Appendix F

River Control and Drainage Works Programme

1. Introduction

This appendix details the river control and drainage channel works permitted in Rule 27.1.8.1 (General Rules) of this Plan and for River Control Works which are designated and listed in Appendix B.

This document updates the Wairau River Floodways Management Plan (1994) Sections D, F & G to allow for the river works that have been carried out and other changes that have occurred over the last three years. This document also incorporates works now proposed on small rivers and drainage channels.

The River Control Programme deals with the Wairau River, its tributaries, distributaries and floodways; and the Drainage Works Programme with channels and small rivers in the Rural 3 Zone.

Discussion of the issues and the reasons for the river works and drainage methods are not repeated in this document.

2. Priority of Works

The higher priority works detailed in the Wairau River Floodways Management Plan have now been virtually completed. The need to specify a priority order for carrying out the further river works required is now much less of an issue. This document therefore does not specify a priority order, though the order of doing works will continue to be a blend of current standard of protection, engineering practicality and consequences of failure.

3. Wairau Floodplain Definition

The Wairau River Floodways Management Plan divided the river systems into two separate zones; the Wairau floodplain zone and tributaries outside the floodplain. The standard of works and method of funding was different for the two zones. This is continued in the Wairau/Awatere Resource Management Plan.

The Wairau floodplain downstream of the Waihopai confluence is a contiguous system of interlocking rivers, diversions and floodways, from which flood breakout is prevented by stopbanks. For this area a standard of flood protection for floods up to a 100 year return period flood is specified, unless impractical to achieve.

This Wairau floodplain generally follows that of the Rural 3 zoning.

The difference is approximately 3500 ha of land in the Rural 3 Zone to the south of the road line New Renwick Road/Dog Point Road/Hawkesbury Road/SH 63 which is not part of the Wairau floodplain. This area does not have a stopbanking system on its rivers and currently it is not economic or practical to provide a one in 100 year flood protection standard here.

4. Maintenance and Flood Damage Repair

Maintenance and flood damage repair will be carried out on all rivers and drainage channels.

These are activities that restore the channel to its existing condition, and/or restore bank edge protection, and/or maintain the stopbanks. (Not all of the listed activities are carried out on every river or drainage channel).

- Rock, rubble and gabion structural bank protection.
- Gravel or sediment shaping above water level.
- Gravel or sediment removal above water level.
- Sediment removal below water level.
- Tree, scrub and other vegetation control and removal from the channel.
- Tree planting and maintenance on the banks or floodway berms.
- Grass and lucerne planting and maintenance on berms and stopbanks.
- Diversions within braided gravel river channels.
- Rock recovery from channel.
- Piled or anchored retards on river banks.
- Aquatic weed control.
- Stopbank maintenance and reconstruction.
- Maintenance and replacement of culverts through stopbanks.
- Repair and replacement of pumps, floodgates (flapgates), control gates, and ancillary structures.
- Lining of drainage channels with timber or concrete.

5. Wairau Floodplain Rivers and Drainage Channel Works

5.1 Lower Wairau

5.1.1 Design Intentions

5.1.1.1 Achieve a hydraulically efficient channel by removal of overhanging willow trees flanking the channel. On the inside of bends this will be complete removal of trees, on the outside of bends this will be removal of overhanging limbs only.

5.1.1.2 Maintain a directly opening hydraulically efficient river mouth by extending existing guide bank or pilot cuts through beach gravels.

5.1.1.3 Raise and upgrade low and/or structurally unsound sections of stopbank in two areas.

5.1.1.4 Encourage channel realignment at Peninsula Road through erosion of the opposite inside of the bend on Morrins Hollow.

5.1.1.5 Subject to detailed hydraulic confirmation, allow stopbanks flanking wide berms to be brought in closer to the river; and in the Jones Road area to construct a new realigned stopbank.

5.1.2 New Works Required

- Deliberate strategic gravel and sediment removal upstream of Ferry Bridge.
- Stopbank raising Ferry Road to Watsons Road.
- Stopbank relocation below Jones Road.
- Stopbank upgrading in vicinity of Eckfords Road.
- Straighten and extend guide bank at river mouth.

