
Kaituna River Re- diversion and Ongatoro/Maketū Estuary Enhancement Project

Construction Description and Drawings

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Purpose of Report

The purpose of this report is to provide an understanding of the construction activities of the Kaituna River Re-diversion and Ongatoro/Maketū Estuary Enhancement Project and their programming, construction environmental effects and risks. Detailed designs will be completed once the project team has sufficient certainty that the consents and land required for the project has been obtained.

The report is for inclusion in the Assessment of Environmental Effects in support of the Application for Consents.

Executive summary

The Kaituna River Re-diversion and Ongatoro/Maketū Estuary Enhancement Project proposes to re-divert 20% of the water from the Kaituna River back into the Ongatoro/Maketū Estuary while keeping Te Tumu Cut open and create at least 20 hectares of new wetland. The preferred option (Figure 1) has been investigated in detail to assess its benefits and any actual and potential environmental effects.

This report describes the various construction activities, their programming and risks and estimated costs. It also provides detail of the expected short-term environmental effects of the construction and outlines the Regional Council's plans to avoid, remedy or mitigate these.



Figure 1 Preferred Option

Features of the works

The features of the work are:

- a) Add more culverts to the existing Ford's Cut culverts to create a larger inlet structure to allow more water from the river into the estuary and prevent return flow.
- b) Widen Ford's Cut to at least 60 metres at the inlet structure, widening to at least 100 metres at the estuary and deepen to RL-1.5m, leaving it with "soft" meandering edges in addition to these widths.

- c) Shape and create appropriate wetland ecosystems on low-lying grassland areas of Mr Brain's Land north of Ford's Cut and on Papahikahawai Island Trust land where negotiations with landowners permit this.
- d) Creation of chenier islands/ridges at both Brain and Papahikahawai properties
- e) Remove the two stopbank/causeways between Papahikahawai Island and Maketu Spit, and the one between Mr Brain's Land and Papahikahawai Island.
- f) Block the downstream section of Ford's Loop and convert to some form of embayment with public boat ramp and parking and create wetland.
- g) Excavate a channel from the river at the western end of Mr Titchmarsh's wetland to meet the existing channel. This will require relocation of the stopbank to the south.

Drawings

A full set of drawings has been prepared to support this report. These are included in Appendix 2.

Staged Re-Diversion

The proposal allows incremental increases of flow from the river into the estuary over months or years while environmental effects are monitored. This is achieved by constructing all features of the works described above and implementing controls on the inlet culvert structure i.e. keep some culverts closed. The most likely option for staging is that flows will be increased from the current average of 150,000m³/tidal cycle to ~400,000m³/tidal cycle, followed by a further increase to ~600,000m³/tidal cycle after a period of monitoring and, if necessary, adaptive management.

Timing

The expected duration of the construction works is approximately 12 months and some of these works such as stopbank construction are best carried out in the summer and autumn. Other works such as culvert construction can be undertaken in any season. Other seasonal constraints included whitebait spawning (March and April), the run (August to November) and the summer recreational use. It is likely, with adequate notice and planning, that construction effects on these constraints can be minimised. Application is being made for earthworks over the winter months to further improve the opportunity to accommodate these constraints.

Commencement of work is dependant on the legal processes of consenting and land access and so the project construction sequence will have to be adjusted accordingly if these cause delays.

Risks

There are the usual risks associated with civil construction, compounded by the wet coastal and riverine environment, that have the potential to exacerbate any identified adverse environmental effects. These include unexpected ground conditions; heavy rain on the work site and high water levels in the river, sea and estuary; unexpected traffic congestion, higher dust and noise nuisances; and conflicting public access requirements.

These risks will be the subject of a risk management plan that consists of risk identification, planning, design, implementation and contingency planning using experienced and reliable personnel.

Contractor Initiatives

This report has been prepared in support of the application for consents and assumptions have been about the construction techniques that could be employed. Any conditions accompanying the consents need to be flexible to accommodate initiatives from the successful contractor.

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Part 1: Assumptions and Constraints

1.1 Assumptions

1.1.1 Land Access

It has been assumed that access is obtained to all lands needed for these works. This is the subject of separate negotiations and legal processes.

1.1.2 Management Plans

The Bay of Plenty Regional Council will prepare a:

- Outline Environmental Management Plan incorporating the conditions of consent at the time the detailed design and contract specifications are completed. The successful contractor will be responsible for preparing the final Environmental Management Plan consistent with the Outline Plan and incorporating their construction methodology.
- Wetland Creation Strategy and Plan that will describe the processes to achieve the desired wetlands on the Brain property and on the fill of the Ford's Loop and the rehabilitation along the southern shoreline of Papahikahawai Island
- A Biodiversity Management Plan (in preparation) for Papahikahawai Island

1.2 Constraints

1.2.1 Environmental

There are a number of environmental effects that constrain the construction methodology including:

- Suspended sediment and water quality issues
- Heavy rain and high water levels
- Potential for ecological damage
- Erosion
- Public access and safety
- Noise, dust, traffic
- Discovery of historic artefacts

1.2.2 Seasonal

Summer is generally better for earthworks when more daylight hours and warmer temperatures allow wet soils to dry and compact and to dry out after any rainfall. Summer also reduces the likelihood of floods although the risk of sub-tropical lows is always present. Winter work can be contemplated for less weather sensitive works such as localised excavation to waste and construction of culverts.

However, during the summer there will be increased public use of the area including walking, fishing, boating and kayaking.

Groundwater levels are generally lower in the summer but in this location so close to the sea this is unlikely to be of significant benefit.

Any landscape planting, re-topsoiling and grassing is best undertaken in late summer and autumn to assist grass strike.

To avoid many of the timing constraints, the ability to work in the winter is being sought within these consents. Earthworks on flat, potentially sandy substrates are less problematic in winter than sloping land with poorer drainage. To avoid some environmental effects associated with spring and summer works consents to operate during winter are being sought.

1.2.3 Whitebait Spawning and Running

The spawning season for inanga, which make up the vast majority of freshwater fish in the Kaituna River is late March to early May and the running season is from mid-August to end of November. These have been considered, but not fully avoided, when preparing the programme.

1.2.4 Commercial Users of the River

This group includes the Coastguard, Mr Boy Corbett, Mr Butch Waterhouse and Mr Vernon Wills who all have a shore based station in the river loop. These are important users whose needs must be accommodated during the works.

1.2.5 Technical Complexity

This is a large earthworks project capably undertaken by a number of Bay of Plenty and Waikato contractors. Scheduling of the work and isolation of the earthworks from sensitive environments will be the most important techniques to minimise the environmental effects.

Excavation for the culvert structure and its placement will be below water levels and in a location where water flows constantly. This will require some form isolation and dewatering.

Excavation below water is required to re-shape and deepen Ford's Cut and the existing river loop and to dig the new inlet channel. This will require careful thought to minimise cost and time and suspended sediment.

