8. Construction of the Project

Overview

Construction of the Project has the potential to cause adverse environmental effects. Some indicative information about key construction activities is provided in this chapter as a basis for the assessment of environmental effects (Part G of this report).

Enabling works will involve works to the existing electricity transmission lines (undertaken as part of the Transpower Project) and the formation of construction access tracks and site compounds. The main site compound will be located next to the proposed SH58 Interchange and will be accessed directly from SH58. This will contain a concrete batching plant.

Construction will be staged with a number of crews working simultaneously on different fronts. It is expected that there will be up to 12 earthworks crews and eight bridge crews working during peak construction. Comprehensive erosion and sediment control measures will be used for all earthworks and for works in and around streams. Construction will involve approximately 6.3 Million (M) m^3 of cut material and approximately 5.8 Million (M) m^3 of fill material. Potential disposal sites for surplus fill have been identified.

Construction of the Project is expected to take approximately six years. Construction will cause minimal disruption to the existing State highway network with works only needed on the highway for the northern and southern tie-ins of the Main Alignment and around SH58 at Pauatahanui.

8.1 Introduction

This chapter contains some high level information about the proposed construction of the Project. The purpose of this information is to provide a basis for the assessment of the environmental effects as part of the consenting process under the RMA. The commencement of works for the Project is not scheduled for a number of years after consenting and many specific details about construction have yet to be determined. Outline plans will be sought with the applicable territorial authorities prior to commencement of construction.

Construction of the Project will be influenced by a number of factors, including:

- the specimen design of the Project which will occur once consents have been obtained;
- the construction duration, and target completion date;
- the procurement method adopted; and
- technological advances.

The information provided in this chapter should be treated as being indicative only and is intended to provide sufficient detail on the proposed construction activities to assess their potential environmental effects and to identify any necessary measures to avoid, remedy or mitigate those effects, where appropriate.

It is recognised that once the contract for the Project has been awarded and a contractor (or contractors) are in place, the construction methodology will be further refined and developed. This will be undertaken within the scope of the conditions which will be in place to manage the environmental effects of the construction activities. Should a contractor wish to undertake construction activities in a manner which is not authorised by the consents held, appropriate authorisations would need to be obtained at that time.

In order to assess the environmental effects associated with the construction of the Project, this chapter contains a description of the following aspects:

- enabling works (Section 8.2);
- site compounds (Section 8.3);
- materials required for construction (Section 8.4);
- water requirements for construction (Section 8.5);
- construction programme (Section 8.6);
- erosion and sediment control measures (Section 8.7);
- works in streams (including diversions) (Section 8.8);
- earthworks (Section 8.9);
- bridges (Section 8.10);
- protection and/or relocation of existing network utilities (Section 8.11); and
- works in existing State highways (Section 8.12).

8.2 Enabling works

Prior to the commencement of construction of the Project, it is proposed that some early enabling works will be undertaken, namely:

- re-alignment of sections of the existing electricity transmission line; and
- creation of some construction access tracks.

Enabling works will require some soil disturbance and vegetation clearance (including felling of plantation forestry). This will be undertaken in accordance with the erosion and sediment control and earthworks principles described further below.

8.2.1 Re- alignment of existing electricity transmission lines

Relocation and strengthening of parts of the existing electricity transmission lines in the Project area will take approximately 12 months and will be undertaken as part of the enabling work before construction of the Project starts. Details of this activity are provided in Transpower's applications (Volume 6) and the proposed re-aligned transmission line is shown in plans **TR01- 12**. It is expected that there will be some efficiencies with Transpower's contractors being able to work with the NZTA's contractors (where appropriate) to coordinate some activities, such as the construction of access tracks and earthworks, and to ensure that they are placed in locations that suit both parties.

8.2.2 Construction access tracks

Access tracks for construction will be needed in a number of locations. The proposed access tracks will be:

The indicative location of proposed construction access tracks is shown in the general layout plans contained in plans **AC01- 21**.

