be able to connect to the Expressway to move north, but to move south will use a new connection to the former SH1. This is less direct access than the current connection with SH1. However, any more of a direct access to the Expressway at this location needs to be balanced with the KCDC Development Management Strategy which is to discourage urban growth at this location. As noted above also the access for Hadfield Road rural residents to Peka Peka Road will change under this proposed intersection design. A relatively small number of people are affected by this change. The Expressway provides an interchange at Te Moana Road which will facilitate access to the north and will join the Waikanae community to Paraparaumu. The shared cycle and walking path will connect to Peka Peka Road and will facilitate the circuit down to the beach - this will also allow use by horse riders. The Te Moana Road interchange is relatively well located to the Ngarara growth area and provision has been made to allow a new road connection to Te Moana Road for access to it. The Expressway does cut through the Ngarara growth area and it will require new planning work to determine an appropriate new form for this area whilst recognising the objectives for the design. A substantial component of urban growth in the Ngarara can still be provided for. Connectivity across the Expressway to allow movement between Waikanae township and the growth area has been considered and will be sufficiently provided for by the bridges across Ngarara and Smithfield Roads in conjunction with the other village and hamlet connections proposed within the Ngarara structure plan.
movement networks	• The Expressway crosses a number of east west oriented local roads linking the beach communities on the coastal side with those inland. These connections need to be maintained to provide for the interaction between these communities. This includes through the construction period. • The Expressway is to provide a consistent highway speed (100kmh) route through the district. The local road crossings will accordingly be grade separated and take the form of a bridge over or road under the Expressway. Walking and cycling movements will be most sensitive to the condition and quality of the crossing - be that having to move under a bridge or on an over-bridge. • SH1 is part of the regional cycle network. Consideration needs to be given to either maintaining this route along its current alignment and/or providing a new commuter cycle route along the Expressway, as well as how this connects at either end to the wide network. In either case, the safety, convenience and amenity of cycling must be a primary consideration to satisfy transport policy and project objectives. • There will be an interaction between the former SH1 and Expressway at the points where interchanges are provided for. The implications for the design of the local roads that connect the two need to be considered in terms of impacts on existing land uses and the quality of the road as a walking and cycling route. • The interaction between the former SH1 and future land uses along its length will need to be considered to ensure that KCDC's urban growth objectives are not put at risk as a result of the change from the current limited access status.	The local road at Peka Peka Road is an east west connector from the current SH1 and also connects at its west end along the coast to Waikanae Beach. The local road will connect back to what will be the former SH1 via an over ramp to the south and to keep the relatively rural connection a simple form. The design of the connection for local road movements by drivers as well as walkers and cyclists will require careful attention to facilitate the access by the community. The KCDC Development Management Strategy is to prevent urban growth in the Peka Peka area and the Expressway assists this by locating the interchanges away from this area. The Te Moana interchange also allows for the growth in the Ngarara area to be provided for with direct access to the Expressway. The design of the cycle/walkway at Peka Peka Road will need to tie in with the design for the next section of the RoNS route - Peka Peka to Otaki
heritage	• Engage with iwi in the Project design to identify how the route alignment options and the landscape of the Expressway can best be designed to provided for Māori cultural values. • Consider the known sites, identify the significance of these, and aim to avoid these as far as possible. However, recognise the avoidance of all sites will not be likely given the many known and still unknown sites. • Consider the opportunities to enhance the awareness of the heritage in the way the Expressway and associated structures, pathways and other elements are designed.	There has been engagement with iwi throughout the design process to ensure cultural values are understood and the design has responded to this as best it can. The sites have been identified including through the use of ground penetrating radar to identify if burial sites exist beyond the known Takamore urupa. A protocol arrangement with iwi has been developed to provide a process for managing sites uncovered in the course of construction. There are opportunities for cultural heritage to be recognised in the developed design process.

