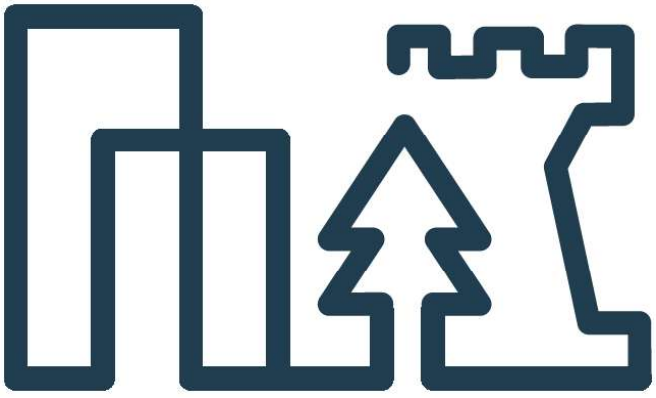
APPENDIX 11: CONSTRUCTABILITY REPORT



GISBORNE DISTRICT COUNCIL
TE KARAKA – FLOOD RESILIENCE PROJECT
Stopbank Construction Methodology

15 April 2026

CONTENTS

Revision history

Revision Number	Revision	Revision Date	Prepared By	Checked By
1	Draft - Issued for review	13/04/2026	MC	JP
2	Final version issued to GDC	15/04/2026	MC	JP

Electronic file name: Te Karaka Stopbank Methodology April 2026

1 PURPOSE

The purpose of this Construction Methodology Report is to provide high level construction sequencing and methodology for the stopbank upgrade works in Te Karaka. This report is intended to support the resource consent application to provide details on the expected environmental impacts and mitigation, plant & equipment, sequence of work and methodology.

1.1 Assumptions and Limitations

This indicative methodology and programme have been developed based on the information provided by Gisborne District Council (GDC). It assumes typical industry standard techniques and equipment. There are likely alternative methods and site layouts that may be used by the contractor to complete the works. This document is not intended to be a complete list of all possible construction options.

It is anticipated that the selected contractor will develop an outline plan in accordance with the resource consent conditions, outlining their proposed methodology and programme which will consider the most efficient and productive method to construct the works.

3 PROJECT DESCRIPTION

3.1 Scope

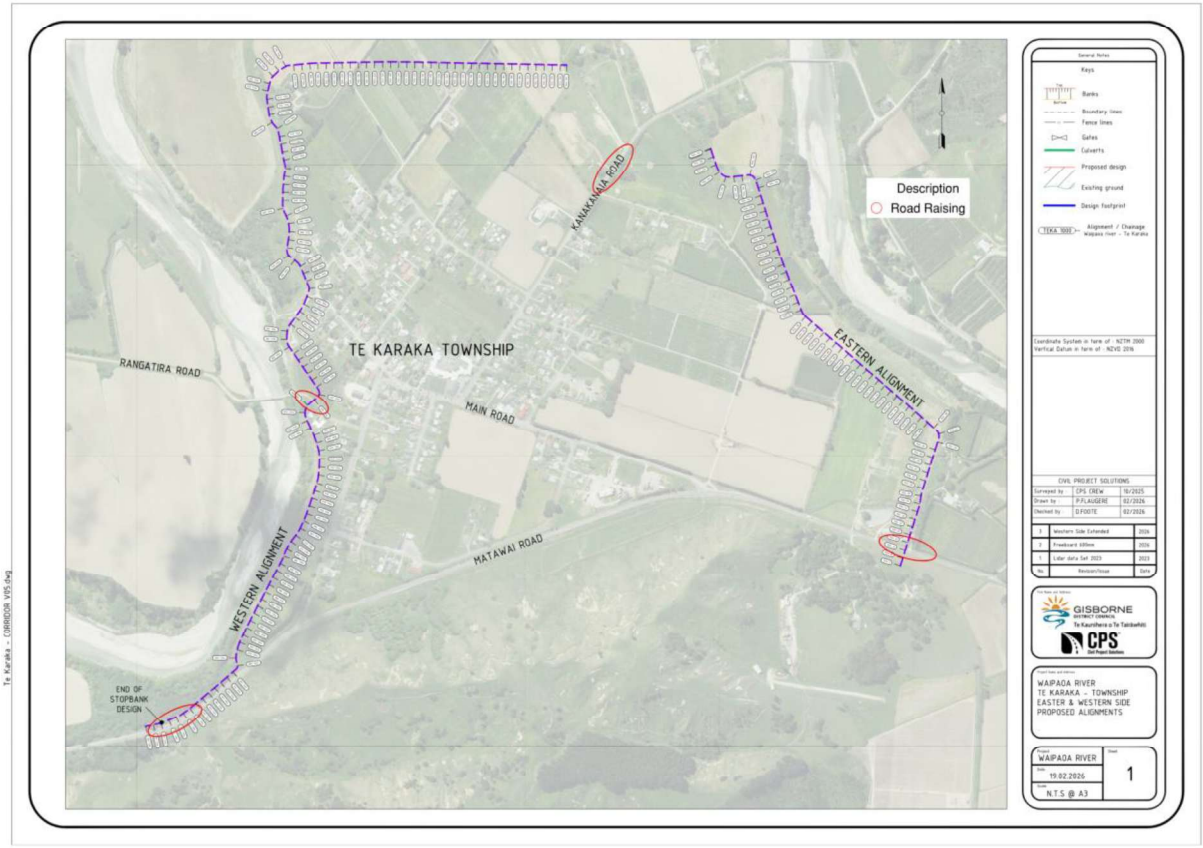


Figure 1 – Te Karaka Proposed Stopbank Alignments.

The scope of work applicable to this report includes work associated with:

Stopbank Construction

- Construction of a new Flood Stopbank along the western and northern side of Te Karaka (2.9km long).
- Construction of a new Flood Stopbank along the eastern side of Te Karaka (1.3km long).
- Installation of new stormwater culvert drainage under stopbanks.
- Extension of existing stormwater culvert under stopbank.

Road Raising

- Raising of State Highway 2 (SH2) at the western tie in with the new stopbank, approx. 480m.
- Raising of SH2 at the eastern tie in with the new stopbank, approx. 370m.
- Raising of Rangatira Road where the western stopbank intersects, approx. 169m.
- Raising of Kanakanaia Road where the western/northern stopbank finishes, approx. 384m.

4 SITE ESTABLISHMENT

4.1 Laydown areas / compound

Five locations have been identified by GDC as potential material laydown areas or site compound as shown in Figure 2. These are:

1. Morris Road
2. SH2 Western Section
3. Rangatira Road
4. Paulson Road
5. SH2 Eastern Section

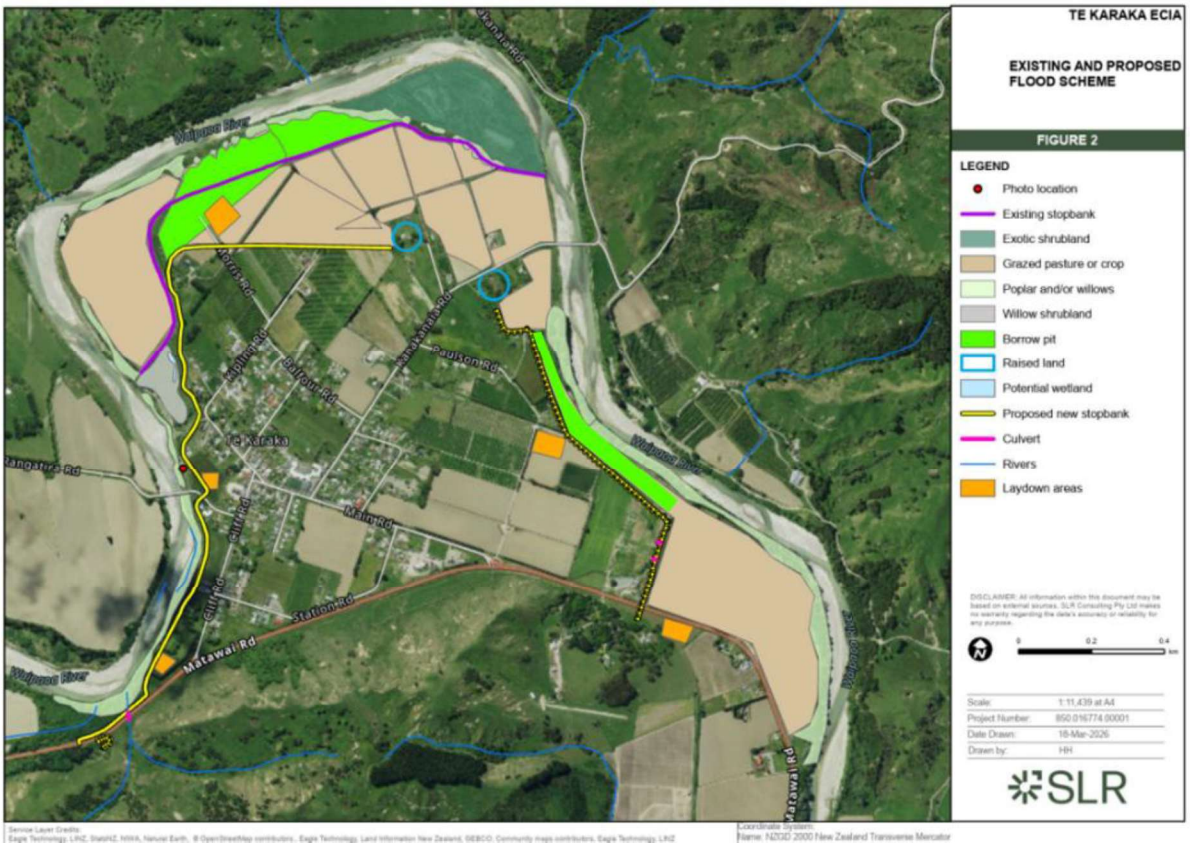


Figure 2 - Preferred Alignment and potential laydown areas.

4.1.1 Morris Road

Morris Road laydown area will likely be used as the main storage facility for the earthmoving plant and equipment due to its proximity to the borrow pit. This site could also be used as the main site office compound with site facilities such as offices, lunchroom, toilets. Plant and materials would also be stored here along with tool and dangerous goods storage.

Bulk fuel storage may also be required depending on the contractor's requirements. Any bulk fuel storage tanks would utilise specific containment controls.

The area required for this compound would be approximately 3,000m2 and accessed via Morris Road.

Figure 3 - Indicative Morris Road compound layout.

4.1.2 SH2 (western section)

The SH2 western section laydown area would be utilised for stopbank fill, pavement fill aggregates and drainage construction equipment and materials.

The area required for this compound would be approximately 2,500-3,000m2 and accessed via SH2 or Cliff Road, depending on traffic management approvals.

The compound would need to be large enough to accommodate a large volume of truck and trailers bringing fill material from the northern borrow pit. Ideally there would be an entry and a separate exit from SH2 to allow safe tipping and passage through the compound.

Figure 4 - Indicative SH2 western section compound layout.

