8 Construction of the Project

Overview

This Chapter provides an overview of the methodologies that are proposed to be used to construct the Project. This information is further detailed in the Construction Methodology (refer to Technical Report 4, Volume 3).

The construction methodology describes a number of techniques that will be used by the contractor to build the proposed Expressway. Inevitably these techniques have environmental effects that need to be assessed as part of this application; effects include those related to noise, vibration, dust, water and traffic (Part G of this Report). The Construction & Environmental Management Plan (CEMP, Volume 4) provides a framework for managing the potential and adverse effects arising from construction activities.

The construction of the Project will take approximately 4-5 years, and will be progressed on several fronts simultaneously, along the 16km length of the route. The construction methodology refers to a number of construction sections within a 'South zone' and a 'North zone' along the alignment.

The majority of construction traffic movements will make use of the proposed alignment and the existing SH1. The use of local roads by construction traffic is likely to be limited to movements in relation to the construction of the interchanges, bridges and service re-locations.

8.1 Introduction

The Project will be delivered by a multi-disciplinary Alliance (refer to Chapter 1). This Alliance is tasked with delivering the approvals stage of the Project (AEE & NoR lodgement to the EPA) and the construction stage. Fletchers Construction, Higgins Contractors and Goodmans (who are members of the Alliance) have been involved with the development of the construction methodology.

The Project construction methodology described within this Chapter has therefore been developed and refined as a realistic and feasible methodology by which the potential environmental effects of construction can be identified and assessed, and potential mitigation measures identified to avoid remedy or mitigate these effects as appropriate.

This Chapter provides an overview of the proposed construction methodology across the Project, followed by further information in regard to the nature, scale and duration of construction activities, within each of the four geographic Project Sectors. A general description of the following construction activities is provided in this Chapter:

- Construction sequencing;
- Construction traffic;
- Construction yards & site set-up;

- Water supply;
- Pre-load and dig-out methodologies;
- Erosion and sediment control;
- Works in streams and rivers;
- Bridges; and
- Network utilities.

Throughout this Chapter there will be cross referencing to relevant Technical Reports and Plans where further information about the Project can be obtained. In particular, a proposed Construction Environmental Management Plan (CEMP) is included within Volume 3 and the Construction Plans are included within Volume 5.

8.2 Pre- construction considerations

8.2.1 Construction environmental management

During construction, specific mitigation measures and environmental monitoring will be required to ensure that potential adverse effects on the environment are avoided, remedied or mitigated, as appropriate.

A Construction Environmental Management Plan (CEMP) has been prepared for the Project (refer to Volume 4). The CEMP outlines specific measures to be implemented by the contractor to manage the potential environmental effects of the Project during construction.

The principles and general approach to managing the environmental effects are set out in the main body of the CEMP. The management of specific construction effects (such as discharges to air, noise and vibration) is set out in more particular detail within the suite of environmental management plans (sub-plans) that form the appendices to the CEMP.

The CEMP is consistent with, and complements the recommended environmental management proposals of the AEE (and its technical reports), and has been developed in accordance with the anticipated designation/consent conditions.

The contractor will be required to undertake construction activities in accordance with the CEMP.

Once the conditions have been confirmed through the consenting process, the CEMP will be reviewed and updated (if required) and provided to the contractor prior to works commencing.

8.2.2 Erosion and sediment control

During construction, erosion and sediment control measures will be put in place to minimise potential adverse effects by utilising measures that meet industry best practice guidelines including:

- Greater Wellington Regional Council's *Erosion and Sediment Control Guidelines for the Wellington Region*, September 2002 (Wellington Guidelines); and

- *NZTA Erosion and Sediment Control Standard for State highway Infrastructure*, dated August 2010 (NZTA Draft Standard).

The Erosion and Sediment Control Plan (ESCP) provides an overview of the erosion and sediment management techniques and measures that will be used by the Project, and outlines methodologies and management techniques that will be applied to achieve the environmental outcomes sought by the Project. The ESCP also includes information on dust management techniques to be utilised within the Project.

Given the scale of this Project, it is expected that site and activity specific erosion and sediment control plans will be developed, which will follow the general principles of the ESCP and comply with any relevant consent conditions. These are referred to as Construction Erosion and Sediment Control Plans (CESCPs).

The installation of erosion and sediment control measures will be staged in co-ordination with earthworks, with site preparation measures being installed progressively, in advance of land disturbance activities. This methodology is critical to reducing sediment generation.

Once the erosion and sediment controls are in place, ongoing site monitoring will occur to check that the proposed erosion and sediment control measures have been installed correctly and are functioning effectively throughout the duration of the works.

Upon completion of the construction works, it is expected that the erosion and sediment controls will be removed and any rehabilitation undertaken as necessary.

Specific details of the erosion and sediment control that have been developed for the Project works can be found within the Erosion and Sediment Control Plan (CEMP Appendix H, Volume 4).

8.2.2.1 Devices for erosion and sediment control

The principal sediment control devices for the construction of the Project will include one or more of the following:

- Sediment Retention Ponds (SRP)

  SRPs operate by withholding sediment laden runoff which causes the sediment to fall out of suspension.

- Decanting Earth Bunds

  A decanting earth bund is a temporary berm or ridge of compacted soil constructed to create an impoundment area where ponding of runoff can occur and suspended material can settle before the runoff is discharged. They are smaller than sediment retention ponds and can therefore be used where insufficient space exists for ponds. They are likely to be used in a variety of locations in the Project but most commonly at the end of benches to capture runoff from the large benched cuts.

- Super Silt fences and Silt Fences

  Silt fences[71] may be used in areas where sediment retention devices (i.e. ponds and earth bunds) are not able to be used. This will typically be on particularly steep slopes. The fences are semi-permeable, meaning water is gradually discharged but the majority of sediment is retained. They can be installed down slope of land disturbance areas to capture runoff. Super silt fences[72] will be used in higher risk areas only which applies to those areas of work adjacent to, or in the immediate vicinity of, watercourses.

- Diversion Channels

  Dirty water diversion channels will be used to prevent uncontrolled runoff within the site boundaries. The channels will ensure that rainfall runoff is diverted to sediment control measures.

- Pumping

  Pumping of sediment laden runoff and groundwater during construction will be required at numerous periods during excavation works. These flows will be pumped either to SRPs, to grass buffer zones or to temporary sediment retention devices such as turkey nests (an enclosed ring of filter sock used to contain and filter discharges from pumped stormwater) to assist with retaining any sediment contained within the runoff. Further pumping will also be required with associated activities such as bridge construction. This pumping activity will also ensure discharges are to treatment devices.

[71] A Silt Fence is a temporary barrier of woven geotextile fabric used to intercept sediment laden runoff to reduce the velocity of the runoff, temporarily allow runoff to pool behind the fence and to impound any sediment that settles out of the water column.

[72] A Super Silt Fence is a temporary barrier of geotextile fabric layers backed with chain link fence, or other approved product, used to intercept sediment laden flows, to reduce the velocity of the runoff, to allow the runoff to pool behind the super silt fence and to impound any sediment that settles out of the water column.

- Chemical treatments

  Chemical treatments may be utilised to treat sediment laden water; however, this is likely to be on a limited basis as a risk management tool, and will be based around the use of polyacrylamide contained within flocculant[73] socks.

Drawings CV – CM 200 to230, Volume 5, illustrate the possible location and full range of devices that are likely to be utilised.

8.2.2.2 Temporary stormwater management

Works in and around urban areas will need to ensure that runoff from the Project construction site does not contaminate the existing stormwater system.

The erosion and sediment control measures detailed above will be utilised as and where required, but additional bunding and/or water diversions may be required to ensure stormwater systems are not contaminated.

Where construction works require the relocation of existing stormwater infrastructure, this will be undertaken in a manner that seeks to ensure that uncontrolled runoff is unable to enter the stormwater network.

The Project includes the installation of a number of operational stormwater treatment features as detailed within Chapter 7 (Project Description Operation). Wherever it is practicable, these features will be established early, and used to assist with the management of stormwater runoff during construction.

8.2.2.3 Site stabilisation

An essential aspect of the erosion and sediment control measures will be the stabilisation of disturbed land as soon as practicable. Some areas may require stabilisation on multiple occasions throughout the construction period.

The treatment options for site stabilisation include the use of top soil (where necessary), seed, mulch and geotextiles.

Stabilisation will apply particularly with respect to stockpiles and batter establishment, and will be designed for both erosion control and dust minimisation. Where dust generation is the predominant issue, water carts will be utilised as the initial treatment option.

[73] Flocculation is defined as the use of chemicals to help treat sediment-contaminated stormwater generated from earthworks sites. The chemical used will be dependent on site characteristics, including soils, with the chemical being used to enhance settlement of sediment from the water column.

In regard to preload activities, short-term batters (less than 6 months) will have a final layer of clean granular material or mulch (straw, hay or wood) applied over sand to limit any wind disturbance of the surface. Longer term batter slopes (greater than 6 months) will have topsoil and grass established. Stabilisation of final cut slopes will have topsoil and grass in place from the top of the slope as the cut progresses.

8.2.2.4 Stream works

Given the high risk of sedimentation and the sensitivity of the receiving environment, any works required within streams or rivers will be undertaken in a "dry" environment. This technique will be based on either the diversion of flows around the area of works or working directly above the stream with no formal stream diversion required. In determining the type of works, consideration will also be given to the fish spawning and migration periods, during which time instream works will be restricted.

Drawings CV – CM 246 to 247, Volume 5, illustrates and describes the proposed methodology.

8.2.3 Service relocations

Construction will affect a number of existing services, including transmission and distribution lines for gas, electricity, telecommunications, water, wastewater and stormwater (as described in Chapter 6). Services are generally (with a few exceptions) located in the roadways of the built-up areas and may require relocating or protecting, particularly at the locations of proposed crossings and intersections.

Protection and/or relocation of existing services will generally occur in conjunction with the Project's construction, prior to the bulk of the earthworks.

