CANTERBURY REGIONAL COUNCIL
Kaunihera Taiao ki Waitaha

River Engineering

Asset Condition Summary

June 2023

1. Summary

Overall, the majority of Environment Canterbury owned flood protection, erosion control and land drainage assets are considered to be in acceptable or better condition and are fit for purpose. The major exceptions are;

- Approximately 17% of the stopbank network has been assessed as vulnerable or somewhat vulnerable due to known stopbank condition issues
- Significant capacity issues have been identified in the Selwyn and North Branch Ashburton Rivers
- The majority of culvert structures have not been internally inspected (CCTV) for over 5 years.

Plans to respond to these major exceptions will be factored into budgeting considerations for individual schemes and the 30 Year Infrastructure Strategy 2024-54. It is anticipated that over time, the level of information and overall condition ratings will improve.

2. Introduction

Asset condition is a measure of the physical state of the asset and is visually assessed by staff on an annual basis. Environment Canterbury has several methods to monitor the condition of the rating districts assets. This information is critical to the overall life cycle management of the assets, with regards to maintaining the asset at minimum cost, whilst maintaining the required level of service, forecast renewal requirements and prioritising works. The assets are inspected depending on the asset type and the importance of the asset.

Condition information is currently available for some of Environment Canterbury's river and drainage scheme assets, but not all. For very localised schemes, the asset management compliance report is sufficient to summarise the condition of assets, these are completed on a yearly basis.

The asset types that have had a documented condition assessment include:

- Stopbanks
- River berms (includes assessment of the relative erosion protection value of trees, groynes and rockwork)
- River fairways (not included in asset valuations but a critical part of scheme capacity)
- Drains.

Condition assessments are typically on a 1-5 scale, where 1 means excellent condition, 3 may be adequate or with minor deficiencies and 5 is very poor condition, or not fit for purpose.

Culverts and other structures tend to be inspected frequently and have generally also had some condition assessment but the documentation for these assessments is ad hoc and not easily summarised.

3 River Scheme stopbank condition assessments

There are two main types of documented stopbank condition assessment.

1. **Localised defect condition assessment:**

Theses are programmed to be assessed in a systematic way, but the assessments can also be added to frequently as issues arise (ad hoc and post-flood event).

2. Reach defect condition assessment/standard assessment:

The localised defect assessments feed into a "standard" assessment of sections of stopbank typically 2-5km long. These assessments are more generalised and on a longer cycle. These generalised assessments can form part of stopbank risk assessments, which assess the likelihood and consequences of failure of a stopbank but are not reported on here.

2.1 Localised stopbank assessments

For most schemes, only moderate and significant localised defects are recorded (3's, 4's and 5's).

The Stopbank reach condition score is based on how the most significant defects can influence the likelihood of failure during a design flood event.

Some schemes have a more detailed localised defect record, including very minor defects (1's and 2's), which in general do not influence the score for a length of stopbank.

Table 1: Localised defect condition assessment scoring example

Score	Severity	Examples
1 (Excellent)	Localised, barely noticeable	Woody/shrubby weeds, Rabbit scratchings, Good tie-in with a well-constructed groyne, track, or structure
2	Noticeable	Locally steep batters at culverts, Minor stock damage
3 (Acceptable)	Evident, a cause for concern	Rabbit hole, Tree growing on bank, Crack traceable part way through bank or 1x top width along bank, Poor tie-in with moderately vulnerable groyne, track or structure adjacent to the bank, Evidence of seepage adjacent to a structure through the bank, Poor grass growth, Well-worn bike/4WD track
4	Significant	Significant stock damage, Insufficient topsoil for grass to grow, Excessive shading, Bike/4WD track that has gouged a path and reduced level of top of stopbank.
5 (Vulnerable)	Extensive, major weak point in structure	Stopbank toe undercut >0.5m, Extensive rabbit network, Large, shallow-rooting tree, Vulnerable tie-in with eroding groyne or track, Poor tie-in with a structure through the bank, Significant level deficiency

2.2 Reach stopbank assessments - Summary of condition assessments of Environment Canterbury stopbanks 2020-2023

A "standard" stopbank condition assessment has been undertaken for several schemes, with a "reach" or section of bank assigned a score according to the weakest link in that bank.

