EDGECUMBE RANGITAIKI PLAINS FLOOD MITIGATION PROJECT

Peter Askey, BE(Ag), CPEng, Opus Consultants

ABSTRACT

In July 2004 a 100 yr flood in the Rangitaiki River breached the main river stopbank upstream of Edgecumbe. Water overwhelmed the Reids Floodway and flooded 17,000 ha of farmland. Parts of eastern Edgecumbe were extensively flooded, the main Transpower substation isolated, State Highway 2 washed out and the Fonterra dairy factory flooded. Localised stormwater from heavy rain caused extensive surface flooding to the west of Edgecumbe.

Bay of Plenty Regional Council (BOPRC) and Whakatane District Council approached Central government for assistance and were invited to submit a joint business case with proposed solutions to mitigate flood risk. Studies identified a range of measures as being required including strengthening of stopbanks, increased flood pumping, localised stopbank raising to preferentially protect urban areas and key infrastructure and a doubling of floodway capacity. A particular feature of the area is the alluvial pumiceous soils which provide poor foundation conditions for stopbanks.

The first phase of the works is now substantially complete. This paper describes the features of the area, the works completed to date and those remaining. The joint cooperative approach of Central Government, Regional Council, District Council, community and key infrastructure owners to produce a comprehensive solution is discussed.

KEYWORDS

Edgecumbe, Rangitaiki River, Flooding, Stormwater

PRESENTER PROFILE

Peter is Principal Environmental Engineer based in the Opus Whakatane office. Peter has extensive experience with river management and stormwater related projects extending over 30 years. As owner of a dairy farm flooded by the 2004 Rangitaiki Flood he has a personal appreciation of the disruption and damage that a major flood brings.

1 INTRODUCTION

The Rangitaiki Plains cover some 30,000 ha of flat land between the Whakatane River to the east and the Tarawera River to the west in the Eastern Bay of Plenty. The Rangitaiki River traverses the Plains to the sea at Thornton. The Rangitaiki is a large river with a catchment area of 2,927 km^2 (Figure 1). The median flow is around 40 m^3/s at Te Teko. The current Q_{100} design flow is 780 m^3/s. The catchment is partly pumice country of the Kaingaroa Plateau and partly greywacke hill country of the western Urewera ranges. The river is dammed at three locations, the small Wheao and Aniwhenua hydro schemes in the south of the catchment and the larger Matahina Dam upstream of Te Teko.

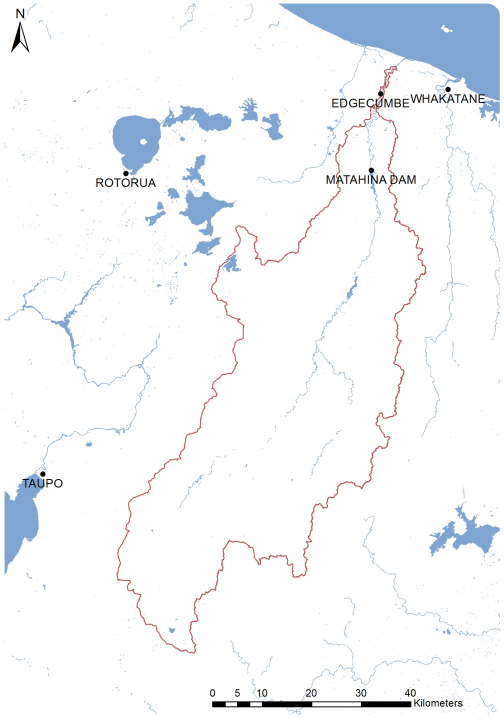

Figure 1: Rangitaiki Catchment Location Map

Where the Rangitaiki River crosses the Plains below Te Teko it is elevated above the surrounding land by natural levees. Some lower areas closer to the coast are below sea level with drainage impeded by a series of beach ridges which extend inland a considerable distance. An extensive system of river diversions, stopbanking, drainage canals and pumping schemes built over the last 100 years has enabled the Plains to be developed into a rich agricultural landscape supporting dairy farming and horticulture. However the land's origin as a large wetland is obvious as is its tendency to revert to its original condition.

The township of Edgecumbe (population 1700) is a service town for the surrounding rural area and the site of the Fonterra dairy factory. The town straddles the river. Originally established on the higher land beside the river, over the years it has expanded onto the lower land to the west. On the eastern side of the river a major substation for Transpower distributes electricity to the Eastern Bay; including the main feeds into Whakatane, Opotiki and the east coast as far as Cape Runaway.

2 DEVELOPMENT OF THE FLOOD CONTROL SCHEMES

2.1 THE RANGITAIKI RIVER FLOOD CONTROL SCHEME

While the stopbank scheme had its origins with land drainage around the First World War, the main development took place in the late 1960's. A series of floods, which caused extensive inundation of farmland on a regular basis, led to pressure for the development of a comprehensive flood control scheme. This was completed in 1972. The main features were extensive stopbanking and the establishment of Reids Floodway on the east side of the river. This was designed to spill water from the main river at a Q_{40} flow and return it to the river just upstream of its mouth at Thornton. The floodway had a simple weir overflow with no control mechanism.