The contractors will continue to work closely with the relevant service providers to undertake the necessary protection and/or relocation works.

8.2.4 Temporary traffic management and access

Construction of the Project involves truck movements, lane and intersection closures and periods of lowered speed limits on some roads, all of which have the potential to cause inconvenience to road users and residents. A Construction Traffic Management Plan (CTMP) is included as Appendix O of the CEMP, Volume 4, detailing traffic management methodologies and mitigation measures to be adopted for the Project during construction.

The CTMP details the traffic control activities, the impacts on pedestrians, cyclists, residents, businesses, public transport, and general traffic and typical mitigation measures that will be considered in the development of Site Specific Traffic Management Plans and in the general management of Project construction.

8.2.5 Noise and vibration

Noise and Vibration will result from construction activities. The construction activities that are likely to generate noise and vibrations within each Project Sector are listed in Table 8.1 below. Other

construction machinery and activities, not specified in Table 8.1, will produce noise and ground vibration also, but generally to a lesser degree. Technical Report 16, Volume 3, provides an assessment of the construction noise effects, and Appendix F of the CEMP, Volume 4, outlines the Construction Noise and Vibration Management Plan.

Table 8.1: Noise and Vibration from Construction Activities

Sector	Noise generating activities	Vibration generating activities
1	Fill delivery for preload construction Excavation and fill Road basecourse and sealing works Bridge construction, including piling Road realignment and resurfacing	Vibratory rollers for road basecourse and sealing works Excavation plant Piling for bridge construction Vibratory rollers for road realignment and resurfacing
2	Excavation and fill Off-road fill transport Road basecourse and sealing works Bridge construction, including piling Road realignment and resurfacing	Vibratory rollers for road basecourse and sealing works Off-road fill transport Excavation plant Piling for bridge construction Vibratory rollers for road realignment and resurfacing
3	Fill delivery for preload construction Excavation and fill Off-road fill transport Road basecourse and sealing works Bridge construction, including piling Road realignment and resurfacing	Vibratory rollers for road basecourse and sealing works Excavation plant Off-road fill transport Piling for bridge construction Vibratory rollers for road realignment and resurfacing
4	Fill delivery for preload construction Excavation and fill Off-road fill transport Road basecourse and sealing works Bridge construction, including piling Road realignment and resurfacing	Vibratory rollers for road basecourse and sealing works Excavation plant Off-road fill transport Piling for bridge construction Vibratory rollers for road realignment and resurfacing

8.3 Construction programme

8.3.1 Construction duration

The Project is anticipated to take four to five years to construct. Construction works are programmed to commence Quarter 3 2013 (dependent on all required land and approvals being secured) and being complete by Quarter 3 2017.

Working hours will generally be between 7.00am and 6.00pm, unless specific arrangements are required due to road closure requirements.

8.3.2 Construction zones

For the purposes of programming and for effectively managing the physical works, the length of the proposed Expressway route will be split into two construction zones (North Zone & South Zone) and 16 individual construction sections. These zones and sections are illustrated within the Construction Zone Diagram (Drawing CV-CM-101, Construction, Zone Diagram and Stages, Volume 5, Folder 1 of 3).

SOUTH ZONE

POP: Poplar Avenue Interchange (Sector 1)

POP-RAU: Poplar Avenue – Raumati Road (Sector 1)

RAU-IHA: Raumati Road – Ihakara Street/Wharemauku Stream (Sector 2)

IHA-KAP: Ihakara Street/Wharemauku Stream – Kāpiti Road (Sector 2)

KAP: Kāpiti Road Interchange (Sector 2)

KAP-MAZ: Kāpiti Road – Mazengarb Road (Sector 2)

MAZ-OT: Mazengarb Road – Otaihanga Road (Sector 3)

NORTH ZONE

OT-WAI: Otaihanga Road – Waikanae River (Sector 3)

WAI-TEM: Waikanae River – Te Moana Road (Sector 3)

TEM: Te Moana Road Interchange (Sector 3)

TEM-NGA: Te Moana Road - Ngarara Road (Sector 4)

NGA: Ngarara Road Area (Sector 4)

SMI: Smithfield Road (Sector 4)

SMI-15400: Smithfield Road – CH.15400 (Sector 4)

15400-PP: CH.15400 – Peka Peka Interchange (Sector 4)

PP: Peka Peka Interchange (Sector 4)

8.3.3 Construction sequence

The likely sequence of construction to complete the works has been broken into six individual stages across the 4-5 year construction duration. These stages are illustrated within the Construction Sequence Drawings CV-CM-101 to 108; Construction, Zone Diagram and Stages, Volume 5, Folder 1 of 3) and described in detail within the Construction Methodology (Technical Report 4; Volume 3).

The Project will be undertaken on a number of fronts or work faces within each stage, such that different construction operations will be progressed across the 16 sections along the route.

Prior to any construction activities commencing on a particular site, a number of site establishment activities will be required, which will include site clearance, service relocations, establishment of erosion and sediment control measures and ground preparations.

A summary of the likely construction programme and sequencing is illustrated in Figure 8.1 below and indicates two main operations:

- Ground improvement works to peat areas:
    - Preload and settlement of peat areas.
- Proposed Expressway construction:
    - Further ground improvement, earthworks, drainage, bridge construction, pavements, landscaping and ancillary works.

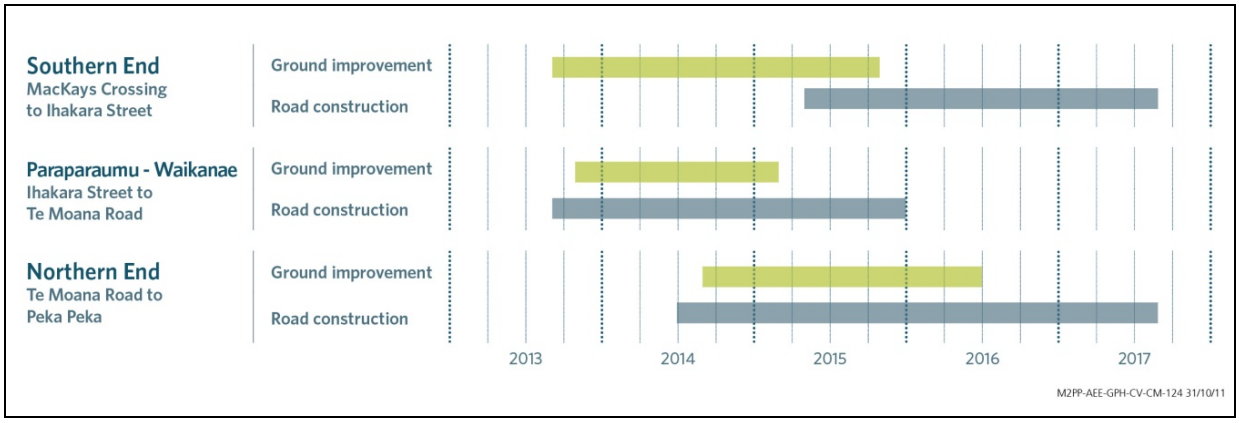

Figure 8.1: Construction Work Programme Summary

In addition to these operations, finishing works will also be required which will include landscaping. Finishing works are likely to commence at Otaihanga Road heading north and south concurrently with completion anticipated at Peka Peka and MacKays Crossing. Further details on the works are provided within Technical Report 4, Volume 3.

8.4 Construction establishment

8.4.1 Construction yards

Due to the physical length of the Project, approximately 11 construction yards will be required to accommodate and service the construction works for the duration of the construction period.

All yards will be fully fenced and made secure. Site establishment activities for construction yards will include site clearance, ground preparation, and establishing erosion and sediment control measures prior to any construction activities occurring. Upon completion of the works, the construction yards will be disestablished and the areas reinstated.

Table 8.2 below outlines the number, type and general location of the construction yards currently anticipated along the length of the project. A general description of the type of construction yard and the general activities to be undertaken in these is provided below.

Table 8.2: Type and General Location of Construction Yards Required for the Project

Construction Zone	Sector	Drawing No. CV-CM-	Location	Yard Type	Specific functions
SOUTH	1	401	Poplar Avenue	Intersection Yard	Poplar Avenue Interchange
	1	402	Raumati Road	Bridge Yard	Raumati Bridge
	2	403	Wharemauku Stream	Bridge Yard	Wharemauku Stream Bridge
	2	404	Kāpiti Road	Intersection Yard	Kāpiti Road Interchange
	2	405	Mazengarb Road	Bridge Yard	Mazengarb Bridge Mazengarb Road realignment
NORTH	3	406	Otaihanga Road	Project Yard	Main project centre Otaihanga Bridge Waikanae River Bridge (S)
	3	407	Waikanae River	Bridge Yard	Waikanae River Bridge Waikanae River Streamworks
	3	408	Te Moana Road	Intersection Yard	Te Moana Interchange Waikanae River Bridge (N)
	4	409	Ngarara Road	Bridge Yard	Ngarara Road Bridge Smithfield Road Bridges
	4	410	Smithfield Road	Bridge Yard	Smithfield Road Bridge Kakariki Stream Bridges
	4	411	Peka Peka Road	Intersection Yard	Peka Peka Interchange

8.4.1.1 Main construction yard

The main construction yard is proposed to be located at the Otaihanga Landfill site, off Otaihanga Road. This site is located adjacent to and close to the mid-point along the length of the proposed Expressway route, and is within one kilometre of existing SH1, with access off a rural local road.

The Otaihanga Project Yard will therefore be the central hub for all construction work and will provide for the:

- Main administrative centre & welfare facility for construction staff;
- Main plant/equipment storage and workshop;
- Pre-cast concrete yard;
- Main access to alignment;
- Main delivery point for materials; and
- Transfer & segregation of site and office waste.

The total area of the site is approximately 20,000m^2. A total area of approximately 12,000m^2 will be required for the precast yard, with approximately 10,500m^2 required for the site office set up as illustrated by Figure 8.2 below.