5.2 Wairau Diversion

5.2.1 Design Intentions

5.2.1.1 Enlarge the existing active channel out to the already constructed rock lines by using strategic sediment removal to encourage and supplement natural erosion.

5.2.1.2 Maintain the existing rock lines that delineate the active channel.

5.2.1.3 Keep the berms hydraulically efficient by keeping in grass cover only.

5.2.1.4 Maintain a directly opening mouth by occasional pilot cuts through the bar.

5.2.2 New Works Required

- Strategic gravel and sediment removal, especially at the top of the Diversion and downstream of Rarangi Bridge.

5.3 Flow Division Area of Lower Wairau and Diversion Including Road and Rail Bridges

(Note: This covers from the road bridge to 1.5 km down each river reach).

5.3.1 Design Intentions

5.3.1.1 To improve the waterway capacity of this reach so as to reduce flood levels in a 5,800 m^3/sec flood to below road and rail bridge soffit levels. This will be done by gravel and other sediment removal.

5.3.1.2 To attain a flow split in floods of 45% lower Wairau, 55% Diversion, but in low flow periods of at least 50% in the lower Wairau.

5.3.1.3 To maintain hydraulically efficient channels by removal of trees and debris from the active river channel.

5.3.1.4 To assess the need and design parameters for a flow control structure here.

5.3.2 New Works Required

- Strategic gravel and sediment removal.

5.4 Wairau (Tuamarina to Waihopai Confluence)

5.4.1 Design Intentions

5.4.1.1 Encourage commercial gravel extraction from the river channel in locations that will be of most benefit to maintaining channel waterway capacity, and/or to achieve a desirable river channel alignment.

5.4.1.2 Maintain a cleared active channel of typically 380 metres by removal of vegetation, on a defined slightly sinuous meander pattern.

5.4.1.3 Provide and maintain bank edge protection for this active channel by means of rock lined training banks on the outside of bends of the defined meander pattern; willow and poplar tree planting on the inside of the bends strengthened by rail iron retards, and as necessary strengthened by isolated rock work.

5.4.1.4 Upstream of Conders groyne where a defined meander pattern cannot be held, to build and maintain rock headed cross banks on the south bank to constrain the active channel.

5.4.1.5 To raise low stopbanks on the south bank between Selmes Road and Giffords Road.

5.4.1.6 To strengthen and raise the training banks in Barnetts area that guide Wairau flood waters away from the Tuamarina village area stopbanks.

5.4.1.7 To raise three low open ended Northbank stopbanks.

5.4.1.8 To strengthen stopbanks identified as prone to piping failure at Hillocks Road and possibly other sites.

5.4.1.9 To complete stopbanking on the south bank by erecting new stopbanking to join the lower Conders and upper Conders stopbanks.

5.4.1.10 To raise and relocate the low stopbank in the lower Conders area and also raise upper Conders stopbank, that to date have been left low until works downstream have been brought to an adequate standard.

5.4.1.11 Improve the hydraulic efficiency of the berms by partial removal of spur banks and guide banks, while leaving enough banking to counter potential stopbank erosion.

5.4.1.12 Maintaining a controlled blend of appropriate trees and vegetation on the berms to achieve good hydraulic efficiency while leaving sufficient vegetation to inhibit scour and erosion.

5.4.1.13 To carry out berm shaping works to inhibit potential channel forming erosion on the berms and promote a slope from the stopbank towards the channel edge.

5.4.2 New Works Required

- Strategic gravel and sediment removal.
- Extension of the 12 rock lined training banks upstream and downstream as required.
- Lowering and partial removal of the ends of guide banks and spurs within the floodway; on the north bank opposite Giffords and Selmes Road; and on the south bank at McLauchlans, Wratts Road, Jeffries Road, near Selmes Road and near Cravens Road.
- Raising stopbanks on the south bank upstream of Selmes Road.