4.1.3 Rangatira Road

An area to the north of Rangatira Road may be utilised for additional plant and equipment storage. The area required for this compound would be approximately 1,500-2,000m2 and accessed via Rangatira Road or Cliff Road depending on land use approvals.

Figure 5 - Indicative Rangatira Road compound.

4.1.4 Paulson Road

A laydown area located at the end of Paulson Road would benefit the eastern stopbank construction.

This site could also be used as a satellite site office compound with site facilities such as offices, lunchroom, toilets, and material and tool storage.

The area required for this compound would be approximately 1,500-2,000m2 and accessed via SH2 or Cliff Road, depending on land use and traffic management approvals.

Figure 6 - Indicative Paulson Road compound.

4.1.5 SH2 (eastern section)

The SH2 eastern section laydown area would be utilised for pavement construction equipment and materials. This site may also be used as the transfer site for all the roading aggregates coming into Te Karaka via truck and trailer direct from the quarry.

This site may also be suitable as the main compound for all works, with the other compounds as satellite sites supporting this main location.

The area required for this compound would likely be approximately 5,000m2 and accessed via SH2.

Figure 7 - Indicative SH2 eastern section compound.

5 ENABLING WORKS

5.1 Electrical overhead lines

There are various locations along the proposed stopbank alignment that will require adjustments made to the existing overhead power lines. The final electrical design will need to be confirmed by Firstlight but the below provides an indication of what might be required. All electrical work will be carried out by the NUO and their nominated contractors.

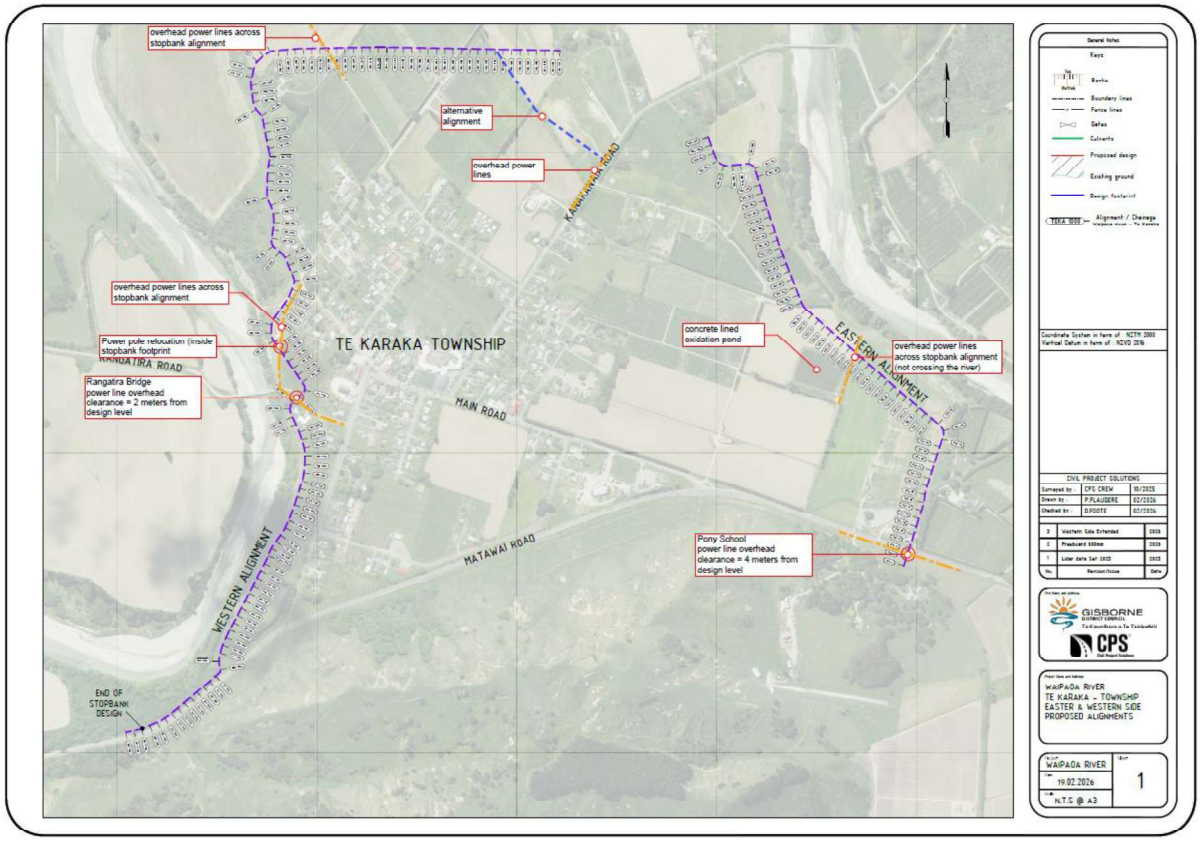


Figure 8 - Overhead power crossing locations.

RANGATIRA ROAD

Due to the proposed road raising and stopbank final levels, the existing power lines that run across Rangatira Road will need to be either lifted to maintain sufficient clearance or be undergrounded.

The overhead lines that run between Rangatira Road and the existing potable water treatment facility will also need to be lifted or underground due to the proposed stopbank alignment. There is also an existing pole that will need to be relocated because its current location is within the new stopbank footprint.

Figure 9 – Photo of existing overhead power lines on Rangatira Road.

Figure 10 - Photo of existing overhead power lines between Rangatira Road and the potable water treatment facility.

Morris Road

The existing lines that run between #29 and #44 Morris Road will need to be removed due to #44 Morris Road being demolished. The property at #29 Morris Road will become the last house on this road and the existing pole outside the property will need to be swapped for a terminal pole and a new property lateral installed.

Figure 11 - Photo of the existing power lines on Morris Road that feed #44.

KANAKANAIA ROAD

The existing overhead power lines that run along the northern side of Kanakanaia Road may require lifting to allow sufficient clearance from the proposed stopbank and road raising levels.

Figure 12 - Photo of the existing overhead power lines on Kanakanaia Road.

WASTEWATER OXIDATION POND

There are existing overhead power lines that run along the driveway to the wastewater oxidation pond. The driveway to the oxidation ponds may or may not be used for the stopbank construction, however, the overhead power lines extend right up to Waipaoa River and cross the new stopbank alignment.

These lines may need to be lifted where they cross the stopbank alignment to maintain sufficient clearance.

Figure 13 - Photo showing the existing overhead power lines running adjacent to the oxidation pond.

Figure 14 - Photo showing the existing terminal pole for the powerlines running adjacent to the oxidation pond.

State Highway 2

The existing overhead power lines running parallel to SH2 at the eastern road raising site may need to be lifted to maintain clearance requirements.

Figure 15 - Photo showing the existing overhead power lines running along SH2.

5.2 Gas main refurbishment

Following GDC consultation with Firstgas regarding the existing gas main running parallel to SH2, it is understood that refurbishment works are required on the existing pipeline to prevent the need to excavate into the new stop bank in the future.

Refurbishment of the existing gas pipe will need to be carried out prior to the drainage works. Details of the refurbishment scope will need to be confirmed by Firstgas. This may include locating the gas main using hydro excavation or hand digging, removal of all existing fill around the gas main at the area of concern, clean pipe and re-paint outer surface, backfill with an approved backfill as per Firstgas requirements.

An example of the refurbishment works may include:

1. Remove unsuitable trench material around the existing pipe under Firstgas stand-over.
2. Recoat the existing pipeline to prevent further corrosion.
3. Backfill and compact around the existing pipe using pedestrian-controlled plate compactors with approved backfill material as per Firstgas requirements.
4. Once the backfill reaches current levels then larger compaction plant could be used pending approval of the Firstgas stand-over.

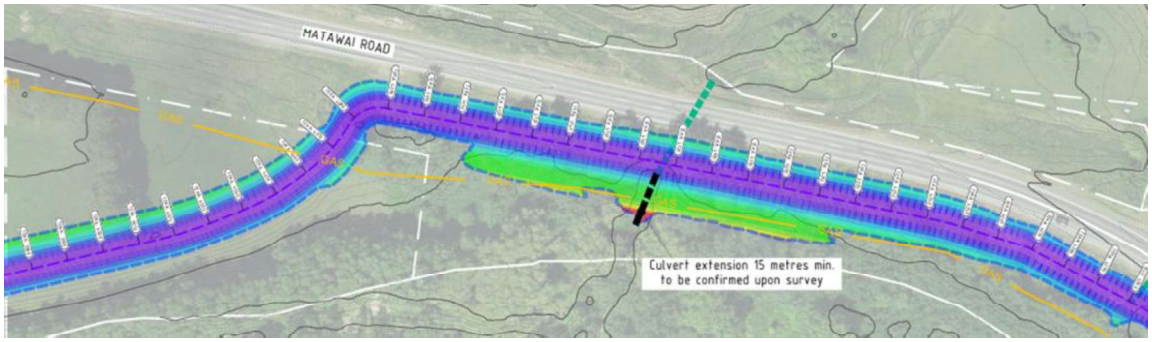


Figure 16 - Indication of where the gas main (yellow line) crosses under the proposed western stopbank adjacent to SH2

5.3 Other utilities protection

An existing 100mm PVC wastewater overflow pipe runs underground across the proposed eastern stopbank between the oxidation pond and Waipaoa River. This pipe will need to be protected during the works and possibly relocated depending on final design. Protection may include additional hardfill bridging over the pipe or similar.

Figure 17 - Indication of the existing wastewater pipe near the oxidation pond at the eastern stopbank.

The is an existing small diameter water pipe runs parallel to SH2 at the eastern road raising site. There is also an unmapped 50mm diameter wastewater private lateral near the water pipe opposite 2424 Matawai Road (SH2). Protection measures for these two pipes may be sufficient during the works, however, if there is risk of damage to the pipe, then a temporary or permanent diversion may be required. This will need to be confirmed prior to construction.

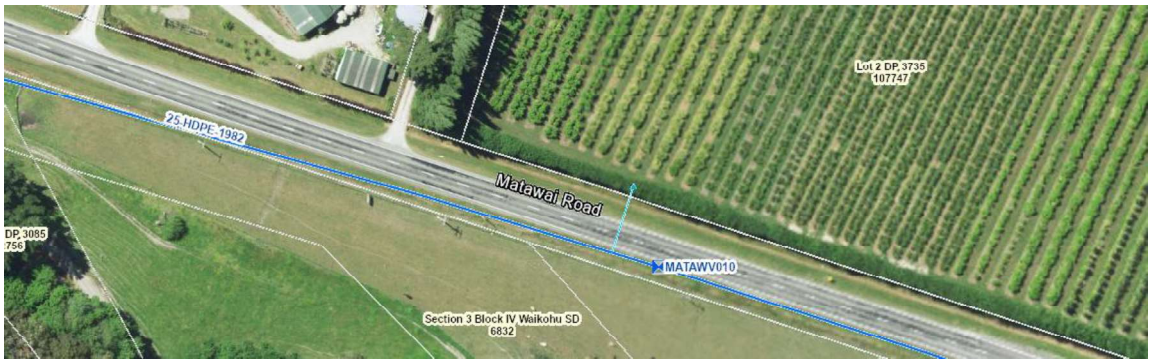


Figure 18 - Indication of the existing small diameter water pipe (blue line) along SH2 near the eastern road raising site.