- an existing forestry track off Ribbonwood Terrace (Ranui Heights), providing access to the area where the Kenepuru Interchange will be constructed;
- a new track off Rangatira Street, providing access to the southern tie-in;
- a new track off existing SH1 at Linden, providing access to the southern tie-in;
- an existing access track of Takapu Road, providing access to the Cannons Creek bridge (Bridge 20);
- an existing access track from Takapu Road through the Belmont Regional Park;
- an existing forestry track off Pacific View, providing access to the area where the James Cook Interchange will be constructed;
- a new track off Bradey Road, providing access to the Main Alignment corridor;
- a new track off Flighty Road, providing access to the Main Alignment corridor;
- a new track off Paekakariki Hill Road, providing access to site compound 3;
- an existing track off existing SH1 at MacKays Crossing connecting to an existing access track running up the Te Puka valley; and
- an existing access track from the Te Puka valley through to Battle Hill.

8.2.2.1 Culverts and fords for construction access tracks

The construction access track will requires 61 temporary culverts, as shown on plans **AC01–21** and listed in Table 8.1. Temporary culverts have been sized for a Q2 event and will be approximately 10m long (4m of road width with 3m either side for road build up). Where fish passage is required the culvert pipe will be countersunk by 300mm. In one instance (TC4), it is likely that an alternative design to allow for fish passage will need to be considered.

Table 8.1: Proposed temporary culverts for construction access (Schedule C)

Temporary culvert ID	Diameter (mm)	Fish passage required?
TC1	3060	Yes
TC2	600	No
TC3	600	No
TC4	750	Alternative design
TC5	600	No
TC6	2550	Yes
TC7	2550	Yes
TC8	750	No
TC9	2300	Yes
TC10	1500	Yes
TC11	1950	Yes
TC12	900	No
TC13	900	Yes
TC14	1500	Yes
TC15	1650	Yes
TC16	1200	Yes
TC17	1950	Yes
TC18	1050	No
TC19	2300	Yes
TC20	600	No
TC21	2300	Yes
TC22	2300	Yes
TC23	2300	Yes
TC24	2300	Yes
TC25	2300	Yes
TC26	600	No
TC27	600	No
TC28	2550	Yes
TC29	3060	Yes
TC30	600	No
TC31	1950	Yes
TC32	3060	Yes
TC33	600	No
TC34	600	No
TC35	3000*2800	Yes
TC36	1200	Yes
TC37	750	Yes

Temporary culvert ID	Diameter (mm)	Fish passage required?
TC38	600	Yes
TC39	1500	Yes
TC40	1500	Yes
TC41	1800	Yes
TC42	600	No
TC43	600	No
TC44	1050	Yes
TC45	600	No
TC46	600	No
TC47	600	No
TC48	900	No
TC49	750	No
TC50	3060	Yes
TC51	600	No
TC52	600	No
TC53	600	No
TC54	600	No
TC55	600	No
TC56	600	No
TC57	750	Yes
TC58	1350	Yes
TC59	600	No
TC60	600	No
TC61	750	No

Some of these crossings will be new while others will be an upgrade of existing fords or culverts. It is necessary to upgrade some of the existing crossings to keep vehicles out of the stream channel and the unsuitably of some existing culverts for heavy vehicles.

8.3 Site compounds

The main site compound (Site compound 1) is proposed to be located at Lanes Flat (immediately next to the area to be occupied by the Pauatahanui Interchange). This is the most suitable location for the main site compound because:

- is already owned by the Crown;
- a sufficient area of flat land is available, for both site requirements but also treatment and mitigation of effects;
- it can be accessed directly from the existing State highway network (SH58); and
- it is located towards the middle of the Project area.

The main site compound will contain features commonly associated with construction facilities, including:

- temporary site buildings;
- material laydown areas;
- workers' office and workshop accommodation;
- plant and equipment maintenance facilities;
- fuel storage and refuelling facilities
- wheel washing and cleaning facilities
- car parking; and
- plant and equipment storage areas.

An indicative layout for the main site compound is shown in Figure 8.1.

