

Canterbury 2021 Flood Recovery Update 3

Ken Tarboton (Aqueus Consulting)
Shaun McCracken (Environment Canterbury)

31 March 2022





200 Tuam Street
PO Box 345
Christchurch 8140
Phone (03) 365 3828
Fax (03) 365 3194

75 Church Street
PO Box 550
Timaru 7940
Phone (03) 687 7800
Fax (03) 687 7808

Website: www.ecan.govt.nz
Customer Services Phone 0800 324 636

Executive summary

Purpose:

This report provides an update on flood recovery progress by Environment Canterbury (ECan) for the period of November 2021 through February 2022. It follows the updates 1 and 2 that have covered flood response and recovery from June to October 2021.

It documents progress with recovery works over this four-month period and provides a summary of costs to date and the agreed amount for the first claim to the National Emergency Management Agency (NEMA) for eligible like-for-like replacement of assets lost as a result of the flood. Furthermore, it provides support for the second claim to NEMA currently being progressed.

Background:

The significant rainfall event of 28-31 May 2021 over much of Canterbury, resulted in wide-spread flooding across the region. A region-wide state of emergency was declared on 30 May 2021. Flood damage as a result of the exceptional rainfall was significant and widespread across the region, affecting community infrastructure, public and private property and damaging or destroying significant ECan flood protection assets. Physical works in response to this event commenced immediately following the event and flood recovery works are ongoing.

Response and Recovery Progress – this period November 2021 to February 2022:

Focus during this period has been on undertaking permanent stopbank repair works over the drier summer favourable for construction. To date approximately 131 flood recovery jobs out of a total of 350 jobs have been completed. This is up from 69 completed jobs reported in the previous update.

The interactive web interface at www.ecan.govt.nz/FloodRepairMap provides real time progress on the status of flood recovery repairs.

Several major stopbank repair jobs have been completed while several others are underway. These are reported on in more detail with a series of before and after photographs for major repair works presented in Sections 8 and 9 at the end of this report. Final design and procurement is underway for the remaining stopbank works. It is expected that most stopbank works will be completed by the next update report that will cover progress through to the end of the financial year (June 2022).

As the weather becomes cooler, conditions will be more favourable for tree planting. Planning is underway for replanting of tree edge protection required to replace the 42km of tree edge protection asset lost during the flood. This will commence in the next few months and continue until late in the calendar year, then again in the winter of 2023.

Financial Status:

The total costs to the end of February 2022 for flood recovery (including response) is \$10.1 Million. Of these costs, \$8.1 Million are estimated to be eligible for application to the National Emergency Management Agency (NEMA) for a 60% central government contribution above a threshold for like-for-like asset replacement.

Environment Canterbury has submitted its first claim to NEMA. Following review of this claim it has been agreed that \$4.93 Million is eligible for the NEMA 60% cost share, which comes to \$489,987 after deduction of the ECan threshold of \$4.1 Million.

The initial estimated cost for total flood recovery was \$19.7 Million. A review of progress and expenditure to date combined with forecast future repairs and their estimated costs, has determined that the project is still on track to complete the flood recovery works for around \$19.9 Million.

The indicative funding mix based on this revised cost estimate is now updated to a likely overall claim to central government for a contribution of \$6.8 million towards flood recovery. This was previously estimated at \$7.5 Million. As a result, the Environment Canterbury contribution is now estimated to be \$13.1 million. This estimate will change as actual costs are recognised and claims to NEMA are finalised.

These cost estimates will be reviewed again at the end of the 2021-2022 financial year. The proposed commitment from Environment Canterbury is currently limited to \$12.2M. If it becomes clear that expenditure above this amount is likely, pre-approval for additional funding will be requested from Council.

Next Steps:

Next steps are to continue with high priority flood damage repairs for areas at greatest risk. It is particularly important to complete all the major permanent stopbank repair works prior to the high flow period over winter.

Tree planting and replacement of tree edge protection will ramp up over the next few months. This will be subject to resource (materials and contractor) availability. It will take some time for the tree edge protection to become established, so erosion protection bunds have been included as additional edge protection for the major stopbank replacement works. Provision of anchored tree protection (ATP) on the upstream edge of these bunds is a priority first step towards re-establishing the tree edge protection asset.

Consideration of Climate Change:

Consideration has been given to options for betterment or improvement on what was previously in place, particularly improvements that account for climate change and the likelihood of increased frequency and more intense rainfall events. These improvements include creating more room for rivers in fairways that have already been widened by the flood. There are also opportunities to undertake cost effective repairs to flood protection infrastructure in the vicinity of flood damaged assets, while contractors are working in the area.

Since climate change betterment and other infrastructure improvements are outside of the like-for-like replacement of pre-flood infrastructure they are not eligible for 60% NEMA co-funding. Discussions are underway with NEMA and River Scheme Committees regarding options for betterment in a small number of key locations. ECan has indicated to NEMA that a comprehensive case for co-funding of betterment is likely across all the affected catchments from this event. Work on this business case has not yet commenced. Consideration of the additional betterment costs by River Scheme Committees has started on a case by case basis in some catchments.

Table of contents

1	Introduction	9
2	Flood Repair Progress.....	9
2.1	Major stopbank repairs	10
2.2	Other major repair works	13
2.3	Next steps	13
3	Procurement.....	13
4	Financials	14
5	Risks	16
6	Communications and Community Engagement	18
7	Betterment Opportunities.....	20
8	Stopbank flood damage repairs - details and photos.....	21
8.1	North Ashburton at Thompsons Track.....	21
8.2	South Ashburton at Blacks Rd.....	24
8.3	Orari at Inglis Rd.....	28
	Orari at Inglis Rd, Site A	30
	Orari at Inglis Rd, Site B	31
	Orari at Inglis Rd, Site C	32
8.4	Orari at SH 79	34
8.5	Orari at railway bridge.....	37
8.6	Waihi at Hawke Rd	39
8.7	Opihi at Collett Rd.....	44
9	Other major repairs - details and photos	45
9.1	Ashburton at River Rd	45
9.2	Orari at racecourse	47
9.3	Waihi at SH79, Geraldine	49
9.4	Waihi at Geraldine NPD.....	53
9.5	Waihi at Geraldine High School.....	55

List of Tables

Table 2-1:	Status of flood damage repairs by District at 28 February 2022.....	10
Table 2-2:	Flood damage summary by type.....	10
Table 2-3:	Stopbank works undertaken during this reporting period and their status.....	11
Table 2-4:	Other major works completed during this reporting period.	13
Table 4-1:	Canterbury 2021 flood response costs for reporting period and total costs at 28 February 2022.	14
Table 4-2:	Canterbury 2021 Flood Response Costs at 28 February 2022.	14
Table 4-3:	Estimated flood recovery costs with portion estimated as claimable from NEMA.	16
Table 5-1:	Residual and Flood Recovery Project risks	17
Table 6-1:	Summary of Public / External Meetings, November 2021 – February 2022.....	18

List of Figures

Figure 2-1:	Sequence and timeline to re-establish stopbank and tree edge protection for typical flood washout.	12
Figure 4-1:	Summary of flood recovery expenditure profile.....	15
Figure 6-1:	Screen clip of flood recovery interactive job status web page at end February 2022....	19
Figure 8-1:	North Ashburton at Thompsons Track, approximately 23km northwest of Ashburton. (a) Aerial view prior to flood, (b) post-flood aerial showing extend of stopbank and tree edge protection asset loss, (c) Replacement stopbank and erosion protection bunds.....	21
Figure 8-2:	North Ashburton at Thompsons Track. Area of stopbank and tree edge protection loss on 3 June 2021.	22
Figure 8-3:	North Ashburton at Thompsons Track. Completed stopbank repair on 16 March 2022. Anchored tree protection and infill planting still to be done.....	22
Figure 8-4:	North Ashburton at Thompsons Track. Looking downstream from end of remnant stopbank, 29 September 2021.	23
Figure 8-5:	North Ashburton at Thompsons Track. Looking downstream from same location as above following completion of stopbank and erosion protection bund repair, 24 February 2022.	23
Figure 8-6:	South Ashburton at Blacks Road 8km north of Ashburton. (a) Aerial view prior to flood, (b) post-flood aerial showing extend of stopbank and tree edge protection asset loss with proposed replacement stopbanks and erosion protection bunds. Location of centre pivots included for reference.	24
Figure 8-7:	South Ashburton at Blacks Road looking downstream (a) from remnant upper stopbank soon after flood, (b) from drone following completion of upper stopbank replacement.....	25
Figure 8-8:	South Ashburton at Blacks Road looking upstream from lower end of remnant stopbank (a) early June 2021, (b) September 2021 and (c) on completion of replacement stopbank in February 2022.....	26
Figure 8-9:	South Ashburton at Blacks Road, installation of anchored tree protection at erosion protection bunds: (a) installation of concrete block anchors, (burying willow poles in trench, and (c) completed ATP on upstream edge of erosion protection bund.	27
Figure 8-10:	Orari at Inglis Road north of Geraldine: (a) Aerial view prior to flood, (b) post-flood aerial showing extent of stopbank and tree edge protection asset loss at three sites...	28
Figure 8-11:	Orari at Inglis Road, flood repair design for sites A, B and C.	29
Figure 8-12:	Orari at Inglis Rd Site A, Stopbank and edge protection loss - 28/9/2021.....	30
Figure 8-13:	Orari at Inglis Rd Site A, Stopbank reinstated - 23/2/2022. Job 23676.	30
Figure 8-14:	Orari at Inglis Rd Site B, Temporary bund work 28/9/2021.	31
Figure 8-15:	Orari at Inglis Rd Site B, Stopbank reinstated with erosion protection bunds. Topsoil to be added. 23/2/2022.	31