5.4 Existing water bore and treatment plant

The proposed stopbank is near the existing Te Karaka water treatment plant which draws water from an underground bore. The haul road would likely be located along the toe of the existing stopbank to maintain a suitable distance from the treatment plant. Vibration and additional water quality monitoring may be required to comply with Resource Consent conditions.

There is also a small diameter outlet/scour pipe discharging on the river side of the existing stopbank. GDC have advised that this may be redirected over the top of the new stopbank following final design development.

The existing pipe will either be removed or plugged to prevent water seepage through the new stopbank.

Figure 19 – Photo showing the existing stopbank and the potable water treatment facility.

Figure 20 - Existing potable water treatment facility.

Figure 21 - Existing Water Treatment Plant outlet / scour pipe.

6 ENVIRONMENTAL

6.1 Silt Control

As per the Gisborne District Council: Engineering Code of Practice, section 2.6, Erosion and Silt Controls (ESC) should follow the Erosion and Sediment Control Guidelines for Land Disturbance Activities (GD05, 2023) by Auckland Council.

The below list provides an example of the type of controls that may be required. The final layout will be subject to a detailed Erosion and Silt Control Plan (ESCP) prepared by the Contractor.

- Stabilised site access points
- Silt Fences
- Clean Water Diversion Bunds (CWD)
- Sediment Retention Ponds (SRP)
- Decanting Earth Bunds (DEB)

A typical ESC installation sequence is outlined below:

1. Install silt fencing along the downstream side of the proposed Stopbank footprint (on the river side).
2. Strip topsoil from the proposed Stopbank footprint and form Clean Water Diversion Bunds along the upstream side of the work area. These CWD bunds will be stabilised in accordance with GD05.
3. Install DEB's as required at the low points along the alignment. These will be on the river side of the work area and outfall towards the river.
4. Install SRP's as required. Due to the nature of this work and the narrow footprint, SRP's may not be a practical solution. The installation and size of DBE or SRP will be dependent on the open and catchment areas.

6.2 Construction water and dust suppression

Water carts will need to be used for dust suppression along the haul roads during construction of the stopbanks and could either be drawn from the local potable water network, existing or new water bores, or the Waipaoa River.

It is expected that water consumption for dust suppression and to support the earthworks would be approx. 30,000L - 50,000L per day. This is based on a single watercart of 10,000L capacity using 3-5 loads per day. The contractor shall monitor water take in accordance with the Resource Consent and Water Take Consent conditions.

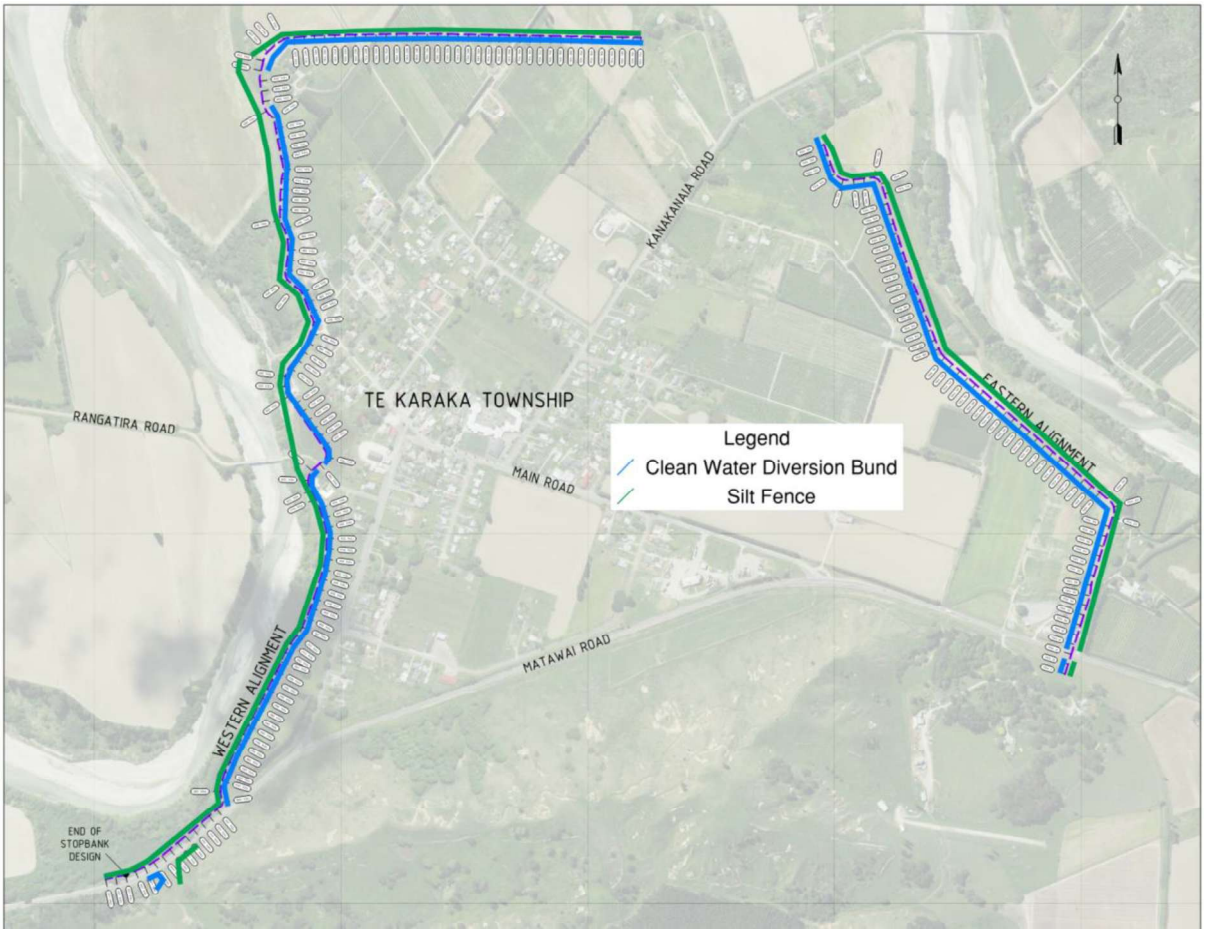


Figure 22 - Indicative Erosion and Silt Control layout around the proposed stopbanks.

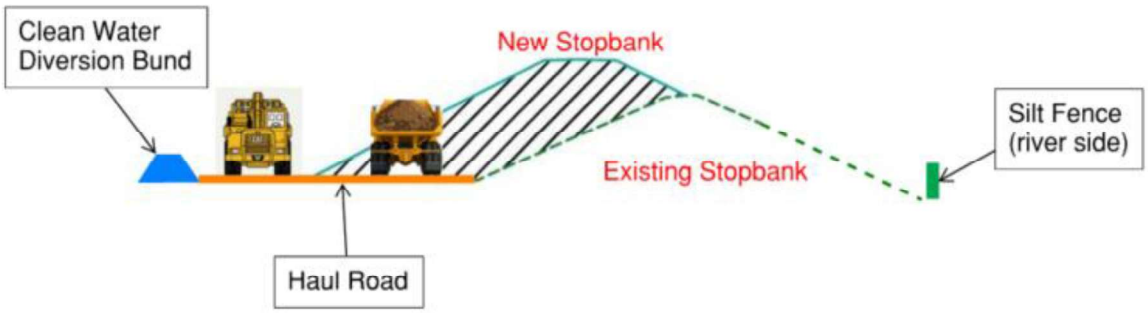


Figure 23 - Indicative Erosion and Silt Control cross-section.

6.3 Noise and Vibration

Noise and vibration monitoring may be required at locations where the proposed alignment is near existing residents and stakeholders. This will be confirmed by the Construction Noise and Vibration Management Plan (CNVMP)

6.4 Public protection and site security

The existing stopbank should be retained until the new stopbank is constructed to safe levels so Te Karaka maintains adequate levels of flood protection.

Te Karaka township is nearby to the proposed Stopbank alignment and access prevention measures to the live construction areas will need to be established along the proposed alignment. This will prevent the public from accessing the site during and after working times.

Wire mesh temporary fencing will be required at locations along the proposed alignment that cross through private property and put the residents at risk of accessing the site. These fences will also be required at locations that intersect with existing roads and at Site Access Points (SAP's).

Orange plastic mesh fences will be used in area that will be considered less risky for public to access the site, such as farm paddocks or orchard areas. These fences will be either attached to existing post and wire fences or attached to temporary waratah fences.

Construction plant shall be parked at the designated staging areas overnight to manage the risk of plant vandalism and theft. The staging areas will also be used for the plant refuelling purposes, which will likely be carried out at the end of normal working hours.

7 CULVERT EXTENSION

The existing culvert that crosses under SH2 requires an extension to enable construction of the new stopbank. This area will be accessed via the temporary site compound on the northern side of SH2.

Construction will commence with tree and vegetation removal, stabilised construction access and haul road over the existing culvert and going back to the adjacent site compound.

Erosion and sediment controls, dewatering works, and works in existing watercourse will be in accordance with the ESCP and GD05 which will be confirmed by the Contractor during ESCP approvals. Temporary high and low flow management will likely be required. A typical approach may include a Decanting Earth Bund (DEB) at the upstream end and temporary pipes inserted through the existing culvert. This will allow a dry working environment to complete the works.

The site will then be stripped of all existing topsoil and buried organic matter within the proposed work area. Works in the existing watercourse shall comply with the resource consent conditions. An ecologist may be required to inspect and supervise earthworks activities within the watercourse.

After completion of gas main refurbishment, the existing concrete haunching around the pipes at the outlet will need to be broken away and removal of any unsuitable foundation material. The new culvert pipes will be lowed into place and rested on approved foundation and bedding material. Approved backfill will then be placed over the pipes and tested as per the geotechnical engineer requirements.

The new outlet structure will be formed after the last pipe has been placed and the downstream receiving creek regraded as per design requirements.

Sufficient backfill will need to be placed over the top of the new culvert pipes before heavy plant is driven over the culvert to allow construction of the proposed stopbank. Details of an acceptable depth of cover over the pipes will need to be confirmed by the engineer.