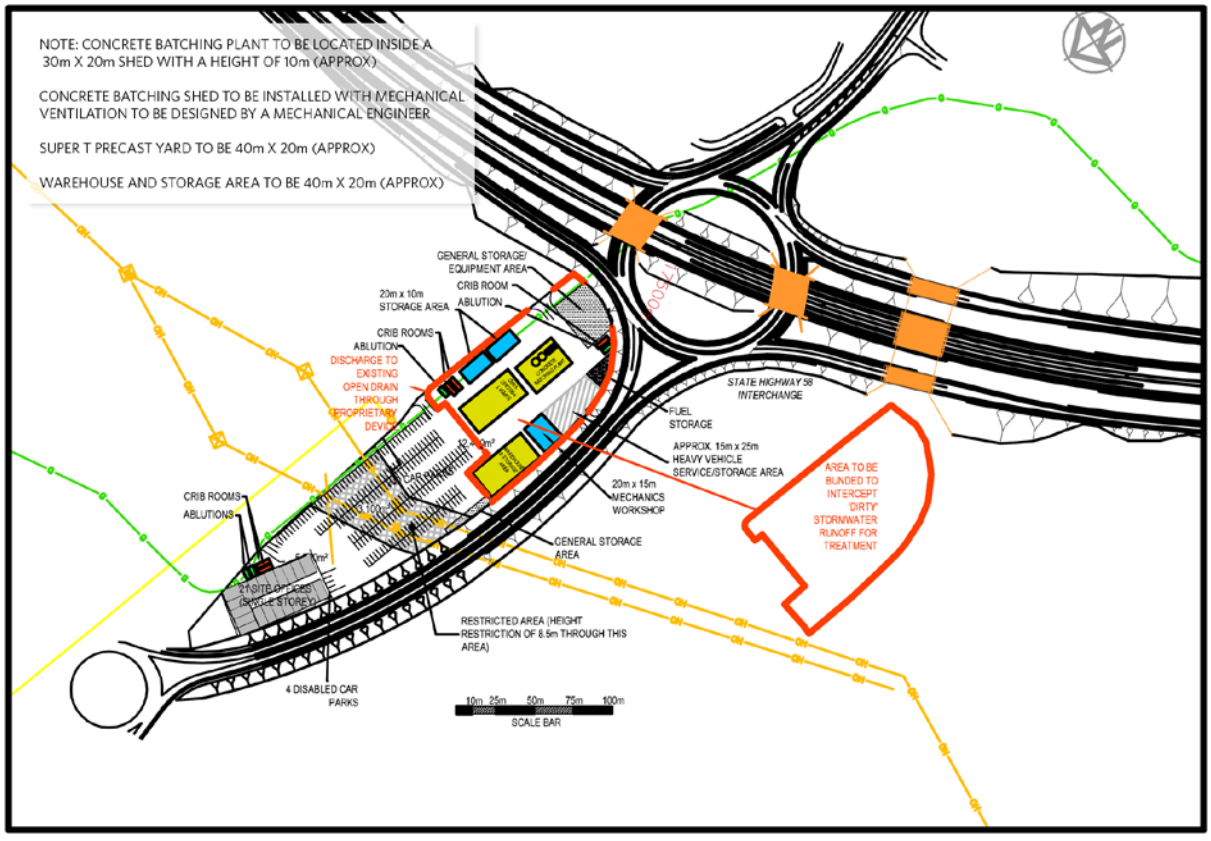

Figure 8.1: Indicative main site compound layout

The eastern-most part of the site compound will contain a concrete batching plant, described further below. In addition to the main site compound, three indicative satellite site compound locations have been identified at:

- approximately 8,500m on the Main Alignment, to the north of BHFFP;

- approximately 11,500m on the Main Alignment, accessed from Paekakariki Hill Road; and
- approximately 27,000m on the Main Alignment, accessed from Little Collins Street.

These will be smaller than the main compound, but will contain similar features. These sites will not contain concrete batching plants but, where appropriate, may contain a mobile rock crushing plant (subject to meeting relevant noise and vibration standards in the CNVMP).