Figure 8-16:	Orari at Inglis Rd Site C, looking downstream following temporary work prior to stopbank rebuild, September 2021.	32
Figure 8-17:	Orari at Inglis Rd Site C, looking downstream following temporary work prior to stopbank rebuild, January 2022.	32
Figure 8-17:	Orari at Inglis Rd Site C, looking upstream. Stopbank rebuild nearing completion, January 2022.	33
Figure 8-19:	Orari at Inglis Rd Site C Stopbank completed to design height 7 of 9 erosion bunds complete, topsoil to follow, 23 February 2022.	33
Figure 8-20:	Orari at SH79: (a) Aerial view prior to flood, (b) post-flood aerial showing extent of stopbank and tree edge protection asset loss.	34
Figure 8-21:	Orari at SH79: (a) following temporary bunding work prior to stopbank repairs. 27/1/2022.	34
Figure 8-22:	Orari at SH7 during stopbank repairs. 17/2/2022.	35
Figure 8-23:	Orari at SH7 completed stopbank repairs. 18/3/2022.	35
Figure 8-24:	Orari at SH7 following completion of temporary repairs 5/8/2021.	36
Figure 8-25:	Orari at SH7 following completion of stopbank and erosion protection bund works 16/3/2022.	36
Figure 8-26:	Orari at the railway bridge: (a) Aerial view prior to flood, (b) post-flood aerial showing extend of tree edge protection asset loss and stopbank damage.	37
Figure 8-27:	Orari at the railway bridge stopbank repair prior to adding or riprap rock protection. October 2021.	37
Figure 8-28:	Orari at the railway bridge stopbank repair addition of rock riprap protection. November 2021.	38
Figure 8-29:	Orari at the railway bridge completed stopbank with rock protection. February 2022 ...	38
Figure 8-30:	Waihi at Hawke Rd, location of three sites at which stopbank and tree edge protection assets have been lost.	39
Figure 8-31:	Waihi at Hawke Rd Site A, following temporary bund work prior to permanent repairs, 28/9/2021.	40
Figure 8-32:	Waihi at Hawke Rd Site A following completion of stopbank repairs and installation of erosion protection bunds 23/2/2022.	40
Figure 8-33:	Waihi at Hawke Rd Site A, showing flood damage to stopbank 28/9/2021.	41
Figure 8-34:	Waihi at Hawke Rd Site A, showing completed stopbank repairs and erosion protection bunds.	41
Figure 8-35:	Waihi at Hawke Rd Site B looking downstream showing temporary bund work prior to permanent repairs, 28/9/2021.	42
Figure 8-36:	Waihi at Hawke Rd Site A, showing completed stopbank repairs and erosion protection bunds, 9/2/2022.	42
Figure 8-37:	Waihi at Hawke Rd Site C looking downstream showing loss of stopbank and tree edge protection, June 2021.	43
Figure 8-38:	Waihi at Hawke Rd Site C looking downstream following completion of stopbank repairs, 23/2/2022.	43
Figure 8-39:	Opihi at Collett Rd prior to stopbank repairs, 23/2/22.	44
Figure 8-40:	Opihi at Collett Rd, following completion of stopbank and erosion protection bund works 23/3/2022.	44
Figure 9-1:	Ashburton at River Rd: (a) Aerial view prior to flood, (b) post-flood aerial showing extend of tree edge protection asset loss and risk to stopbank.	45
Figure 9-2:	Ashburton at River Rd, initial temporary protection bunds, August 2021.	45
Figure 9-3:	Ashburton at River Rd, erosion protection groynes under construction, 23/9/2021.	46
Figure 9-4:	Ashburton at River Rd, completed groynes with ATP, 3/3/2022.	46
Figure 9-5:	Orari at racecourse: (a) aerial view prior to flood, (b) post-flood aerial showing extend of tree edge protection lost.	47
Figure 9-6:	Orari at racecourse installation of rope and rail.	47

Figure 9-7:	Orari at racecourse infill with willow poles.....	48
Figure 9-8:	Orari at racecourse completed work 21/10/21.	48
Figure 9-9:	Waihi at SH79, Geraldine: (a) aerial view prior to flood, (b) post-flood aerial showing extent of tree edge protection lost.	49
Figure 9-10:	Waihi at SH79, Geraldine TRB upstream of bridge, flood damage, September 2021...	50
Figure 9-11:	Waihi at SH79, Geraldine TRB upstream of bridge with completed Heyman Fence repair. March 2022.	50
Figure 9-12:	Waihi at SH79, Geraldine TRB upstream of bridge. Aerial view looking upstream - completed Heyman Fence repair. March 2022.	51
Figure 9-13:	Waihi at SH79, Geraldine TLB downstream of bridge. Completed Heyman Fence repair. March 2022.	52
Figure 9-14:	Waihi at SH79, Geraldine TLB downstream of bridge. Aerial view looking upstream - completed Heyman Fence repair. March 2022.	52
Figure 9-15:	Waihi at Geraldine, NPD: (a) aerial view prior to flood, (b) post-flood aerial showing extent of tree edge protection lost.	53
Figure 9-16:	Waihi at Geraldine, NPD flood damage to rock groynes on TRB. June 2021.	53
Figure 9-17:	Waihi at Geraldine, NPD completed repair to rock groynes and access track on TRB. March 2022.....	54
Figure 9-18:	Waihi at Geraldine, NPD repaired rock groynes on TRB looking downstream. March 2022.....	54
Figure 9-19:	Waihi at Geraldine High School: (a) aerial view prior to flood, (b) post-flood aerial showing extent of tree edge protection lost.....	55
Figure 9-20:	Waihi at Geraldine High School flood damage 11/6/2021.	55
Figure 9-21:	Waihi at Geraldine High School temporary repair 15/6/21.....	56
Figure 9-22:	Waihi at Geraldine High School Hayman Fence being implemented 27/1/2022.	56
Figure 9-23:	Waihi at Geraldine High School, completed Hayman Fence repair 23/2/2022.....	57
Figure 9-24:	Waihi at Geraldine High School, completed Hayman Fence repair aerial view, March 2022.....	57

1 Introduction

This report is the third report to be provided to the National Emergency Management Agency (NEMA) documenting Environment Canterbury's flood recovery progress from November 2021 to February 2022. Previous reports have covered flood response and recovery from the June to October 2021.

This report provides an update on recovery works undertaken to the end of February 2022, including a summary of their costs for the period from November 2021 through February 2022 inclusive. Communication and community engagement is also summarised in this report.

Details of the flood event of 28-31 May 2021 have been provided previously so are not repeated in detail here, other than the following summary for completeness.

The significant rainfall event of 28-31 May 2021 over much of Canterbury, resulted in wide-spread flooding across the region. Rainfall amounts exceeding the largest 72-hour rainfall totals on record were recorded at 28 of Canterbury's 84 rain gauges. Mount Somers rain gauge recorded 546mm in 72 hours, more than double the previous record 72-hour total. A region-wide state of emergency was declared on 30 May 2021. Flood damage as a result of the exceptional rainfall was significant and widespread across the region, affecting community infrastructure, public and private property and damaging or destroying significant ECan flood protection assets. Peak flows exceeded design capacities in several rivers in the Ashburton, Timaru and Mackenzie districts resulting in several stopbank breaches and extensive erosion control vegetation loss.

2 Flood Repair Progress

Flood repair progress is being tracked on the Environment Canterbury flood recovery webpage with an up-to date flood damage repair status map located at: ecan.govt.nz/FloodRepairMap.

The previous report indicated that 281 sites had been assessed as requiring permanent repairs and that repairs had been completed at 69 locations. Further assessment has increased the total number of repair jobs to 350 of which 131 have now been completed. The number of jobs has increased mostly as tree edge protection reinstatement is planned in more detail, with a job being allocated to each repair site rather than a single job for an entire reach of river. The overall scope of work therefore has not significantly changed (it is simply better defined).

The status of flood damage repairs (to the end of February 2022) is summarised for each district in Table 2-1 below. While these numbers match the web site snapshot (shown in Figure 6-1), note that the website is updated daily with direct links to the ECan job management system, so will always reflect the latest flood repair status.

Key points to note from the tables below are that flood damage repairs have progressed steadily over the four-month reporting period. The focus during this period has been on major stopbank repairs (detailed in Table 2-3) during the months with suitable ground conditions to undertake these works.

Table 2-1: Status of flood damage repairs by District at 28 February 2022.

2021 Flood Repair - Job Status (Number in each category)						
District or Description	Draft	Accepted	Open	Monitoring	Completed	Total
Selwyn	11		1		1	13
Ashburton	90	2	10	12	81	195
Orari-Waihi-Temuka	35	8	3	7	18	71
Opihi	6	1	1		5	13
Ashley	2				4	6
Waimakariri-Eyre-Cust	5				12	17
Upper Hinds	2				8	10
Lower Hinds	5		1		1	7
Little River					1	1
Response and flood monitoring						17
Totals	156	11	16	19	131	350

Table 2-2: Flood damage summary by type.

Repair Type	Number of sites	Length of repair
Tree Replacement	225	42 km
Stopbank repair	47	5 km
Rock Protection	10	200 m
Groyne repair	7	
Fairway clearing	32	
Erosion repair	26	
Culvert Repair	3	
Total	350	

2.1 Major stopbank repairs

The focus over the past four months has been to undertake the major stopbank repairs required to reduce flood risk in the system. These works required option analysis, design and competitive procurement. Most of these works commenced in December 2021 or early January 2022 and have been completed by the end of February 2022 as shown in Table 2-3 below. Photos showing the progress and completed stopbank works at each site are shown in Section 8 at the end of this report. Although this report is on progress through to the end of February 2022, where more recent photos are available of the status of works at the major stopbank repair sites, these are included for completeness.

Table 2-3: Stopbank works undertaken during this reporting period and their status

Location	Sites repaired	Stopbank length (m)	Erosion Protection Bunds (m)	Tree edge protection to follow (m)	Status at 28 February 2022 (Job numbers)
Ashburton North at Thompsons Track	1	340	250	420	Stopbank and erosion bunds complete (24279). Temporary repairs complete (24278, 23036). ATP and tree infill work to follow.
Ashburton South at Blacks Rd	2	670	480	570	Stopbanks and erosion bunds complete (23589). Groyne construction and ATP complete (23408). Return flow channels and tree infill planting still to do.
Orari at Inglis Rd	3	950	810	1670	Temporary repairs complete. Stopbank and erosion bunds complete at sites A,B,C (23678, 23679, 23680) ATP and tree infill work will follow.
Orari at SH79	1	230	160	290	Stopbank and erosion bunds complete (23682). Temporary repairs complete (23102). ATP and tree infill work to follow (23683).
Orari at railway bridge	1	130	80	80	Temporary work complete (23718) Stopbank repair undertaken by Kiwi Rail (at their cost) Erosion protection bunds and tree infill still to be done
Waihi at Hawke Rd	3	550	90	880	Stopbank and erosion bunds complete (23746, 23736). ATP and tree infill work to follow (23774)
Opihi at Collett Rd	1	120	150	150	Stopbank and erosion protection bunds complete (23103). ATP and tree infill work to follow.
Total	12	2,990	2,020	4,060	

At each of the locations listed above, not only were stopbanks washed out but also the tree erosion protection assets. Erosion protection bunds have been established along the riverside edge of the stopbanks as a first step towards re-establishing the tree edge protection. Anchored tree protection (ATP) will be installed along the upstream edge of each erosion protection bund, over the next few months and into the winter of 2022 as the next step towards re-establishing tree edge protection. Finally, tree infill planting will be undertaken between the erosion protection bunds. It will take many years (at least 5-10) for the infill trees to grow to the point where the tree edge protection has replaced the edge protection lost during the flood.

Figure 2-1 below shows the steps and approximate time for the repair of tree edge protection from well-established tree edge protection pre-flood, to re-established tree edge protection over a period of 5-10 years.