- Raising low stopbanks at upper Conders and lower Conders area.
- Two new rock headed groynes at upper Conders.
- Construct new stopbanking to complete the stopbanking between upper and lower Conders areas.
- Planting trees as bank edge protection, and in places strengthening with rail iron retards.
- Raising low open ended stopbanks on the north bank at Barnetts, Norths and Huddlestones.
- Stopbank strengthening work at Upper Barnetts and Hillocks Road.
- Berm shaping works at Upper Barnetts, Cravens Road, Wratts Road areas.
- Tuamarina pocket stopbank raising.

5.5 Waihopai River (Confluence to 300 metres upstream of SH 63 Bridge)

5.5.1 Design Intentions

5.5.1.1 To clear and maintain a fairway of typically 150 metres width on the river.

5.5.1.2 To provide and maintain bank edge protection for this reach by maintenance of existing rock training banks, by retards and tree planting and as necessary isolated rock work.

5.5.1.3 To prevent overflow on to the Wairau/Waihopai floodplain.

5.5.2 New Works Required

- Stopbank on the right bank above the confluence with the Wairau.
- Tree planting and piled retards bank protection.

5.6 Lower Opawa/Taylor (up to Wither Road)

5.6.1 Design Intentions

5.6.1.1 To increase the hydraulic efficiency of the lower Opawa by removal of trees growing on the banks or overhanging into the river from upstream of Swamp Road.

5.6.1.2 To increase the effective waterway capacity of the berms and better flow interaction with the main channel by removing impeding banking (much of it natural 'banking') and carrying out berm shaping works upstream of Swamp Road.

5.6.1.3 To control vegetation planting on the berms that may impede flood flow upstream of Swamp Road.

5.6.1.4 To reconstruct lengths of narrow, weak and under-height stopbank downstream of Riverlands corner.

5.6.1.5 To repair or replace inadequate culverts through the stopbanks.

5.6.1.6 To strengthen or replace structurally questionable lengths of stopbank of the Taylor through Blenheim.

5.6.2 New Works Required

- Removal of overhanging willow and other riparian trees from upstream of Swamp Road.
- Berm shaping works on both banks from upstream of Swamp Road.
- Stopbank raising from downstream of Riverlands corner.
- Narrow stopbank reconstruction.
- Stopbank strengthening of Taylor River in Blenheim.
- Replacement of inadequate culverts.

5.7 Upper Opawa and Roses Overflow

5.7.1 Design Intentions

5.7.1.1 Ensure the extensive berms are maintained in a hydraulically efficient state by removing impeding vegetation and preventing the planting of impeding vegetation.

5.7.1.2 Upgrade poor condition stopbanks in isolated areas.

5.7.2 New Works Required

- Reconstruct and raise low stopbanks downstream of Thompsons Ford Road.

5.8 Omaka River (to Hawkesbury Road Bridge)

5.8.1 Design Intentions

5.8.1.1 Maintain a cleared fairway of typically 50 metres width within a stopbanked system or natural terrace system.

5.8.1.2 Maintain bank edge protection of this cleared fairway of willow tree plantings supported by retards, and in places of heavy bank attack, rock work.

5.8.1.3 To have a moratorium of gravel extraction downstream until there is evidence of the river channel aggrading and reducing waterway capacity.

5.8.2 New Works Required

- Tree planting bank edge protection with rail iron retards.

5.9 Fairhall and Mill Streams (up to New Renwick Road)

5.9.1 Design Intentions

5.9.1.1 For the stopbanked Fairhall diversion to maintain its river berms in a clear hydraulically efficient condition.

5.9.1.2 For the Fairhall and Mill stream channels up to New Renwick Road to maintain clear stable channels and enlarge if proven necessary to carry a one in a 100 year flood.

5.9.2 New Works Required

- Enlarge and clear Fairhall and Mill channels downstream of New Renwick Road.

5.10 Riverlands Floodway and Wither Hills Streams

(Note: the Wither Hills streams include Mapps, Jacksons, 15 Valley, Sutherlands, Wither and Rifle Range).