8.3.1 Concrete batching plant

The southern-most part of the Lanes Flat yard will contain a concrete batching plant, with raw materials storage areas and associated pre-cast concrete construction yard and loading areas. Key components are:

- a temporary concrete batching plant unit comprising hoppers, aggregate storage bins, a cement silo, conveyors and a concrete mixing drum;
- aggregate storage bunkers (with covers for fine material);
- a water tank or tanks; and
- precast concrete construction yard – where concrete components are cast, stressed and stored before loading and transporting onto the construction site proper.

The site will have a single designated “dirty” area, comprising the concrete batching plant and the concrete truck access, delivery and loading area. The second area is the surrounding pre-cast construction yard which has its own stormwater controls. The concrete batching plants and the concrete truck access, delivery and loading areas will be located on concrete pads which will drain to the holding tanks described below. The perimeter of the concrete pad will be bunded with a mountable kerb to contain dirty water. The site may also operate a concrete truck wash-out area which will also drain to the tanks.

All runoff from the “dirty” areas of the concrete batching plant will drain to holding tanks. The runoff and washdown water is expected to have high pH and high sediment loads. The tanks will have multiple stages to allow any sediment to settle out in the first stage, and then chemical treatment to reduce pH to suitable levels for discharge if required. The tanks will have the capacity to store a Q10 storm event and will also be used as the main water supply for the concrete batching plant. In the event that a storm event larger than Q10 occurs, the tank will discharged to the treatment device or devices for additional treatment before discharging into the receiving environment. The on-site stormwater treatment device will be designed to Q10. In an event greater than Q10, stormwater will be diluted and discharged through a proprietary device overland or to an open drain.

The remainder of the concrete batching plant activities comprise cast concrete and aggregate storage areas which will be located within the yard area. The water from the yard areas drain to a combination of stormwater treatment devices and/or swales which will be designed to provide treatment before discharging to the receiving environment. The yard area will have bunding around the concrete batching plant, as shown in Figure 8.1.

8.4 Materials required for construction

All of the fill material required for the Project will be sourced from cuts undertaken as part of the Project. As such, no importation of fill material will be needed. A mobile rock crusher will be used throughout the construction site to crush cut material as needed.

Some of the aggregate required for concrete manufacturing (to be undertaken at site compound 1) will be sourced from the other quarries in the region and will be delivered to the concrete batching plant directly from SH58. Steel required for structural components will be manufactured off-site.

All other common components of a State highway will be manufactured off-site and transported in as required, including:

- surfacing materials (including bitumen);
- road furniture; and
- stormwater treatment and erosion and sediment control devices.

8.5 Water requirements for construction

Water will be required for a number of construction activities, including:

- dust suppression;
- general earthworks; and
- concrete production.

The peak water demand (typically full scale construction occurring during the summer months) has been estimated at 1.2 million litres per day. The volume of water required will be reduced during periods of wet weather.

This water needs to be readily available across the construction site. It is considered that storage at a maximum of 4km intervals would be desirable. There are various options to obtain the water required. It has been determined that some water may be able to be abstracted from within the construction site. Additional options include drawing water from existing bulk water supply and transporting water to the site.

The successful contractor will be required to obtain sufficient water supply for construction of the Project. At this stage it is not desirable to confine the contractor to a particular source. If their chosen source required additional resource consents, they will be required to obtain these from GWRC

Although the construction water source has not been determined, the assessment of construction traffic (Chapter 13) and construction noise (Chapter 16) has been undertaken on the basis of all water being transported to the site. From a construction traffic and noise perspective this represents the most conservative case and the worst case scenario. If a contractor did choose to source water locally, any resource consents required would be applied for.

8.6 Construction programme

A preliminary construction programme has been developed to inform the AEE. Construction is expected to take approximately six years and to be undertaken on three fronts, with construction on all fronts starting towards the end of 2015. These fronts are detailed in Table 8.2.

Table 8.2: Potential construction fronts

Front[71]	Location	Station value
1	SH58 to Cannons Creek	16,830m to 23,600m
2	MacKays Crossing to SH58	0m to 16,830m
3	Cannons Creek to Linden	23,600m to 27,700m

The indicative construction programme includes construction of the main components of the Project, namely:

- enabling works;
- earthworks;
- bridges;
- interchanges;
- works on existing State highways; and
- pavements.