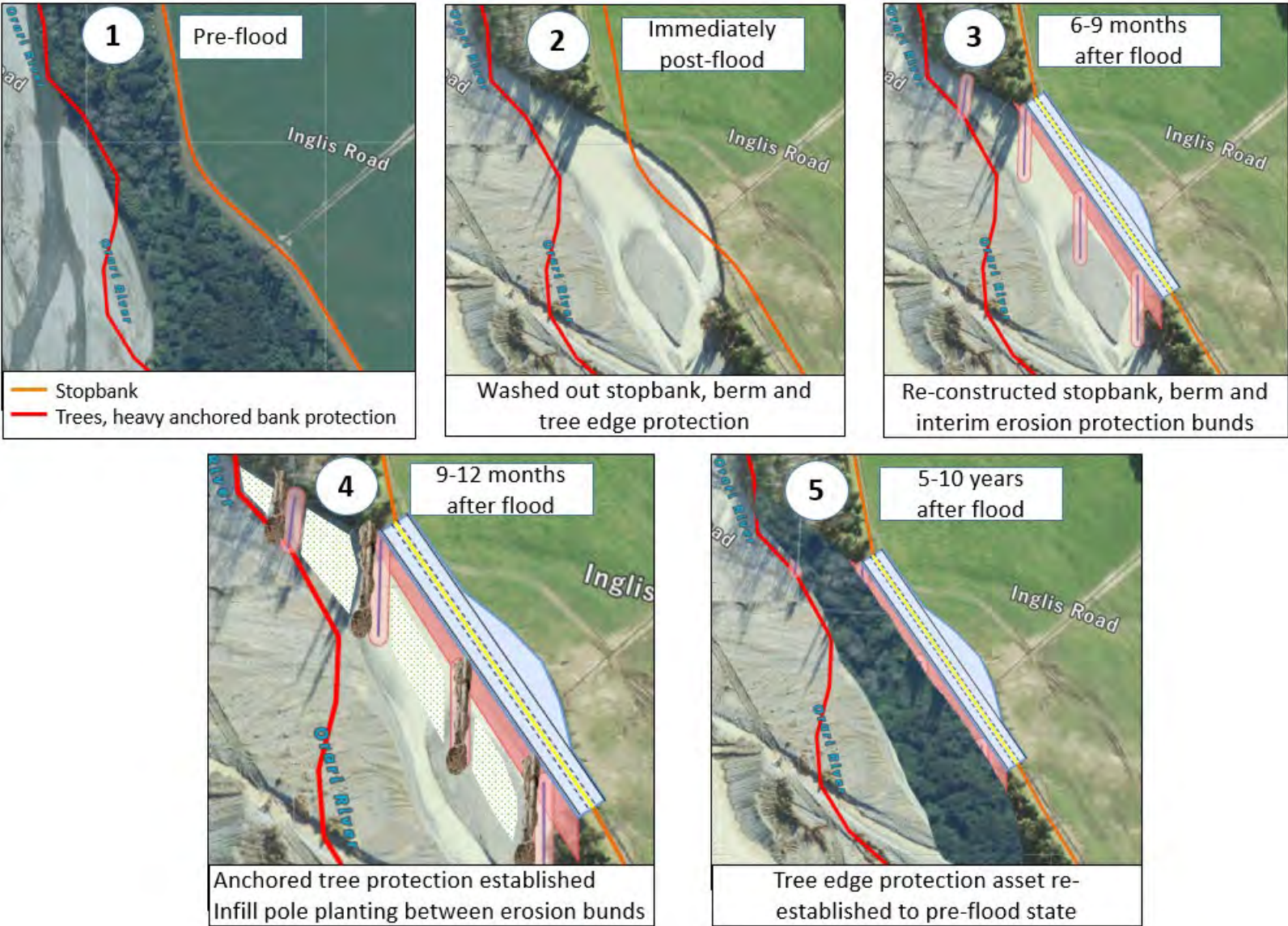


Figure 2-1: Sequence and timeline to re-establish stopbank and tree edge protection for typical flood washout.

2.2 Other major repair works

Other major repairs completed over this period have included the re-establishment of rock groynes, implementation of “Hayman” and “rope and rail” fences in areas of bank scour, and installation of anchored tree protection. The larger of these works are listed below in Table 2-4 with associated photos presented in section 9 at the end of this report.

Table 2-4: Other major works completed during this reporting period.

Location	Description
Ashburton at River Rd	310m of tree edge protection lost. Groynes and ATP works to reinstate edge protection.
Orari at racecourse	160m of tree edge protection lost. Rope and rail installed and infilled with willow pole planting.
Waihi at SH79, Geraldine	90m of tree edge protection on TRB upstream of SH79 and 100m of tree edge protection on TLB downstream of SH79. Repaired with rope and rail “Hayman Fence” due to lack of space for other options.
Waihi at Geraldine NPD	150m of tree edge protection lost and existing rock groynes damaged. Repair included rebuilding 4 rock groynes and adding 2 new groynes to provide equivalent protection for the tree edge protection lost.
Waihi at Geraldine High School	120m of tree edge protection was lost. A Hayman Fence repair has been implemented with follow up planting still to be undertaken.

2.3 Next steps

While significant tree planting and edge tree protection work has been undertaken in the works completed to date, the next major round of tree edge protection work will need to wait until the winter of 2022 to maximise tree survivability.

To compensate for the time it will take for tree edge protection to become established, erosion protection bunds have been included as additional edge protection for the major stopbank replacement works. These bunds will provide a degree of erosion protection to the stopbanks until tree edge protection can be established.

3 Procurement

All of the emergency response work and temporary flood damage repairs were undertaken using ECan's list of pre-qualified contractors. Some future reinstatement works, particularly anchored tree protection will still need to be procured in this way. This is because the work is complex and hard to specify, it is best completed by experienced operators on an hourly rate basis under adequate supervision. However, wherever possible, larger works will be put to open tender following best procurement practice.

In the reporting period, requests for tenders (RFT) have been advertised on the Government Electronic Tendering System (GETS) for five relatively large stopbank replacement works on the Orari, Waihi and Ashburton Rivers. These works total approximately 3.0km of stopbank replacement as shown in Table 2-3.

4 Financials

Flood Response and Recovery

Flood response costs to the end of February 2022 are \$10.05 million as summarised in Table 4-1 below. Approximately \$3.5 million has been spent on flood recovery during the report period from November 2021 to February 2022. Costs are subdivided into the flood affected river rating districts. A summary of the total costs to date separated into estimated non-eligible and eligible costs for claim to NEMA for subsidy is provided in Table 4-2.

Table 4-1: Canterbury 2021 flood response costs for reporting period and total costs at 28 February 2022.

Description	Costs for period Nov 2021 to Feb 2022	Total costs to date
Flood monitoring costs	1,494	289,693
Selwyn 2021 Flood Repair	23,603	44,862
Ashburton 2021 Flood Repair	2,558,689	6,622,485
OWT 2021 Flood Repair	550,420	1,184,299
Opihi 2021 Flood Repair	85,033	113,900
Ashley 2021 Flood Repair	17,914	129,913
WEC 2021 Flood Repair	233	479,319
Upper Hinds 2021 Flood Repair	140,689	167,572
Lower Hinds 2021 Flood Repair	89,462	97,150
Little River 2021 Flood Repair	0	4,487
Sub-total	3,467,538	9,133,680
CDEM Response	0	414,541
Regional Parks Repair	0	334,473
Other Costs	20,600	168,226
TOTAL	3,488,137	10,050,919

Table 4-2: Canterbury 2021 Flood Response Costs at 28 February 2022.

Description	Estimated non-eligible costs	Estimated eligible costs	Total costs to date
River Rating Districts	864,960	8,268,720	9,133,680
CDEM Response	414,541		414,541
Regional Parks Repair	330,511	3,962	334,473
Other Costs	146,111	21,742	168,226
TOTAL	1,756,123	8,294,424	10,050,919

Flood monitoring costs include external goods and services such as post flood surveys and inspection flights, and external contractor on ground services not specified into a particular rating district. The estimated non-eligible monitoring costs include ECan staff costs, staff travel, vehicle use and administrative charges.

Flood repair costs for each of the affected rating districts relate to both temporary and permanent flood damage.

Figure 4-1 below shows the expenditure profile to date. It is to be expected that the profile will not be an even spend over the 2 year forecasted lifespan of the project. Rather it will have an initial high rate of spend that gradually decreases. The temporary works have been completed and larger stopbank rebuilds while be phased earlier so will alter the spend profile.

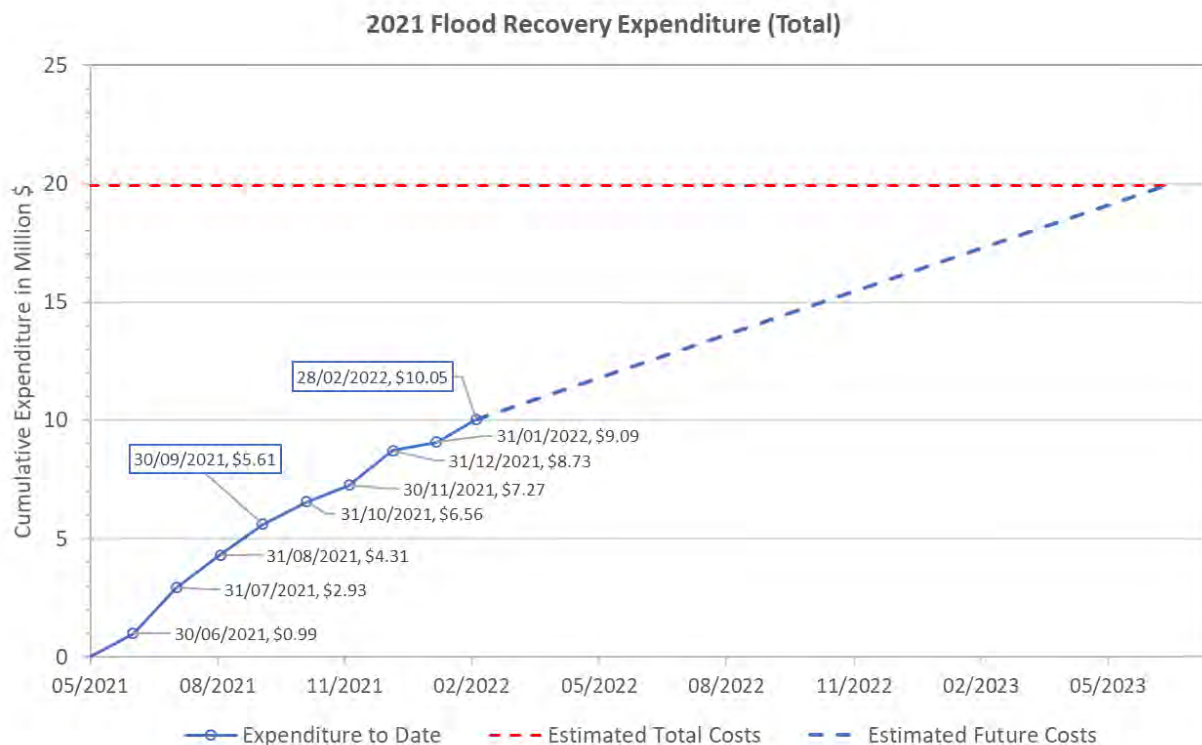


Figure 4-1: Summary of flood recovery expenditure profile.