1.2.6 River and Tide

The worksite is beside the river and estuary and is subject to the usual water level fluctuations caused by the tide and flows in the river. These range from twice daily tidal fluctuations to less frequent flood and sea rise and falls.

There are some existing water takes for domestic supplies and farm animals that need to be considered.

The works will affect the existing stopbanks which form part of the Kaituna River Catchment Control Scheme. Where this occurs, some form of flood protection must be maintained at all times.

1.2.7 Public and Private Access

The work will occur on land owned by private landowners, the Crown and the local Territorial Authority (Western Bay of Plenty District Council). Agreements detailing land ownership, access, works, ongoing operations, maintenance, monitoring and review will be negotiated with each affected landowner.

Mr Allan Titchmarsh, on whose land the stopbank is to be relocated and on which the new inlet channel is to be dug, runs a dairy farm. Construction activities will need to accommodate his ongoing operations.

The construction of the new culverts under Ford Rd will require closure of Ford Rd for between 3 and 4 months and because there is no alternative route this must be well planned and advertised.

Whatever the season there is fairly steady use of the lower river, the mole at Te Tumu and the boat ramp at Mr Corbett's for recreation. Ford Rd averages 300 vehicle passes per day busiest from August whitebait season through till autumn.

The boat ramp on the property owned by Mr Boy Corbett is used by the public and any boat activity in the river during the work will create a conflict. There is an alternative boat ramp at Bell Rd and Maketu.

The mole (sea wall structure) at Te Tumu is well used by fisherpeople most of the year but more so in the warmer months.

1.2.8 Cultural and Archaeological Significance

The site of the works is culturally significant being the landing place of Te Arawa waka and the existence of the historical Te Tumu Pa site nearby. There is potential for archaeological finds and the Bay of Plenty Regional Council is applying for a Heritage NZ "Authority to Disturb", and will have cultural monitoring and accidental discovery protocols in place in case the works uncover finds of significance.

Part 2: Construction Activities

2.1 Post-letting formalities

Once a contract has been let there are formalities to complete which include conforming and executing the contract, arranging any bond and insurances and provision of drawings. In accordance with the consent conditions and the tender documents, the Contractor will prepare and submit a program, a quality plan, an environmental management plan and a health and safety plan. These plans will be submitted to the Regional Council for comment and approval.

There are other pre-construction tasks to be completed such as final land access arrangements, temporary fencing, signage and publicity. Concurrently the contractor will finalise his work force and source his equipment and materials.

The time period for this is generally in the order of 4 to 6 weeks.

This activity is obviously not weather dependent and has no adverse environmental impact to manage.

2.2 Establishment

Immediately prior to the contractor taking possession of the site of work it is appropriate that a blessing is undertaken. Establishment on site will then commence of the contractor's offices, telecommunications, power and water supplies, canteen and ablution facilities, secure storage areas and storage areas for fuel, materials, vehicles and equipment. Temporary fencing will be erected around some areas and other areas will be signposted as a construction site. Some form of security is also envisaged.

The areas that can be made available to the contractor for their establishment area are constrained by:

- the need to close Ford Rd for ten weeks while the new culverts are installed
- the existing boat ramp and parking area on Mr Corbett's land
- the tourism business and other recreation activities undertaken by and on Mr Corbett's land
- the farming operations of Kaituna Pastoral farms Ltd (Mr Titchmarsh)

A piece of Mr Corbett's land has been identified for the contractor's site. The owners and leasee of the land have been approached (Figure 2; Drawing Sheet 19). Presently there is a willingness from them to continue discussions to provide this land for the contractor's temporary use.

2.2.1 Environmental Effects

Arrangements to protect the safety of the public will be required at the commencement of the establishment period. Access can still be provided for the 3 commercial users, the recreational boaties and the coastguard with safety controls including speed restrictions, safety fencing and signage. At times they will be required to use the ramps at Bell Rd and Maketu.

Safe access will also be provided to the adjacent landowners (Mr Allan Titchmarsh, Mr Boy Corbett, Mr Alan Brain (and fellow trustees) and Trustees of Papahikahawai Island).

Ablutions for the contractor can consist of regularly service portaloos or arrangements can be made with the landowner to use their existing tourist facilities. There is no requirement for treatment or disposal to land.

There will be a few weeks when traffic movements along Kaituna Rd and Ford Rd will be quite high as portacoms, equipment and materials are delivered by heavy vehicles. These roads are used on a daily basis between August and May by dairy tankers. Tanker access to Allan Titchmarsh's dairy shed will be maintained throughout. This will create safety issues and a noise and dust nuisance but these are short term, minor and can be managed with appropriate traffic controls, signage and water trucks.



Figure 2 Possible Contractor Establishment Area

2.3 New Culverts

The 21 new rectangular box culverts (2m square internal) will be pre-cast in short units off-site (1.5m and 1.0m long) and will be transported on heavy truck and trailers. There are 84 of these to be transported meaning approximately 20 truck and trailer movements to site where they will be unloaded by crane.

These 21 units will be installed alongside the existing, operating culverts (Figure 3; Drawing Sheet 14). Because the new units must sit on strong foundations at a depth approximately 2 metres below high tide the site will be protected with sheetpiling. Piles will be driven into place using conventional crane and driving equipment. Within the area protected by the sheetpiling the ground will be excavated down to the design foundation level. When the water table is reached, the foundation zone will have to be constantly dewatered using a trash pump that will pump the water into ponds on Mr Brain's Land to the north. Timber foundation piles will be driven and the excavation backfilled with gravel and overlaid with concrete to create the foundations. Culvert units will be placed and the upstream and downstream concrete aprons constructed.

The material excavated out from within the sheetpiling is likely to consist of strong rockfill, used to construct the original causeway, over softer silt and sand. The stronger material will be stockpiled on the north side of the culverts for later use in the parking area fills. The wet silt and sand will be used for contouring of the proposed wetland.

After sections of the new causeway are completed the sheetpiling will be removed. The new culverts will be locked closed until all works are complete. This will help control the spread of suspended sediment from other works and their opening is a key requirement in the commissioning section of the Environmental Management Plan. At the southern end of the culverts on the west side, a platform will be cut in the existing causeway with a ramp to allow digger access for log removal.

After the culverts are completed and before Ford Rd is permanently realigned, there will be need for some temporary fill to maintain the road connection.