This programme has been prepared on the assumption that there will be a reduction in available working hours over winter due to poor weather. The programme also assumes that there will be up to 12 earthworks crews and eight bridging crews working simultaneously at any one time across the Project.

A key driver for the programme has been the consideration of the movement of material around the Project (i.e. approximately 6.3Mm^3 of cut material and approximately 5.8Mm^3 of fill material). The final mass-haul approach to be used will be determined by the contractor but in general terms, the mass-haul distances will be minimised to increase efficiency.

8.7 Erosion and sediment control

The scale of the Project means that a large area of land will be disturbed. Land disturbance refers to the removal of vegetation and/or earth (i.e. soil and/or rock). An overriding principle for the Project has been to minimise the land disturbance required in order to restrict sediment entering streams and in turn, the Pauatahanui Inlet.

This has significant implications for erosion and sediment control requirements. The key erosion and sediment control principle has been to minimise the area and length of time that particular areas of

71. The numbering of front does not necessarily indicate a particular construction sequence.

ground are open. In general, the extent of open areas in any one catchment will be restricted and will be stabilised as soon as practicable.

8.7.1 Site preparation

Prior to any land disturbance, erosion and sediment control measures will be implemented. This will involve one or more of the following approaches:

- installation of perimeter controls (predominantly earth bunds and drains) to:
- divert clean runoff away from the land disturbance area;
- divert sediment laden runoff to the sediment retention devices;
- installation of sediment control devices, being:
- sediment retention ponds, or alternative sediment control devices;
- decanting earth bunds (where there is insufficient space to use ponds);
- sediment fences; or
- silt socks.

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 is critical to reducing sediment generation.

8.7.2 Sediment control devices

Plans **DR01-21** show the currently proposed location of the various sediment control measures and these are also discussed in Appendix E of the draft CEMP (Volume 5). The size, type and locations of sediment control measures shown on the plans should be treated as indicative only.

8.7.2.1 Sediment retention ponds

Sediment retention ponds operate by withholding sediment laden runoff which causes the sediment to fall out of suspension. The number, sizing and location of sediment retention ponds will be relative to the size and slope of the catchments. Where higher sediment loads are expected (typically in larger catchments and/or on steeper slopes) the effectiveness of ponds will be increased through the addition of a chemical flocculation agent. This causes sediment to bind together and hence fall out of suspension.

In total, approximately 300 sediment retention ponds are proposed throughout the construction phase of the Project. Generally ponds will be formed from bunded earth, but where topographical constraints prevent this, other methods, such as the use of shipping containers, may be employed. The sediment pond size, type and locations as illustrated on the plans show the expected extent of earthworks associated with the assessed pond size. Not all of the ponds will be required or in operation at the same time. Some ponds may be replaced with alternative treatment devices, such as those discussed below.

8.7.2.2 Decanting earth bunds

A decanting earth bund is a temporary berm or ridge of compacted soil constructed to create impoundment areas where ponding of runoff can occur and suspended material can settle before runoff is discharged. They are smaller than sediment retention ponds and can therefore be used where insufficient space exists for ponds. They will 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.

8.7.2.3 Sediment fences

Sediment fences will 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 will be installed down slope of land disturbance areas to capture runoff.

8.7.2.4 Silt socks

Silt socks are used in a similar way to sediment fences but can also be pinned to steep slopes and chemically dosed to provide additional effectiveness. They also allow access to site more conveniently than sediment fences.

8.7.3 Site stabilisation

An essential aspect of the erosion and sediment control measures will be the stabilisation of disturbed land as soon as practicable. In some areas techniques such as top soiling and seeding will be adequate, but in many areas (particularly on steep faces) geotextile, mulching and hydroseeding will be required. Some areas are likely to require stabilisation on multiple occasions throughout the construction period.

8.7.4 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. This is a potential risk for the works in eastern Porirua and around Linden and Tawa.

The erosion and sediment control measures detailed in section 8.7 will be utilised, but additional bunding and/or diversions may be required to ensure stormwater systems are not contaminated. Where works require the relocation of stormwater pipes, this will be undertaken to ensure that uncontrolled runoff is not able to enter the stormwater network.