The 1960's were a period of regular flooding in the Eastern Bay of Plenty, linked to the interdecadal oscillation. By one of those quirks of nature, the year the scheme was finished the oscillation went into a low rainfall phase. For the next 25 years there were only small floods in the river, and the Floodway was never used.

2.2 EDGECUMBE DRAINAGE

Stormwater for Edgecumbe was developed around the adjoining rural drainage canals. With the general fall away from the river the canals do not discharge directly to the Rangitaiki River. Land to the west drains via the Omeheu canal to the Tarawera River, while the east side drains to the Reids Canal in the floodway. The township has a simple layout of piped and open drains. Always somewhat challenged by drainage, Edgecumbe's situation deteriorated in this regard after the 1987 earthquake in which the land was lowered by up to 2m. Land which had previously drained under gravity to the adjacent Omeheu canal system has subsequently had to rely on pumping.

This exacerbated drainage and stormwater problems for the residential subdivisions which had been built, with hindsight perhaps unwisely, on low lying land over the previous 10-20 years.

3 FLOODING PROBLEMS COME TO A HEAD

3.1 1998 TO 2004

The benign period for flooding in the Rangitaiki catchment came to an abrupt end in 1998 with a flood of 464 m^3/s; a 15 year event. This was not sufficient to spill into the floodway but nonetheless did cause concern regarding stopbank stability at several locations. The flood hydrograph had a double peak and elevated water levels were sustained for 10 days. Road seal was heaving in Ngaio Place, and there was seepage at the stopbank toe behind the Transpower substation. Emergency action was taken to toe load the banks in the vicinity of the substation. Subsequently Environment Bay of Plenty (now BOPRC) undertook strengthening work on the stopbanks at several locations, including College Rd and the Fonterra dairy factory.

At the same time pressure was mounting on Whakatane District Council to address the on-going problems with stormwater in the southwest of Edgecumbe. An investigation was undertaken and a scheme based on a low ring bank to isolate the urban area from the rural drainage, and pumping of stormwater to the Rangitaiki River, was proposed.

However, 1998 was to provide but a foretaste of what was to come.

3.2 JULY 2004

The winter of 2004 was wet with an almost weekly series of low pressure systems bringing above average rainfall into the Bay of Plenty. This culminated in a large low pressure system in the second week of July. Three days of heavy rain across the entire catchment, already saturated from the previous storms, produced large floods in the Whakatane, Waioeka and Rangitaiki Rivers. Heavy rainfall was widespread across the Rangitaiki catchment from the headwaters to the Plains with 284mm of rain recorded at Edgecumbe.

By the Friday evening the local drainage system was already under pressure with extensive surface flooding and out of canal flows in a number of locations. With continued heavy rain overnight and Saturday the Rangitaiki River rose steadily and reached approximately the Q_{40} level of 610 m^3/s by mid-morning Sunday 18th July. Flow was just starting to spill to the Reids Floodway. A piping failure developed at Sullivan's Farm, 3 km upstream of Edgecumbe. The stopbank rapidly washed out and some 250-300 m^3/s flowed into the Reids Floodway, at least three times its design capacity. The floodway stopbanks overtopped and over the next day large areas of farmland were flooded. The Rangitaiki River peaked at Te Teko at 760 m^3/s, close to a Q_{100} flow.

The Transpower substation was flooded and only quick work by BOPRC staff and contractors, assisted by the washout of the State Highway 2 bridge over Reids canal downstream, averted a disastrous loss of power to the entire Eastern Bay of Plenty. Such a failure would have also cut power for stormwater and sewer pumping at a critical time for Whakatane and Opotiki. The Fonterra site was flooded, fortunately without major damage, and lower lying houses on the east of Edgecumbe were severely flooded. While the west side of Edgecumbe was spared a river breach, the accumulation of local rainfall caused very extensive flooding which entered a number of houses. River erosion came dangerously close to breaching the stopbank at Kokohinau on the west side of the river upstream of Edgecumbe. Ground was heaving in Edgecumbe itself. The general opinion afterwards was that if the river had not breached when and where it did, it would have breached the bank at College Road within Edgecumbe with catastrophic consequences for the town.

Photograph 1: Flooding in Edgecumbe and on the Rangitaiki Plains following the stopbank breach (foreground) at Sullivan's Farm

Drainage of the flood waters from the lower areas of the Plains took up to 3 weeks of sustained flood pumping (up to 20 tractor pumps running) and the innovative use of shipping containers as flood gates by BOPRC. Economic losses to farms and the township

were substantial. Central Government contributed $29M to recovery works resulting from flooding in the Eastern BOP. Subsequent economic analysis for the business case assessed the potential loss from a major flood to the Edgecumbe/Rangitaiki area at $35M, being direct damage to property and infrastructure and lost agricultural production.

Photograph 2: Reids Floodway looking south on Sunday 19th July with extensive overtopping both sides

The July 2004 flood event therefore exposed a number of weaknesses in the flood control and stormwater infrastructure. It also created the impetus to address these weaknesses.