It is currently intended that each section of the proposed Expressway will be constructed consecutively and progressively away from Otaihanga. As each bridge and Section is completed, it will provide a passage through to the next Section. Materials can then be moved through the site, using the proposed Expressway corridor from Otaihanga Road as a haul route. This methodology would minimise both the volume of construction traffic on local roads and the amount of disturbed land area within the designation at any one time.

The main construction yard is expected to generate an estimated 480 daily round trips on Otaihanga Road at the peak of construction between 2014 and 2016 (refer to Technical Report 33, Volume 3).

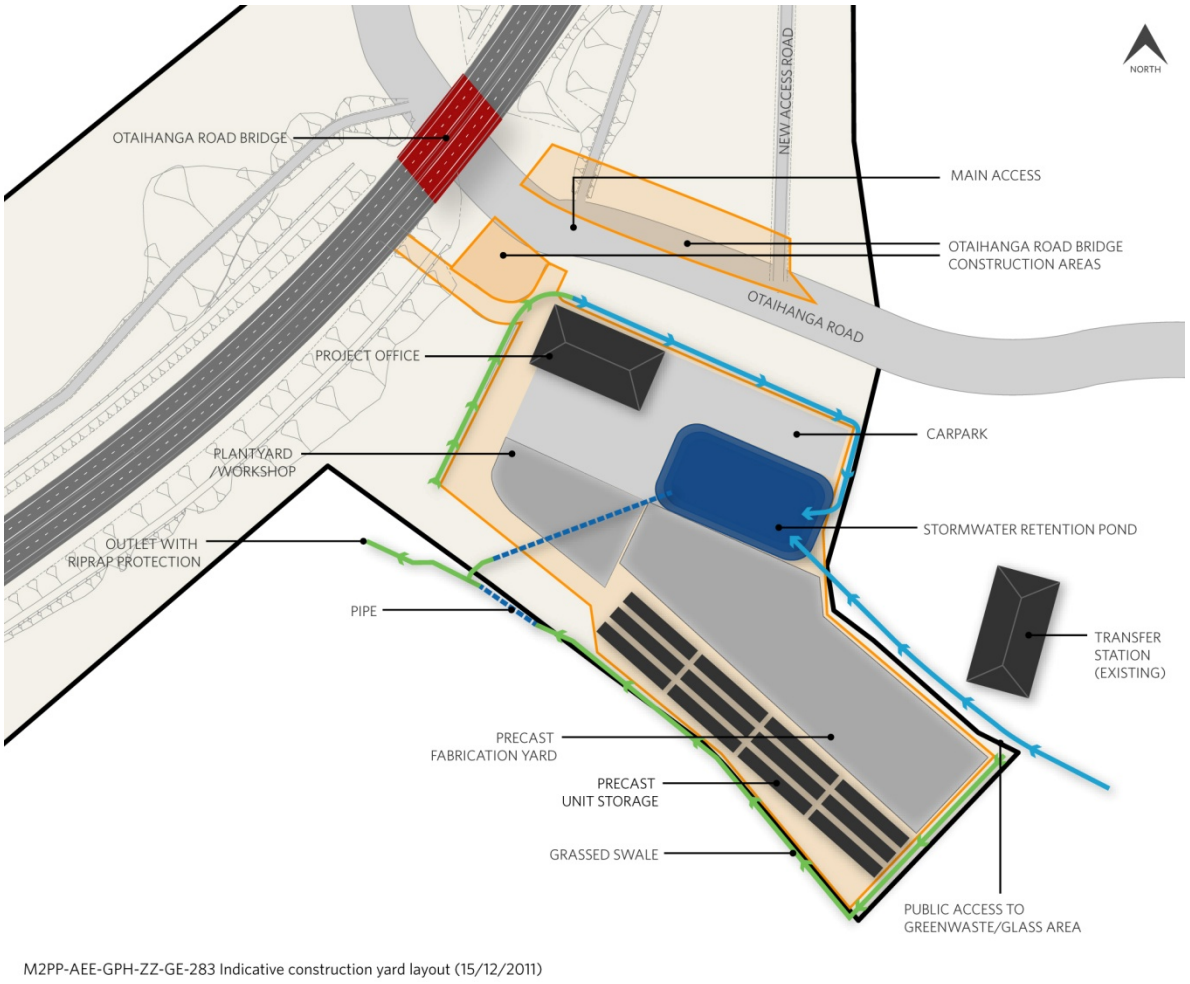

Figure 8.2: Indicative main construction yard layout

8.4.1.2 Interchange construction yards

At each interchange location, an interchange construction yard will be established as the administrative centre for works in that particular area. The purpose of each yard is to provide the following services:

- Administrative centre & welfare facility for all works in the vicinity of the interchange;
- Local plant/equipment storage;
- Local access to alignment;
- Delivery point for construction materials; and
- Collection of site waste.

8.4.1.3 Bridge construction yards

A small construction yard will also be set up at each bridge location. The purpose of each bridge yard will be to provide a small office and welfare facility specifically for the duration of the bridge construction works. Services provided will be:

- Welfare/small office facility;
- Local plant/equipment storage;
- Local access to alignment;
- Delivery point for bridge construction materials; and
- Collection of site waste.

8.4.2 Water required for construction

Water will be required to carry out a number of construction activities, including dust suppression, compaction of granular materials, ground improvements and structural work. It is proposed that this water be primarily sourced from deep-water bores.

Peak water demand is likely to occur during drier months and at peak construction periods in each bore location. The maximum supply of water will be 800 cubic metres (cum) per day, although the required volume is expected to reduce during periods of wet weather.

Where practicable, and to minimise the impact on water resources, water from sediment retention devices will be reused in construction operations. However, to ensure adequate supply of water, up to nine deep water bores will be positioned along the proposed Expressway route.

The proposed positions for deep water bores are generally dispersed across the route to minimise haulage. The positions are listed below and illustrated within Drawing CV-CM-400, Volume 5:

- Poplar Avenue;
- Raumati Road;
- Ihakara Street;
- Kāpiti Road;
- Mazengarb Road;
- Waikanae River;
- Te Moana Road;
- Ngarara Road; and
- Peka Peka Road.

Where necessary, these bores will also provide water supply to the office/welfare facility in the construction yards.

8.4.3 Materials required for construction

Embankments will largely be constructed using cut to fill material generated from the proposed Expressway alignment. However, there will be a requirement for imported fill to be used in the embankments. There are a number of local options for sourcing the imported fill, which include:

- Kāpiti Quarry, Paraparaumu;
- Otaihanga Sand Quarry;
- Waikanae Quarry; and
- Ōtaki Quarry.

The sourcing of material from each quarry will be carefully managed during construction to minimise both haul distances to each embankment and truck movements from each quarry. Should any additional consents be required for quarrying, these will be obtained and implemented by the contractor.

A precast yard will be established within the main construction yard at the Otaihanga Landfill site on Otaihanga Road. Within this yard, concrete elements such as bridge beams and concrete barriers will be manufactured.

Other required materials to be manufactured off-site and transported to site as required would generally include:

- Steel required for structural components;
- Surfacing materials (including bitumen);
- Road furniture;
- Stormwater treatment and erosion and sediment control devices; and
- Pipes and drainage materials.

8.4.4 Construction lighting

Lighting will be required in some construction areas to enable operations to proceed during the hours of darkness. Construction operations that are on or very near existing roads and are likely to cause disruption to traffic will generally take place at night.

Operations that are expected to be carried out during night time hours are:

- Erection of bridges at:
    - Raumati Road
    - Kāpiti Road
    - Mazengarb Road
    - Otaihanga Road
    - Te Moana Road
    - Ngarara Road
- The widening of Kapiti Road at the east and west ends of the Kāpiti Road intersection.
- Set-up, changes to and removal of General Traffic Management throughout the life of the contract (all Sectors).

At these locations, the site and adjacent construction yard will require full illumination during the night to complete the required operations. During the erection of the bridges at each of the above locations, the precast yard on Otaihanga Road will also be illuminated to enable loading of bridge units. Mobile lighting towers will be erected on a temporary basis for night works.

Each construction yard area will utilise temporary lighting to enable operations to proceed during the hours of darkness during the winter period. In addition, lighting will be provided to guide staff, plant and vehicles at the start and end of each shift during the winter months.

8.5 General construction activities

8.5.1 Ground improvements

The Project traverses dune sands and swamp deposits of the Kāpiti coastal lowlands. Peat deposits present in the low lying inter-dunal depressions are generally soft, with high organic contents. Groundwater is typically encountered at a shallow depth in the peat deposits.

Where peat deposits are present below the new road embankments, ground improvements are required to limit post-construction settlement of the proposed Expressway. The treatment approaches will vary along the proposed Expressway depending on the depth and extent of the peat expected to be encountered and the sensitivity of adjacent areas. Two peat treatment methods are proposed:

- Preload and Surcharge; and
- Excavate and Replace.

There are loose to medium dense sand deposits present along the proposed alignment that have the potential to liquefy under a moderate earthquake event. Ground improvements are required at the bridge abutments to mitigate this potential liquefaction, and subsequent instability. The treatment proposed is to install:

- stone columns below bridge abutments.

The ground improvements on each site will be undertaken prior to the bulk earthworks activity on that site.

Refer to the Assessment of Ground Settlement Effects (Technical Report 35, Volume 3) for further information.

8.5.1.1 Preload and surcharge

Sections of the proposed alignment will be preloaded and surcharged. This activity involves the placement of sand or granular material over the alignment (Refer to Drawing CV – CM – 244 and CV – CM – 260 to 270, Volume 5, Folder 3 of 3). This approach will generally be applied in locations where the peat is of greater depth or extent.

The preload and surcharge method involves constructing the road embankment over the peat deposits and allowing the majority of settlement to occur prior to pavement construction. Preload and surcharge fill is to be placed above the final design level of the proposed Expressway, during the settlement period to reduce long-term settlement. The depth of preload fill is equivalent to the expected settlement depth and the surcharge is the additional fill placed and removed at the end of the settlement period. Some on-going secondary and creep settlements are expected due to the nature of the underlying peat.