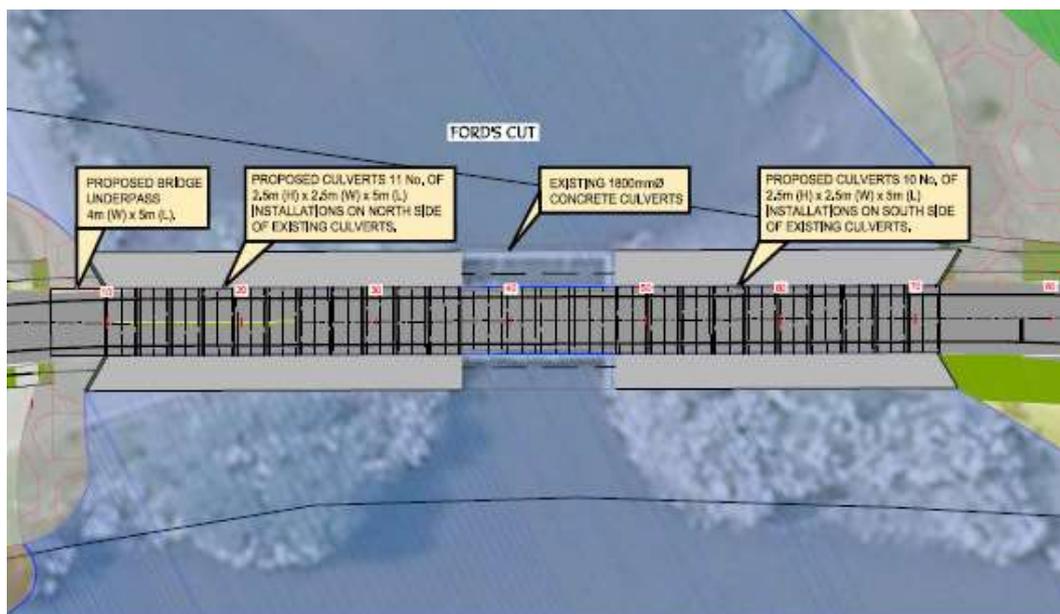


Figure 3 New Culverts

2.3.1 Environmental Effects

For the duration of these works Ford Rd will have to be closed to the public. The expected duration is 10 weeks. This has been shown in the programme to occur during September and October prior to the high summer recreation use time but during the whitebait season. The effect of this is to prevent access to 230 metres of

river bank along which whitebait run (from the river mouth at Te Tumu up to the first bend in the river). This is considered to be a less than minor effect in consideration of the remainder of the river that will still be accessible. If this is conflict is unacceptable the construction programme will be adjusted accordingly or access can be provided along the southern shoreline of Ford's Cut. Throughout these works water will be able to flow through the four existing culverts as usual – the sheetpiling will only isolate the new culvert locations.

The material excavated from within the sheetpiling will be transported to Mr Brain's Land. There will be about 3,000m³ of sand and gravel for later use and a similar amount of silts and sands that will be used for wetland contouring.

The groundwater pumped from the excavation site will be piped across and discharged onto Mr Brain's Land into soakage areas. The whole area of this low lying site can be used for this water disposal by either retaining the perimeter stopbanks or if they are removed/breached then the drainage channels could be blocked to prevent water entering the estuary.

The boat ramp at Mr Boy Corbett's will be open for use during these works.

2.4 Construct New Titchmarsh Stopbank

A new stopbank approximately 600 metres long will be constructed to a height of approximately 3 metres to the south of the existing stopbank. This will allow construction of the new inlet channel while maintaining the existing flood protection for the farmland. The new stopbank can be constructed concurrently with the culvert construction and the rock for the rip-rap lining can be carted onto site.

The inlet location of the new diversion channel has been selected to maximise the freshwater diverted from the river. Its exact location downstream of the bend was chosen to maintain the alignment of main river channel and to minimise floating debris entering the new channel. A second location option, just upstream on the outside of the bend, is currently being investigated as it avoids destruction of valuable wetland. Two options were considered for the alignment of the channel – either through the wetland along the northern edge of the existing stopbank, or through the pasture land along the southern edge of the wetland. The selected option is through the pasture land because it avoids major destruction of wetland and is technically easier to build and of lower cost. It does however require relocation of the existing stopbank approximately 90 metres to the south (Figure 4; Drawing Sheet 13).

In this location there are some existing services that have to be relocated (power, water supply lines) and some to be avoided (effluent irrigation line). The grass and topsoil will be stripped from the foundation area and windrowed to form a stormwater run-off retention bund along the southern edge of the new stopbank toe. The new stopbank will be built using materials from along the line of the new channel. These materials are expected to be silts suitable for immediate spreading, moisture conditioning and compaction in the new stopbank.

The new stopbank will have a crest level of RL 3.2m, a crest width of 3 metres and side slopes of 1 on 3. It will be constructed in accordance with specifications agreed with the Natural Hazards Group of the Bay of Plenty Regional Council. Except for the tie-ins with the existing stopbank, there is enough material in the Titchmarsh paddock between the southern toe of the existing stopbank and the northern toe of the new stopbank to construct the new bank. At the tie-ins two alternative exists with approval of the Natural Hazards Group – use of material from the existing bank, or import new material. The recommended option will be identified after due consideration of the risks of flooding during construction and prior to work commencing.

The stopbank will be covered with the topsoil from the windrow and re-grassed and planted with shallow rooting, low growing native plants.

At the commencement of the de-construction of the existing stopbank, soil fill will be used to access the location of the new channel inlet across the wetland. The fill will be used to create a working platform on what is very wet land. Once the platform is created an excavator will dig out the required inlet shape and line it with rockfill. The excavated fill will be carted away from the flood zone, spread on the Titchmarsh land in thicknesses of up to 500mm and covered with topsoil.