3.3 THE 2004 RESPONSE

With both Whakatane District Council and Bay of Plenty Regional Council assets having suffered substantial damage, the Councils approached Central Government for assistance with clean up and repairs. Central Government, through Ministry of Civil Defence & Emergency Management (MCDEM), recognised the integrated nature of the problems. They asked the Councils to submit a joint proposal for flood mitigation and a supporting business case.

Opus Consultants were engaged by the joint councils to prepare an engineering options report.

4 THE PROBLEMS

Review of the 2004 event and an assessment of the existing flood control infrastructure identified a number of distinct but interrelated problems. These needed to be addressed holistically to achieve a comprehensive improvement to the level of flood protection for Edgecumbe and the Rangitaiki Plains.

4.1 RIVER BANK EROSION

The 2004 flood resulted in river bank erosion at a number of locations. At at least one of these, Kokohinau bend, this was severe and 2/3 of the stopbank width eroded before it could be brought under control.

4.2 STOPBANK STABILITY AND FOUNDATIONS

The Rangitaiki River scheme has a history of piping failures to stopbanks. In one case in the 1960's farmers and drainage board staff were sandbagging one of the lower river stopbanks when they noticed water coming up in the paddock some 200 m inland. They had only time to move vehicles and clear the bank before the failure had piped back to and breached the stopbank. The 2004 breach at Sullivan's Farm was a very similar case.

The root cause of these failures is the poor foundation conditions upon which stopbanks have had to be built. Foundations comprise pumiceous alluvium and soft silt and peat deposits (Figure 2). Ground conditions are highly variable and many buried flood channels from the main river lead into what would have been swamp lands. The stopbanks were largely built from local materials excavated from drains or the river berms and comprise silts and sands. Banks were largely built without specific foundation treatment or seepage protection, although some of the known weak spots were toe loaded. On-going settlement, compounded by liquefaction damage in the 1987 earthquake, may also have weakened banks.

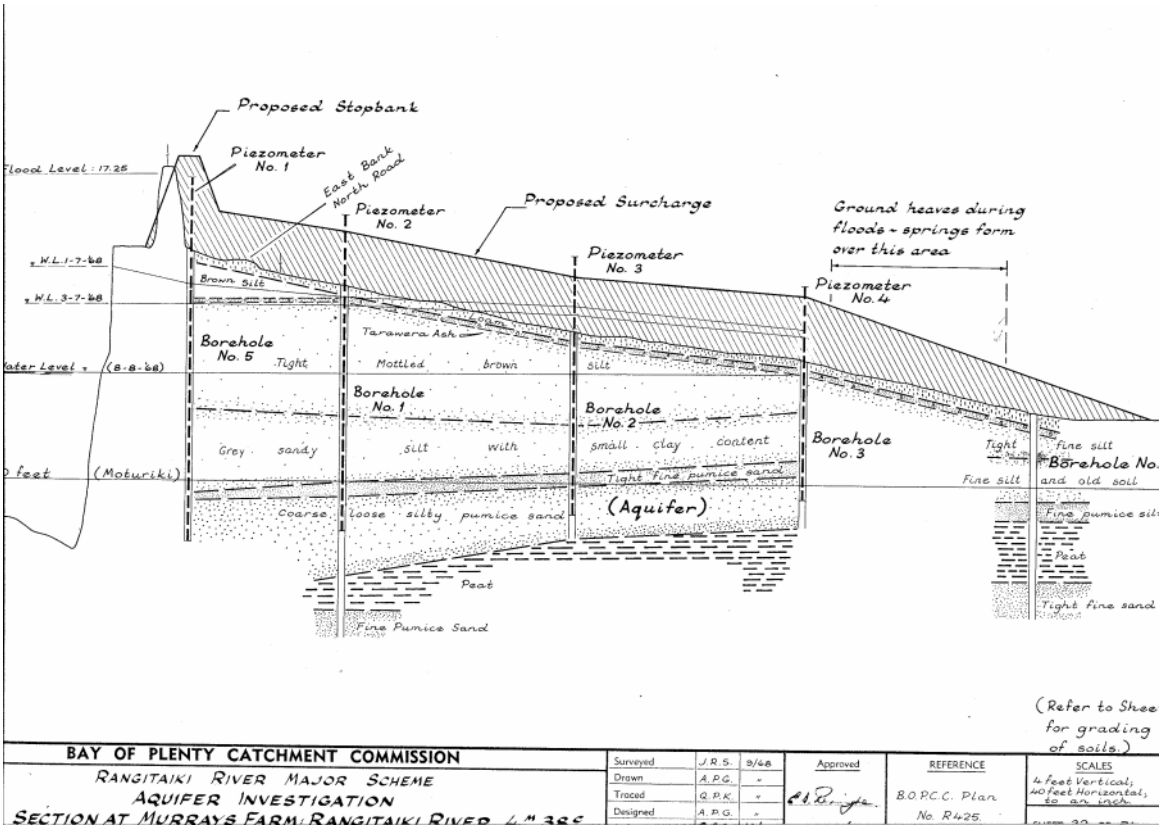

Figure 2: Typical river bank cross section (From Original Scheme Plans, 1968)

Clearly the structural integrity of the stopbanks and the foundations was a major issue that needed to be addressed.