Prior to placement of the preload and surcharge material, the site is likely to be prepared as follows:

- Top soil will not be removed;
- A high strength geotextile will be placed directly on the existing ground surface; and
- The base 1.0m of the embankment will be constructed using a granular rock fill, and engineered bulk fill will be placed above this initial starter layer.

Erosion and sediment controls are expected to remain in place throughout the entire preload period. These controls can remain in place, with associated maintenance, once the preload is completed and road formation has commenced.

8.5.1.2 Excavation and replacement

Where peat replacement is the selected approach for construction, this process will be undertaken in a series of steps as detailed within Drawings CV – CM 240 to 243, Volume 5, Folder 3 of 3.

The methodology of this approach involves the excavation of peat with immediate sand backfilling. This is achieved with a combination of groundwater pumping and driving water ahead of the sand to keep the excavation dry.

Prior to excavation of the peat, each site (where excavation and replacement is used) will be prepared as follows:

1. Topsoil will be stripped and utilised to form a stabilised bund that will function as a clean water diversion for water from outside the alignment; it will also function as a dirty water diversion for the alignment works.

2. Removing peat from the site and stockpiling this material between the topsoil bund and the excavation area.

3. Sand will be placed within the excavation. This is expected to occur shortly following the excavation to minimise the length of time the excavation remains open for stability purposes and to reduce water ingress. The base of the excavation will be inspected by a geotechnical engineer prior to backfilling.

8.5.1.3 Stone columns

As part of the bridge establishment process, ground improvement of the soils below the bridge abutments and surrounding ground will be required. This can be achieved by numerous engineering

methodologies, with the currently preferred methodology for this Project involving reinforcement of the soils with densely compacted granular columns through the process of vibro-replacement (refer to Figure 8.3). These columns also provide vertical drainage. A vibrator is used to penetrate and displace the soil and to compact the clean stone in stages to form a dense column. Jetting water may be utilised to assist the penetration of the vibro probe. A drainage blanket would be constructed above the top of the stone columns. These stone columns would mitigate the liquefaction potential of the saturated sand deposits.

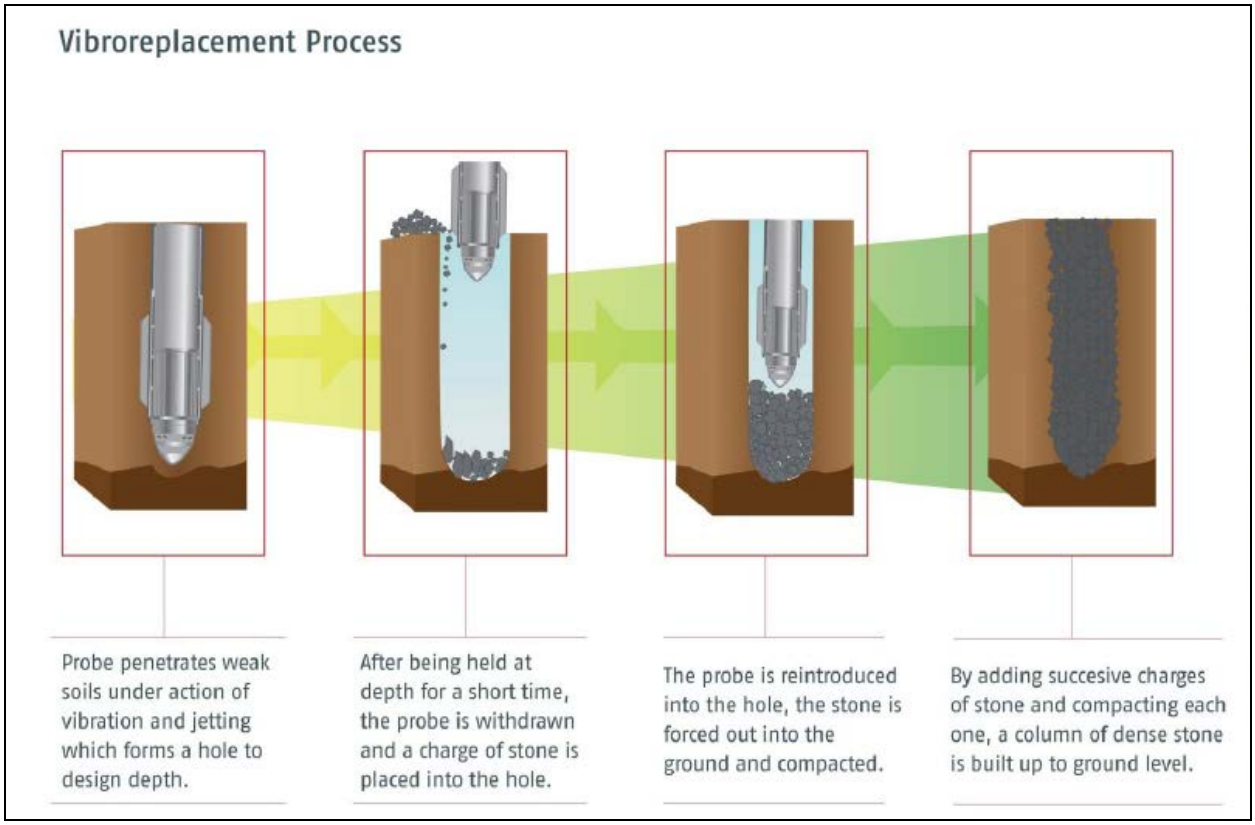

Figure 8.3: Vibro- replacement Process

8.5.1.4 Disposal of excavated peat

Initially, the peat will be stockpiled adjacent to the site and allowed to dry sufficiently to reduce haulage around and off the site. The peat material will be used as far as possible within the Project designation, including incorporating it into landscaping and the formation of acoustic barriers where practicable. Excess peat will then be removed from the site via the proposed Expressway corridor haul route, to consented dump sites. Possible dump sites could include:

- Bright's Cleanfill, Kāpiti Quarry, Paraparaumu, via on-road haul route exiting from Poplar Avenue;
- Former Waikanae Oxidation Ponds, Paetawa Road, to assist in the rehabilitation of this reserve (ref. Technical Report 26, Volume 3), via on-road haul route exiting from Te Moana Road; and
- Former Otaihanga Landfill, via off-road haul route exiting direct from the proposed Expressway corridor.

8.5.2 Earthworks

Generally the earthworks required for construction of the proposed Expressway will involve cut to fill of existing sand along the alignment.

The earthworks will comprise new embankments typically 2 to 3m high across low lying areas, cut slopes typically 10m and up to 25m high through sand dunes, and new approach embankments for structures. Embankments up to 7m high are required at local road crossings to provide sufficient height clearance.

- In some areas, particularly to the south of the Project, more fill may be required than is available locally. In these situations, sand fill will be transported to these areas from the cuts in the north of the route. Where insufficient material can be supplied from the alignment, imported fill will be brought in from nearby quarries.
- Sand dunes are particularly prone to wind and water erosion. Cuts and embankments will therefore need to be permanently stabilised by re-vegetation (refer to CEMP Appendix H, Volume 4).

Upon completion of cut to fill activities within each Construction Zone Section, any further earth-moving required between sections is likely to be carried out after completion of the bridge structures. Off-road dump trucks will utilise the completed proposed Expressway corridor and bridges as a haul route.

8.5.2.1 Site preparation for earthworks

Site preparation prior to earthworks commencing may require:

- Identification of the location of services. Services may require diversion outside the area of excavation;
- Clearing of vegetation and stripping of topsoil; and
- Installing erosion and sediment control measures (outlined within Appendix H, Volume 4).

8.5.2.2 Earthwork construction methods

The construction methods for earthworks include:

- Cut to fill within the section;
- Cut to fill using the haul road; and
- Import fill.

Compaction of fill material will take place in layers until it is at the required level and compaction to receive the road pavement layers.

8.5.3 Drainage

The installation of stormwater drainage along the proposed Expressway route will generally be completed during or prior to ground improvements and earthworks.

Wetland and flood offset storage areas will be formed at the time of earthworks and used for sediment control during construction wherever practicable.

Culvert installation or the extension of existing culverts (temporarily or permanently) will be required in a number of locations to allow for road construction. Culverts provide for a dry environment over which the construction activity can then occur. Where works are required within a stream channel to construct the culverts, two main methodologies will be used: either by pumping around the area of works or by creating a temporary stream diversion around the culvert footprint (refer to the CEMP Appendix H, Volume 4 for details on these methodologies).

8.5.4 Bridge construction

The construction of the bridges will be a significant part of the Project. Bridge construction works, at the ends of each Section, will be completed during earthworks activities. Bridges over or under the proposed Expressway would be constructed at various local road crossings.

As discussed in Chapter 7, 16 bridges will be built as part of the Project, with seven of these crossing watercourses; namely the Waikanae River, Wharemauku Stream, Kakariki Stream, Paetawa Stream and the three bridges over the Waimeha stream at the Te Moana Road interchange. Where works in and around streams are required, erosion and sediment control measures will be employed. Road bridges will have differing environmental controls to watercourse crossings (refer toCEMP Appendix H, Volume 4).

Bridge construction will typically involve piling operations and reinforced concrete column and crosshead construction. Bridge beams will be cast off-site in the precast concrete construction yard and then transported to site and placed in position with the top slab cast in situ. Barriers will also be pre-cast and settlement slabs and wing walls cast in situ. The likely sequence of bridge construction is detailed within the Construction Methodology (Technical Report 4, Volume 3).

Concrete supply will be from a supplier local to Kāpiti Coast. Concrete deliveries will be to either the Otaihanga Yard for prefabrication activities or to the individual bridge sites. All sites will be accessed via SH1 and local roads.

At each bridge construction site, a small construction yard will be established to provide welfare facilities and material and plant storage.

The Construction Traffic Management Plan (CEMP Appendix O, Volume 4) details the proposals to control vehicular, pedestrian, cyclist and equestrian traffic during bridge construction.