5.10.1 Design Intentions

5.10.1.1 To maintain the Riverlands floodway in a clear and easily maintained condition.

5.10.1.2 To achieve a hydraulically efficient channel of Wither Stream through Blenheim by construction and maintenance of a concrete lined channel.

5.10.1.3 To minimise debris and sediment being brought down from Wither Hills streams into the Riverlands channel system.

5.10.2 New Works Required

- Completion of concrete lined channel.
- Construct debris retards and screens.

5.11 Doctors Creek (up to New Renwick Road)

5.11.1 Design Intentions

5.11.1.1 To upgrade to a consistent standard and maintain a small channel to carry minor floods.

5.11.1.2 To zone as a flood hazard area land flanking Doctors Creek that floods and ponds in major floods.

5.11.2 New Works Required

- To enlarge and improve channel downstream of New Renwick Road culvert.

5.12 Pukaka

5.12.1 Design Intentions

5.12.1.1 To strengthen weak stopbanks.

5.12.1.2 To maintain an overflow spillway on the eastern bank that spills into a zoned flood hazard area at times of high Pukaka flood and/or coincidence of high Diversion flood.

5.12.1.3 To investigate options of increasing Pukaka outlet culvert capacity into the Wairau Diversion.

5.12.1.4 To investigate options of environmental planting on the Pukaka berms.

5.12.2 New Works Required

- To reconstruct weak parts of the eastern stopbank beside the spillway.
- Enlarge Pukaka outlet culvert.

5.13 Gibsons Creek

5.13.1 Design Intentions

5.13.1.1 To maintain the Gibsons Creek channels to carry water abstracted from the Waihopai so as to recharge the aquifer downstream of Renwick.

5.13.1.2 To improve the hydraulic efficiency of Gibsons Creek through Renwick to prevent breakout of floods in a 1 in a 100 year return period flood.

5.13.1.3 To reduce flood levels in Gibsons Creek to enable good outflow in flood conditions for School Creek and Terrace Creek.

5.13.1.4 Investigate the use of the Earthquake Swamp as a controlled detention area.

5.13.2 New Works Required

- Enlargement of the channel to 8 metres width so as to restore it to its previous size.
- Clearing willow trees and other obstructions from this channel.

5.14 Small Urban Rivers

(This includes Opawa Loop, Fultons Creek, Murphys Creek in Blenheim; School Creek and Terrace Creek, Renwick).

New works on these rivers will be subject to consultation with affected urban residents and specific resource consent to carry out the works.

5.15 Small Rural Rivers and Drainage Channels

5.15.1 Design Intentions

5.15.1.1 To maintain drainage channels in a hydraulically efficient state by regular removal of deposited sediment and weed growth.

5.15.1.2 To maintain the 305 floodgated outlet structures into the major rivers that prevent the backflow of river floodwater.

5.15.1.3 To maintain and enlarge the pumping stations that supplement the gravity outfalls.

5.15.2 Proposed Works

- The enlargement of 25 pumping stations as follows:

Item	Location	Existing Discharge	Increased Discharge
		(Units are mm of runoff in 24 hours)	
1	Lower Wairau	9.20	15.40
2	Pembers Road	25.60	25.60
3	Dillons Point	8.20	10.25
4	Waterlea Creek	46.00	74.40
5	Chaytors	7.00	10.50
6	Swamp Road	9.35	16.20
7	Grovetown	8.80	17.60
8	Alabama Road	36.50	36.50
9	Monro Street	86.00	86.00
10	Andrew Street	57.00	89.00
11	Rouses Drain	8.90	16.30
12	Roberts Drain	11.00	22.50
13	Caseys Creek	18.40	32.20
14	Tuamarina Lagoon	15.20	22.60
15	Thomas Road	25.60	25.60
16	Blind Creek	19.30	19.30
17	Blind Creek	19.30	19.30
18	High Street	35.90	72.00
19	Main Street	25.00	42.90
20	Redwood Street	27.70	55.30
21	Woolley and Jones	17.30	17.30
22	Pukaka Road	20.88	29.80
23	Town Branch	36.50	36.50
24	Watsons Road	18.50	18.50
25	Boyce Street	75.00	75.00

- The upgrading of culvert outlet structures including outlet floodgates as follows:

1. Marukoko Return Bank

M-001 Install gabions

M-009 Replace with twin 900 mm diameter fibreglass gates and install gabions.