4.3 FLOOD FLOW CONVEYANCE

The 2004 flood highlighted deficiencies in the conveyance of the river below Edgecumbe. Immediately before the Sullivan's breach, while the river had not yet peaked and was at approximately a Q_{40} flow of 610 m^3/s with spill flow only just starting, it was already on the point of overtopping at Law's Bend some 5 km downstream of Edgecumbe. A lack of conveyance in the lower river was known prior to 2004. This had been flagged in the Asset Management Plan as an issue that needed to be addressed, possibly by dredging.

The Reids Floodway itself had several factors constraining its ability to effectively contribute to flood passage.

Firstly, and most obviously, is the reduction in cross section over the lower 4 km of the channel. The first 7 km have a canal section, and a 200 m wide stopbanked Floodway. However, this narrows to only 40 m for much of the lower 4 km (Figures 3 & 4). This is understood to be the result of landowner intransigence at the time the Reids Floodway was built.

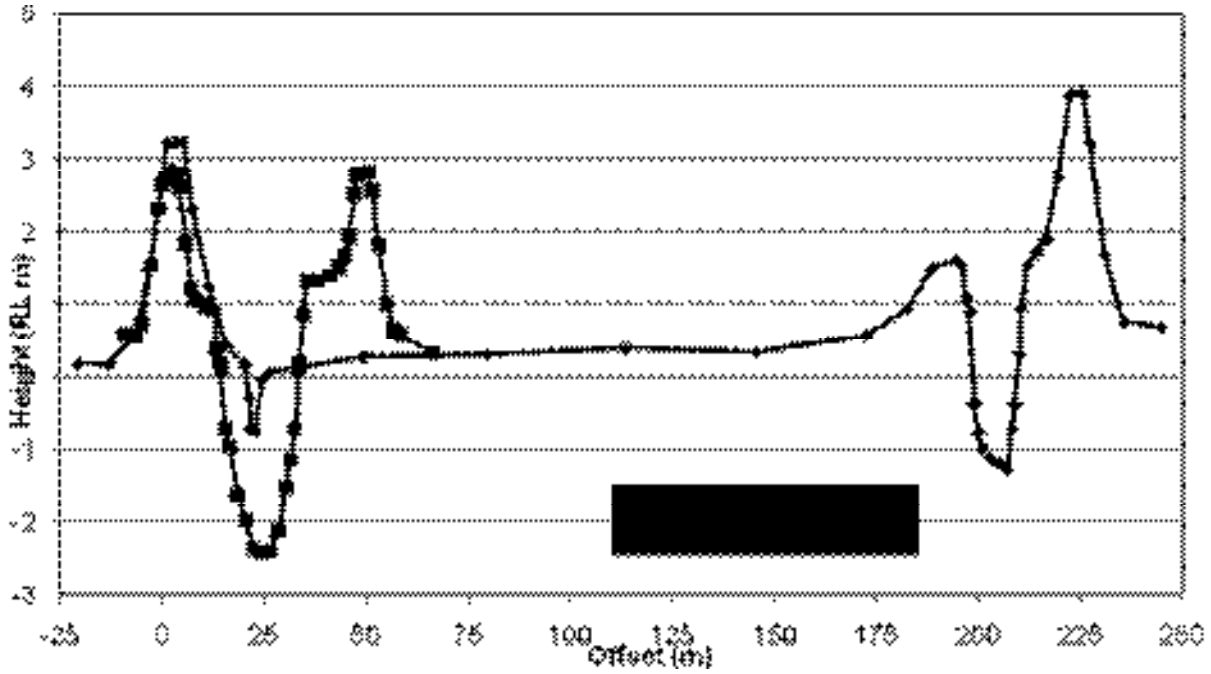

Figure 3: Reids Floodway Sections

Second, there was an offset of the floodway and severe constriction at the State Highway 2 road and rail bridges (Figure 4). The State Highway bridge itself is only 20 m wide. The 2004 flood flows showed little concern for the constriction and rapidly washed out the bridge approach, damaging the bridge in the process.