8.8 Works in streams

8.8.1 Stream realignment

Where the permanent diversion of streams is required, new channels will be formed to as naturalised state as possible. To the extent possible, new channels will replicate the form and morphology of existing natural channels. The following factors will be considered when forming new channels:

- the composition of the stream bed (material type and particle size);
- the hydraulic characteristics of the channel (including its gradient and flow capacity);
- whether fish passage needs to be provided; and
- the existing riparian vegetation and any proposed new riparian planting to be provided.

8.8.2 Culverts and erosion control and protection structures

Installation of culverts and associated erosion control and protection structures will require the temporary diversion of streams in most instances. Diversion channels will be stabilised using geotextile liner prior to water being diverted. Water will be discharged back into the natural channel downstream of the works.

Culverts and erosion control and protection structures will then be installed in the dry stream bed as quickly as possible. Temporary erosion and sediment control methods (as detailed in section 8.7) will be used around the works to limit sediment runoff into the stream. Once all the in channel works have been completed water will be diverted back to its natural channel.

The area used for temporary diversions will be stabilised as quickly as possible.

8.9 Earthworks

The Project will involve large volumes of earthworks. It will generate approximately 6.3Mm^3 of excavated (cut) material and will require approximately 5.8Mm^3 of material to be placed for fill embankments. As such, an excess of approximately 510,000m^3 of cleanfill will be created.

8.9.1 Cut slopes

As discussed in Chapter 7, cut slopes will be up to 70m in height and 3m wide benches with an initial vertical rise of 15m and 10m thereafter are likely to be used. Material will be excavated mechanically from cut faces and will be stockpiled or loaded directly onto trucks to be transported for use elsewhere on the Project.

This will be a challenging aspect of construction for the largest of the proposed cut slopes. Figure 8.2 provides an indication of how access to the top of the cut slopes will be gained using temporary haul roads across the cut face of up to a 15° gradient.

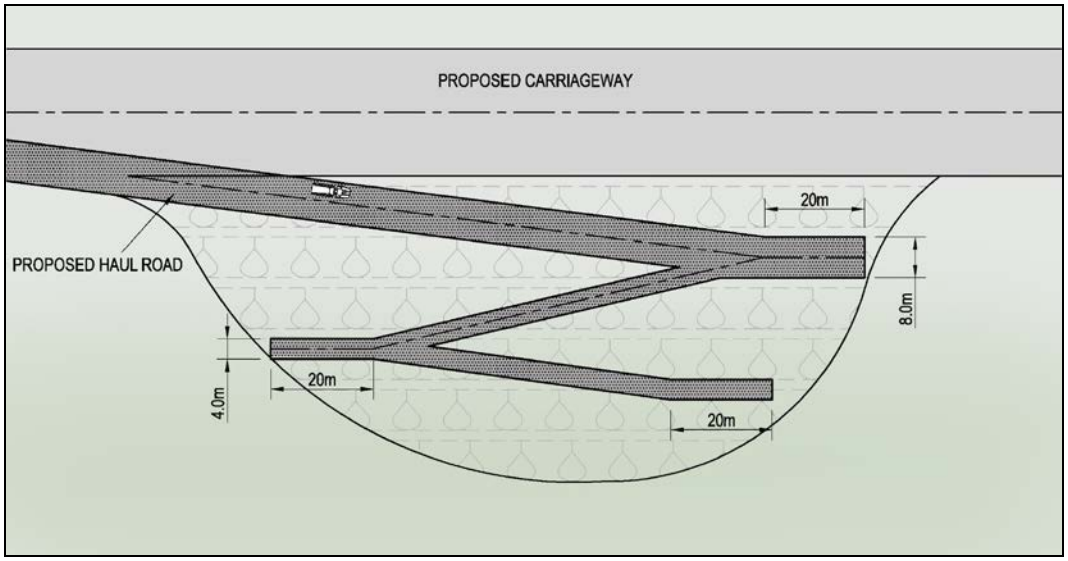

Figure 8.2: Indicative haul road configuration for large cut slopes

Figure 8.3 indicates how material from the upper slope faces will be deposited on lower benches before being loaded onto trucks.