2. Opawa River

OR-001	Replace with fibreglass gate and install gabions
OR-006	Replace with fibreglass gate and install gabions
OR-014B	Replace with steel gate
OR-018	Replace with fibreglass gate
OR-022	Replace with fibreglass gate

3. Pukuka Stream

PS-001	Install gabions
PS-011	Install gabions
PS-012	Install gabions
PS-015	Install fibreglass gate and gabion

4. Riverlands Floodway

RC-006	Extend pipeline and install fibreglass gate
RC-010	Replace with fibreglass gate
RC-011	Replace with fibreglass gate

5. Roses Overflow

RO-002	Extend and install fibreglass gate
RO-004	Replace with fibreglass gate
RO-005	Improve outlet and install fibreglass gate
RO-006	Install gabions
RO-009	Improve outlet and install fibreglass gate

6. Spring Creek

SC-002	Replace with fibreglass gate
SC-003	Replace with fibreglass gate
SC-007	Replace with fibreglass gate
SC-009	Replace with fibreglass gate
SC-011	Replace with fibreglass gate
SC-012	Replace with steel gate
SC-013	Replace with fibreglass gate
SC-014	Replace with steel gate
SC-023	Replace with steel gate
SC-026	Replace with fibreglass gate

7. Tuamarina River

TU-011	Replace with fibreglass gate
TU-012	Extend pipeline

TU-014 Extend pipeline

8. Vernon Lagoons

VL-002 Replace with fibreglass gate

VL-003 Replace with fibreglass gate

VL-004 Remove

VL-005 Remove

9. Wairau River

WR-005a Replace with side hung gates

WR-012 Install gabions

WR-021 Install gabions

WR-024 Replace with fibreglass gate and install gabions

WR-025 Replace with side hung gate

WR-026 Install gabions

WR-027 Install gabions

WR-031 Install gabions

WR-034 Install gabions

WR-042 Install gabions

WR-043 Install gabions

10. Wairau River Diversion

WRD-001 Replace with side hung gate

WRD-002 Replace with fibreglass gate

WRD-006 Replace with fibreglass gate

11. Taylor River/Opawa River (Urban Blenheim)

TR-002 Replace with "Penstock" gate with new intake structure

TR-003 Replace with "Penstock" gate with new intake structure

TR-007 Replace with "Penstock" gate with new intake structure

TR-012 Replace with a new 600 mm diameter floodgated culvert

TR-014 Replace with a new 600 mm diameter floodgated culvert

TR-015 Install debris screens and a supplementary "Penstock"gate

- To investigate drainage improvements in the Cravens Road and Riverlands area.

6. Rivers Outside Wairau Floodplain

6.1 Wairau Above Waihopai Confluence

6.1.1 Design Intentions

6.1.1.1 To prevent obstructions by willow trees or other debris forming islands in the active channel which could divert braids against the river banks.

6.1.1.2 To carry out flood damage repair work to existing bank protection works on an as practical and economic basis.

6.1.1.3 For non-programmed works where the landowner(s) desire river works to a higher standard, then jointly funded works may be carried out with Council contribution of up to 50%.

6.2 Other Tributaries

6.2.1 Design Intentions

6.2.1.1 To maintain clear stable channels as far as practical and economic.

6.2.1.2 To carry out maintenance and flood damage repairs on an as practical and economic basis.

6.2.1.3 To use the annual rate intake from the relevant tributary ratepayers as a guide to the scale of works to be carried out.

6.2.1.4 To liaise with local residents/advisory groups in carrying out these tributary river works.

6.2.1.5 For non-programmed works where the landowner(s) desire river works to a higher standard, then jointly funded works may be carried out with Council contribution of up to 50%.