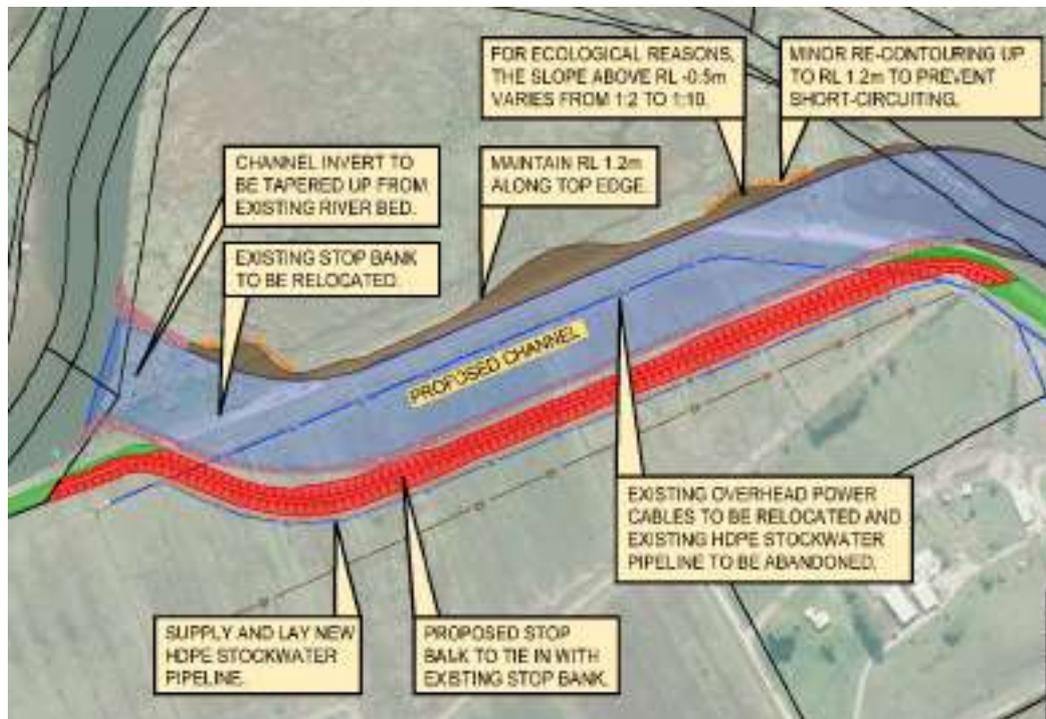


Figure 4 New Titchmarsh stopbank and new channel alignment

2.4.1 Environmental Effects

It is estimated to take 8 weeks to build the stopbank including stripping of topsoil, foundation preparation, excavation, carting, filling, compaction and then replacement of the topsoil. Grass will be sown but may have to be repeated in the autumn if the summer is dry. Full flood protection will be maintained by the existing stopbank for this period *except* for when the tie-ins are made at each end. These final works are of short duration (few days) and will be undertaken when fine weather is forecast and agreed with the BoPRC Natural Hazards Group.

Other construction effects of sediment laden runoff, noise, dust and traffic are all confined to the work site and can be controlled by use of appropriately muffled equipment and hours of work, signage and traffic controls and water carts. The stopbank site is surrounded by pasture.

The excavation and construction of the inlet will occur at the edge of the flowing river – there is no alternative to separate this work site from the river. This will take approximately 1 week during which sediment plumes will be seen in the river.

Importation of rock for the rip-rap lining of the new channel bank will occur over September October to avoid the summer recreation period and Mr Corbett's high tourism season. There will be approximately 100 truck and trailer loads to come in down Ford's Rd, across the front of Mr Corbett's property and stockpiled on Mr Titchmarsh's land. Appropriate safety, dust, noise and hours of work controls will be described in the Environmental Management Plan. Pre and post-carting inspections of Ford Rd will be undertaken with Western Bay of Plenty District Council so that remedial works can be quantified and agreed.

The boat ramp at Mr Boy Corbett's will be open for use during these works but care will be required as trucks deliver the rock for the channel lining.

2.5 De-construct Existing Stopbank

Once the new stopbank has been completed to the satisfaction of the Natural Hazards Group of BoPRC, the existing stopbank can be de-constructed. This good quality material of approximately 20,000m³ will be carted in trucks past Mr Corbett's and over the new culverts and used as fill to build the new carpark for the boat ramp (see Figure 5).

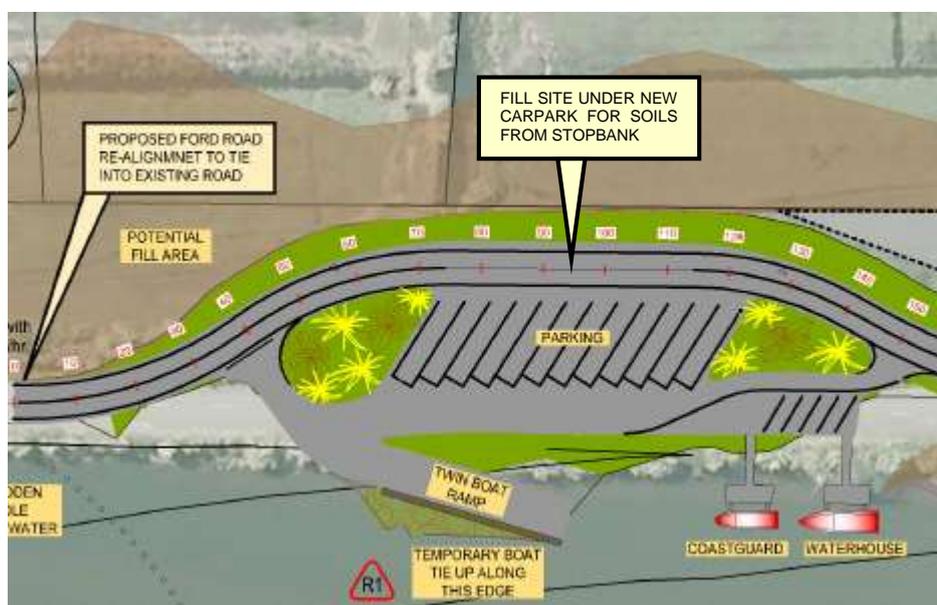


Figure 5 Fill Sites for material from existing stopbank

2.5.1 Environmental Effects

It is estimated to take 8 weeks to remove this bank. Approximately 1,000 truck and trailer loads will travel from the Titchmarsh land, across the front of Mr Corbett's and over the culverts to the fill site for the road and parking areas. This is programmed to occur in October, November and early December.

This will be a noisy and dusty operation using heavy vehicles. Appropriate safety, dust and noise controls will be applied.

The fill site drains to flat pasture land with no or little risk of sediment entering water ways. Where the risk does exist, use will be made of low height soil bunds and silt curtains.

The boat ramp at Mr Boy Corbett's will have to be closed during these works because of the high number of truck and trailers passing this location. Extreme care will be required on Ford Rd where these trucks interact with public traffic.

2.6 New Channel

Working from downstream to upstream, using the pre-stopbank foundation as a platform, the new channel will be excavated (Figure 6; Drawing Sheet 2). A small section will be left temporarily at both the upstream and downstream ends to contain the suspended sediment. The excavated material will be trucked to the future parking area adjacent to Ford Rd and used as fill. There will be about 15,000m³ of material to shift which will take approximately 4 weeks.

At the same time the southern bank of the new channel will be lined with rock rip-rap.

There will be a 5 metre wide berm between the top of the southern bank and the toe of the new stopbank at a level to encourage inanga spawning.