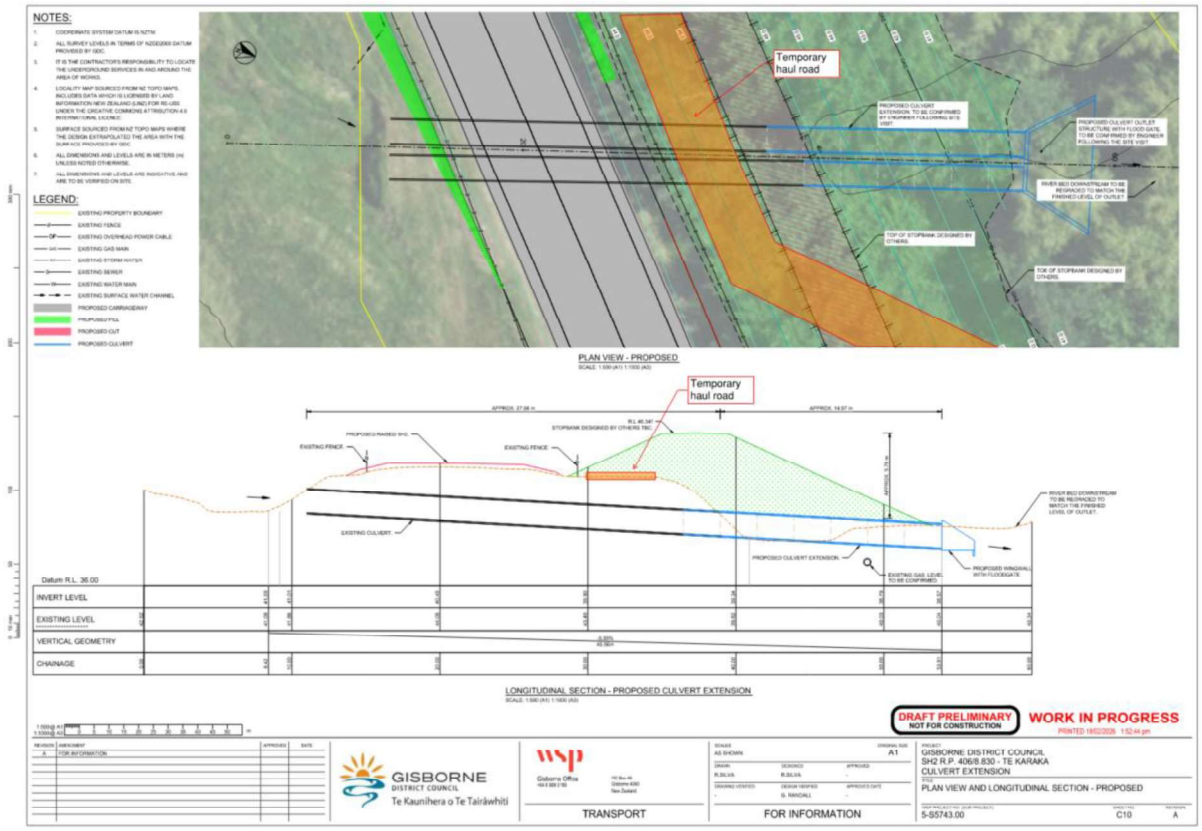


Figure 24 - Proposed culvert extension plan

Figure 25 - Photo showing the outlet of the existing culvert and the downstream creek

8 TRAIN ENTRANCE BUND

The existing tunnel entrance on the southern side of SH2 requires an earth bund to prevent floodwater entering the tunnel. Access to the site will need to be established from SH2 with a truck turnaround area of approx. 500m2. This will allow trucks that are carrying the fill material from the northern borrow pit to enter and turn around before reversing down to the proposed stopbank location and tipping.

The existing farm fence will need to be removed, and a new temporary or permanent fence installed around the southern side of the site. The type of fence and location will need to be confirmed by GDC prior to the works commencing.

Erosion and silt control will need to be established around the site with a clean water diversion bund taking water from above the tunnel entrance and diverting it around the site towards the existing creek.

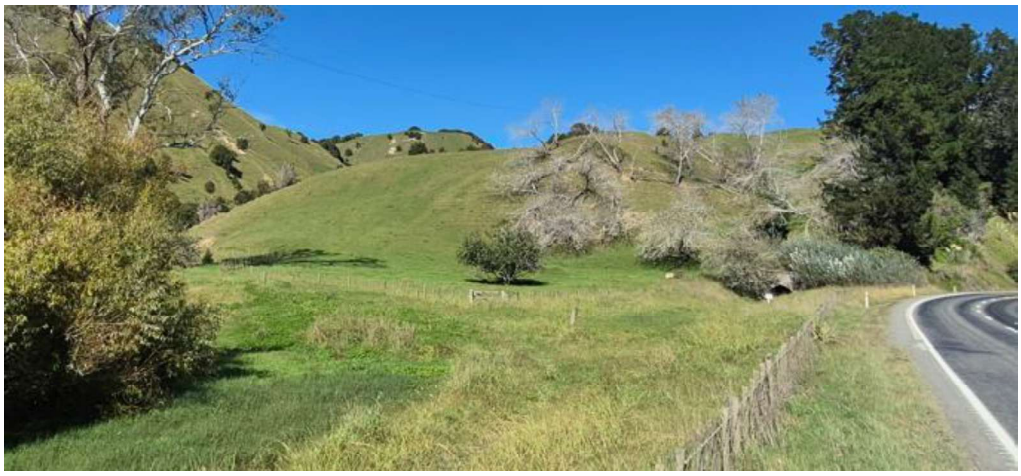


Figure 26 - Existing tunnel entrance site condition

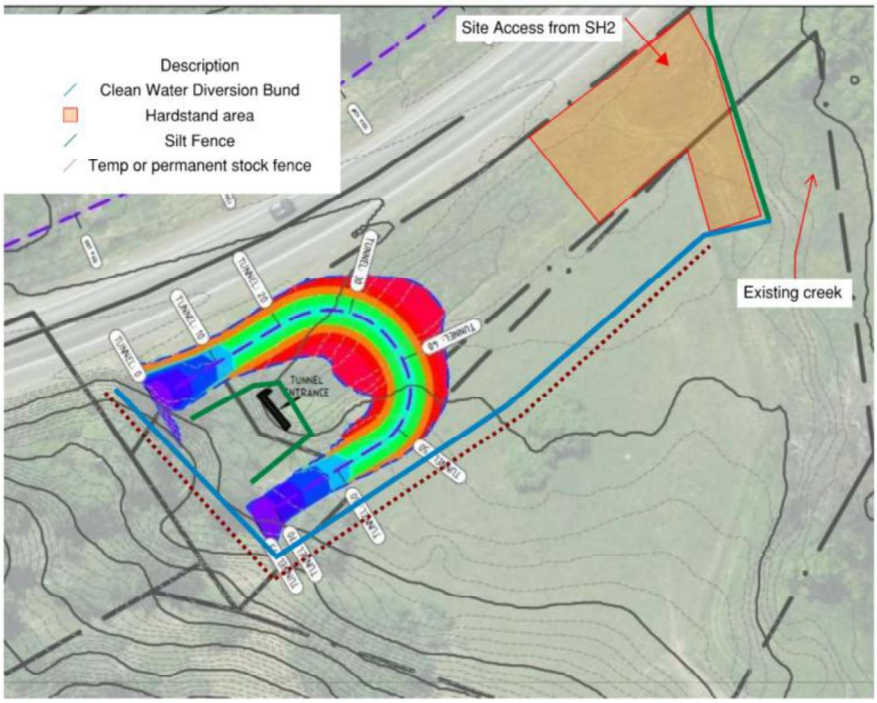


Figure 27 - Indicative site layout for the tunnel bund

9 SH2 ROAD RAISING

SH2 needs to be lifted at the western and eastern stopbank intersections. The western section needs to be lifted by approximately 1m, and the eastern section by approximately 2m above the existing surface to allow tie-in with the new stopbank levels.

The aggregate material required for the filling operation will be sourced offsite from a local quarry. This will ensure consistency of supply and quality of the road embankment material.

A typical sequence is as follows:

1. Relocate or protect impacted services (gas, water, and overhead power lines).
2. Construct temporary road widening to create a safe working area for the permanent works.
3. Construct the road raising embankment in lifts along one lane at a time using a stop/go lane closure traffic management.
4. Switch the live traffic over onto the partially lifted lane, continue to fill the other lane.
5. Continue to fill single lane width whilst switching traffic back and forth until the design level is reached.
6. Carry out surfacing works.
7. Move traffic onto the newly constructed road.

Refer to Figure 28 to Figure 31 for an indicative layout and typical cross section for the lane diversion for the western and eastern road raising.

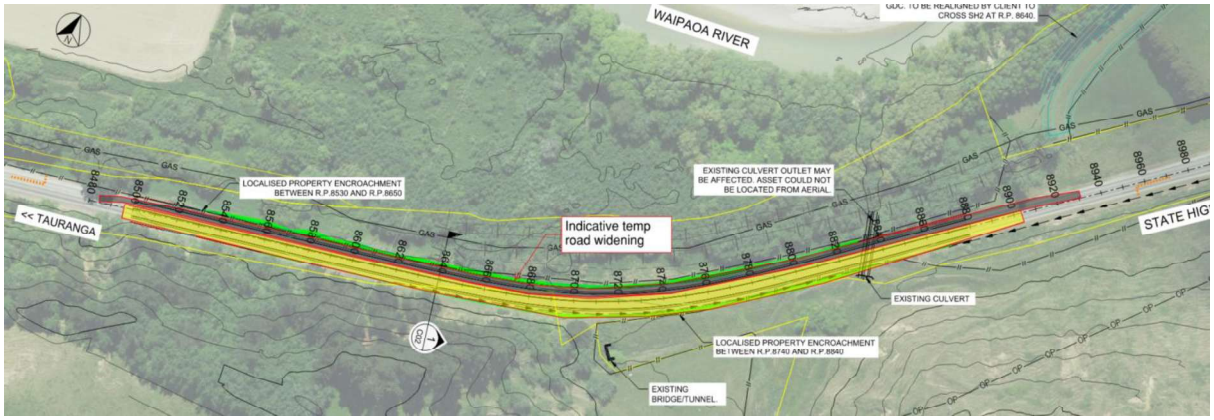


Figure 28 - Indicative temporary lane diversion for the western road raising.

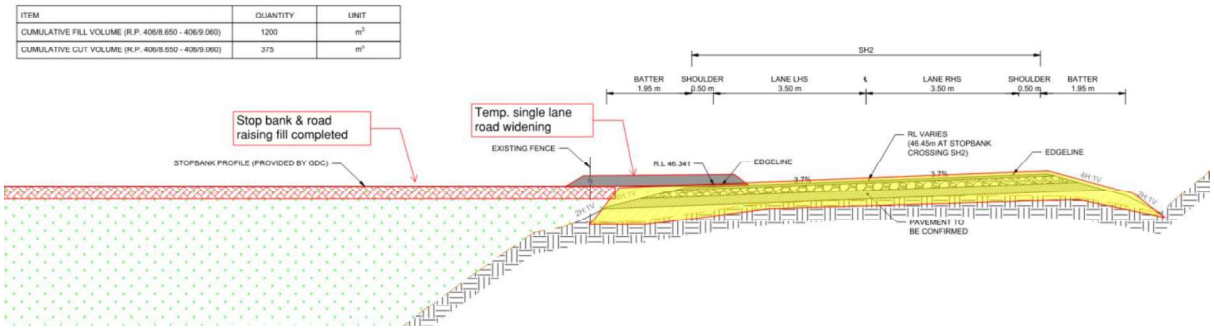


Figure 29 - Indicative cross-section of the temporary lane diversion for the western road raising.

Figure 30 - Indicative alternating temporary lane diversion for the eastern road raising.