8.5.5 Pavement and surfacing

Upon completion of the earthworks, drainage and bridges in each section, pavement materials will be laid. One carriageway of the proposed Expressway will be completed and sealed to enable immediate protection of the sub grade pavement layers and allow a progressive completion of the proposed Expressway. The other carriageway will be completed to subbase level to protect the sub grade and create the proposed Expressway corridor haul route for the bulk earthmoving activity and other construction traffic.

Upon completion of the required settlement periods for the preload areas, which on average are expected to be approximately 12 months, construction of the proposed Expressway in these areas will proceed. The preload surcharge will be removed and used as fill elsewhere along the proposed Expressway corridor, thus minimising the overall use of imported fill on the proposed Expressway. Pavement materials can then be placed on the remaining embankment to complete the road structure.

As the main carriageway is completed in each Section, the cycleway/walkway will also be completed. Once all works are complete within each carriageway section, traffic services, roadside furniture and landscaping, including acoustic barriers, will be able to be installed.

8.6 Sector specific construction activities

8.6.1 Sector 1

This Sector (between chainage 0m and 4500m) includes the following specific construction stages of the South Zone:

- Poplar Avenue (POP)
- Poplar Avenue-Raumati Road (POP-RAU)
- These sections are illustrated within the Construction Zone Diagram (Drawing CV-CM-101 to 108, Construction, Construction Zone Diagram and Stages, Volume 5, Folder 1 of 3).

8.6.1.1 Construction activity overview

Sector 1 includes the new partial interchange at Poplar Avenue, with a bridge constructed to take the proposed Expressway over Poplar Avenue. The proposed Expressway will then continue northwards from Poplar Avenue to Raumati Road.

Underbridge Construction – Poplar Avenue

Construction of the underbridge at Poplar Avenue will involve ground improvements using vibro-replacement techniques, piling operations and reinforced concrete column and crosshead construction. Bridge beams will be cast off-site in the pre-cast concrete construction yard (within the main construction yard), transported to site and placed in position. Traffic on Poplar Avenue will diverted around the worksite during this process, to enable construction to proceed during the day.

Poplar Avenue- Raumati Road

Initially, preload fill will be brought into this section and allowed to settle. Imported fill and cut material from Sector 4 will be delivered by truck & trailer units and placed using bulldozers and compactors during daytime working hours. Following the preload settlement period, the new alignment will be constructed using earthmoving and road construction plant and equipment during the day.

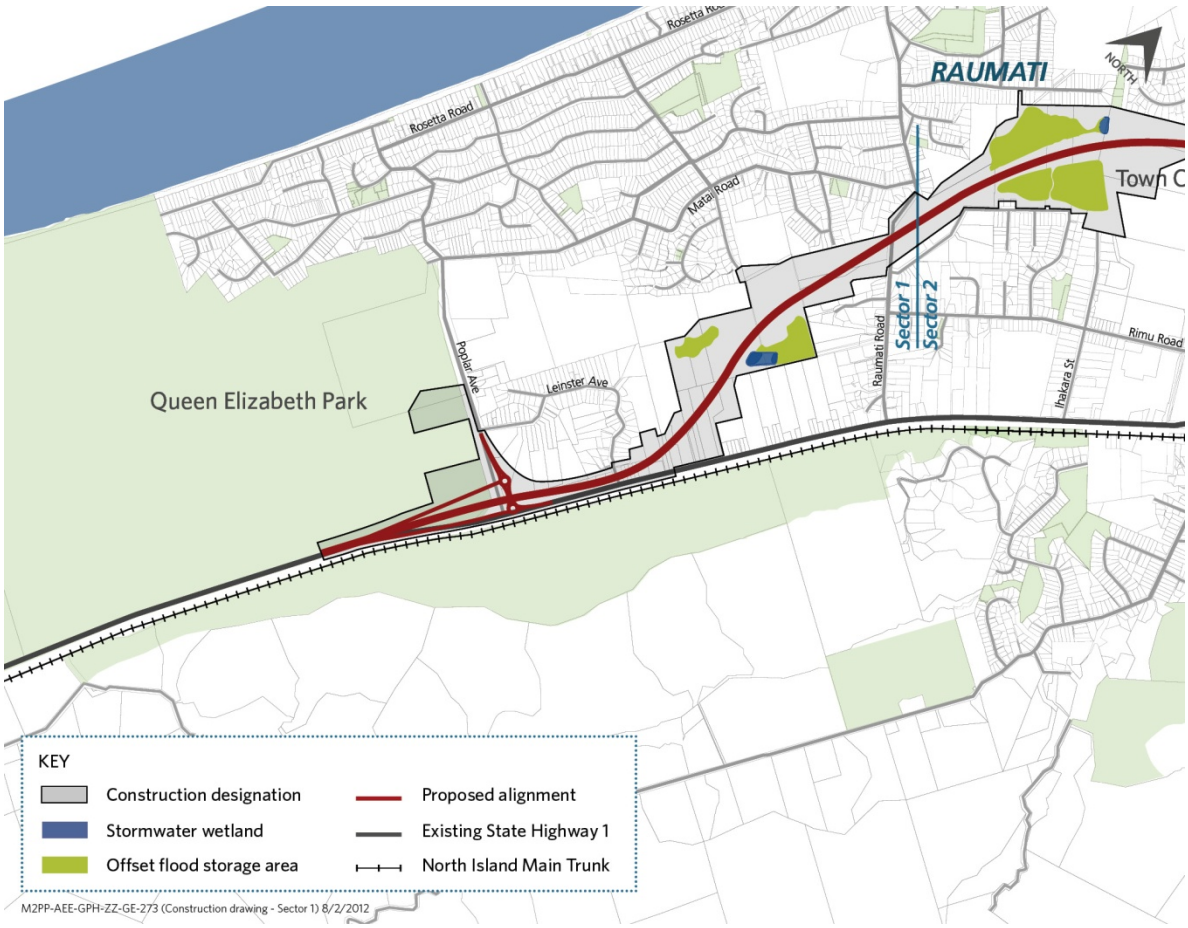

Figure 8.4: Extent of proposed construction designation in Sector 1

Poplar Avenue- Raumati Road

Initially, preload fill will be brought into this section and allowed to settle. Imported fill and cut material from Sector 4 will be delivered by truck & trailer units and placed using bulldozers and compactors during daytime working hours. Following the preload settlement period, the new alignment will be constructed using earthmoving and road construction plant and equipment during the day.

Stormwater Wetland Ponds

A stormwater wetland pond will be constructed either side of the proposed Expressway at approximate chainage 3800m. This will require a cut to waste activity, with any waste material being removed from site transported to an appropriate location.

8.6.1.2 Temporary traffic management

Poplar Avenue and the existing SH1/Poplar Avenue intersection are planned to be realigned in three phases to allow off-line construction of the Poplar Avenue interchange.

The NZTA will seek to have the SH1/Leinster Avenue intersection closed permanently.

8.6.1.3 Erosion and sediment control

Sector 1 is anticipated to include the following erosion and sediment control methods:

- SRP's (number 1 to 4)
- Dirty water diversion channels;
- Silt fences and super silt fences where required;
- Progressive stabilisation of batters; and
- Decanting earth/topsoil bunds.

These methods are detailed within CEMP Appendix H, Volume 4and illustrated on Drawing CV – CM 201 - 204, Volume 5, Folder 3 of 3.

8.6.1.4 Temporary stormwater management

Sector 1 is anticipated to include the following temporary stormwater methods:

- Drainage swales and associated rock filters (generally at approximately 50m intervals) are to be developed as part of the long term stormwater management;
- Long term stormwater wetlands and flood storage areas will act as a backup for managing sediment as necessary; and
- Culvert extensions

These methods are outlined within Technical Report 4, Volume 3 (Construction Methodology) and the CEMP Appendix H, Volume 4. The location for each method is illustrated on Drawings CV – CM 201 - 204, Volume 5, Folder 3 of 3.

8.6.1.5 Service relocations

A number of existing services will require relocation within Sector 1. These will include:

- A wastewater pumping station;
- Water mains and wastewater pipelines; and
- Telecom, Telstra and Electra cabling.

8.6.2 Sector 2

This Sector (chainage 4500m to 8300m) includes the following specific construction stages of the South Zone:

- Raumati Road-Wharemauku Stream/Ihakara Street (RAU-IHA);
- Ihakara Street/Wharemauku Stream-Kāpiti Road (IHA-KAP);
- Kāpiti Road-Mazengarb Road (KAP-MAZ); and
- Mazengarb Road-plus 300m (MAZ-OT).

These sections are illustrated within the Construction Zone Diagram (Drawings CV-CM-101 to 108, Volume 5, Folder 1 of 3).

8.6.2.1 Construction activity overview

Sector 2 includes the construction of the proposed Expressway from Raumati Road to 300m north of Mazengarb Road, through the predominantly urban environment of Paraparaumu. Underbridges will be constructed over local roads at Raumati Road and Mazengarb Road, along with an underbridge spanning the Wharemauku Stream.

A vertical realignment of Mazengarb Road will be required to accommodate the proposed Expressway bridge. Kāpiti Road will be widened as part of the construction of the new interchange. A bridge will be constructed over Kāpiti Road to carry the proposed Expressway, with on- and off-ramps in each direction.

Construction is likely to proceed in a north-south direction from Sector 3. This will enable the progressive completion of the bridges and earthworks to enable a haul route to be established along the new alignment and over the proposed bridges to transport fill material from Sector 4 to Sector 2.