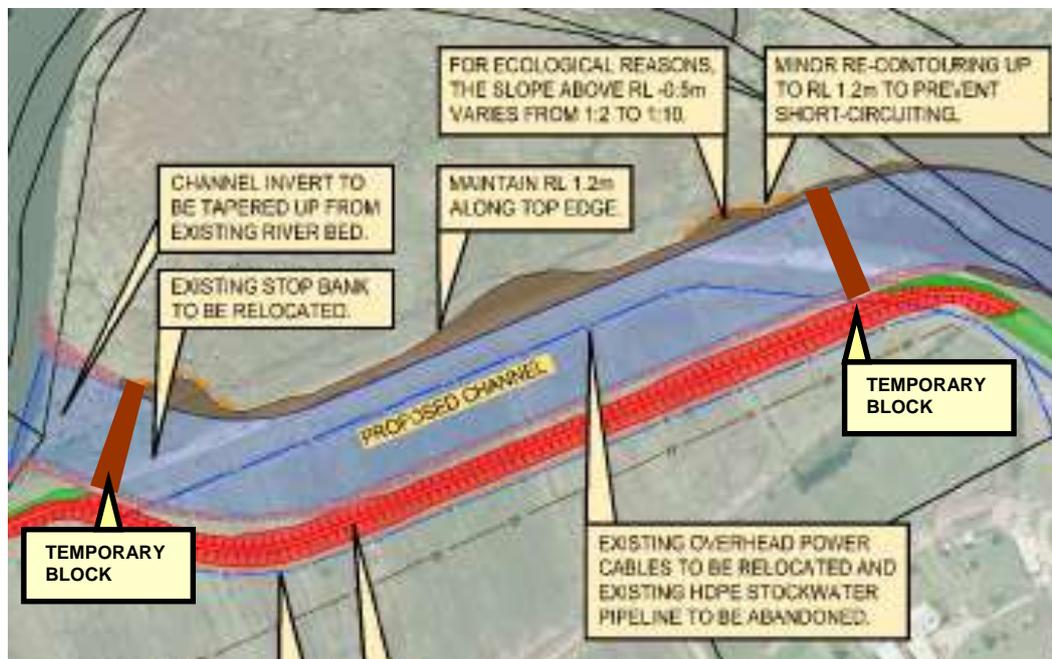


Figure 6 New Diversion Channel showing un-excavated land at each end to contain suspended sediment.

2.6.1 Environmental Effects

The excavation is well contained within no-flowing water and will not create a suspended sediment problem. Sediment laden run-off from the paddock fill site can be controlled by keeping the fill higher on the edges and surrounding the site with silt fence.

The boat ramp at Mr Boy Corbett's will have to be closed during these works because of the high number of truck and trailers passing this location. Extreme care will be required on Ford Rd where these trucks interact with public traffic.

2.7 New Moorings, Parking Area, Boat Ramp

After the new culverts have been placed and while the Titchmarsh stopbank works are underway, construction can commence on the new boat ramp and moorings (Figure 7; Drawing Sheet 3). Then, once fill starts to arrive from the stopbank site, the carpark and Ford Rd structural fills can commence.



Figure 7 New boat ramp, moorings, carpark and realigned Ford Rd

The purpose of this activity is to get the major structural earthworks and the two moorings completed first and outside the busy traffic times of the summer season. The rest of the work (final shaping, sealing, facilities can be done at any time).

The boat ramp will be constructed by re-shaping the channel side and re-arranging the existing rockfills. Some additional rockfill will be imported concurrently with that required for the new channel lining. Some dredging of the river channel is required to be sure the two moorings have adequate depth. This will be undertaken with a shore based excavator reaching out into the channel and will take about 2 to 3 days. Dredgings will be placed on Mr Brain's Land against the Ford Rd embankment. Concrete will be laid to form the wet section of the ramp and roading gravel will be used for the dry section and the carpark (for later sealing).

The moorings will be created with driven timber piles and the jetties and gangways will be proprietary floating units. Adequate space will be created for the Coastguard and commercial fisherman shore facilities (container, loading and carparking).

2.7.1 Environmental Effects

It is estimated to take 6 weeks to construct these works during which the public can continue to use Ford Rd with care but the boat ramp at Boy Corbett's will have to be closed for safety reasons.. Once completed the moorings can be occupied by the Coastguard and the commercial fisherman for their uninterrupted use. It is planned

these works are completed before the Christmas holiday period to avoid the high vehicle numbers using Ford Rd.

After the Christmas holiday period, the road and carpark can be completed, at which time the public will be relocated to the new parking and boat ramp. Dust control using watercarts will be necessary over this time.

All the fill to be placed on the east side of Ford Rd will be on flat pasture land with no or little chance of sediment entering waterways. Where the risk does exist, low height soil bunds and silt fences will be used until the area is stabilised.

There will be sediment plumes entering the river when the boat ramp is constructed and when the river is dredged. This will be of short duration (days). Installation of wooden poles for the breakwater and the moorings will have less than minor effects.

2.8 Salinity Block

To prevent the estuary filling with highly saline water it is necessary to close the existing channel between Ford Island and Ford Rd, referred to as Ford's Loop Channel (Figure 8; Drawing Sheet 15). This closure is referred to as the salinity block because it prevents highly saline water from Te Tumu entrance entering the culverts. The bulk of the material for this block will come from the widening of Ford's Cut. It will be trucked the short distance, crossing Ford Rd in one location and pushed into the river channel. These soils will be supplemented with soils from the new channel and some dredgings.

At the northern end the proposal is to construct a permanent rockfill to act as a containment bund with a crest level above spring high tides. At the southern end of the channel a permanent, low height, rockfill toe will be pushed across the channel to provide containment. This will have a crest level at approximately low tide level. The weak fill will be placed at the northern end behind the rockfill and pushed out into the river and then to the south down to this toe to create a gently sloping surface. It may be that the southern rockfill has to be constructed with a temporarily high crest to enable the construction to occur. The rockfills will be graded appropriately, or use made of filter fabric, to prevent migration of fines from the fill through the rock to the river.

Upon completion, the fill above water line will be shaped as much as the practical to form walking access to Ford Island and the substrate of a wetland.

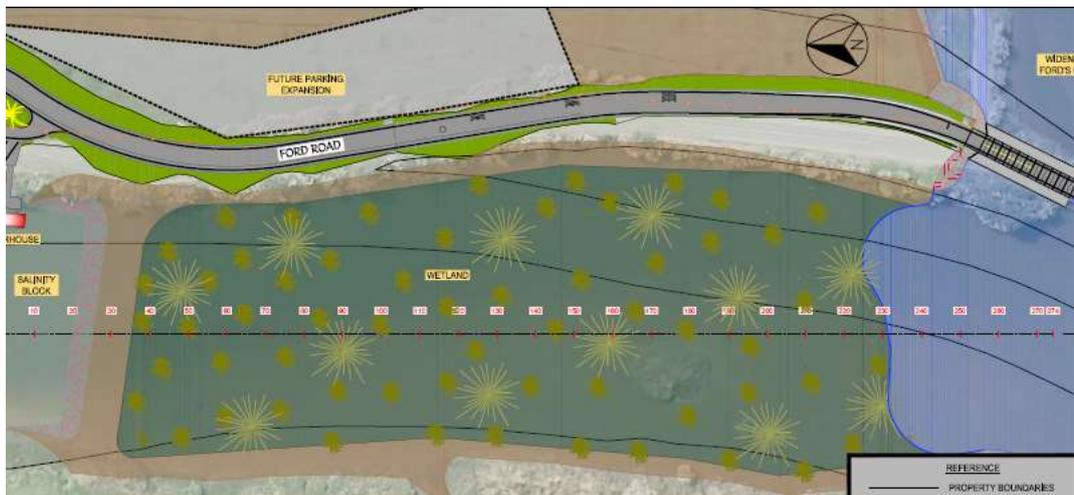


Figure 8 Closure of Ford Loop Channel showing salinity block and wetland

If agreement can be reached with Ford Island owners the access to Ford Island will be constructed to provide vehicle access – however this will require an engineered and stronger fill e.g. using more Rockfill and gravels.