NEMA Eligible Costs

Government policy¹ is to reimburse 60 percent of the combined eligible costs (response and essential infrastructure costs above 0.002 percent of the net capital value in the case of regional councils. For environment Canterbury the threshold has been determined to be \$4.1 million.

As presented in Table 4-1 above, Environment Canterbury has assessed that of the flood recovery expenditure to the end of February 2022, approximately \$8.3 million are NEMA eligible costs (subject to NEMA confirmation).

Environment Canterbury has submitted its first claim to NEMA. Following review of this claim it has been agreed that of the first \$6.56 Million spent, \$4.93 Million is eligible for the NEMA 60% cost share, which comes to a reimbursement value of \$489,987 after deduction of the initial threshold of \$4.1 million.

The estimated reimbursement value of Claim 2 (November 2021 – Feb 2022) is \$1.9 million (subject to NEMA review).

¹ Section 33 of the Guide to the National CDEM Plan, 2015.

Estimated Cost Apportionment

The overall estimated cost for flood recovery has been reviewed and adjusted to \$19.9 million (previously \$19.7 million). A summary of costs including costs to the end of February 2022 is provided in table 4-3 below.

Based on these estimates and what we have learnt through the processing of our first NEMA claim, the overall cost for flood recovery to Environment Canterbury is estimated to be \$13.1 million with an expected central government contribution of \$6.8 million through claims to NEMA.

These cost estimates will be reviewed again at the end of the 2021-2022 financial year. The proposed commitment from Environment Canterbury is currently limited to \$12.2 million. If it becomes clear that expenditure above this amount is likely, pre-approval for additional funding will be requested from Council.

Table 4-3: Estimated flood recovery costs with portion estimated as claimable from NEMA.

Estimated Costs	Million \$
Flood Recovery costs (incl. response) to Feb 2022	\$10.1
Estimated Future Flood Recovery Costs	\$9.8
Total Flood Response & Recovery Estimate	\$19.9
Estimated non-Eligible Recovery Costs	-\$4.4
ECan Threshold for NEMA claim	-\$4.1
Eligible for 60% government subsidy (NEMA)	\$11.4
Estimated Funding Mix	Million \$
ECan initial threshold	\$4.1
ECan – Non Eligible Costs	\$4.4
ECan – 40% of Eligible Costs	\$4.6
Total ECan Estimated Cost	\$13.1
NEMA – 60% of Eligible Costs	\$6.8
Total	\$19.9

5 Risks

Due to the extent of flood damage and the number of breakouts and breaks through flood protection infrastructure, the risk of further inundation remains high until permanent repairs can be implemented.

Most of the major stopbank breaches have now been repaired. Without vegetation adjacent to them though, these stopbanks still remain a vulnerable point in the schemes. Re-establishing this vegetation is a high priority through the coming winter season, though it is acknowledged a return to 'full strength' will take years as this vegetation will take time to grow.

The following table provides a summary of residual risk and ongoing risks to the flood recovery programme together with mitigation actions to reduce the likelihood of the risks becoming issues.

Table 5-1: Residual and Flood Recovery Project risks

Risk	Description	Mitigation Action
Further Floods	Severe weather may cause further flooding before or during flood damage repairs. This could increase the flood damage.	Undertake temporary repairs as soon as possible. (Complete) Communicate elevated residual risk to the community, especially in areas where river break-out has occurred. (Complete & Ongoing)
Spring thaw	High spring flows in the rivers when snowmelt occurs could pose further flood risk.	Assess most likely locations of high flows following spring thaws. Undertake priority temporary repairs in these areas. (Complete)
Funding	Security of funding	Ongoing communication with ECan Councillors is needed to keep them aware of funding needs from Council Reserves and potential risks. (Underway / Ongoing) Work closely with NEMA to maximize NEMA contributions and flood recovery. Closely monitor contractor and materials cost. Follow council procurement processes. Public tender for large works. (Underway / Ongoing)
Cost of Works: Fuel Cost Increases	The cost of fuel has increased significantly since the initial cost estimate was undertaken. Contractor rates are starting to reflect this.	A contingency amount of 10% of the remaining physical works estimate has been added to the overall project cost estimate. This is one of the elements of the total \$19.9 million estimate.
Material availability	The availability of material, particularly to undertake tree replacement. Both heavy and light anchored bank protection requires significant lengths of cable and anchors (typically concrete blocks).	Councils around the country have been made aware of ECan's need for steel cable. Alternative sources are being investigated. Immediate needs are covered. Contingencies may need to be considered, including the use of higher cost rock protection where material availability limits the reinstatement of anchored tree protection.
Tree growth time	The time for re-establishment of tree edge protection poses a risk until trees can be established.	In critical areas of high risk, alternatives, particularly rock protection, may need to be considered to mitigate risk. As far as is practicable, live trees are being salvaged from the river fairways and being utilised in repair works. Many of these large trees will resprout and form the future erosion protection.
Staff Resource	Staff resources are limited to undertake oversight and coordination of significant flood damage repairs.	Consider additional contract resource for flood damage assessment, prioritisation and works and on-site works supervision that cannot be delivered in-house.
Programme length	Property owners want works associated with their property undertaken first.	Prioritise flood damage repairs based on risk and develop and implement a communications plan. (ongoing) Communicate directly with property owners, and with the community as a whole keeping them informed of works priorities. (ongoing)
Ground conditions	River levels from time to time will restrict access and be generally unsuitable to undertake large scale works.	Monitor river levels and plan works for drier months if possible. Communicate this risk to directly affected landowners. (ongoing)

6 Communications and Community Engagement

An essential part of undertaking flood recovery is ongoing communication and community engagement.

The Environment Canterbury Flood Recovery web page is the primary means of communicating information regarding flood recovery efforts. Communication via the website is an effective way to communicate project progress to a wide audience and engage the community, particularly during periods where community engagement has been somewhat hampered by Covid 19 restrictions. The Flood Recovery webpage is located at: ecan.govt.nz/flood-recovery

During the reporting period, a live map indicating the status and location of flood damaged sites needing repairs was added. This interactive map can be accessed from the above webpage, or located directly at: ecan.govt.nz/FloodRepairMap

This map, and its associated summary tables, provides information on all flood damage repair jobs for the affected Canterbury districts. Summaries can be viewed based on user selection either of "All" areas, or by selecting a specific district. Clicking on each individual repair site on the map gives top-level information about the nature of the repair at that location and its status. A screen clip of the website is included in the following figure.

One-on-one communication continues with affected landowners particularly around works planned or underway on or adjacent to their land. The interactive web page provides a valuable tool to keep landowners updated on the status of works at specific sites that affect them or are of interest to them.

Meetings

Further updates have been provided by way of the following meetings with council and rating district liaison committees. Additionally, many one-on-one meetings with impacted landowners have been undertaken to discuss works proposed at their property.

Table 6-1: Summary of Public / External Meetings, November 2021 – February 2022

Date	Meeting Description
1 November 2021	Selwyn River / Waikirikiri Liaison Committee Rating District Meeting
3 November 2021	Little River Liaison Committee Rating District Meeting
9 November 2021	Opihi River Liaison Committee Rating District Meeting
9 November 2021	Orari River Liaison Committee Rating District Meeting
9 November 2021	Upper & Lower Hinds / Hekeao Liaison Committee Rating District Meeting
24 November 2021	Selwyn District Council – Councillor Briefing - Update on Flood Recovery
24 November 2021	Canterbury Mayors – Update on Flood Recovery
2 December 2021	Mid & South Canterbury Civil Defence – Update on Flood Recovery



Figure 6-1: Screen clip of flood recovery interactive job status web page at end February 2022.

7 Betterment Opportunities

The future state of Canterbury's braided rivers may well look different to the pre-flood state, particularly when referencing overall river width, indigenous biodiversity, mahinga kai, recreation and other values. Because fairway widths have been reduced over the last 50 years, in many cases it may not be acceptable to simply build back 'like for like'.

In undertaking flood recovery repairs consideration is being given to opportunities for betterment that create a better balance between:

- providing an acceptable (or design) level of flood protection,
- incorporating the effects of climate change,
- restoring river ecosystems,
- incorporating "Te Mana o te Wai" principles,
- allowing more room for rivers,
- recognizing land owner expectations and
- provide a fair and reasonable transition pathway for change.

Furthermore, there may of necessity be some inadvertent betterment. This includes the need to replace the function of an asset with a different asset that performs the same function. For example, there may be certain locations where it is necessary to replace tree river edge protection with rock protection because of the level of risk, and the time limitations to establish replacement tree edge protection. As these opportunities are considered there will be ongoing discussion with NEMA as to the government co-funding eligibility.

8 Stopbank flood damage repairs - details and photos

8.1 North Ashburton at Thompsons Track

Like-for like reinstatement of 340m of stopbank has been completed. This work included construction of 250m of erosion protection bunds to provide equivalent edge protection until tree edge protection can be established. Anchored tree edge protection and tree infill planting will follow in the winter of 2022.