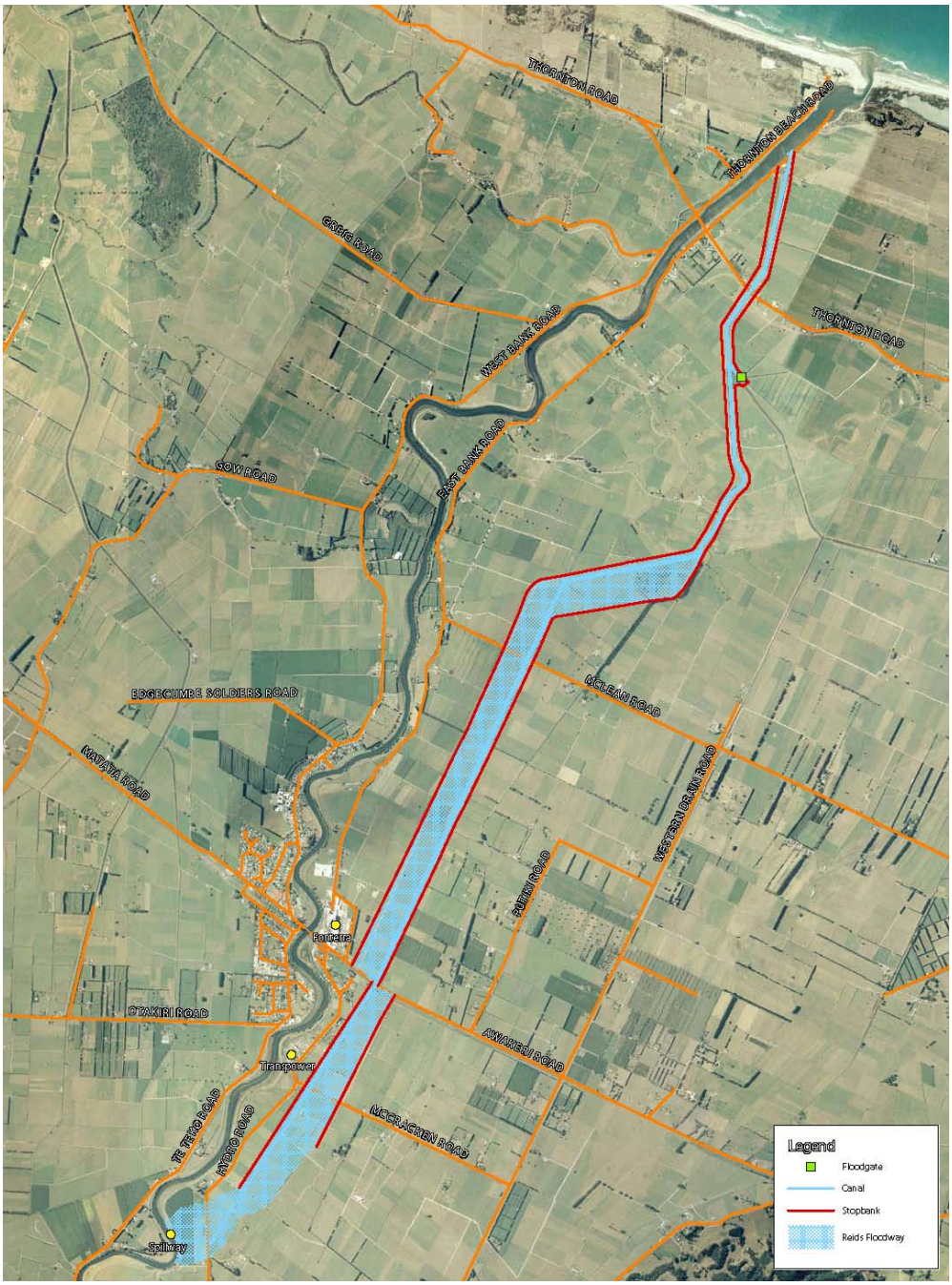

Figure 4: Reids Floodway Plan

Third, the spill into the Floodway is via a simple weir overflow (graded to match the main river profile). There is no control over flow into the Floodway. For example, flow cannot be spilled at a lower main river level to relieve pressure on banks (as would have been desirable in 1998). Also, flow cannot be restricted into the Floodway if there are problems with its stopbanks.

4.4 LOCAL STORMWATER SYSTEMS IN EDGECUMBE

Edgecumbe was relying on what was essentially a rural drainage scheme to provide drainage to urban property. Whereas ponding of water upon rural pasture land for up to 48 hrs is tolerable as a design standard, residents of urban streets become somewhat aggrieved when streets and gardens are under 200-300 mm of water for this long.

Ponding of stormwater in the lower parts of the township was also having serious impacts upon the sewerage system. It contributes to high levels of infiltration and direct inflow; a

problem compounded by the damage to the sewer from the 1987 earthquake, and on-going ground settlement of up to 10 mm/yr.

5 THE PARTIES

To develop a solution that would address all of the above issues required the involvement and 'buy-in' from a number of parties:

5.1 WHAKATANE DISTRICT COUNCIL

Whakatane District Council (WDC) has responsibility for the urban drainage and the overall roading network. Thus it is the lead party for the Edgecumbe township. The urban stormwater system then discharges on the town boundary into the rural drainage network managed by Bay of Plenty Regional Council.

5.2 BAY OF PLENTY REGIONAL COUNCIL

Bay of Plenty Regional Council (BOPRC) manage the Rangitaiki River and Drainage scheme infrastructure; including the erosion protection, stopbanks, drainage canals on rural land and rural pump stations that protect and service Edgecumbe. The assets are closely linked, with drains being managed by WDC on one side of a culvert and BOPRC on the other. WDC roads traverse Floodway land and also cross stopbanks.

5.3 NZTA

State Highway 2 (SH 2) runs across the Plains and crosses the Reids Floodway. The SH 2 bridge constriction meant that NZTA involvement was essential in the development of solutions involving the floodway. The existing bridge is under-width and unsatisfactory in any case.