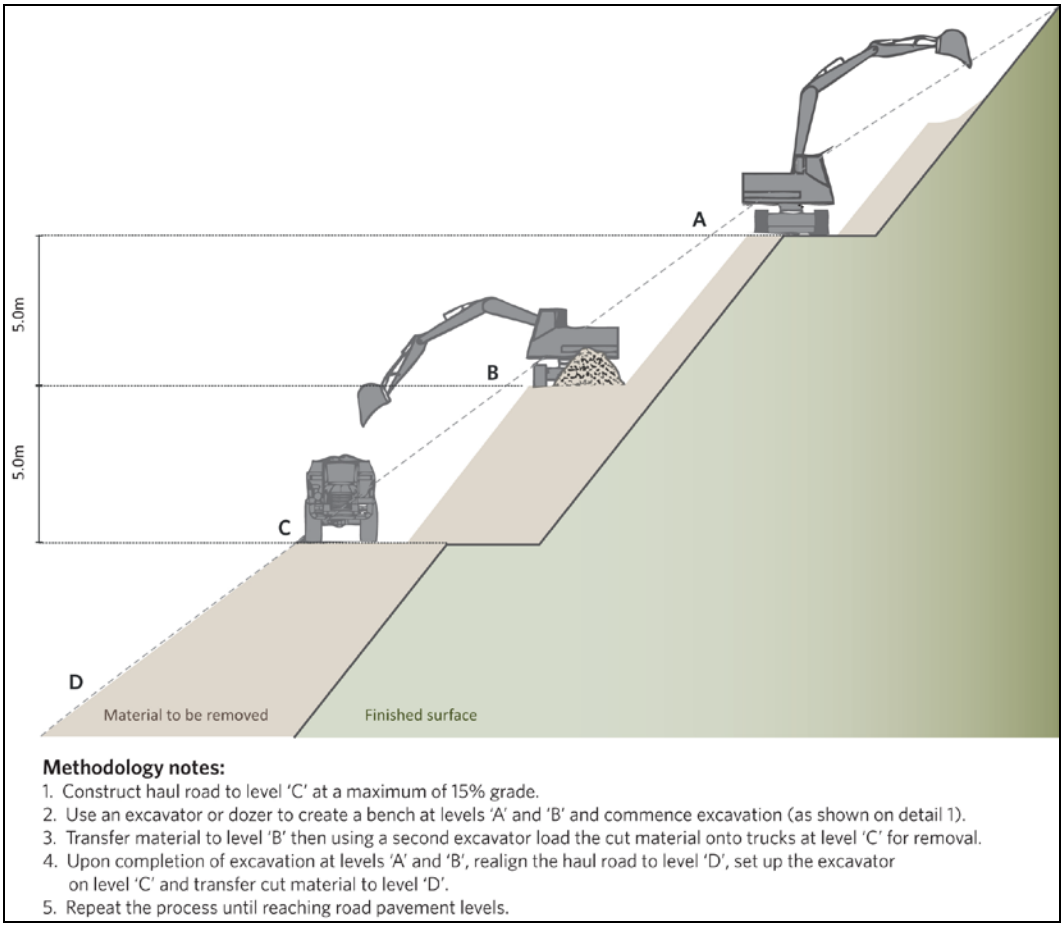

Figure 8.3: Indicative excavation method for cut slopes

8.9.2 Fill embankments

The fill embankment slopes will be formed primarily from materials sourced from cuttings in greywacke rock. Along the route, some older alluvium (silt and gravel) deposits and overburden / completely weathered rock materials are also expected to be suitable for fill embankments. Where the local silty gravels are used for fills, an allowance has be made for treating or drying of the materials and for the provision of drainage layers formed from the rockfill in the deeper cuts.

8.9.3 Disposal of surplus cleanfill

Construction of the Project will generate approximately 510,000m³ of surplus cleanfill material. A number of possible fill disposal sites have been identified as shown in the plans **GM01- 21**. Selection of the potential fill disposal sites involved a range of technical disciplines including road design, structural design, hydrology, ecology and landscape and visual.