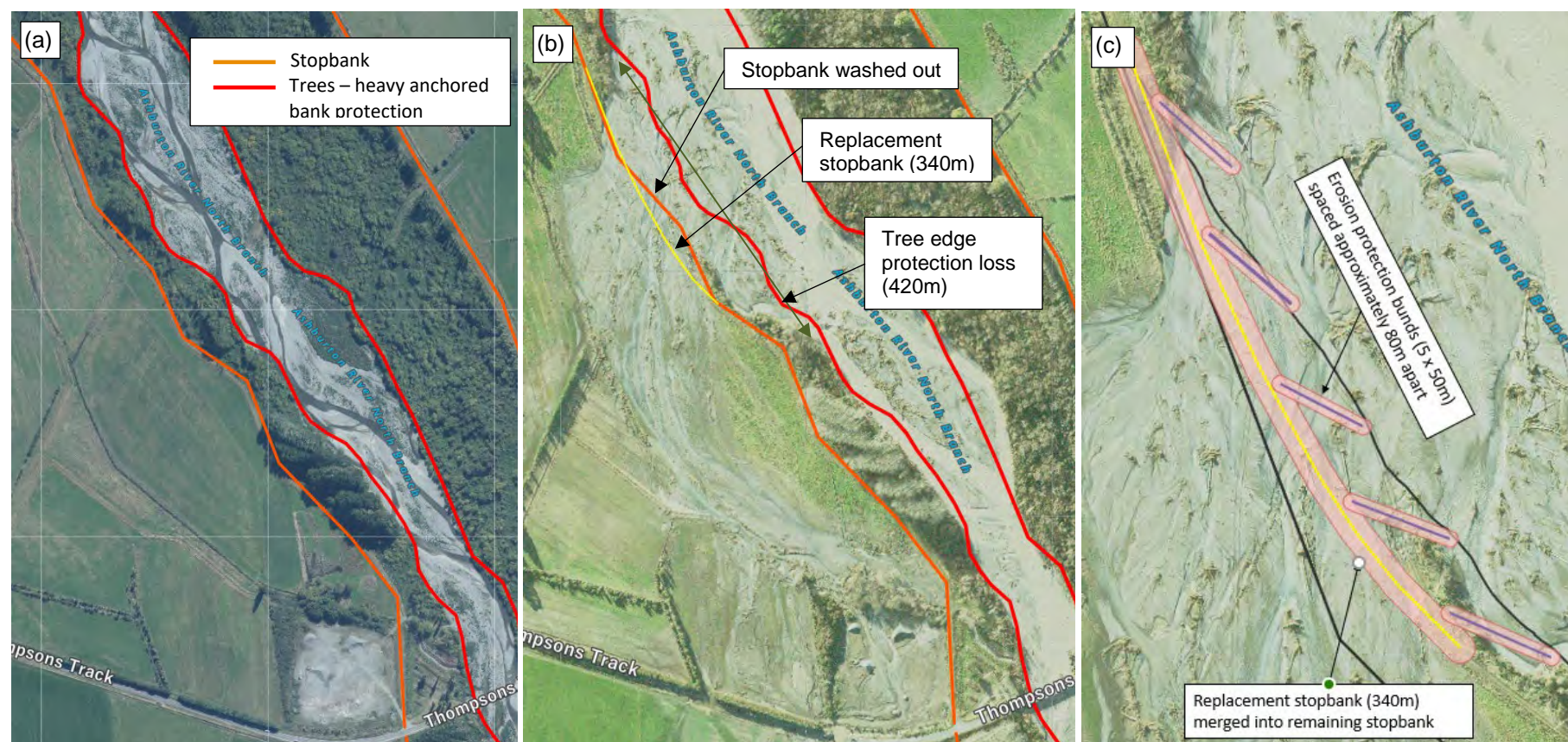


Figure 8-1: North Ashburton at Thompsons Track, approximately 23km northwest of Ashburton. (a) Aerial view prior to flood, (b) post-flood aerial showing extend of stopbank and tree edge protection asset loss, (c) Replacement stopbank and erosion protection bunds.



Figure 8-2: North Ashburton at Thompsons Track. Area of stopbank and tree edge protection loss on 3 June 2021.



Figure 8-3: North Ashburton at Thompsons Track. Completed stopbank repair on 16 March 2022. Anchored tree protection and infill planting still to be done.



Figure 8-4: North Ashburton at Thompsons Track. Looking downstream from end of remnant stopbank, 29 September 2021.



Figure 8-5: North Ashburton at Thompsons Track. Looking downstream from same location as above following completion of stopbank and erosion protection bund repair, 24 February 2022.

8.2 South Ashburton at Blacks Rd

Like-for like asset replacement required reinstatement of 670m of stopbank and 570m of tree edge protection. Stopbank repairs have been completed.

Betterment at this site included the establishment of erosion protection flanges along the upper stopbank where centre-pivot wheel access was required and tree edge protection is not possible. It also includes establishing new tree edge protection on the lower stopbank (not previously there) and some tree removal to establish a return flow channel back to the river. This work is being coordinated across ECan departments to look for opportunities to combine the return flow pathway with the enhancement of a wetland area.

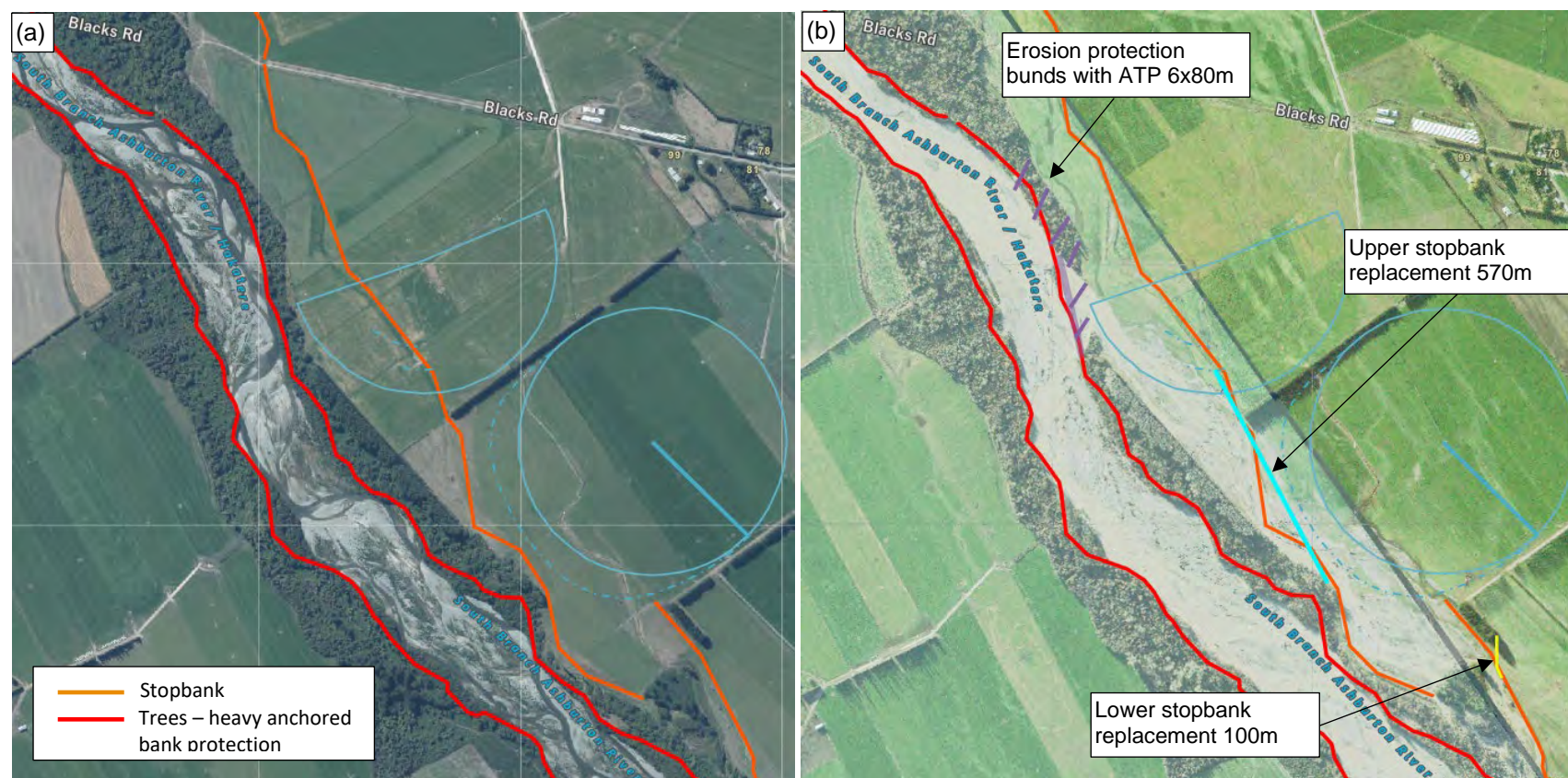


Figure 8-6: South Ashburton at Blacks Road 8km north of Ashburton. (a) Aerial view prior to flood, (b) post-flood aerial showing extent of stopbank and tree edge protection asset loss with proposed replacement stopbanks and erosion protection bunds. Location of centre pivots included for reference.

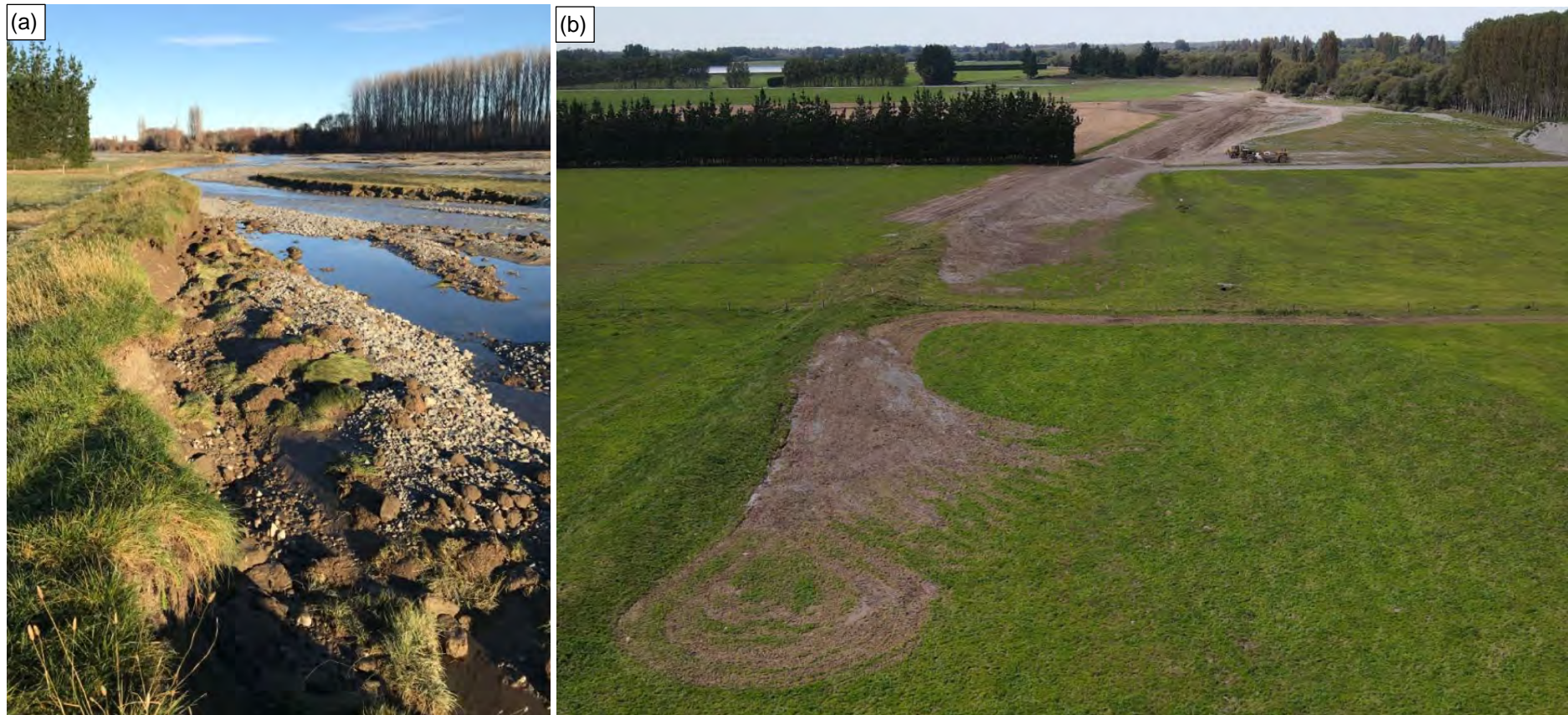


Figure 8-7: South Ashburton at Blacks Road looking downstream (a) from remnant upper stopbank soon after flood, (b) from drone following completion of upper stopbank replacement.