5.4 TRANSPOWER

Transpower's major substation on the southeast of Edgecumbe is vital infrastructure for the whole Region. Following the close call with the substation in July 2004, Transpower initiated its own review of options for increasing the standard for flood protection to the substation.

5.5 FONTERRA

Fonterra is a substantial player in the scheme. Its Edgecumbe dairy factory is right beside the river. Their adjacent Awaroa farm extends over the Reids Floodway. Fonterra relies on large areas of the Plains for its waste disposal via an extensive network of pipes for whey irrigation, and it depends on the dairy production from the Plains.

5.6 OTHER INFRASTRUCTURE OWNERS

Both rail and natural gas have substantial assets that cross the Reids Floodway at the SH 2 Bridge.

5.7 THE EDGECUMBE COMMUNITY

The residents of Edgecumbe are the ones who have to live with the residual flood risk. They will also have to pay through rates for a substantial proportion of the capital cost, and most of the operating costs, for stormwater infrastructure, including contributing to the river scheme through BOPRC rates.

5.8 THE RURAL COMMUNITY

The farmers of the lower Plains are the primary beneficiaries and funders of the Rangitaiki Flood Control and Drainage Scheme. However, a number of individual landowners have

scheme assets on their land. Their 'buy-in' is essential for any proposal that would involve redirecting flood waters (for example shifting the balance of flow between the main river and the floodway) or building new assets.

5.9 IWI

Iwi have a close interest in the water quality of the river and drainage canals, some of which were originally streams. They are also rural landowners and residents.

6 THE PROCESS

Development of solutions to the above issues was a collaborative and iterative process involving all the above parties. WDC and BOPRC were the lead agencies, working closely together to jointly promote the project, and to seek funding from Central government and others. BOPRC managed the upgrading of their stopbank and river scheme assets. Opus Consultants assisted with technical advice on engineering solutions, and supported the lead Councils in consultation with the other stakeholders. Allen & Clarke completed a business case (BOP/WDC 2007) and this went to MCDEM for approval in November 2007. Funding approval was received in June 2009.

6.1 CONSULTATION

The development of technical solutions was integrated with consultation and feedback from the stakeholders. Consultation was extensive reflecting the range of parties, shared interests, and the issues involved and included:

- Public open days at Edgecumbe for the urban and farming community.
- Presentation to the Rangitaiki River Scheme liaison group.
- Meetings with the key industry and infrastructure stakeholders.
- Presentation to iwi.
- Numerous one-on-one meetings with those landowners potentially directly affected by works on, or adjacent to their farms.

6.2 KEY FEEDBACKS

Several key messages came out of the consultation:

i. Edgecumbe residents were not supportive of high ring-banking options. They fear that if the river was to breach into a ring-banked area, water levels would rise rapidly to catastrophic levels rather than dispersing onto the flood plain.

ii. The principle of "equal dis-benefit' as applies to rural land, ie "*its bad enough being flooded, but worse if your neighbour is not equally flooded!"* Any proposal to preferentially flood some areas to protect a wider area proved highly contentious. This is a substantial issue for over-design or river breach events and climate change scenarios. Current work on the Rangitaiki Flood Plain management strategy being undertaken by BOPRC will need to explore this issue in more detail.

7 THE SOLUTIONS

From the consultation and technical studies a suite of upgrading works was developed (Opus Consultants 2007).

7.1 RIVER EROSION

Following the July 2004 flood event BOPRC undertook a detailed assessment of how the river bank protection works had performed. This identified several sites where additional rock work was required, such as at Kokohinau. This work was undertaken over the following 4 years, and is now complete. In total 7.6 km of river bank in the reach from Te Teko to the mouth received increased protection.

Photograph 3: Reconstruction of river bank protection works at Laws bend following 2004

7.2 STOPBANK STABILITY AND PIPING FAILURES

Ensuring stability of the stopbanks under high flood conditions was identified as a major challenge, with 72 km of stopbanks (Rangitaiki River and Reids Floodway) traversing the Plains. BOPRC embarked upon a major programme of stopbank investigation and remedial works. The investigation and design work was undertaken by ICE Geo & Civil. The resulting remedial work was undertaken by contract under BOPRC Rivers and Drainage staff supervision.

Work commenced with the banks in the Edgecumbe urban area, and then progressed along the stopbanks in the rural area from Te Teko to Thornton. Investigations are continuing on the Reids Floodway banks. Investigations consisted of hand augering and drilling, and seepage modeling of the banks. A typical situation encountered was 1-2 m of confining silt overlying bands of pumiceous sands (Figure 2). These extended from the river berms out into the adjoining country. As land falls away from the river levees, the permeable layers in parts come close to the surface. Thus minor excavation work, and even the working of paddocks for cropping, can create pathways for piping.

A range of remedial works were implemented depending upon the soil profile and physical constraints. These included:

- Toe loading of the inland side of the stopbanks to increase the confining pressures. This tended to be the preferred option where constraints allowed.

- Relief drains on the inland side of the stopbank toe. This was used in the Edgecumbe urban area where housing and roads restrict space and limit other options. Relief drainage was also used where toe loading areas became excessive and uneconomic.