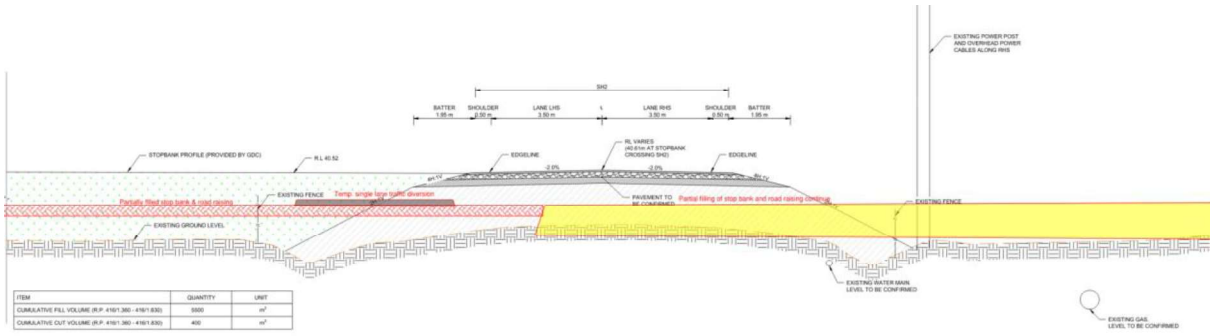


Figure 31 - Indicative cross section of the temporary lane diversion for the eastern road raising.

The proposed construction method and sequencing above is similar to the SH2 Hakanui Straight Project which is currently in progress. Refer to Figure 32 and Figure 33 below for the construction sequencing.

Figure 32 - Example temporary single lane road diversion along the Hakanui Straight road raising project.

Figure 33 – Further example of temporary single lane road diversion along the Hakanui Straight road raising project.

10 RANGATIRA ROAD RAISING

Rangatira Road needs to be lifted by approximately 2-3m above the existing surface to allow tie-in with the new stopbank levels.

The aggregate material required for the filling operation will be sourced offsite from a local quarry.

Due to the very low volume of traffic that use this road, a typical traffic management approach might be to use a “Road Closure – Residents Access Only” approach. This is subject to the GDC Local Road Controlling Authority traffic management approvals.
The residents that use Rangatira Road will be informed of full closure times so they can plan accordingly. Alternatively, the Contractor will carry out the filling operation in such a way that the road can easily be made safe if a vehicle needs to get through.

A typical sequence is as follows:

1. Relocate or protect impacted services (water and overhead power lines).
2. Strip the existing road surface and dispose.
3. Construct the road raising embankment in lifts using a road closure traffic management.
4. Carry out surfacing works.
5. Fully open the road to the public.

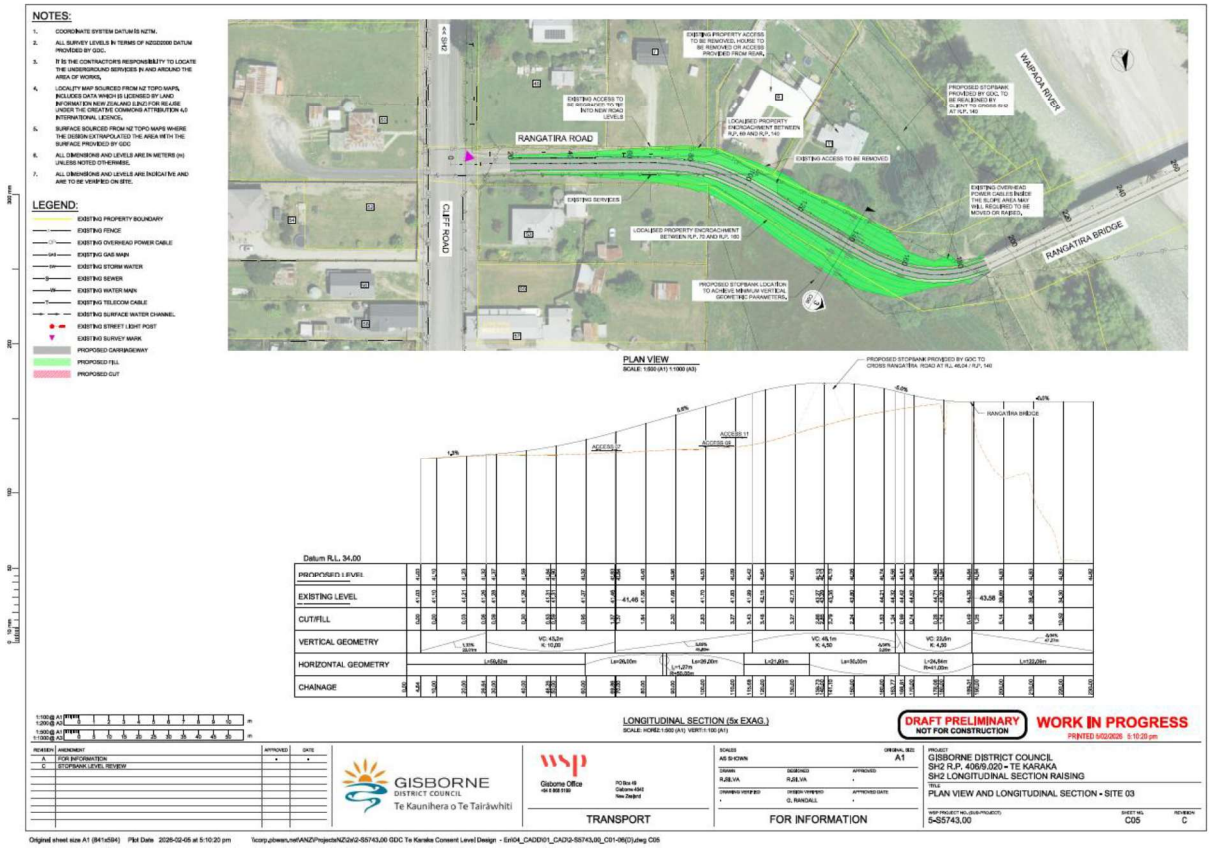


Figure 34 – Plan showing the Rangatira Road raising.

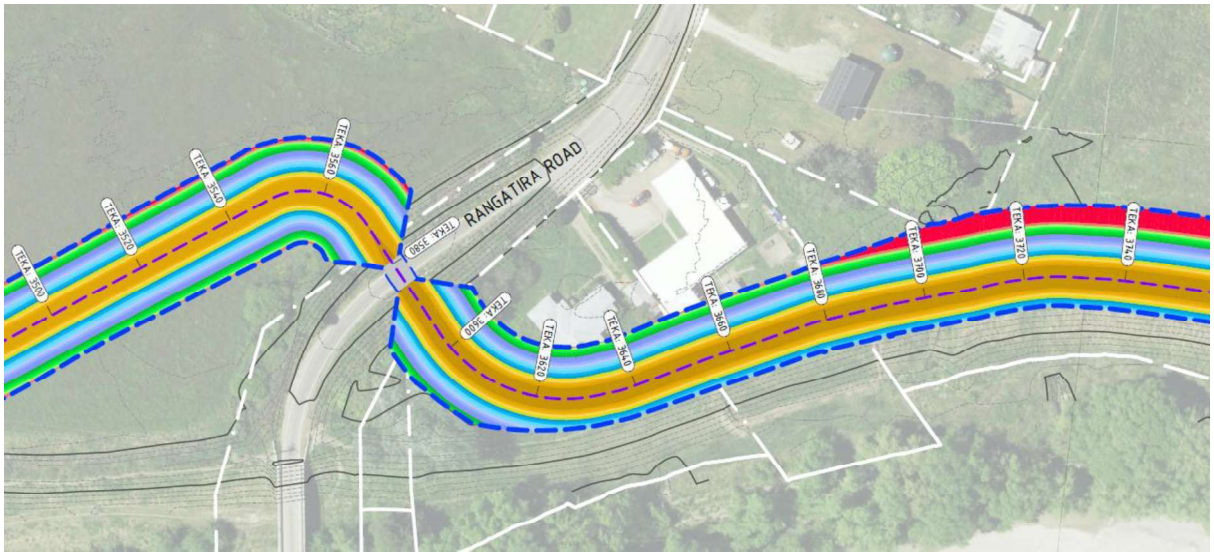


Figure 35 - Plan showing the Rangatira Road raising.

11 KANAKANAIA ROAD RAISING

Kanakanaia Road needs to be lifted by approximately 3m above the existing surface to allow tie-in with the new stopbank levels.

The aggregate material required for the filling operation will be sourced offsite from a local quarry.

A typical traffic management approach for Kanakanaia Road might be to use a 3-way lane closure due to the connection with Paulson Road. This is subject to the GDC Local Road Controlling Authority traffic management approvals.

A typical sequence is as follows:

1. Relocate or protect impacted services (water and overhead power lines).
2. Relocate existing boundary fences that will be impacted.
3. Construct temporary road widening to create a safe working area for the permanent works.
4. Construct temporary road connection to Paulson Road.
5. Construct the road raising embankment in lifts along one lane at a time using a stop/go lane closure traffic management.
6. Switch the live traffic over onto the partially lifted lane, continue to fill the other lane.
7. Continue to fill single lane width whilst switching traffic back and forth until the design level is reached.
8. Carry out surfacing works.
9. Move traffic onto the newly constructed road.

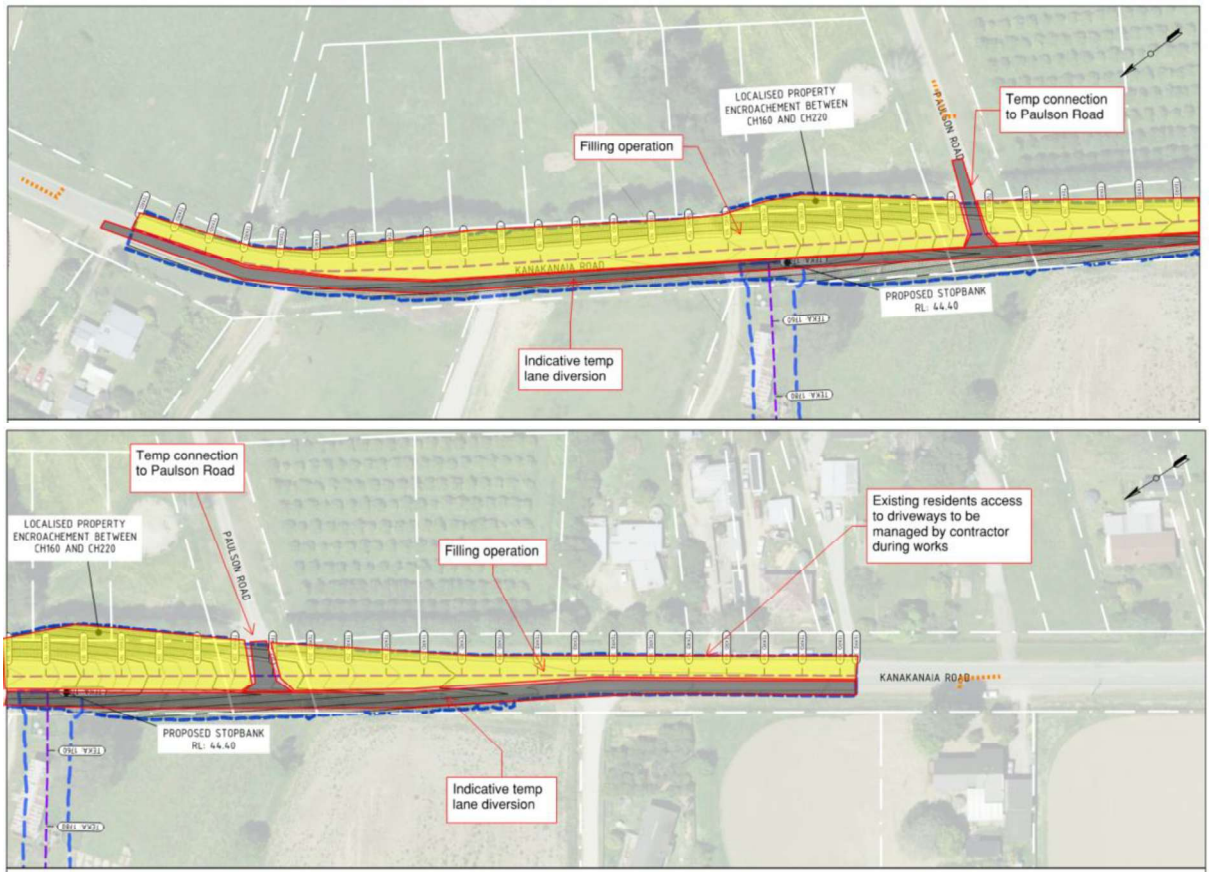


Figure 36 - Indicative alternating temporary lane diversion for the Kanakanaia Road raising.