Figure 8-8: South Ashburton at Blacks Road looking upstream from lower end of remnant stopbank (a) early June 2021, (b) September 2021 and (c) on completion of replacement stopbank in February 2022.



Figure 8-9: South Ashburton at Blacks Road, installation of anchored tree protection at erosion protection bunds: (a) installation of concrete block anchors, (burying willow poles in trench, and (c) completed ATP on upstream edge of erosion protection bund.

8.3 Orari at Inglis Rd

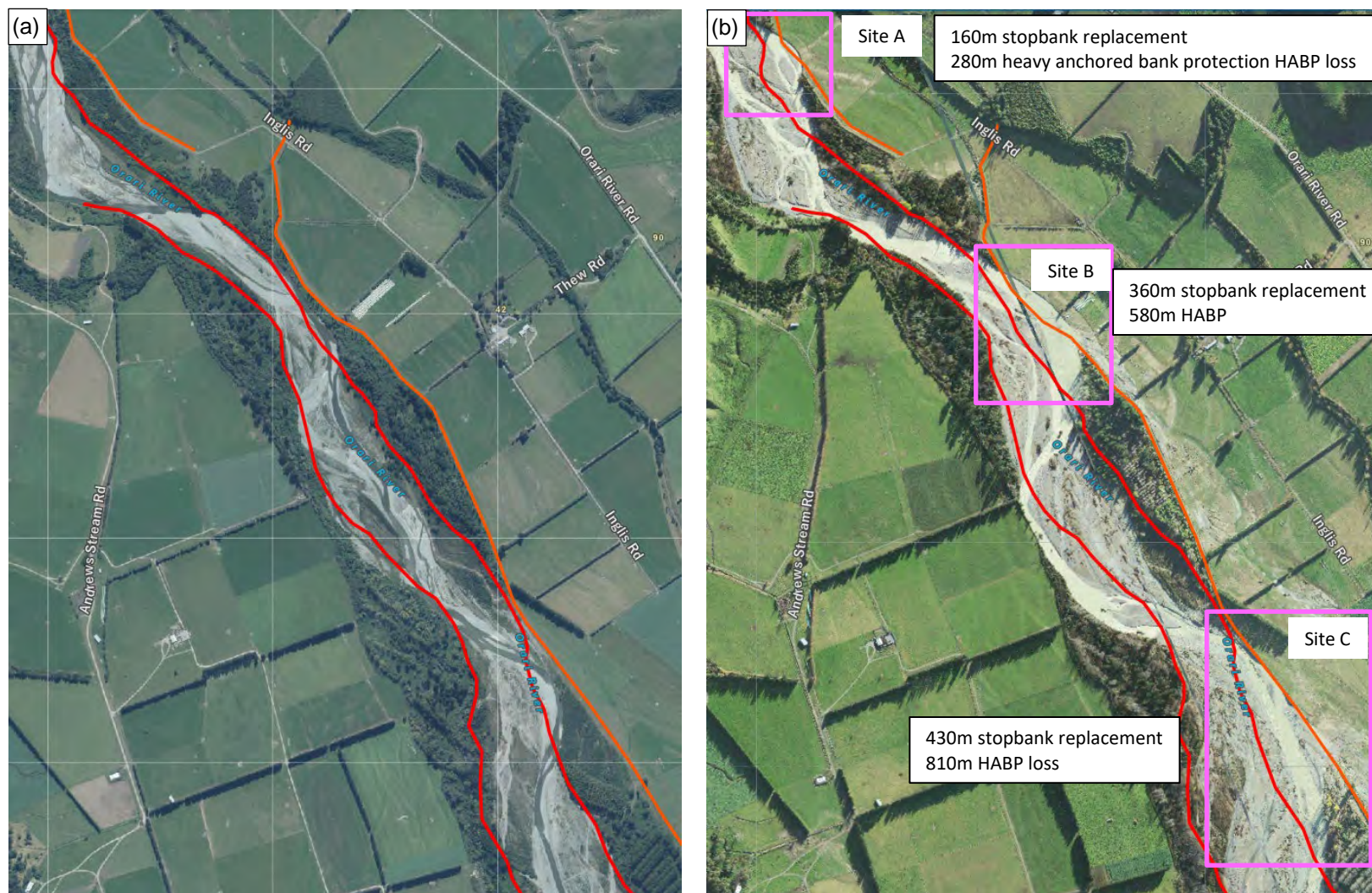


Figure 8-10: Orari at Inglis Road north of Geraldine: (a) Aerial view prior to flood, (b) post-flood aerial showing extent of stopbank and tree edge protection asset loss at three sites.

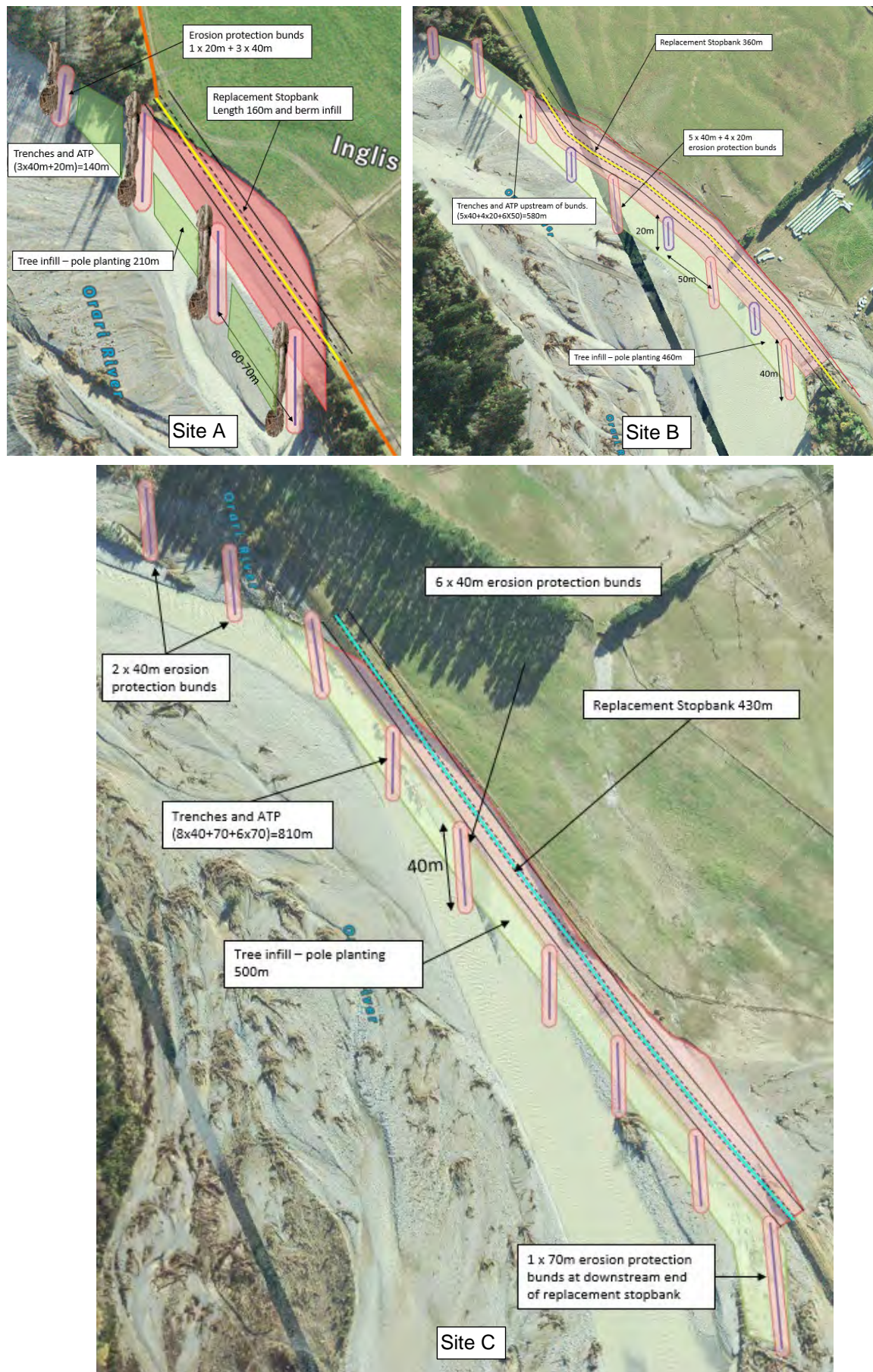


Figure 8-11: Orari at Inglis Road, flood repair design for sites A, B and C.

Orari at Inglis Rd, Site A



Figure 8-12: Orari at Inglis Rd Site A, Stopbank and edge protection loss - 28/9/2021.



Figure 8-13: Orari at Inglis Rd Site A, Stopbank reinstated - 23/2/2022. Job 23676.

Orari at Inglis Rd, Site B



Figure 8-14: Orari at Inglis Rd Site B, Temporary bund work 28/9/2021.



Figure 8-15: Orari at Inglis Rd Site B, Stopbank reinstated with erosion protection bunds. Topsoil to be added. 23/2/2022.

Orari at Inglis Rd, Site C



Figure 8-16: Orari at Inglis Rd Site C, looking downstream following temporary work prior to stopbank rebuild, September 2021.



Figure 8-17: Orari at Inglis Rd Site C, looking downstream following temporary work prior to stopbank rebuild, January 2022.



Figure 8-18: Orari at Inglis Rd Site C, looking upstream. Stopbank rebuild nearing completion, January 2022.



Figure 8-19: Orari at Inglis Rd Site C Stopbank completed to design height 7 of 9 erosion bunds complete, topsoil to follow, 23 February 2022.

8.4 Orari at SH 79

Like-for-like reinstatement of 230m of stopbank rebuild; 160m of erosion protection bunds. Anchored tree protection and infill planting still needs to be undertaken in winter of 2022.