- Relief drainage to ensure stability of the retaining walls on College Rd and at Fonterra factory.

- Sealing exposures of high permeability soils on the river side of the berm. Such sites may have been exposed by the borrowing of silts for stopbank construction in the past.

Several sites in the lower river and Reids Floodway are particularly problematic because of the large differential head over short distances. This problem is compounded by the ground being below sea level. Controlled flooding of these areas of low ground may be one option.

The stopbank remedial works have been a large project for BOPRC. In total to date, 11.5 km of stopbanks have been treated at a cost of $2.7M.

7.3 RIVER CONVEYANCE

Several options were considered to increase the conveyance of the lower river system. These included:

- Dredging of the river below Edgecumbe. This could give a useful reduction in water level (200 mm) and increase the flow capacity. However, it involves shifting very large quantities of sand (280,000 m^3) from the river. The longevity of any gains is potentially limited by the continued inflow of sediment from the river bed between Te Teko and Matahina. This did not appear a cost effective option.

- Increasing stopbank heights on the main river. This is not favoured for geotechnical reasons. The stopbanks and foundations are already close to failure under even moderate differential heads. Any increase in water level would only compound the problems.

- Management of flood flows through Matahina Dam to reduce flood peaks. This was a major issue with the community who often focus on the operation of the dam as the cause of flooding. However, the reality is that the storage available in the normal dam operating range is small (approx 10%) relative to the Q_{100} flood volume. Notwithstanding that, the dam can play a useful role in trimming the peak from moderate floods, and in altering the timing of peak flows in the lower river to avoid coinciding with high tide. BOPRC and Trustpower are working closely to optimize the flood mitigation opportunities provided by the dam and are developing a real time rainfall-runoff model.

- A new 'western diversion" to take flood flows to the Tarawera River; perhaps via the Omeheu canal system. The Omeheu canal only has a 5-10 year capacity and its capacity is fully utilized during large rain events to service local drainage needs. A major capacity upgrade would be needed to accommodate flood overflows from the Rangitaiki

- Increasing capacity in the Reids Floodway. Easing of the constriction at the SH 2 Bridge, and increasing the width in the lower 4km of the Floodway, is an obvious way to increase conveyance. This option is favoured and has been carried forward to the resource consent and final design process. NZTA are in the process of replacing the SH 2 Bridge with a new structure with a flow capacity of 300 m^3/s, sufficient for the upgraded Floodway.

- Installing a flow regulation structure on the Reids Floodway entrance. Significant advantage is seen in being able to exercise control over the flow split between the main river and Floodway. To address this it was recommended that a rubber dam flow control structure be installed over a portion of the floodway.

7.4 EDGECUMBE FLOOD PROTECTION

Edgecumbe conveniently divides into four quadrants by the Rangitaiki River running north-south and Rail Embankment running east-west. Each has distinct problems and solutions (Figure 5).

Figure 5: Edgecumbe Proposed Stormwater Improvements

7.4.1 SOUTHEAST

Normal stormwater drainage is good in this area with adequate falls out to Reids Floodway. The key issue for this quadrant is protection of the Transpower substation from over-design flows in the Rangitaiki River or Reids Floodway. Transpower independently assessed options for the substation, including complete relocation. Critical items of plant at the station were raised. From analysis of flood levels during the 2004 event, and modeling

of the river, a solution was developed. This provides a differential freeboard on the Reids Floodway stopbanks in favour of the western side. Note that the main river stopbanks already incorporate a higher freeboard adjacent to the Edgecumbe urban area of 600mm cf 300 mm in the adjoining rural areas.

Raising of the western bank of the Reids Floodway by 600mm was sufficient to provide protection to the southeastern quadrant in event of another overdesign flow in the Floodway. At the south end, Hydro Road has to be locally raised to the new stopbank level. Water will then spill to the east. Replacement of the SH 2 Bridge is an essential part of this work, removing the downstream constriction and lowering water levels. Strengthening of the main river stopbank by BOPRC was also an essential part of this scheme.

Recognising that the differential freeboard would reduce the work they would have to do on their own site, Transpower made a substantial financial contribution to the cost of works.

7.4.2 NORTHEAST

The main beneficiaries of flood control in this quadrant are the Fonterra factory, SH2 and the Eastpack kiwifruit packhouse. Again, normal stormwater drainage is satisfactory in this quadrant, as the development is on the higher land adjacent the river. The main river stopbank was strengthened and additional berm rock protection placed after 2004. The risk to be mitigated is again overtopping of the Reids Floodway in an over-design event.

A similar solution to the southeast was adopted. This involved building a differential freeboard in favour of the Fonterra factory, and locally raising East Bank Road. Fonterra made contribution in kind by making land available on their Awaroa farm for the return stopbank, and shifting their whey irrigation main lines.

Both the southeast and northeast quadrants incorporate provision for tractor pumping to remove local stormwater from within the ringbank when the Reids Floodway is in use.