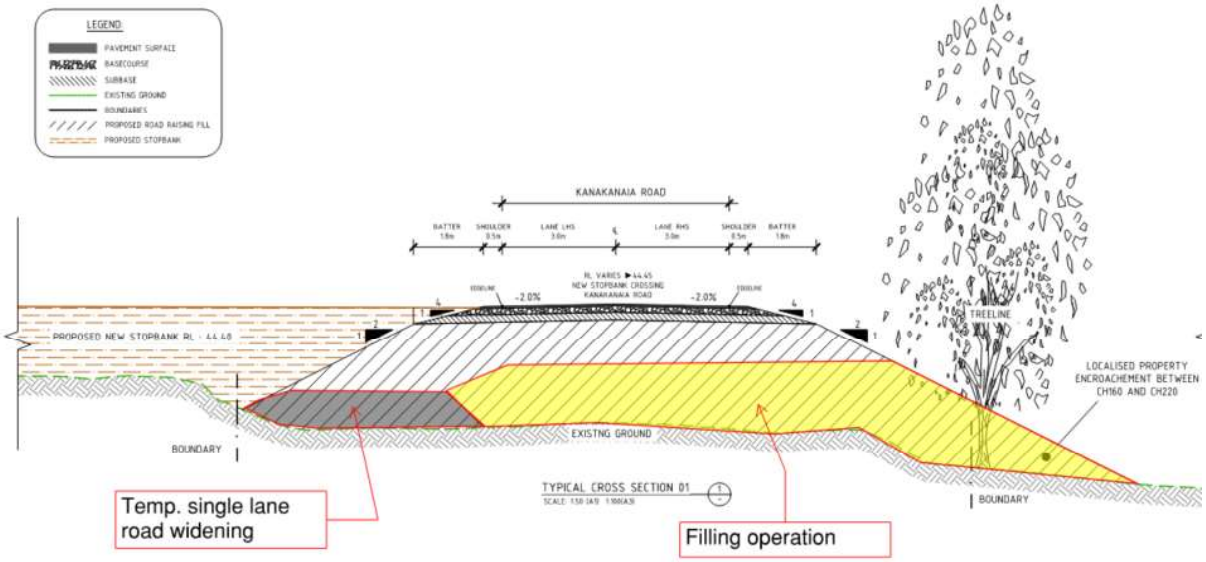


Figure 37 - Indicative cross section of the temporary lane diversion for the Kanakanaia Road raising.

12 STOPBANK CONSTRUCTION

It is assumed that the existing level of stopbank protection shall remain in place during construction of the new stopbanks, i.e. the existing stopbank shall not be removed until the new one is completed or at an acceptable elevation specified by GDC.

12.1 Land Remediation

Removal of contaminated land will need to be carried out by the Contractor in accordance with the Site Management Plan (SMP)[1] and Worksafe NZ Health and safety at Work (Hazardous Substances) Regulations to remove exceedance hotspots located along the proposed stopbank alignment, borrow pit and site compound locations. Any contaminated material encountered onsite will be tested and management of the material shall be carried out under the guidance of the Contaminated Land Specialist/ SQEP. Contaminated material that cannot remain onsite will need to be disposed of at approved landfill as per the procedures outlined in the SMP.

12.2 Borrow Pits

The anticipated earthworks volumes required for the stopbank and road raising construction are shown in the table below. The volumes are subject to change following completion of the detailed design.

Table 1 – Estimated earthworks volumes

Area	Estimated Fill Volume	Source
Western stopbank	111,000 m3	Northern borrow site
Eastern stopbank	48,000 m3	Northern + eastern borrow site
Western SH2 Road raising	1,200 m3	Quarry
Eastern SH2 Road raising	5,500 m3	Quarry
Rangatira Road	3,280 m3	Quarry
Kanakanaia Road	10,000 m3	Quarry

Approximately 13 hectares have been identified as borrow pits to extract the required stopbank fill material from two locations. The northern borrow pit and the eastern borrow pit. Across these two locations there is approximately 350,000m3 of material available depending on the condition of the in-situ material.

The extraction will be in controlled stages to minimise the environmental impact and to comply with the ESCP.

NORTHERN BORROW PIT

The northern borrow pit is located to the north of Te Karaka at the end of Morris Road. This site covers approx. 11ha and can be cut down by 3m, which may generate approx. 330,000m3.

[1] GDC Te Karaka Stopbank Site Management Plan - Rev A – LDE, 1 April 2026, ref. 30019

An open area of approximately 10,000m2-30,000m2 will be required to sustain the stopbank fill requirements. This will need to be confirmed by the Contractor prior to construction based on their specific methodology and ESCP.

The existing stopbank currently runs through the middle of the northern borrow pit. The river side of the existing stopbank will likely be extracted first. This is shown as Area 1 and Area 2 in Figure 38. Area 3 and the existing stopbank should only be removed after the new western stopbank has been constructed to acceptable flood protection levels.

A typical approach may be to start at the lower elevations which is likely to be closest to the river. This is to ensure surface water can always drain from the area efficiently to avoid excessive ponding which will delay startups after rain fall events. The topsoil will be stripped from the active area and stockpiled nearby.

This could follow a sequence such as stripping topsoil from Area 1 and stockpiling it in Area 3. Once Area 1 is exhausted, then strip the topsoil from Area 2 and place over Area 1. When Area 2 has been exhausted, then strip the topsoil from Area 1 and place over Area 2. Once all required fill has been removed then place remaining topsoil back over Area 3. This example assumes that all bulk earthworks is to remain within the borrow pit footprint. It may be more efficient to stockpile topsoil outside the borrow pit area, but this will need to be confirmed by GDC if an area is available.

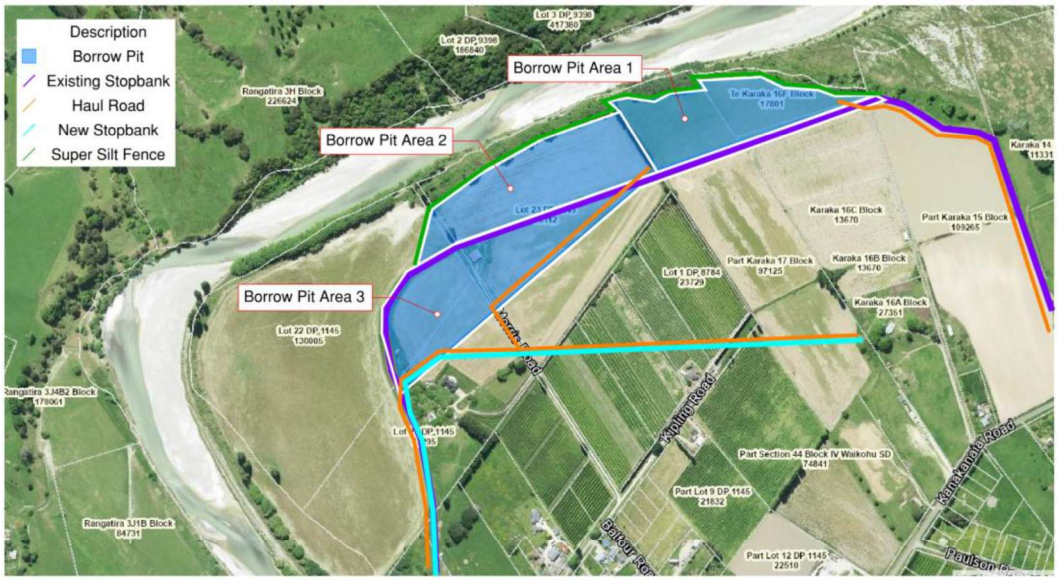


Figure 38 - Northern borrow pit

Eastern Borrow Pit

The eastern borrow pit is to the east of Te karaka near the end of Paulson Road. This site covers approx. 3ha and can be cut down by 1m, which may generate approx. 30,000m3.

The existing stopbank currently runs through the middle of the eastern borrow pit. The river side of the existing stopbank will likely be extracted first. This is shown as Area 1 in Figure 39. Area 2 and the existing stopbank should only be removed after the new eastern stopbank has been constructed to acceptable flood protection levels. The sequence of works and the extraction logic will be like what is discussed for the northern borrow pit.

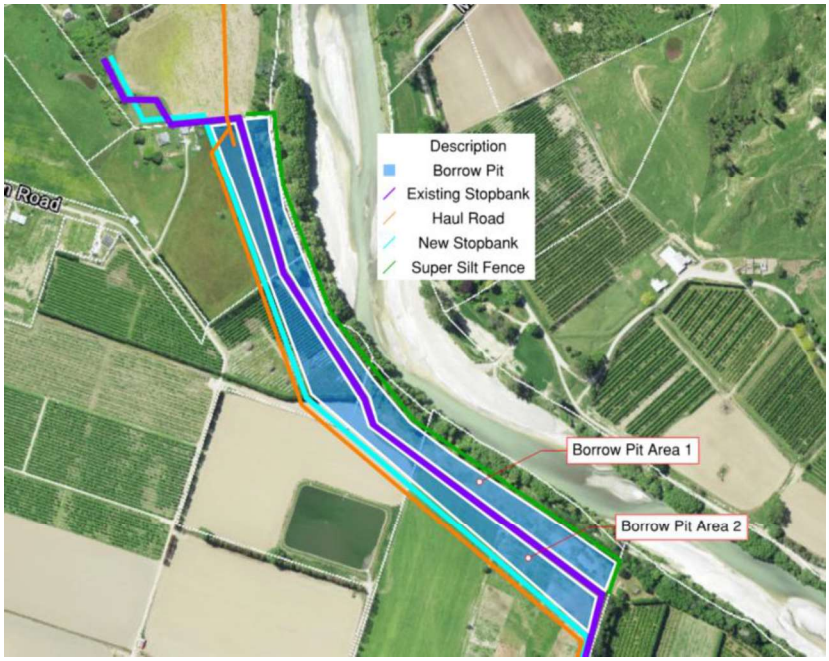


Figure 39 - Eastern borrow pit

12.3 Haul Routes

Off-Road Routes

Haul roads are temporary off-road tracks that will be required to transport excavated material from the borrow pits to the new stopbank construction location along the proposed alignment.