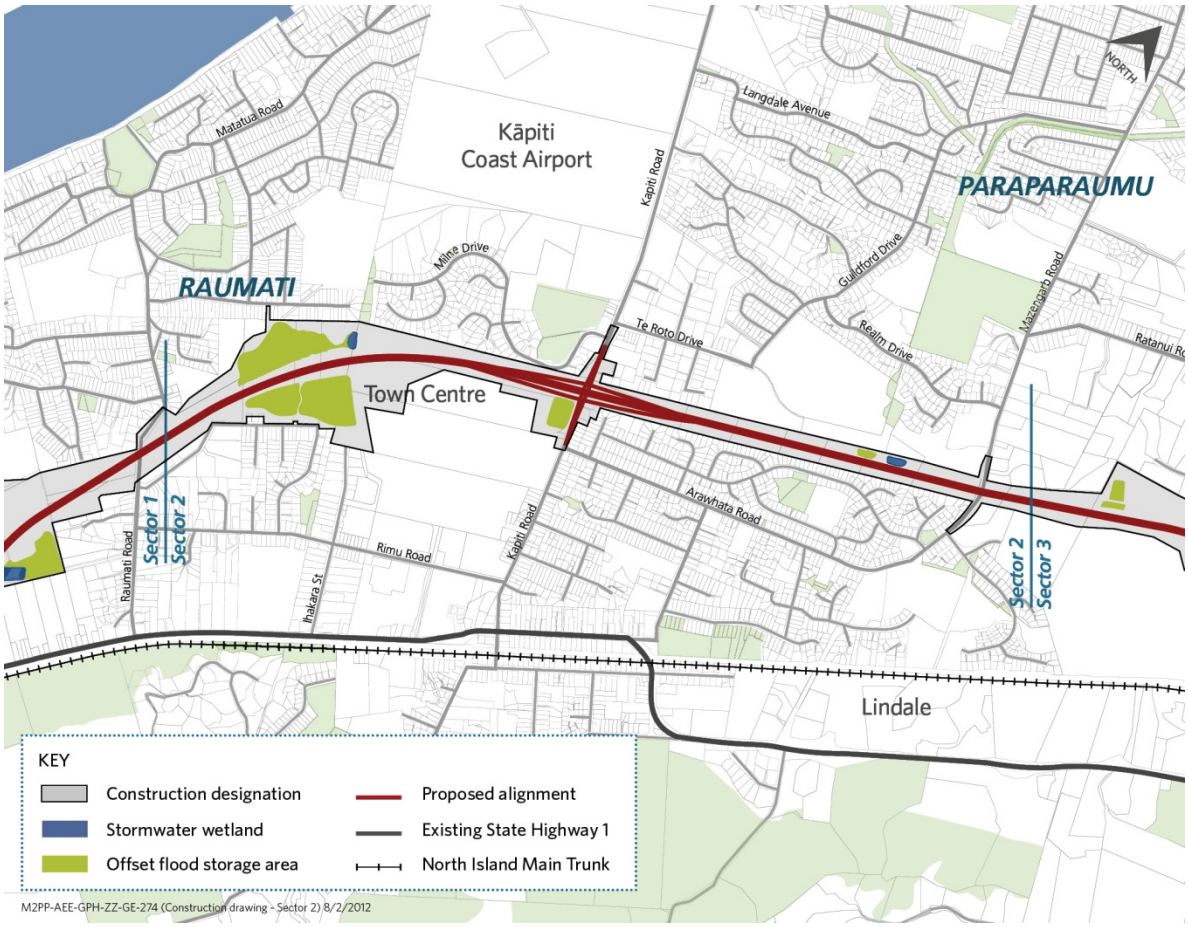

Figure 8.5: Extent of proposed construction designation in Sector 2

Underbridge Construction – Raumati Road

Construction of the underbridge at Raumati Road will involve ground improvements using vibro-replacement techniques, piling operations and reinforced concrete column and crosshead construction. Bridge beams will be cast off-site in the precast concrete construction yard and then transported to site and placed in position. Due to traffic using Raumati Road during the placement of bridge beams, this operation is likely to proceed during the night with Raumati Road closed.

Raumati Road- Wharemauku Stream

Preload fill will be brought into this section and allowed to settle for up to six months. Imported fill will be initially delivered by truck & trailer units and placed using bulldozers and compactors. The embankments will be completed by moving cut material within the section using bulldozers and motor scrapers. Earthworks will occur during daytime working hours. Following the preload settlement period, the new alignment will be constructed using earthmoving and road construction plant and equipment during the day.

Underbridge Construction - Wharemauku Stream

Construction of the underbridge across the Wharemauku Stream will involve ground improvements using vibro-replacement techniques, piling operations and reinforced concrete column and crosshead

construction. Bridge beams will be cast off-site in the precast concrete construction yard and then transported to site and placed in position. The access to the bridge site will be via a temporary access track constructed from the end of the existing Ihakara Road. Construction will proceed during the day.

Wharemauku Stream- Kāpiti Road

Preload fill will be brought into this section and allowed to settle for up to one year. Imported fill will be initially delivered by truck & trailer units and placed using bulldozers and compactors. The embankments will be completed by moving cut material within the section using bulldozers and motor scrapers. Earthworks will occur during daytime working hours. Following the preload settlement period, the new alignment will be constructed during the day using earthmoving and road construction plant and equipment.

Widening of Kāpiti Road

The widening of Kāpiti Road will be carried out using standard road construction machinery. It is anticipated that the work will proceed using temporary traffic management arrangements during the day. However, some operations may be required at night due to significant daytime traffic volumes.

Underbridge Construction – Kāpiti Road

Construction of the underbridge at Kāpiti Road will involve ground improvements using vibro-replacement techniques, piling operations and reinforced concrete column and crosshead construction. Bridge beams will be cast off-site in the precast concrete construction yard and then transported to site and placed in position. Due to the extent of traffic using Kāpiti Road, bridge beam placement is likely to proceed under night-time closures.

Kāpiti Road- Mazengarb Road

The earthworks phase of this section will involve scrapers moving material along the alignment between Kāpiti Road and Mazengarb Road. Upon completion of the earthworks activity, the proposed Expressway pavement will be completed using standard road construction machinery. One carriageway will be completed to subbase level only at first to provide a haul route through Sector 2. Following completion of all earthworks in Sector 2, the haul route will be paved and surfaced to completion. Work is likely to be carried out during the day.

Vertical realignment of Mazengarb Road

The vertical realignment of Mazengarb Road will be carried out using standard road construction machinery. Construction of the retaining walls will also occur in this area using piling machinery and earthmoving equipment. It is anticipated that the work will proceed under temporary traffic management arrangements during the day. However, some operations may be required at night due to high daytime traffic volumes.

Underbridge Construction – Mazengarb Road

Construction of the underbridge at Mazengarb Road will involve ground improvements using vibro-replacement techniques, piling operations and reinforced concrete column and crosshead construction. Bridge beams will be cast off-site in the precast concrete construction yard and then transported to site and placed in position. Due to the traffic volumes on Mazengarb Road, bridge beam placement is likely **to proceed under night- time closures.**

Mazengarb Road + 300m

The earthworks phase of this section will involve scrapers moving material along the alignment between Kāpiti Road and Mazengarb Road. Upon completion of the earthworks activity, the proposed Expressway pavement will be completed using standard road construction machinery. One carriageway will be completed to subbase level only at first to provide a haul route through Sector 2. Following completion of all earthworks in Sector 2, the haul route will be paved and surfaced to completion. Work is likely to be carried out during the day.

8.6.2.2 Stormwater wetland ponds

Stormwater wetland ponds will be constructed at the following locations in Sector 2:

- either side of the proposed Expressway south of Wharemauku Stream
- south-east side of Kāpiti Road
- south-west side of Mazengarb Road

These ponds will require a cut to waste activity, with any waste material being removed from site transported to an appropriate location.

8.6.2.3 Temporary traffic management

The construction of overbridges on Raumati Road and Mazengarb Road and the lowering of Mazengarb Road are planned to be constructed under a staged process. The lanes and shoulder are proposed to be narrowed and realigned around the construction works. Bridge beams are planned to be lifted under a detour, most likely overnight. Pedestrians will be diverted to the opposite footpath to the construction area.

During the Wharemauku Stream Bridge construction, pedestrians and cyclists on the Wharemauku Stream trail will be temporarily diverted around the works or to the opposite bank via a temporary bridge and the permanent cycleway bridge.

The construction of the Kāpiti Interchange is planned to be constructed under three phases. Kāpiti Road is planned to be realigned in each phase around the construction area and will make use of the additional road width that will be constructed for the new interchange. Pedestrians will be diverted around the construction area or to the opposite footpath.

8.6.2.4 Erosion and sediment control

Sector 2 is anticipated to include the following erosion and sediment control methods:

- SRP's (number 5 to 9);
- Silt fences and super silt fences will be established where required;
- Decanting topsoil/earth bunds;
- Pumping;
- Progressive stabilisation of batter slopes; and
- Dirty water diversion channels.

Dust is anticipated to result from construction works between Kāpiti Road north to Mazengarb Road. Works during the winter period will be encouraged to take advantage of wetter conditions, while at other times, a programme of dust management using water carts will be used.

These methods are outlined within Technical Report 4, Volume 3 (Construction Methodology) and the CEMP Appendix H, Volume 4. The location for each method is illustrated on Drawings CV –CM - 204 to 211, Volume 5, Folder 3 of 3.

8.6.2.5 Temporary stormwater management

Sector 2 is anticipated to include the following temporary stormwater management methods:

- Four of the long-term stormwater wetlands will be utilized as SRP's (number 5, 6, 8 and 9);
- Drainage swales and associated rock filters which are to be developed as part of the long-term stormwater management; and
- Culvert extensions.

These methods are outlined within Technical Report 4, Volume 3 (Construction Methodology) and the CEMP Appendix H, Volume 4. The location for each method is illustrated on Drawings CV –CM - 204 to 211, Volume 5, Folder 3 of 3.

8.6.2.6 Service relocations

A number of existing services will require relocating in Sector 2. These will include:

- Gas supply pipelines;
- Water mains and wastewater pipelines; and
- Telecom, FX Networks and Electra cables.

8.6.3 Sector 3

This Sector (chainage 8300 to 12400m) includes the following specific construction stages of the North Zone:

- Mazengarb Road-plus 300m to-Otaihanga Road (MAZ-OT);
- Otaihanga Road-Waikanae River (OT-WAI);
- Waikanae River-Te Moana Road (WAI-TEM); and
- Te Moana Road-plus 600m (TEM-NGA).