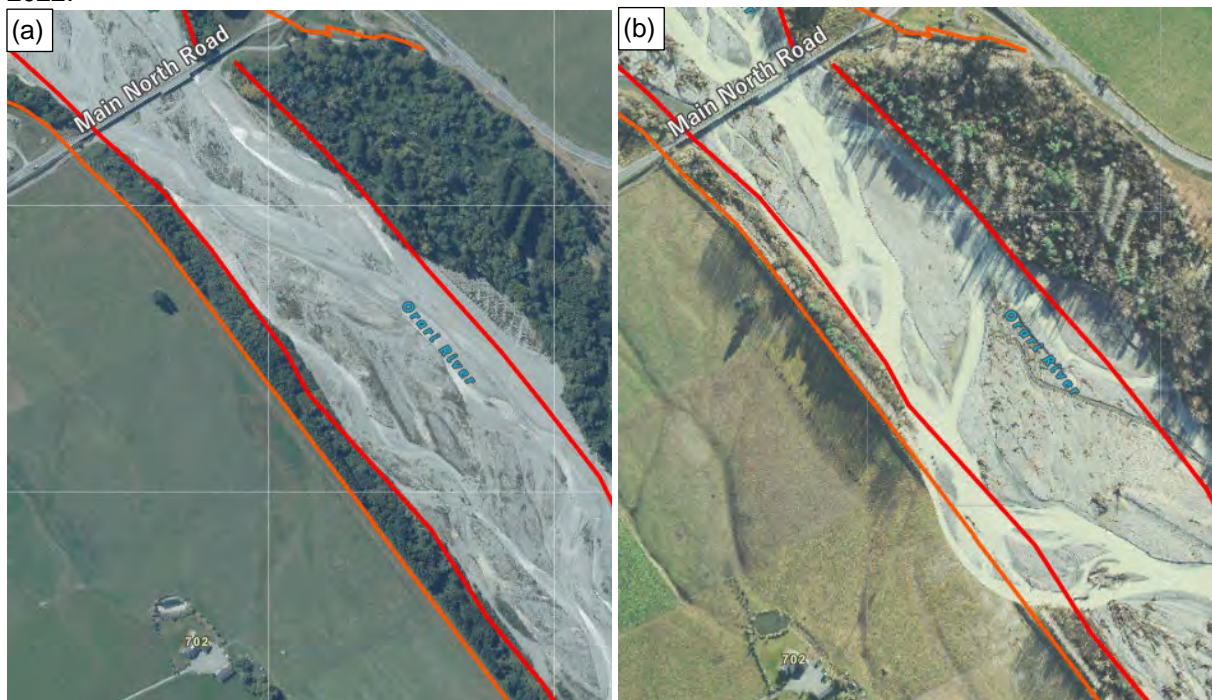


Figure 8-20: Orari at SH79: (a) Aerial view prior to flood, (b) post-flood aerial showing extent of stopbank and tree edge protection asset loss.



Figure 8-21: Orari at SH79: (a) following temporary bunding work prior to stopbank repairs. 27/1/2022.



Figure 8-22: Orari at SH7 during stopbank repairs. 17/2/2022.



Figure 8-23: Orari at SH7 completed stopbank repairs. 18/3/2022.



Figure 8-24: Orari at SH7 following completion of temporary repairs 5/8/2021.



Figure 8-25: Orari at SH7 following completion of stopbank and erosion protection bund works 16/3/2022.

8.5 Orari at railway bridge

Stopbank repairs on the Orari at the railway bridge have been undertaken by KiwiRail, to protect their bridge. Erosion protection bunds and anchored tree protection will still be required upstream of these works as a first step towards re-establishing the lost tree edge protection.

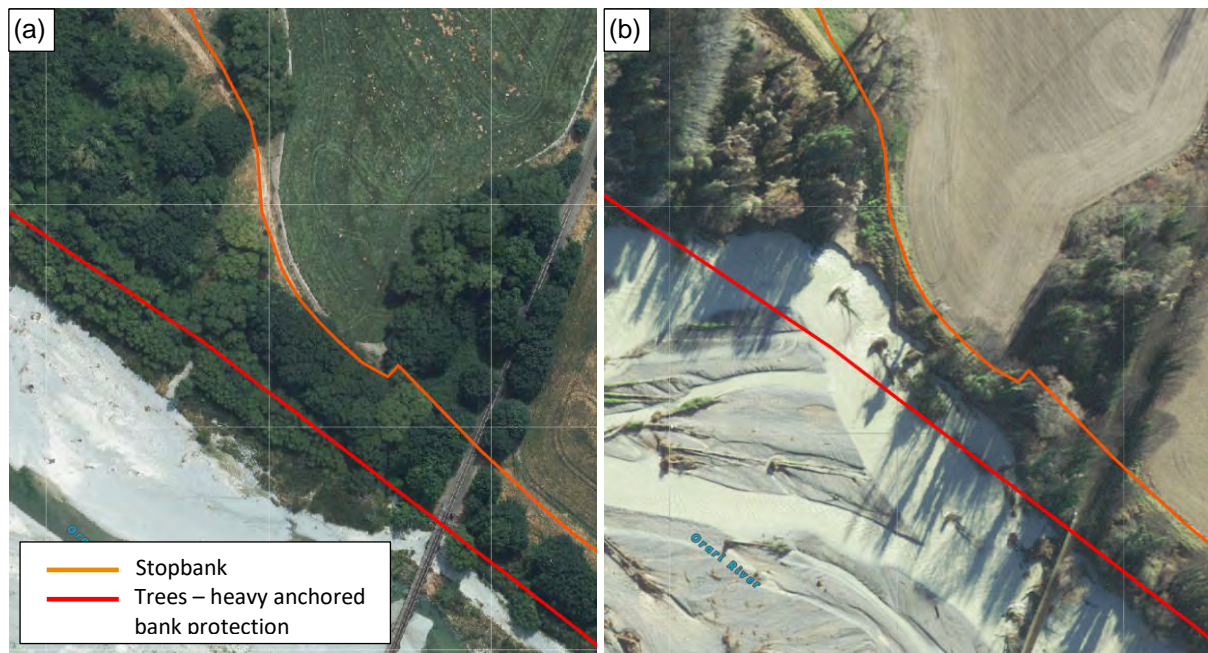


Figure 8-26: Orari at the railway bridge: (a) Aerial view prior to flood, (b) post-flood aerial showing extend of tree edge protection asset loss and stopbank damage.



Figure 8-27: Orari at the railway bridge stopbank repair prior to adding or riprap rock protection. October 2021.



Figure 8-28: Orari at the railway bridge stopbank repair addition of rock riprap protection. November 2021.



Figure 8-29: Orari at the railway bridge completed stopbank with rock protection. February 2022

8.6 Waihi at Hawke Rd

Repairs were required at three sites to reinstate a total of 550m of stopbank and 880m of tree edge protection. Stopbank repairs have been completed including erosion protection bunds at the most upstream site as a first step towards re-establishing tree edge protection. Installation of anchored tree protection at the upstream site and infill tree pole planting at all three sites is due to commence in winter 2022.

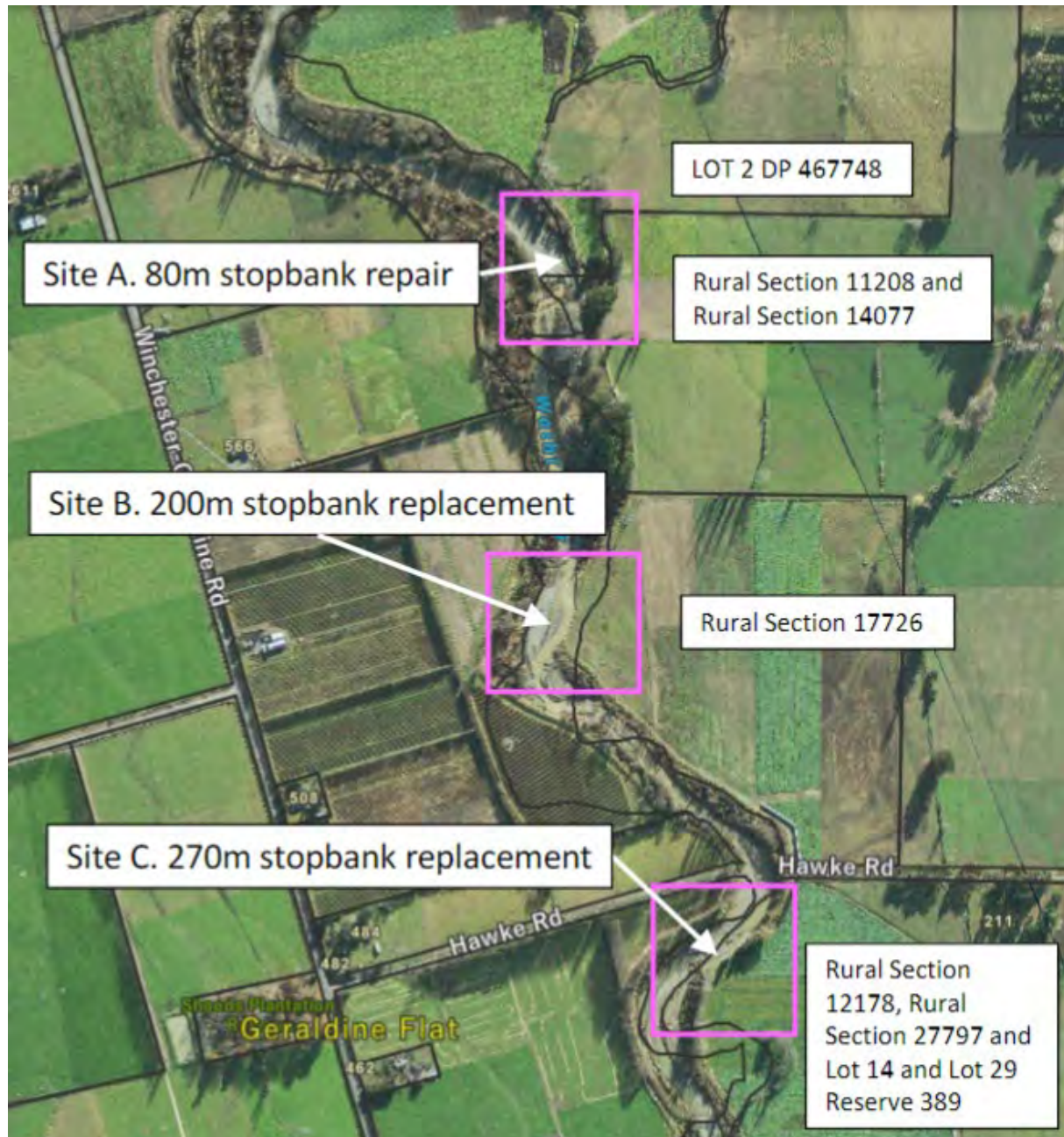


Figure 8-30: Waihi at Hawke Rd, location of three sites at which stopbank and tree edge protection assets have been lost.



Figure 8-31: Waihi at Hawke Rd Site A, following temporary bund work prior to permanent repairs, 28/9/2021.



Figure 8-32: Waihi at Hawke Rd Site A following completion of stopbank repairs and installation of erosion protection bunds 23/2/2022



Figure 8-33: Waihi at Hawke Rd Site A, showing flood damage to stopbank 28/9/2021.



Figure 8-34: Waihi at Hawke Rd Site A, showing completed stopbank repairs and erosion protection bunds



Figure 8-35: Waihi at Hawke Rd Site B looking downstream showing temporary bund work prior to permanent repairs, 28/9/2021.



Figure 8-36: Waihi at Hawke Rd Site A, showing completed stopbank repairs and erosion protection bunds, 9/2/2022.



Figure 8-37: Waihi at Hawke Rd Site C looking downstream showing loss of stopbank and tree edge protection, June 2021.



Figure 8-38: Waihi at Hawke Rd Site C looking downstream following completion of stopbank repairs, 23/2/2022.