To limit environmental impact, a practical approach is to create a haul road that runs parallel to the new stopbank footprint. The haul road would need to be wide enough to accommodate heavy earthmoving plant travelling in both directions. The Contractor would need to confirm the preferred haul road construction and layout, but a typical allowance would be a 10m wide haul road running along the toe of the new stopbank.

Figure 40 illustrates the indicative off-road haul roads from the borrow pits to the stopbank construction locations.

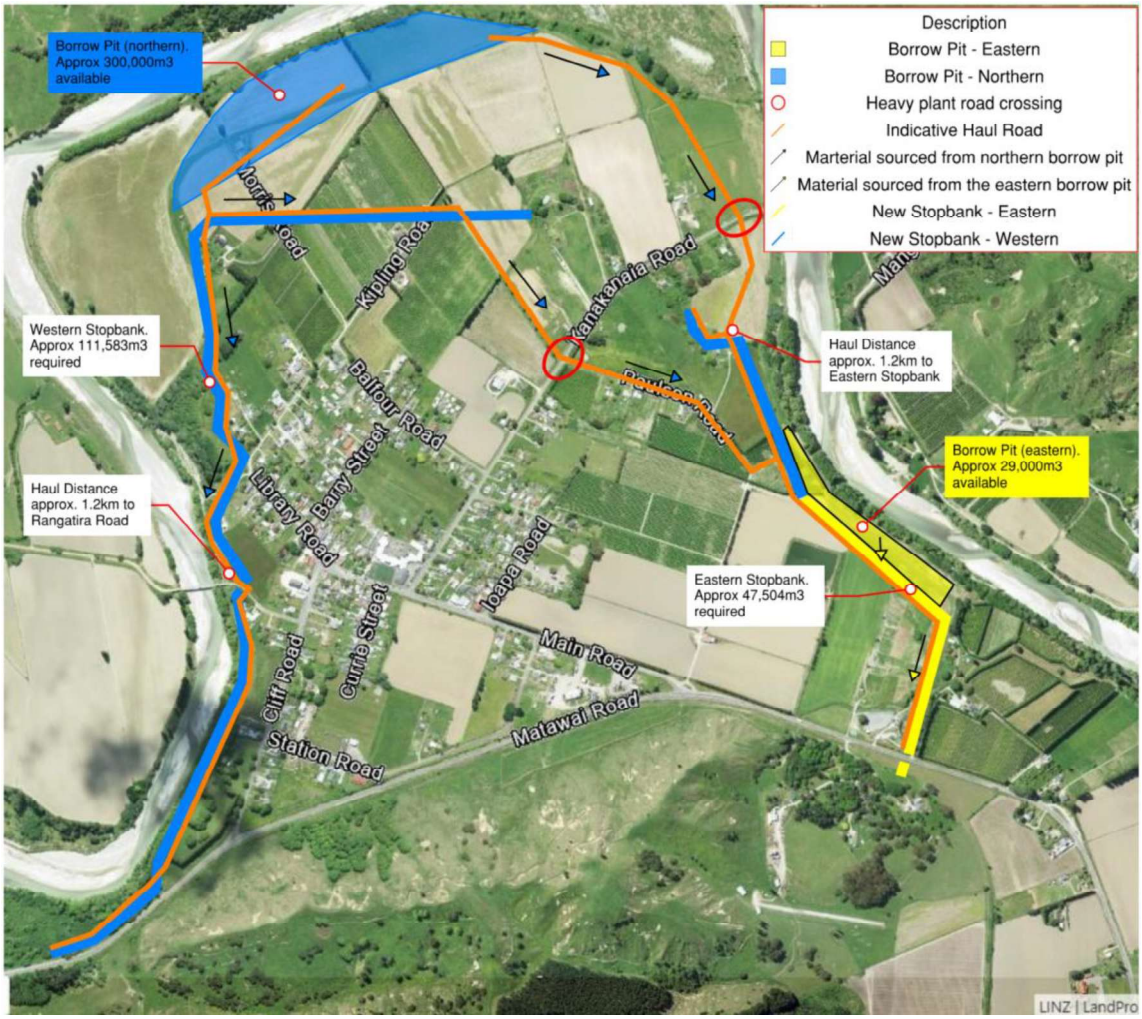


Figure 40 - Example of Off-road haul road layout with Kanakanaia Road crossing

TEMPORARY CROSSING

A temporary heavy plant road crossing will likely be required on Kanakania Road to allow transportation of fill material from the northern borrow pit to the eastern stopbank construction location.

Similar crossings have been used in other construction projects around New Zealand. A recent example was the East Coast Road crossing required for the O Mahurangi – Penlink project. This crossing included a temporary raised section to strengthen the existing road, and temporary remote controlled traffic signals to stop the traffic when a construction vehicle approached.

Figure 41 - Visual example of a heavy plant road crossing on Kanakania Road.

ON-ROAD ROUTES

Haul routes are the on-road routes the construction traffic will likely follow to transport excavated material from the borrow pits to the new stopbank construction location along the proposed alignment. They will also be utilised for transporting various other materials around the site.

Due to typical maximum efficient haul distances, the section between SH2 and Rangatira Road will likely require the fill material to be transported via the on-road routes using truck and trailer. Due to the tight nature of the stopbank construction corridor, the truck and trailers would offload the material at the western SH2 compound. From there Articulated Dump Trucks (ADT) would likely be used to transport the fill material to the stopbank construction location.

Temporary traffic management controls may be implemented at designated Site Access Points to manage the increased truck movements. Sealed access points and wheel washes can be implemented if debris on the road become excessive from the truck movements.

Figure 42 illustrates the indicative on-road haul routes from the borrow pits to the stopbank construction locations.

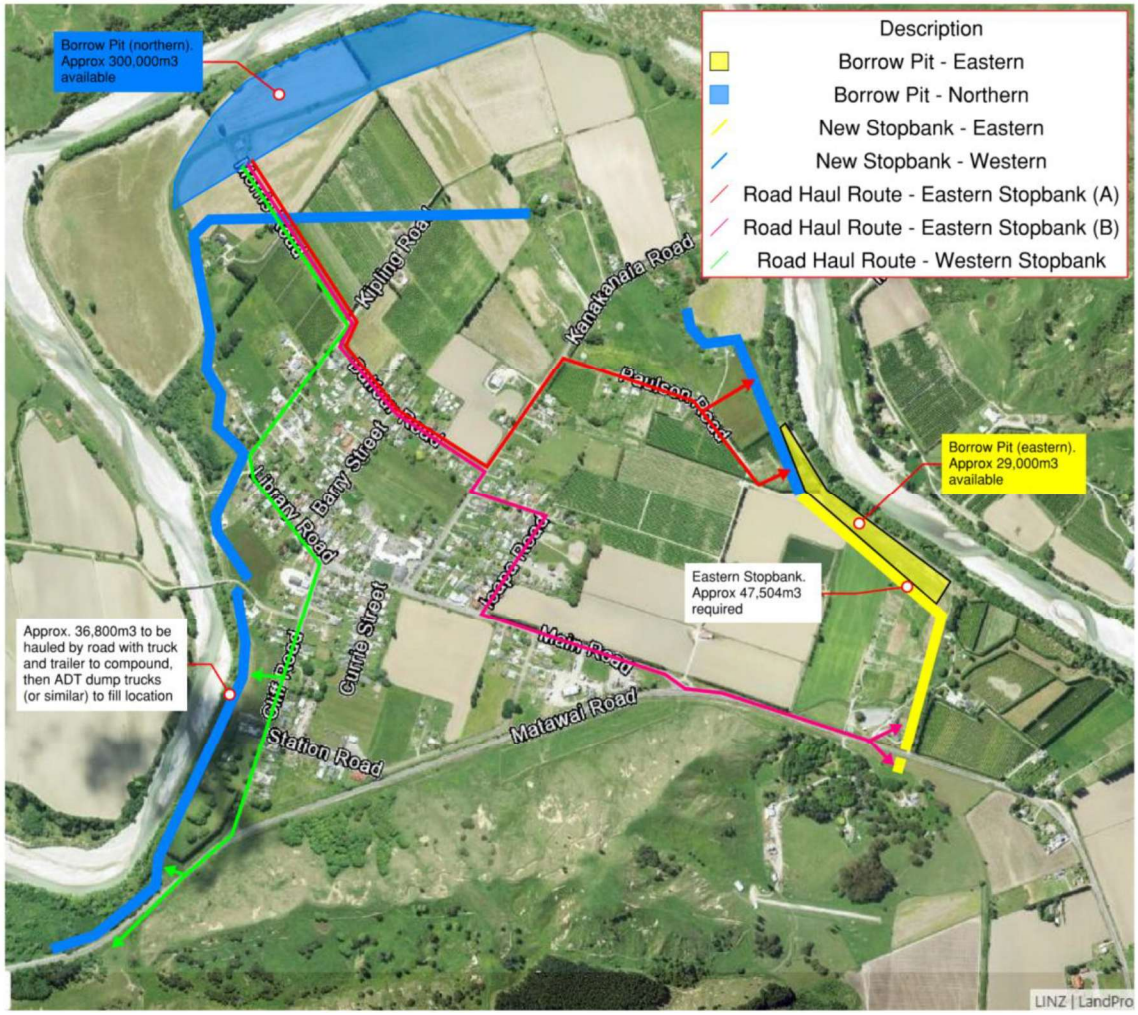


Figure 42 – Indicative On-road routes

13 TRUCK MOVEMENTS PER DAY

WESTERN STOPBANK – LOWER END

Approximately 36,800m3 of fill material will be required for the construction of the stopbank between Rangatira Road and SH2. This material will likely be transported from the borrow pit to site using road-going truck and trailers. It is assumed that there would be approximately 30-40 truck and trailer loads per day for approximately 4 months to import the required fill volume.

As shown in Figure 42, the trucks would travel along Morris Road, Kipling Road, Library Road and Cliff Road.

WESTERN STOPBANK – UPPER END

The upper section of the western stop bank is within an efficient distance from the northern borrow pit. Therefore, the fill material will be transported via motor scrappers, ADT 's or similar along the off-road haul roads.

Due to earthworks season constraints, this operation would need to be running concurrently with the lower section of the western stopbank.

EASTERN STOPBANK

The lower section of the eastern stopbank is within close distance to the new stopbank. Therefore, a combination of bulldozer and motor scrapers would be the most efficient method of fill.

Due to the limitations on the available material from the eastern borrow pit, approximately 19,000m3 would be required to be transported form the northern borrow pit. This could be done via off-road or off-road routes. It is assumed that there would be approximately 40 truck and trailer loads per day for approximately 2 months.