These sections are illustrated within the Construction Zone Diagrams (CV-CM-101 to 108, Volume 5, Folder 1 of 3).

8.6.3.1 Construction activity overview

Sector 3 involves the construction of the proposed Expressway 300m north of Mazengarb Road to 600m north of Te Moana Road. An underbridge will be constructed at Otaihanga Road, along with a new, realigned accessway. Construction of a 170m bridge spanning the Waikanae River will also be constructed in this Sector. At Te Moana Road, the existing road will be realigned to incorporate two new roundabouts that will form the intersections with the proposed Expressway off and on ramps. An underbridge will be constructed to carry the proposed Expressway over Te Moana Road, with on- and off-ramps in each direction.

The main construction yard and project office will be established at the Otaihanga landfill site and transfer station on Otaihanga Road. This will become the main access onto and off the alignment for delivery of materials and movement of plant and vehicles. Construction will be staged to enable movement of construction traffic along the route from this main access point.

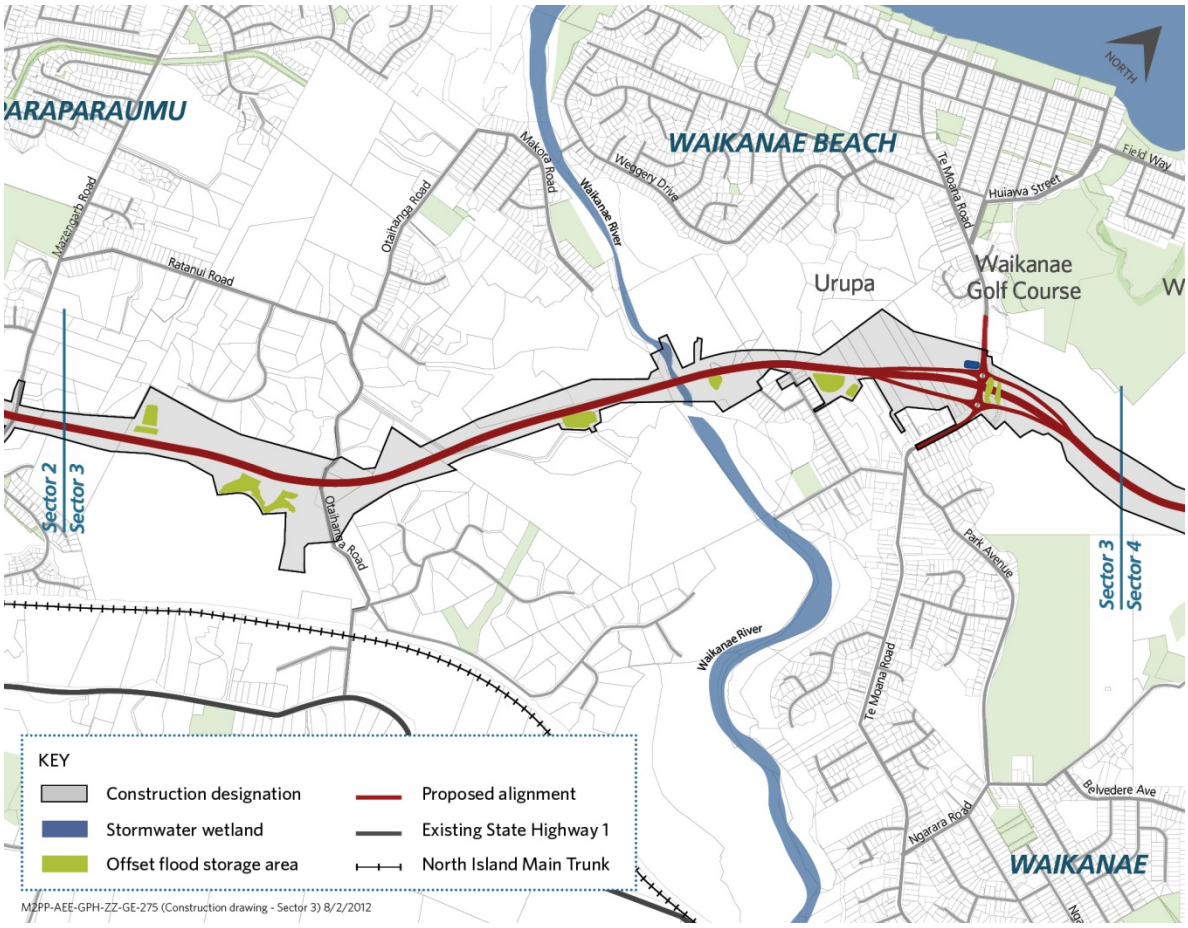

Figure 8.6: Extent of proposed construction designation in Sector 3

Mazengarb Road +300m – to Otaihanga Road

Preload fill will be brought into this section and allowed to settle for up to 6 months. Imported fill will be initially delivered by truck & trailer units and placed using bulldozers and compactors. The embankments will then be completed by moving cut material within the section, using bulldozers and motor scrapers and transporting material from Sector 4 along the haul route, using off-road dumpers. Following the preload settlement period, the new alignment will be constructed using earthmoving and road construction plant and equipment. One carriageway will only be completed to subbase level at first to provide the earthworks haul route. Following completion of all earthworks in Sector 2, the haul route will be paved and surfaced to completion. Works are likely to be carried out during the day.

Underbridge Construction – Otaihanga Road

Construction of the underbridge at Otaihanga Road will involve ground improvements using vibro-replacement techniques, piling operations and reinforced concrete column and crosshead construction. Bridge beams will be cast off-site in the precast concrete construction yard and then transported to site and placed in position. Due to the daytime traffic volumes on Otaihanga Road, bridge beam placement is likely to proceed under night-time road closures.

New access road to Otaihanga Road

A new access road for properties to the west of the proposed Expressway will be provided. This road will link to Otaihanga Road, and will be constructed using standard road construction machinery. It is anticipated that the work is likely to proceed under temporary traffic management arrangements during the day.

Otaihanga Road- Waikanae River

The earthworks phase of this section will involve scrapers moving material along the alignment between Otaihanga Road and Waikanae River. Upon completion of the earthworks activity, the proposed Expressway pavement will be completed using standard road construction machinery. One carriageway will only be completed to subbase level at first to provide a haul route through Sector 3. Following completion of all earthworks in Sector 3, the haul route will be paved and surfaced to completion. Work is likely to be carried out during the day.

Waikanae River Bridge

Construction of the Waikanae River Bridge will involve ground improvements using vibro-replacement techniques, piling operations and reinforced concrete column and crosshead construction. Bridge beams will be cast off-site in the precast concrete construction yard and then transported to site and placed in position. Bridge beams will be transported to the construction site along the alignment, accessing from Otaihanga Road and from Te Moana Road. Streamworks and flood mitigations works to the Waikanae River will also be carried out at this time using standard earthmoving equipment.

Waikanae River – to Te Moana Road

The earthworks phase of this section will involve scrapers moving material along the alignment between Waikanae River and Te Moana Road. Upon completion of the earthworks activity, the proposed Expressway pavement will be completed using standard road construction machinery. One carriageway will only be completed to subbase level at first to provide a haul route through Sector 3. Following completion of all earthworks in Sector 3, the haul route will be paved and surfaced to completion. Work is likely to be carried out during the day.

Te Moana Road Interchange

The formation of the new intersection at Te Moana Road will be carried out using standard road construction machinery. It is anticipated that the work will proceed under temporary traffic management arrangements during the day. However, some operations may be required at night due to daytime traffic volumes.

Underbridge Construction – Te Moana Road

Construction of the underbridge at Te Moana Road will involve ground improvements using vibro-replacement techniques, piling operations and reinforced concrete column and crosshead construction. Bridge beams will be cast off-site in the precast concrete construction yard and then transported to site

and placed in position. Due to daytime traffic volumes on Te Moana Road, bridge beam placement is likely to proceed under night-time closures.

8.6.3.2 Stormwater wetland ponds

Stormwater wetland ponds will be constructed either side of the proposed Expressway at the Te Moana Interchange. These ponds will require a cut to waste activity, with waste material transported to the Otaihanga Yard via the route of the proposed Expressway.

8.6.3.3 Temporary traffic management

As described above, the main project office and yard are planned to be established off Otaihanga Road.

The construction of the proposed Expressway bridge over Otaihanga Road are planned to be staged, requiring traffic lanes to be realigned around the construction works, maintaining bi-directional flow. The proposed Expressway Bridge beams are planned to be lifted in place under a detour, probably overnight.

The construction of the Waikanae River Bridge is expected to require the realignment of the Waikanae River trail. Pedestrian and cycle detours are expected to be required during abutment construction and bridge beam placement.

The construction of the Te Moana Road Interchange is planned to be constructed in three phases: south side, north side and central area. In each phase, the existing Te Moana Road will be temporarily diverted around the construction area, making use of the additional width provided by the new configuration. The Te Moana Road Bridge beams are planned to be lifted in place under a detour, probably overnight.

8.6.3.4 Erosion and sediment control

Sector 3 is anticipated to include the following methods:

- SRP's (number 10 and 11);
- topsoil bunds and decanting earth bunds;
- pumping;
- progressive stabilisation of batter slopes; and
- Super silt fences.

A portion of the existing land fill and transfer station area will be utilised as a construction yard with specific erosion and sediment controls for the establishment of this yard as illustrated in drawing CV-SP-159, Volume 5.

These methods are outlined within CEMP Appendix H, Volume 4. The location for each method is illustrated on Drawings CV – CM - 212 to 218, Volume 5, Folder 3 of 3.

8.6.3.5 Temporary stormwater management

Sector 3 is anticipated to include the following temporary stormwater management methods:

- Long term stormwater wetlands will be utilised as SRP number 10 and 11;
- Other long term stormwater wetland areas will be utilised where necessary;
- Drainage swales and associated rock filters which are to be developed as part of the long term stormwater management; and
- Culvert extensions.