6.5 Sector 4 Waikanae North

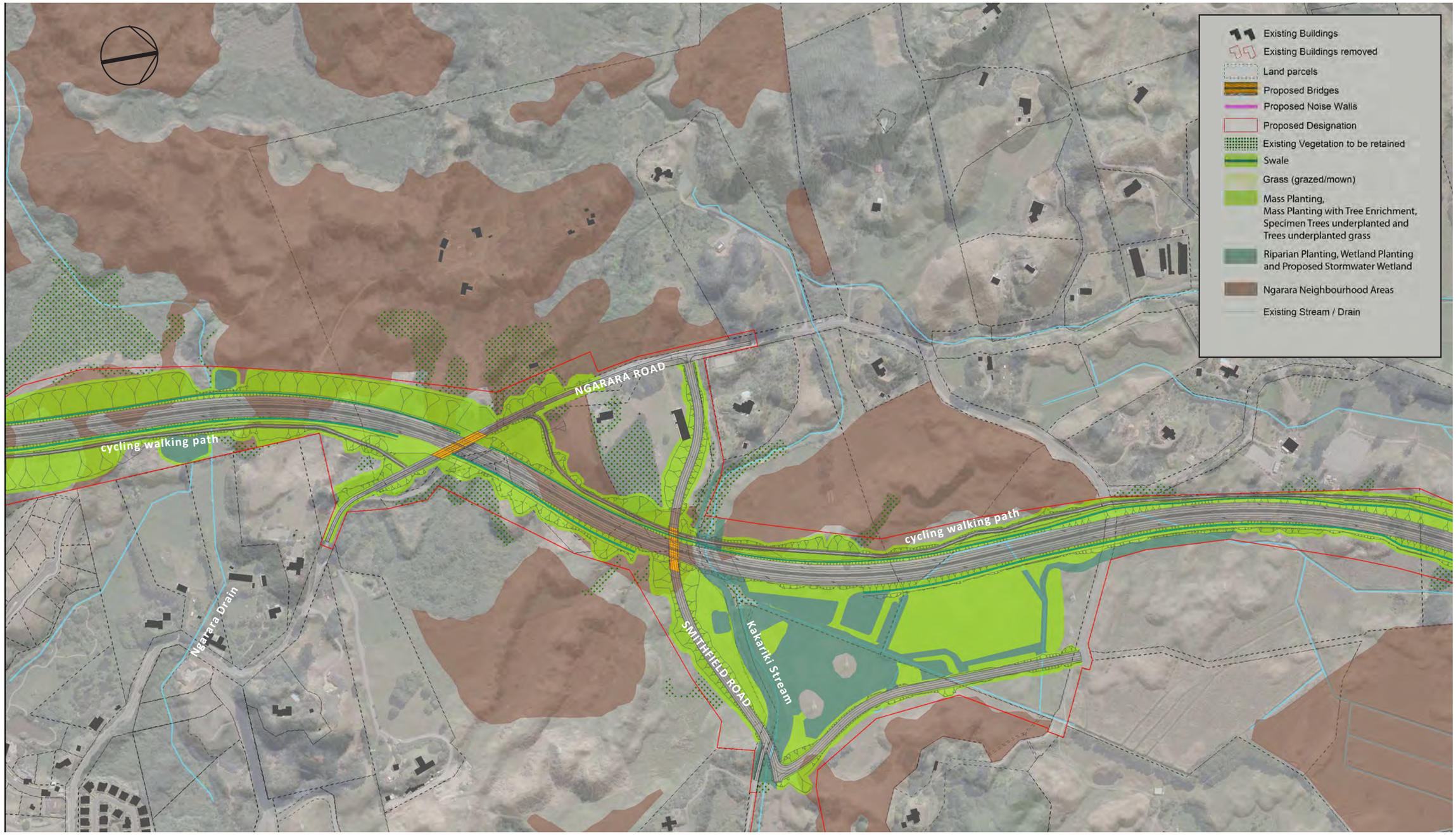


Figure 147

6.5 Sector 4 Waikanae North