2.8.1 Environmental Effects

The environmental effect to be managed during this operation is that of suspended sediment in the river channel and the resulting plumes into the river, out through Te Tumu and also through the culverts and into the estuary. As the fill is pushed into the river it will require containment at each end of the channel, particularly the northern end where it must not encroach on the recently completed moorings, hence the Rockfill toes.

To minimise the plumes into the river and through Te Tumu, silt curtains and silt screens will be deployed¹ across the channel between the boat moorings and the rockfill location (Figure 9). These curtains will also be placed at the eastern end of Ford's Cut to prevent suspended sediment entering the estuary. These use a series of floats on the surface, and a ballast chain or anchors along the bottom. Silt curtains are made from impervious material such as coated nylon and primarily redirect flow around the dredging area rather than blocking the entire water column. Silt screens are made from synthetic geotextile fabrics, which allow water to flow through but retain a fraction of the suspended solids. If necessary, to further reduce sediment release into the river and out through Te Tumu, this work will be undertaken on an incoming tide. Once the northern Rockfill has been placed the potential for suspended sediment to enter the river will reduce.



Figure 9 Example of silt screen

Once the new boat ramp is operational and once work commences on placement of the salinity block the boat ramp at Mr Boy Corbett's will be closed to the public.

¹ <http://www.epa.gov/greatlakes/arcs/EPA-905-B94-003/B94-003.ch4.html#RTFTtoC90>

2.9 Improve Ford's Cut and Deepen River Loop

The channels in these locations need to be deepened and in the case of Ford's Cut, widened (Figure 10, Drawing Sheet 16). These operations are required to improve the flow capacity of the existing river loop upstream of the culverts and of Ford's Cut and will take about 10 weeks. This will be undertaken using a combination of barge mounted excavators, land based excavators and suction dredges. No excavation will occur on the southern bank or channel edge that might compromise the integrity of the existing stopbank or rock erosion protection.

The northern bank of Ford's Cut will be shaped to create habitat and, in conjunction with the landforms for the wetland, low height contouring will be shaped to prevent direct flow of the water from Ford's Cut entering the wetland. The works here are to strike a balance between water velocities low enough to allow marsh establishment around the edges but high enough in the low-lying areas to help flush away algae. The bulk and form of these works will be described in the Wetland Creation Strategy and Plan.

Suitable excavated material from Ford's Cut (approx 40,000m³) will be transported to fill Ford Loops Channel (described above). Excess material will be placed around the perimeter of and over the Brain land shaped to create the proposed wetland. Excavated material from the river loop deepening (approx 13,000m³) will be used to supplement the fill for the salinity block and the remainder placed as ground raising fill on the Titchmarsh land.

The excavated materials will be wet and weak and will be placed on flat ground at shallow angles and allowed to dry as much as possible before final shaping. Sediment laden runoff will be contained behind low height bunds and silt curtains.

Rockfill will be placed around Ford Island and around the nose of the Corbett No2 Fill on the south bank and the log deflector built (Figure 11).

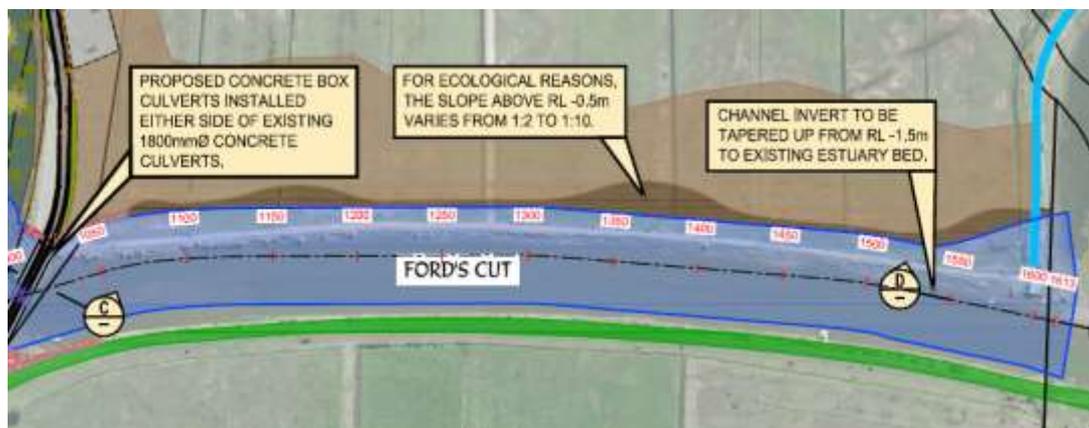


Figure 10 Ford's Cut widening and deepening

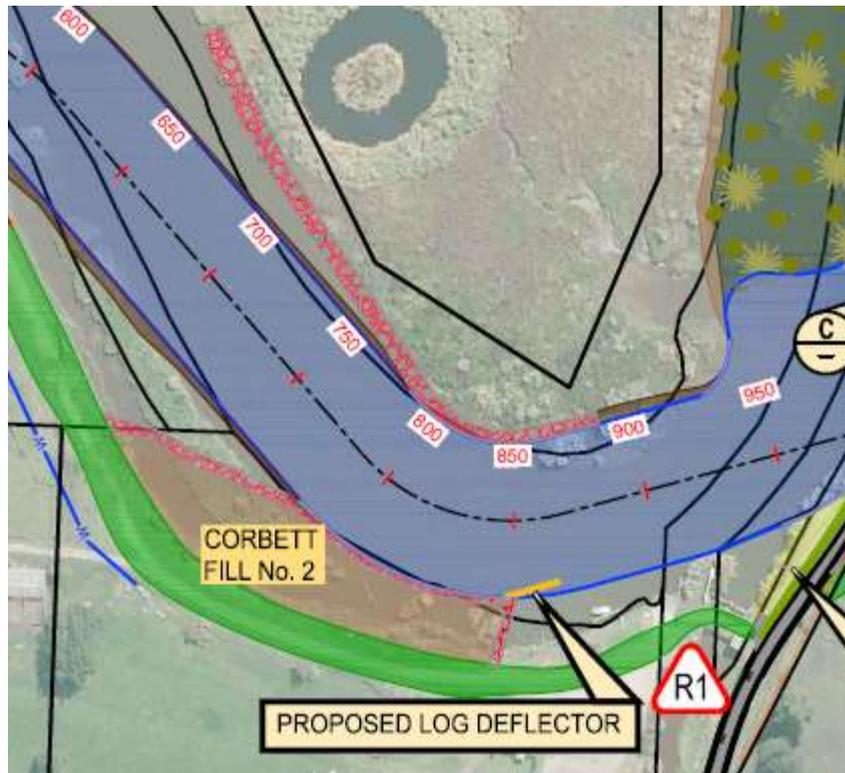


Figure 11 Deepen existing river loop, fill Corbett land, protect with rockfill

2.9.1 Environmental Effects

Excavation in Ford's Cut and the existing river loop will create suspended sediment in the channel and estuary. Because Ford's Loop Channel has been blocked by this stage there will be no flow of suspended sediment into the river. For the same reason there will be no flow of water from the river through the culverts into Ford's Cut. Flows in and out of Ford's Cut and the existing river loop will be subject only to tidal flows in the upper estuary which are very slow.