These methods are outlined within Technical Report 4, Volume 3 (Construction Methodology) and the CEMP Appendix H, Volume 4. The location for each method is illustrated on Drawings CV – CM - 212 to 218, Volume 5, Folder 3 of 3.

8.6.3.6 Service relocations

A number of services will require relocating in Sector 3. These include:

- Gas supply pipelines and delivery point station;
- Water mains and waste water pipelines;
- Telecom, Telstra and Electra cables. A length of the twin Vector gas supply pipelines, north of the Waikanae River, will require relocation.

The final design detail of the Te Moana interchange may require the relocation of the KCDC bore water supply near the Market Gardens.

8.6.4 Sector 4

This Sector (chainage 12400 to 18050) includes the following specific construction stages of the North Zone:

- Te Moana Road-plus 600m to Ngarara Road;
- Ngarara Road-Peka Peka (NGA-PP); and
- Peka Peka Interchange (PP).

These sections are illustrated within the Construction Zone Diagram (Drawings CV-CM-101 to 108, Volume 5, Folder 1 of 3).

8.6.4.1 Construction activity overview

Sector 4 involves construction of the proposed Expressway through a mainly rural area to link back with the existing SH1 at Peka Peka or the Peka Peka to Ōtaki Project, depending on if and when that is constructed. A new alignment of Ngarara Road will be built with the road crossing the proposed Expressway, which will include construction of an overbridge. Smithfield Road will be relocated to the

south of its existing position, with an overbridge constructed to carry the new alignment over the proposed Expressway.

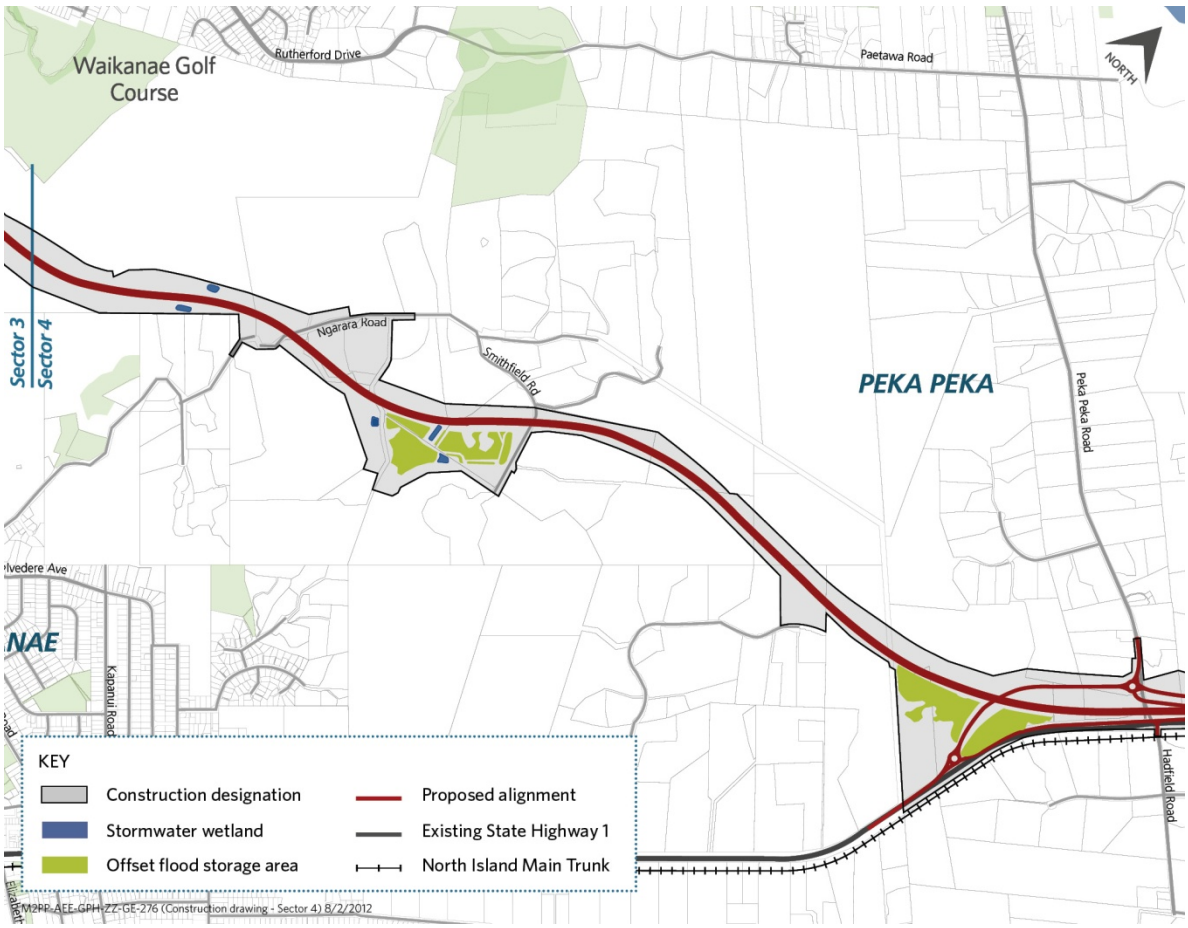

Figure 8.7: Extent of proposed construction designation in Sector 4

Te Moana Road +600m- to Ngarara Road

The earthworks phase of this section will involve scrapers moving material along the alignment between Te Moana Road and Ngarara Road. This section is also the main source of fill material for the proposed Expressway, so in addition to scrapers forming the alignment in this area, excavators will also be loading off-road dump trucks for transport to fill locations to the north and south via the haul routes . Upon completion of the earthworks activity, the proposed Expressway pavement will be completed using standard road construction machinery. Work is likely to be carried out during the day.

Ngarara Road Realignment

The realignment of Ngarara Road will be carried out using standard road construction machinery. It is anticipated that the work will proceed under temporary traffic management arrangements during the day.

Overbridge Construction – Ngarara Road

Construction of the overbridge to carry the new Ngarara Road alignment over the proposed Expressway will involve ground improvements using vibro-replacement techniques, piling operations and reinforced concrete column and crosshead construction. Bridge beams will be cast off-site in the precast concrete construction yard and then transported to site. They will be lifted into position from the new alignment and so work should be able to proceed during the day.

Smithfield Road Realignment

The formation of the new Smithfield Road alignment will be carried out using standard earthworks and road construction machinery. As the new alignment is away from existing roads, work is likely to proceed during the day.

Overbridge Construction – Smithfield Road

Construction of the overbridge to take the new Smithfield Road over the proposed Expressway will involve ground improvements using vibro-replacement techniques, piling operations and reinforced concrete column and crosshead construction. Bridge beams will be cast off-site in the precast concrete construction yard and then transported to site. They will be lifted into position from the new Smithfield Road alignment and so work should be able to proceed during the day.

Ngarara Road- Peka Peka

Initially, preload fill will be brought into this section and allowed to settle for up to eighteen months. Imported fill will be initially delivered by truck & trailer units and placed using bulldozers and compactors. The embankments will then be completed by moving cut material within the section, using bulldozers and motor scrapers and transporting material from the TEM-NGA section along the haul route, using off-road dumpers. Following the preload settlement period, the new alignment will be constructed using earthmoving and road construction plant and equipment. One carriageway will only be completed to subbase level at first to maintain the haul route to the Peka Peka Interchange. Following completion of all earthworks, this haul route will be paved and surfaced to completion. All works are likely to be carried out during the day. Access will be directly from SH1 at Peka Peka Beach Road.

Peka Peka Interchange

The formation of the new interchange at Peka Peka will be carried out using standard earthmoving and road construction machinery. It is anticipated that the work will proceed under temporary traffic management arrangements during the day. However, some operations may be required at night due to daytime traffic volumes.

Overbridge Construction – SH1 (Peka Peka)

Construction of the overbridge to carry SH1 across the proposed Expressway at Peka Peka Interchange will involve ground improvements using vibro-replacement techniques, piling operations and reinforced concrete column and crosshead construction. Bridge beams will be cast off-site in the precast concrete construction yard and then transported to site and placed in position.

8.6.4.2 Temporary traffic management

The Ngarara Road Overbridge and Smithfield Road Extension will be constructed off-line, using a haul road from Peka Peka Road. Ngarara Road will be temporarily realigned during the Ngarara Road Bridge construction to enable traffic to be diverted around the worksite.

The existing connection of Peka Peka Road to SH1 will be maintained while the proposed bridge and link to SH1/the Peka Peka to Ōtaki Project, is constructed. The proposed roundabout on Peka Peka Road will be built off line and the link road to Te Kowhai Road then constructed. Once complete traffic on Peka Peka Road and Te Kowhai Road will be diverted onto the new links and the proposed Expressway.

8.6.4.3 Erosion and sediment control

Sector 4 is anticipated to include the following erosion and sediment control methods:

- SRP's (number 12 and 13);
- Dirty water diversion channels;
- Silt fences and super silt fences; and
- Decanting earth bunds.

These methods are outlined within Technical Report 4, Volume 3 (Construction Methodology) and the CEMP Appendix H, Volume 4. The indicative location for each method is illustrated on Drawings CV – CM – 218 to 231, Volume 5, Folder 3 of 3.

8.6.4.4 Temporary stormwater management

Sector 4 is anticipated to include the following temporary stormwater management methods:

- Long term stormwater wetlands will be utilised as SRP's (number 12 at approx. chainage 14000m and 13 at approx. chainage 14200m);
- Drainage swales and associated rock filters which are to be developed as part of the long term stormwater management; and
- Culvert extensions.

These methods are outlined within Technical Report 4, Volume 3 (Construction Methodology) and the CEMP Appendix H, Volume 4. The location for each method is illustrated on Drawings CV – CM – 218 to 231, Volume 5, Folder 3 of 3.

8.6.4.5 Service relocations

A number of services will require relocation in Sector 4. These will include:

- Water mains and waste water pipelines; and
- Telecom and Electra cables.