As shown in Figure 42, the trucks would travel along Morris Road, Kipling Road, Balfour Road, Kanakanaia Road and Paulson Road.

An alternate route for the eastern stopbank would be Morris Road, Kipling Road, Balfour Road, Kanakanaia Road, Ioapa Road, Main Road, and SH2. This route may be used for transporting fill to the lower section of the eastern stopbank. However, this route takes a slightly non-direct journey due to avoiding Te Karaka Area School.

ROAD RAISING

It is likely the contractor will utilise one of the compound sites previously mentioned in section 4.1 to bulk store the roading aggregate before being taken to the tip site with 6-wheeler tip trucks. This bulk aggregate storage site may be off SH2 near the eastern road raising site.

It is assumed that there would be approximately 30 truck and trailer loads per day coming into Te Karaka for approximately 2-3 months. This duration would overlap with the construction of the road raising so the bulk stockpile size remains at a manageable level.

The western SH2 section requires approx. 1,200m3, and the eastern SH2 section approx. 5,500m3, Rangatira Road requires approx. 3,280m3, Kanakanaia Road requires approx. 10,000m3 (assumed). Therefore, a total volume of roading aggregate required is approximately 20,000m3.

It is assumed that 6-wheeler trucks will transport the roading aggregates to the active road raising sites, with approximately 40-60 loads per day overall.

Table 2 – Truck Movements table

Work Area	Road-going Volume (m3)	Duration (Months)	Truck Movements	
			Local Roads (loaded trucks per day)	State Highway 2 (loaded trucks per day)
Western stopbank – Lower end	36,800	4	40	40
Eastern stopbank	19,000	2	40	40
Bulk Roading Aggregate Import	20,000	3	0	30
SH2 Western road raising	1,200	0.5	30	30
SH2 Eastern road raising	5,500	1	30	30
Rangatira Road	3,280	0.5	30	30
Kanakanaia Road	10,000	2	30	30
Other Materials deliveries			15	15

It is worth noting that not all work activities will happen concurrently. Therefore, a fair assumption for local roads may be 70 loaded truck movements per day as an average. This assumes that the lower western stopbank and a local road raising activity may be happening at the same time.

There will be additional vehicles from the figures shown above that will be delivering other materials to and around the site. It is assumed that this will be approximately 15 truck movements per day.

14 PROGRAMME

The bulk earthworks will be constrained by the earthworks season from October to April inclusive. It is assumed that no earthworks activities will be carried out between May to September due to the risk of inclement weather and inefficiencies with earthworks activities. The bulk earthworks is recommended to commence at the beginning of the earthworks season to optimise overall project duration. This will rely on a timely design development and procurement process.

Construction of the road raising and the stopbank construction can commence concurrently. The road construction will likely be able to continue through the winter months assuming the road embankment will be constructed using imported granular material sourced from a local quarry.

It is assumed that the work will be carried out by one work crew for the stopbank construction and one crew for the road raising works. The selected construction contractor may plan to utilise multiple work crews to expedite the programme.

Variables that could alter the programme durations are as follows:

- Total volume of earthworks based on the final design and alignment.

- Project commencement and maximising the available earthworks season, from October to May. A delayed start to the earthworks season may have a longer impact to the overall programme.
- Increasing the earthworks productivities by engaging more crews to work on multiple work fronts.
- Project scope and geotechnical conditions, such as additional culverts, unforeseen ground conditions/ subgrade improvements required, contaminants, delayed property acquisitions/ site possessions.

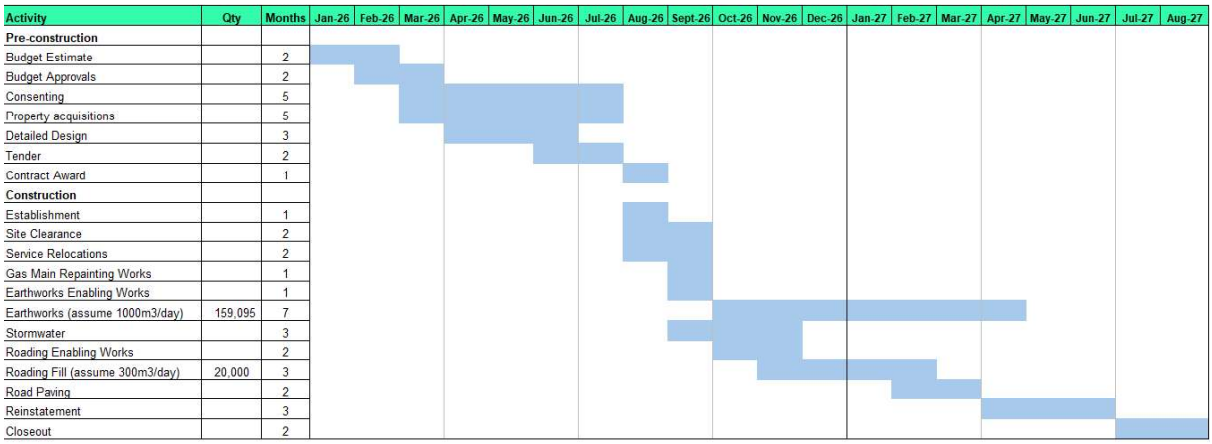


Figure 43 - Indicative programme

14.1 Sequencing

A high-level construction staging has been developed to inform the Resource Consent application.

It is envisaged the project will take approximately 11-13 months to complete based on the indicative methodology, scope of works, quantities, assumed resourcing levels and typical productivity rates. Due to the large volume of earthworks within this project, the construction duration will be highly dependent on favourable weather conditions during the earthwork's season.

The assumed construction sequence is as follows:

- Site establishment
- Land Remediation
- Electrical relocation works
- Enabling works and Environmental Controls
- Existing gas main refurbishment works
- Culvert extension on SH2
- Bund around historical train tunnel portal
- SH2 road raising (western section)
- Western Stopbank construction
- Rangatira Road raising
- Kanakanaia Road raising
- Eastern Stopbank construction
- SH2 road raising (eastern section)
- Disestablishment

15 CONSTRUCTION RESOURCES

15.1 Plant & Equipment

Construction plant selection will depend on the Contractors methodology. However, a typical list of construction plant will include:

- 20-30t excavators
- 5-14t excavators
- 30-40t Articulated Dump Trucks
- Motor scrappers
- Tractor and scoops
- Bulldozer and scoops
- Bulldozers
- 12-15t Compaction plant
- 6-8-wheeler trucks
- Truck and Trailer trucks
- Water Carts
- Grader
- Road surfacing plant (bitumen sprayer, chip spreader trucks, rollers)

15.2 Materials to be stored

The site compounds will enable required materials to be stored during construction. Various materials such as fill material, drainage materials, erosion and silt control equipment, small tools and equipment.

Dangerous Goods will be stored within locked shipping containers such as diesel, petrol, oils, grease.

15.3 Working Hours

The expected working hours are 7:00am – 7:00pm Monday to Saturday to maximise the available work hours, particularly during the earthworks season, excluding public holidays.

It is anticipated that the works can be completed over one summer earthworks season between 1st October – 30th April. Depending on the weather during this period, there is a possibility the earthworks could push into the next earthworks season.

16 DIS-ESTABLISHMENT

Upon completion of all for work packages, dis-establishment will commence.

All construction plant and equipment will be removed from site.

The site compound will be dis-established with all site facilities, surplus materials and rubbish will be removed.

All temporary works and hardstand areas removed and reinstated to original condition.

APPENDIX A – PHOTOS OF PREVIOUS STOPBANK PROJECTS IN GISBORNE DISTRICT

The below photos are examples of other similar GDC flood resilience projects.

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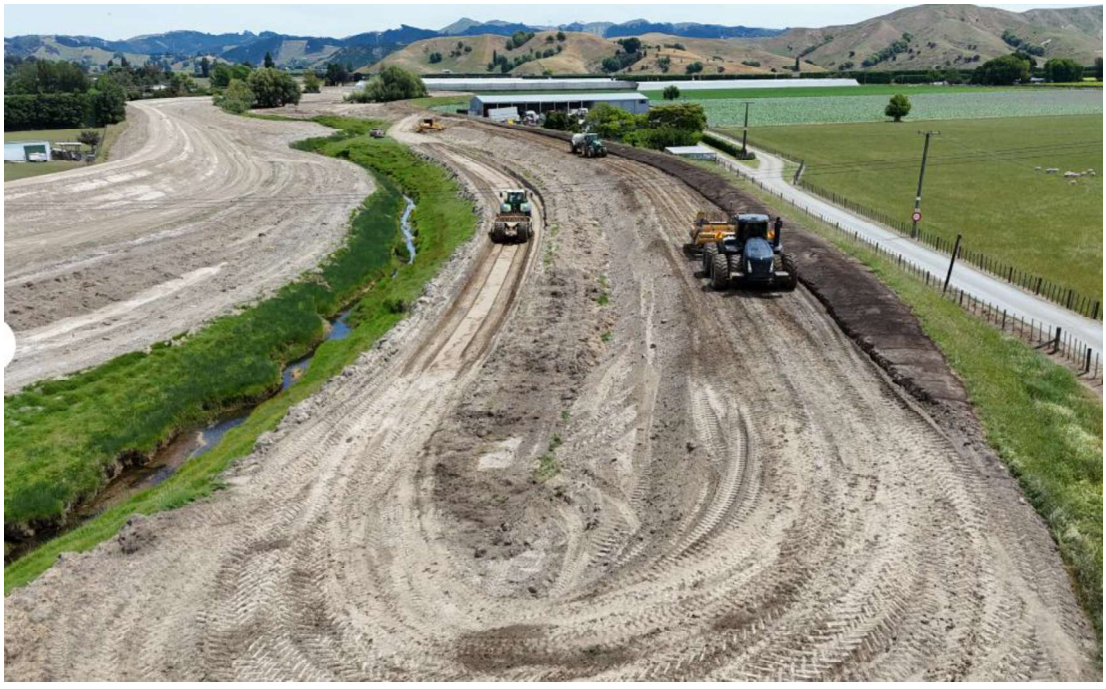

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[2] https://www.gdc.govt.nz/council/major-projects/waipaoa-river-flood-control-scheme
[3] https://www.gdc.govt.nz/council/major-projects/waipaoa-river-flood-control-scheme

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[4] https://www.gdc.govt.nz/council/major-projects/waipaoa-river-flood-control-scheme
[5] https://www.gdc.govt.nz/council/major-projects/waipaoa-river-flood-control-scheme

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[6] https://www.gdc.govt.nz/council/major-projects/waipaoa-river-flood-control-scheme
[7] https://www.gdc.govt.nz/council/major-projects/waipaoa-river-flood-control-scheme

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[8] https://www.gdc.govt.nz/council/major-projects/waipaoa-river-flood-control-scheme
[9] https://www.gdc.govt.nz/council/major-projects/waipaoa-river-flood-control-scheme

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[10] https://www.gdc.govt.nz/council/major-projects/waipaoa-river-flood-control-scheme

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[11] https://www.civilprojects.co.nz/featured-project/stopbank-upgrades
[12] https://www.civilprojects.co.nz/featured-project/stopbank-upgrades