8.7 Opihi at Collett Rd

Tree edge protection was washed out and the existing stopbank partially damaged. The most cost effective repair was to relocate 120m of the stopbank inland, making more room for the river and to enable the reinstatement of 150m of tree edge protection.



Figure 8-39: Opihi at Collett Rd prior to stopbank repairs, 23/2/22.



Figure 8-40: Opihi at Collett Rd, following completion of stopbank and erosion protection bund works 23/3/2022.

9 Other major repairs - details and photos

9.1 Ashburton at River Rd

At this location 310m of tree edge protection were lost placing the stopbank and downstream dwellings at risk. Repairs have included temporary bunds followed up with greyiness and anchored tree protection to start to re-establish the tree edge protection.

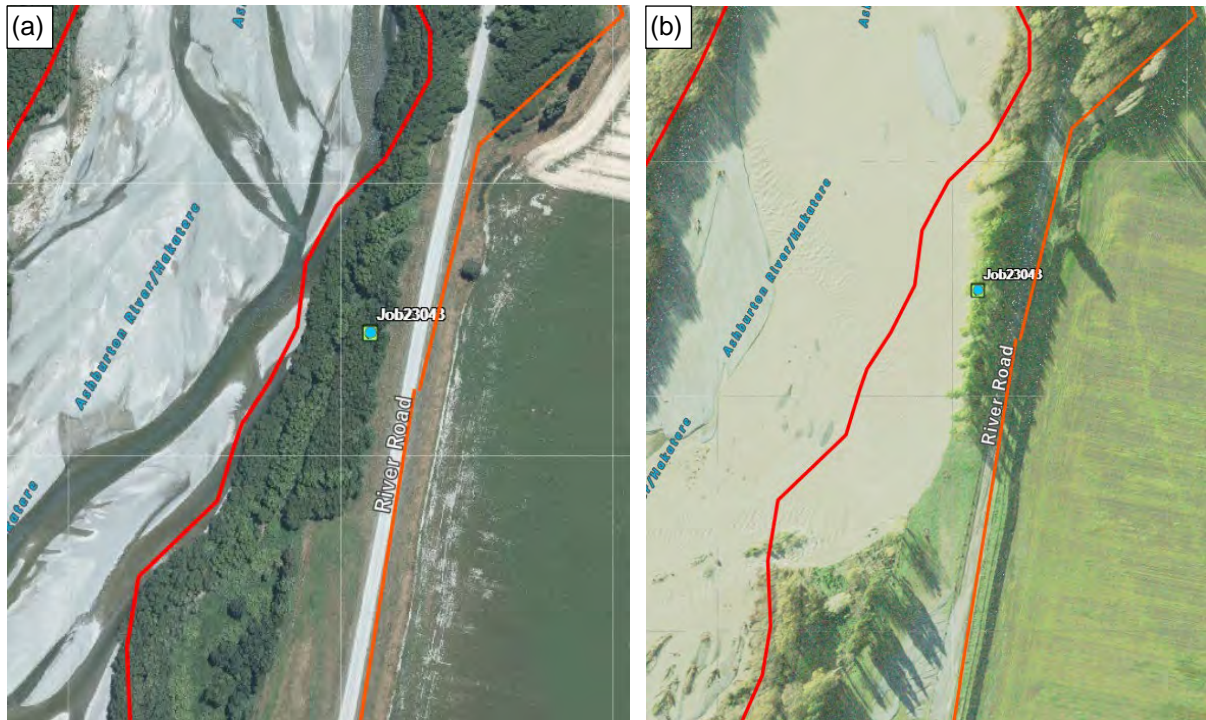


Figure 9-1: Ashburton at River Rd: (a) Aerial view prior to flood, (b) post-flood aerial showing extend of tree edge protection asset loss and risk to stopbank.



Figure 9-2: Ashburton at River Rd, initial temporary protection bunds, August 2021.



Figure 9-3: Ashburton at River Rd, erosion protection groynes under construction, 23/9/2021.



Figure 9-4: Ashburton at River Rd, completed groynes with ATP, 3/3/2022.

9.2 Orari at racecourse

At this location temporary channel alignment was undertaken followed replacement of tree edge protection lost over 160m.



Figure 9-5: Orari at racecourse: (a) aerial view prior to flood, (b) post-flood aerial showing extend of tree edge protection lost.



Figure 9-6: Orari at racecourse installation of rope and rail.



Figure 9-7: Orari at racecourse infill with willow poles.



Figure 9-8: Orari at racecourse completed work 21/10/21.

9.3 Waihi at SH79, Geraldine

Two areas of scour occurred removing 90m of tree edge protection on the true right bank (TRB) and 100m of tree edge protection on the true left bank (TLB) directly upstream and downstream of the SH79 bridge in Geraldine. Due to the lack of space to implement other options, a “Heyman Fence” rope and rail has been installed at these sites.



Figure 9-9: Waihi at SH79, Geraldine: (a) aerial view prior to flood, (b) post-flood aerial showing extent of tree edge protection lost.



Figure 9-10: Waihi at SH79, Geraldine TRB upstream of bridge, flood damage, September 2021.



Figure 9-11: Waihi at SH79, Geraldine TRB upstream of bridge with completed Heyman Fence repair, March 2022.



Figure 9-12: Waihi at SH79, Geraldine TRB upstream of bridge. Aerial view looking upstream - completed Heyman Fence repair. March 2022.



Figure 9-13: Waihi at SH79, Geraldine TLB downstream of bridge. Completed Heyman Fence repair. March 2022.



Figure 9-14: Waihi at SH79, Geraldine TLB downstream of bridge. Aerial view looking upstream - completed Heyman Fence repair. March 2022.

9.4 Waihi at Geraldine NPD

Tree edge protection was damaged and lost over a length of 150m on the TRB of the Waihi River in this area. Flood damage and scour at this location placed the NPD garage and other commercial property at risk of collapse into the river. Existing rock groynes were damaged requiring rebuilding of 4 existing groynes and building 2 new groynes to provide equivalent protection for the tree edge protection lost.



Figure 9-15: Waihi at Geraldine, NPD: (a) aerial view prior to flood, (b) post-flood aerial showing extent of tree edge protection lost.



Figure 9-16: Waihi at Geraldine, NPD flood damage to rock groynes on TRB. June 2021.



Figure 9-17: Waihi at Geraldine, NPD completed repair to rock groynes and access track on TRB. March 2022.



Figure 9-18: Waihi at Geraldine, NPD repaired rock groynes on TRB looking downstream. March 2022.

9.5 Waihi at Geraldine High School

Tree edge protection was lost over 120m and subsequent bank scour placed school facilities at risk. A Hayman Fence repair has been implemented with follow up planting still to be undertaken.

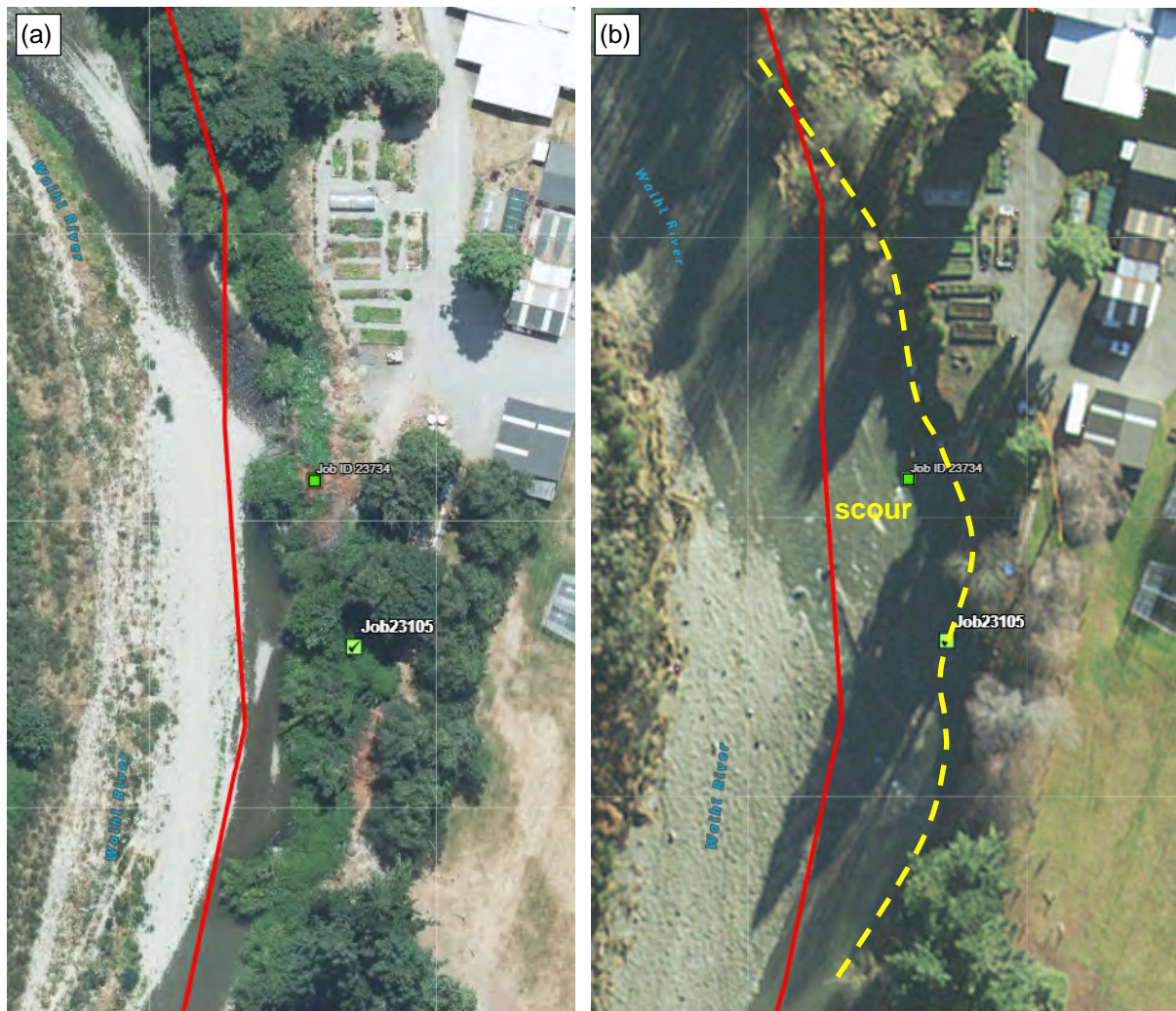


Figure 9-19: Waihi at Geraldine High School: (a) aerial view prior to flood, (b) post-flood aerial showing extent of tree edge protection lost.



Figure 9-20: Waihi at Geraldine High School flood damage 11/6/2021.



Figure 9-21: Waihi at Geraldine High School temporary repair 15/6/21.



Figure 9-22: Waihi at Geraldine High School Hayman Fence being implemented 27/1/2022.



Figure 9-23: Waihi at Geraldine High School, completed Hayman Fence repair 23/2/2022.



Figure 9-24: Waihi at Geraldine High School, completed Hayman Fence repair aerial view, March 2022.