It is proposed to use silt screens and curtains and these will be installed at the estuary end of Ford's Cut. These were considered more effective than blocking the channel completely with a fill barrier (cofferdam) which will create its own suspended sediment plume during both construction and removal. Also a coffer dam makes it more difficult to manage the flows from the Ford Rd drain and pumpstation which will need to continue throughout the works.

For a brief period there will be sediment plumes produced in the estuary where the tapered, improved connection is made at the eastern end of Ford's Cut and the estuary. This will be of short duration (days) and can be undertaken on incoming tides to minimise plume travel distances.

Sediment laden water running from the excavated material as it is transported to the loop fill will be directed by use of appropriate ground slopes to Mr Brain's Land. This will flow down on to flat land and be contained by the existing contours. Drains will be blocked as necessary to prevent runoff into the estuary.

The timing of the deepening of the existing river loop has been considered in relation to the use of the water by Mr Corbett's tourism business. Their high season is February and March. The programme currently shows this work beginning in early March. Access might be provided along the stopbank on south side of Ford's Cut to

Mr Corbett's business operator for tourism purposes so they can still access the estuary. As the project becomes more certain these dates, and others, will be the subject of discussions with stakeholders.

2.10 Brain Stopbanks and Causeways

A temporary culvert will be installed through the causeway from the Brain land to Papahikahawai Island to improve flushing of waters from the western end of the estuary and still retaining vehicle access to Papahikahawai Island.

The two causeways in Papahikahawai Creek from the island to the Maketu spit and the stopbanks around Mr Brain's Land will be removed early in the project. Early removal will provide immediate benefit to the lagoon by allowing flushing of poor quality water and accumulated algae and anoxic organic material. The causeways will be removed by excavator and the underlying estuary bed level will be matched to the estuary bed level of RL0m either side within the reach of the excavator. The excavated materials will be either used for erosion protection on the south shore of the island or spread on the island for re-contouring, grassing and planting. The proposed new bridge will be constructed at the same time.

The Brain stopbanks will be flattened with bulldozers, recontoured and planted.

The causeway between Mr Brain's Land and the island will be removed once all works are complete on Papahikahawai Island. The top, drier materials will be cut off and carted and stockpiled on the island for future remediation if agreed with the landowner. The lower wetter materials will be cut out with an excavator and the material used on the adjacent land to fill drains and contour. This will be removed using long and short reach excavators loading trucks. The work will proceed from east to west along the causeway and the underlying bed level of RL0m to 0.5m will be shaped to match estuary bed levels.

2.10.1 Environmental Effects

Any excavation of the existing stopbanks around the Brain property will be shaped to shed water away from the estuary and back into the lower land. Any drainage channels to the estuary will be blocked. The same technique will be applied to the removal of the causeway to Papahikahawai Island as far as practical. However there will come a time when the removal of the final materials below high tide level will be below water. At this time there will be discharge of suspended sediment and other contaminants (bacteria/faecal material, vegetation, and nutrients) that will travel with the tidal flows. The duration of this discharge is short (days) and will be minor and will dissipate quickly.

2.11 Papahikahawai Island Works

The work on Papahikahawai Island aims to satisfy the landowners desire to prevent further loss of their land along the southern edge with the estuary and if possible to recreate the wetlands lost over the years in this location. The work is shown on Drawing Sheet 20 and can be split as follows:

1. Initial work
2. Ongoing work subject to monitoring
3. Environmental enhancements jointly proposed by the landowners and supported by the Bay of Plenty Regional Council's Land Management Group. These works are the subject of a Biodiversity Management Plan (BMP) currently in preparation. The Plan will describe various land management initiatives to improve the

environmental values of the property. These initiatives focus primarily on retirement of land from farming, replanting with native vegetation and pest control. The BMP is being prepared so that it is consistent with the rediversion and wetland creation project.

2.11.1 Initial Work

- Removal of the causeways that link Mr Brain's Land to the island and those that link the island to Maketu Spit (as described in the sections above).
- Construction of a small bridge for foot and appropriate light vehicle such as ATV traffic from the Maketu Spit to the island. This will be a piled timber structure designed to clear flood levels in the Papahikahawai Creek at a soffit level of RL 2.0m.
- Appropriately located breaches in the bund (details agreed with landowners) to restore hydraulic connectivity with the estuary and to enhance wetland recovery behind the bund, while initially maintaining the protection provided by the bund. These breaches would initially be small and would be monitored – so they can be modified (or even closed) if issues arise.
- Stockpiling on the island near the southern shoreline, but above RL 1.5m, of materials suitable for future potential erosion control e.g. coarse sand.

2.11.2 Ongoing Work

- Maintenance of the existing bund/stopbank along the southern shoreline to maintain erosion protection to areas further landward (at least until uncertainties around erosion are resolved and/or other more appropriate solutions have been developed). This maintenance may include periodic placement of sand along the seaward face if required to offset aggravated erosion (the erosion monitoring will have a trigger, agreed with the landowners, for any such intervention). The sand will stockpiled during the initial work.
- Significant or even complete removal of the bund at a later date – subject to outcomes from monitoring and trials and to agreement of the landowners

If it is desired to restore wetland vegetation seaward of the bund, then other activities, in consultation with the owners and project ecologists to maximise the ecological and cultural benefits while minimising any adverse environmental effects, may include:

- Placement of appropriate sediment over part of the intertidal flats to lift bed levels to required elevations for the vegetation communities being restored
- Placement of appropriate sediment to form chenier island type features (Figure 13) (for reasons related to wetland recovery, retention of placed sediment, providing habitat diversity, wave shelter, erosion protection, etc)
- Use of other natural features or vegetation as appropriate to assist wetland recovery (e.g. shelter, erosion protection) or provide erosion protection



Figure 13 Typical chenier

2.11.3 Environmental Effects

The desired materials will be coarse sand with very low silt and mud content to provide the erosion protection required and to hold the desired forms of the banks. There is potential for some sediment to be released into the estuary waters and this will be minimised by spreading and shaping during low tide when there is no water present. The water velocities are not high and sediment plumes will not travel far and will soon settle. Dirtier water is probably produced at present by southerly winds creating wave chop in the shallow water.