7.4.3 SOUTHWEST

The southwest has several issues:

- Local runoff from the higher parts of town accumulating in the lower areas to the west in heavy rain.
- Flooding from the rural Omeheu catchment entering the town from the west (Photograph 1).
- Potential river breach upstream from the main river.

The main constraint to increasing the level of flood protection to this area is the limited capacity in the Omeheu canal. This canal has only a 5-10 year capacity before it overtops. Given this, there was strong opposition from the rural community to ring-banking Edgecumbe and pumping the urban stormwater onto the rural land. A new pump station to divert water completely out of the Rangitaiki catchment was the logical solution.

Elements of the scheme are:

- A low ring-bank, in part a formed stopbank, and in part local raising of the ground to meet the existing contour to RL 2.8 (0.3m freeboard over the Omeheu floodplain 1% AEP level as modeled by BOPRC).
- The stopbank was formed by borrowing soil from the drainage reserve immediately west of the town. This has the double benefit of providing fall to existing sections to drain water, and increasing storage for the pump station.

- Associated minor upgrades to the urban reticulation, and in particular providing secondary flow paths.

- A new pump station of capacity 350 l/s discharging to the Rangitaiki River.

The new pump station is expensive to run requiring a 7 m static lift and 100 m rising main compared to the existing Omeheu Adjunct pump station (2 m static lift and 5 m discharge line). Therefore gravity flow out to the Adjunct is maximized. The Otakiri Road station provides supplementary capacity when the levels in the Adjunct canal rise. Floodgates on the outlet drains prevent back flow of water from the Omeheu canal.

The scheme does provide some limited protection in event of a breach from the main river, however, it is not designed to cope with a major breach at Kokohinau (Section 6.2).

7.4.4 NORTHWEST

This quadrant has similar issues to the southwest, with the loss of drainage outlets to the lower lying urban streets when the rural canals are high. A large pump station at Omeheu East (capacity 1.5 m3/s) serves this area. However, it is 1.5 km from the perimeter of the urban area and it also serves a large rural catchment.

The proposal for this area is to build a new pump station to discharge water to the main Omeheu Canal closer to Edgecumbe. This will provide more immediate relief for the urban drainage outlets. The capacity provided is the same as the Otakiri Road station. This ensures that there is no nett dis-benefit to other landowners further down the Omeheu system.

Other elements of the scheme include associated minor upgrades to the urban reticulation and in particular providing secondary flow paths, flapgates to prevent return flow from the rural land, provision for emergency tractor flood pumping and drainage improvements.

8 PROGRESS TO DATE

8.1 WORKS COMPLETED

Consents for the scheme upgrades were obtained in 2010. Approvals from affected parties were obtained and no hearings were required. To date the following works have been completed:

- Stopbank works (2.7 km) in Reids Floodway in the southeast and northeast quadrants.

- Geotechnical improvements to stopbanks (11.7 km).

- Upgraded river protection rockwork (7.6 km).

- Construction of the Otakiri Road pump station.

- Stopbanking and associated drainage improvements in the southwest.

Construction work on the northwest pump-station is about to commence.

NZTA have the Reids Bridge replacement out to tender (March 2011).

Final modeling and design for the Reids Floodway widening and the rubber dam control gate is underway and programmed for construction in 2012-14.

8.2 OUTCOMES SO FAR

A large flood event occurred late January 2011.

The weekend of 23-24 January saw 230mm of rain fall in the Edgecumbe area. This had barely drained before Cyclone Wilma added a further 130 mm in 12 hrs; most of which came as burst of 59.5 mm in 1 hour at the end of the storm. This initially caused localized flooding in low parts of Edgecumbe. While the pump station at Otakiri Road operated as per design, the associated storage and stopbanking were not complete. However, the rain had been sufficient to overtop the Omeheu Adjunct canal. While the pump cleared the water in the morning, the flood from the rural land returned in the afternoon. As the ring-bank was not yet complete, there was ponding very close to floor level in two streets.

Flows in the Rangitaiki River peaked at 386 m3/s (around a 5-10year flow) on two consecutive weekends. Water was spilled from Matahina Dam to control flow peaks. The water level in the Rangitaiki River was well over the berms, but still below the spill level into Reids Floodway. Worryingly, seepage was observed through the stopbank toe at a similar location to the Sullivans breach. Emergency action was taken by BOPRC staff. This again highlighted the challenge that the river scheme managers face in containing water in this difficult geology.

9 CONCLUSIONS

Progress of the Edgecumbe flood mitigation project highlights several points:

i. To achieve retrofit upgrading of a scheme with numerous elements requires a comprehensive and integrated approach.

ii. Consultation and the involvement of stakeholders from the initial concept proved beneficial during the later consenting and approval processes.

iii. The history of the Rangitaiki scheme highlights the evolving nature of such engineering works. Improvement is achieved both gradually by ongoing organic growth of the assets, and with accelerated bursts of construction activity precipitated by particular events. The latest works will lift the level of service further.

iv. When viewed in the context of 100 years of land development and drainage on the Rangitaiki Plains, the works described above are just further steps on a continuum of improvements. Such improvements are needed to accommodate changing landuse, changing community expectations, and changing climate.

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