In total, six potential fill sites have been identified:

- the upper Duck Creek valley, between 23,000m and 23,500m (plan **GM18**);
- close to the Takapu Road Substation, at approximately 24,250m (plan **GM18**); and
- four sites in the vicinity of the proposed Kenepuru Interchange (plan **GM20**).

These site are all located towards the southern end of the Project which is where these is surplus of material. This means that haulage distances can be reduced. There is more than enough capacity within these sites to accommodate the currently identified volume of surplus fill although the NZTA may also chose to use some of the fill for one or more of their other projects in the region. Selection of volumes for each site will occur as part of the specimen design as part of the overall Project design. The following general principles will be applied:

- Disposal sites should be developed at locations and in such a way that they do not create a hazard to the road, landowners or the environment, either through potential slope failure and/or widespread erosion following heavy rainfall.
- Disposal sites need to be founded on competent ground to avoid failures, though settlement may be accommodated by appropriate design.
- Disposal sites should incorporate good drainage.
- Earthworks and compaction control is important to ensure that disposal sites are stable.
- Unsuitable and wet materials disposed need to be contained behind bunds.
- Disposal areas will be landscaped and vegetated as part of the overall landscaping plan for the Project. This will minimise erosion and assist in integrating the sites into the existing landscape.

The four sites around the Kenepuru Interchange contain existing streams, most of which are ephemeral. Subsoil drains will be aligned at the base of these fill sites. Following completion of works water will either drain around the edge of the fill area or across the surface[72].

8.10 Bridges

The construction of the bridges will be a significant part of the Project. Where possible, bridge components will be pre-cast at the main site compound. Where required, bored piles will be cast in-situ.

Where works in and around streams are required, erosion and sediment control measures (as described in section 8.7) will be employed.

A key aspect of the construction of some of the largest bridges will be gaining access. This will be a particular challenge where bridges span steep gullies. In some cases access will be available to the bottom of gullies using existing tracks. Where this type of access is not available, new tracks will be formed from the top of the gully.

Where such new access is required, erosion and sediment control measures will be employed to protect any streams at the bottom of gullies. These access tracks will only be required for construction of the bridges and accordingly, will be removed once construction is complete. This will involve the contouring and stabilisation of the slopes, including revegetation, where appropriate.

8.11 Protection and/or relocation of existing network utilities

As described in Chapter 6, there are a number of existing network utilities within the Project area. Protection and/or relocation of existing utilities will be an important aspect of the Project's construction.

Protection and/or relocation of existing utilities (with the exception of the previously discussed electricity transmission lines) will generally occur in conjunction with the Project's construction, as it is more efficient to undertake both sets of works at the same time. In virtually all instances, NZTA's contractors will need to work closely with the relevant network utilities owner's contractor to undertaken the necessary protection and/or relocation works. This process will be undertaken in accordance with the network utilities management plan (NUMP) which is proposed as a condition of the designations. Further details about this process are provided in Chapter 15 of this report.

8.12 Works to existing State highways

Construction of the Project will mostly be able to occur without requiring works to the existing State highway network. The exception to this is at the proposed SH58 Interchange and at the southern tie-in with SH1 at Linden.

At the northern tie-in at MacKays Crossing there will be very minimal works to existing SH1.

72. The installation of subsoil drains in these four sites is applied for as part of the reclamation of Kenepuru Stream and its tributaries (as part of application RC 11).

At the SH58 Interchange, a section of approximately 200m of SH58 (between the exiting roundabout and the proposed new interchange) will be realigned to the south. Part of the existing road alignment will be retained to provide ongoing access to the Pauatahanui Substation and a small number of properties.

At Linden, a length of approximately 300m of existing SH1 will be raised by up to 6m to provide adequate clearance for the proposed Kenepuru Link Road, which will pass under the existing State highway. This raised section will also be realigned slightly to improve its horizontal alignment.

The management of State highway traffic during construction is discussed in Chapter 13 and the Construction Traffic Management Plan. Overall, there will be minimal disruption to the existing State highway network.