2.12 Lower Kaituna Wetland Management Reserve

The Project results in decreased water volumes entering the Reserve particularly during summer low flows. The estimated reduction is approximately 11,000m³ per tidal cycle and represents about 10% of the volume and is a significant amount for this sensitive environment. This has been discussed with DOC and Fish and Game and to mitigate this reduction it is proposed to install an additional culvert to allow more water to flow under gravity from the river to the wetland. The exact location and size of the culvert is yet to be agreed with DOC, Fish and Game and the Natural Hazards Group of the Regional Council. It is likely to be at the upstream end of the wetland and be approximately 900mm in size. A trench will be dug from the river to the toe of the existing stopbank and through the bank. The culvert will be laid in the trench and backfilled and the stopbank re-constructed.

2.12.1 Environmental Effects

Work under and through the stopbank can be isolated from the wetland and river waters. Some sediment will be produced in the river and the wetland when the trench is connected. Erosion protecting gravels and rocks will be installed where required. The stopbank will be re-constructed as specified by the Natural Hazards group.

2.13 Open New Channel Inlet

After all excavation, filling and construction works is completed in Ford's Cut, the new culvert inlet structure, Ford's Loop Channel, the existing channel and the new channel, the downstream end of the new channel can be removed.

Following that, the inlet to the new channel at the western end can be opened up to the river allowing water to flow. This will be undertaken by excavators working off the fill platforms previously pushed out. Taking care to not disturb the previously placed rock rip-rap and channel entrance, the remaining land will be excavated and carted away. To complete the job the rock rip rap will be placed along the southern bank.

Initial water velocities in the new system will be lower than present because the flow will be controlled by the 4 existing culverts and the channels have a larger flow area.

The excavated material will be spread as additional overlay over the land to the south of the Titchmarsh stopbank.

2.13.1 Environmental Effects

Suspended sediment will be produced in the river adjacent to the work sites and will move with the tidal and river flows. However the durations are again short (5 to 6 days) and the silt curtains and screens can be left in place at the estuary end of Ford's Cut.

2.14 Commissioning and Staged Flow Increase

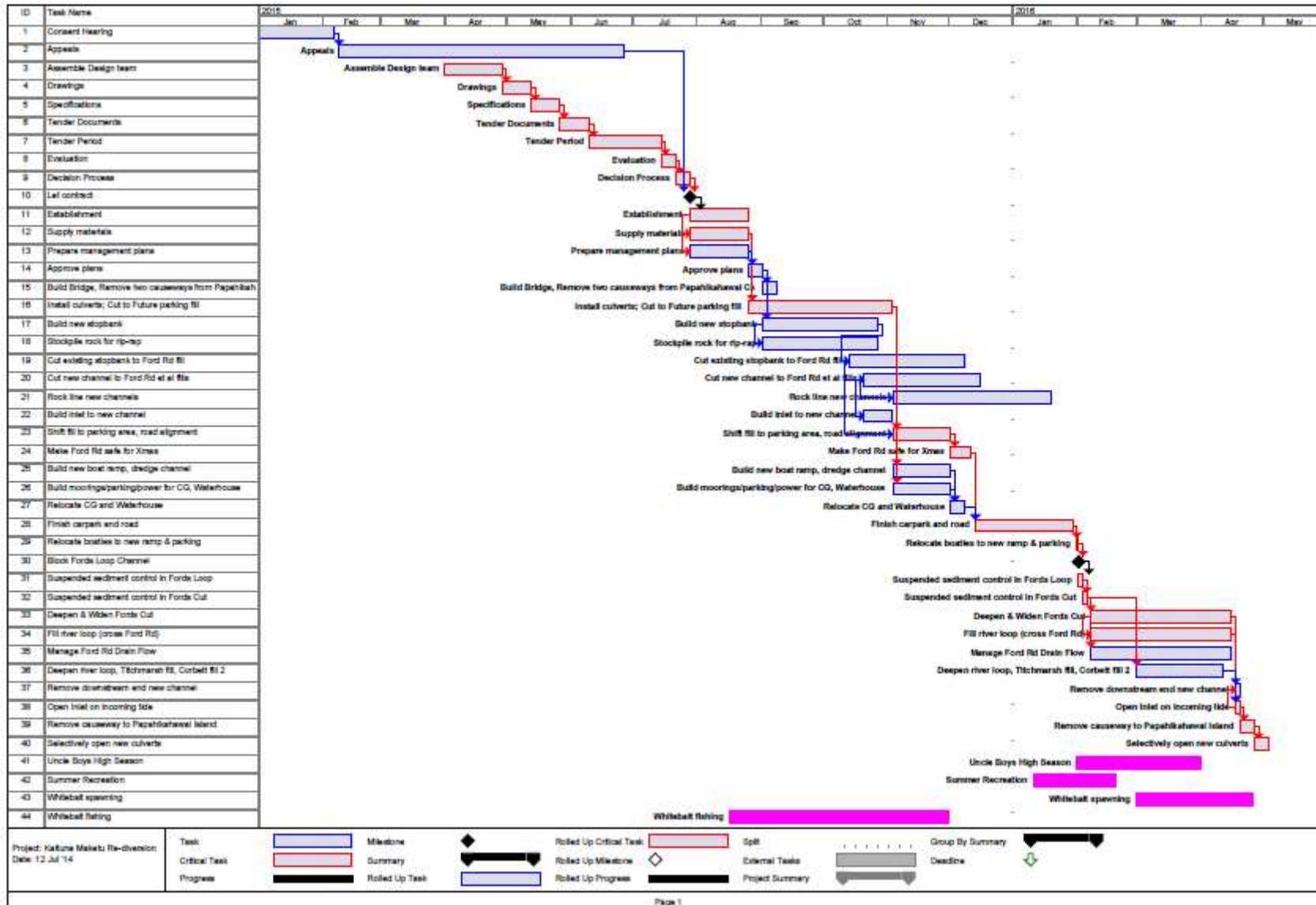
Prior to opening up of the final channel block, the Commissioning Section of the Environmental Management Plan will be prepared and agreed with the consent authorities. At the time water is allowed to flow again through the system from the river in the west to the estuary only the four existing culverts will be open. This will limit the flow rates to that experienced at present. Flow velocities will be low and so disturbance of sediments will be as low as practical.

Observations will be made of all critical areas and water quality will be monitored at various locations. As agreed with the Regional Council additional culverts will be progressively opened as any effects are observed and considered. The potential effects to be monitored include:

- Erosion and sedimentation in key locations – the new inlet, Te Tumu, Papahikahawai island, Maketu Estuary entrance, Maketu foreshore, the back of the spit, the flood tide delta, Ford's Cut
- Flow velocities at key locations – Maketu Estuary entrance, Te Tumu, the boat ramps, Papahikahawai Lagoon, the culverts, the new inlet
- Water quality – observations of clarity, algae distribution changes.
- Water levels – particularly at times of high flow, along the Maketu township foreshore and at the outlets of the gravity and pumped drains from the farmland.

Appendices

Appendix 1 Detailed Construction Programme



Appendix 2 Drawings