Figure 148

6.5 Sector 4 Waikanae North

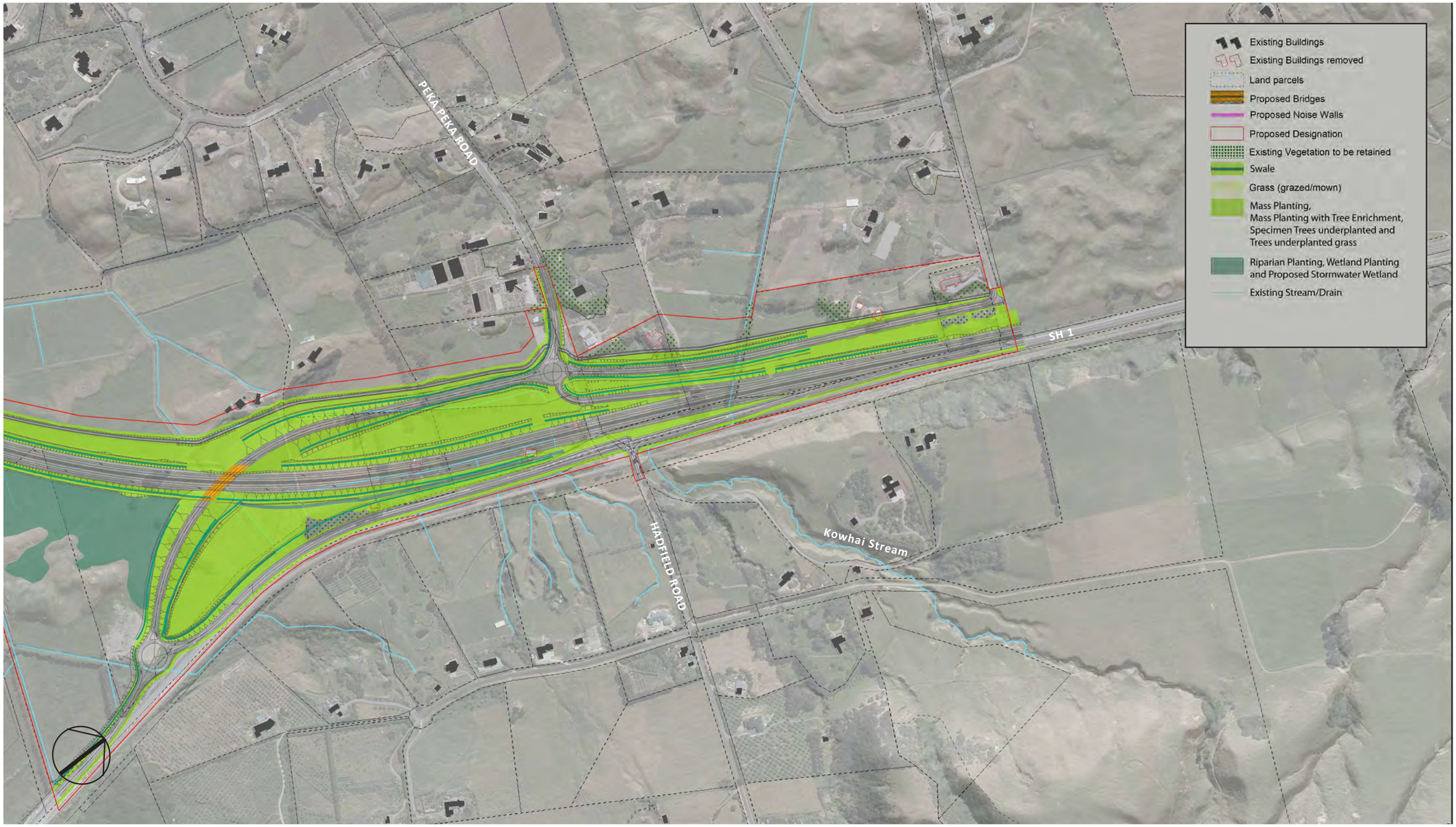


Figure 149