A note on capacity

In most cases, it is difficult to relate stopbank capacity and stopbank condition as the two processes are carried out quite separately, involve very different information and are monitored separately. Stopbank capacity is measured using hydraulic models that either use cross-section or Lidar information to model water levels and compare them to stopbank levels, while stopbank condition is assessed visually. The condition scores below generally do not account for capacity – but an exception was made in some sections of the North Branch Ashburton River where the capacity was known to be deficient after the May 2021 flood and some sections of stopbank downgraded. This lack of capacity has since been confirmed by hydraulic modelling.

Significant lack of capacity is known in the following stopbanked reaches:

- North Branch Ashburton River, Thompsons Track to Mt Harding Creek – typically 350 cumecs compared to a design capacity of 550 cumecs
- Selwyn River downstream of Coes Ford – typically 350 cumecs compared to a design capacity of 560 cumecs. (A scheme review is underway to investigate possible responses).

A more modest lack of capacity, typically managed by gravel extraction, is evident in the following reaches:

- Waimakariri River downstream of the Eyre diversion 1-13km
- Ashley/Rakahuri River downstream of SH1 1-3km
- Ōrāri River (several discrete reaches)

Table 2: Asset Condition as of June 2023

		Number of reaches in each category					
		1	2	3	4	5	Not assessed
Kaikoura Rivers 34km	Kowhai River		6	6	3		10
	Mt Fyffe streams		5	7		1	7
Hanmer 1km			1				
Lyndon 0.5km					1		
Waiau Town 1km		1				1	
Kowai 0.5km			1				
Ashley River Scheme 35km			13	1			
Waimakariri - Eyre – Cust Scheme 145km	Waimakariri River	11	10	1			
	Eyre, Cam, Cust, other	2	10	10	1		1

Table 2: Asset Condition as of June 2023, continued

		1	2	3	4	5	Not assessed
Dry Creek 1km		1		1			
Ashburton Rivers Control Scheme 77km	Ashburton Main Stem		2	3	1		
	Ashburton North Branch		5	6	2	2	1
	Ashburton South Branch		1			1	
Lower Hinds River Control Scheme 20km	Lower Hinds River		1	1	2		
Upper Hinds Catchment Control Scheme 2km	South Branch Hinds River				1		
Orari - Waihi - Temuka Rivers 128km	Orari River and tributaries	3	5	4	2	2	1
	Waihi River	1	2	4		1	
	Temuka River		2	1			
	Opihi River left bank d/s Temuka and Milford			2			
Opihi Catchment Control Scheme 72km	Opihi River		7	1	1	1	6
Seadown Drainage 9km			1				
Washdyke Creek 5km			1	1	1		
Saltwater Creek 3km				1			
Lower Pareora River 28km	Pareora River			5	1		
Waihao Wainono Rivers and Drainage 62km	Waihao River			5			
	Waihao Arm			1	2		
	Minor watercourses	1	4	3			3

Table 2: Asset Condition as of June 2023, continued

		1	2	3	4	5	Not assessed
Twizel 4km						2	1
Penticotico 3km					2		
Omarama 1km					1		
Total		20	77	64	21	11	30
	21 schemes representing 630km of stopbanks	10% of those assessed	40%	33%	11%	6%	10% of all stopbanks in these schemes

The condition of the Selwyn River stopbanks (22.5km) were documented in 2017 but the assessment was superseded by the May 2021 floods when a post-flood inspection was undertaken, including one significant stopbank breach. The stopbank scores were not reassessed but the most significant repairs have since been completed.

The following stopbanked schemes have not had recent condition assessments:

Table 3 Stopbanks yet to be assessed

River/scheme	Length to be assessed (km)	Priority
Sefton-Ashley	5.0	Medium
Rakaia Double Hill	3.6	Low
Rangitata River	3.6	Low (recently rebuilt)
Waiau Spotswood	2.3	Low (informal banks)
Total	14.5 km not assessed	

3 Fairway and berm condition assessments:

Fairway and berm condition assessments were undertaken for a number of rivers from 2020. The desired fairway widths and ideal and minimum buffer widths were assessed before scoring. The assessments were based largely on aerial photography from around 2017, with some more recent assessments using photography flown in 2022. A few of these have been supplemented in places by more recent Google and satellite images.

Table 4 shows the scoring examples for each condition score given.

Table 4: Scoring examples

Score	Condition description	Fairway examples	Berm buffer examples
1	Ideal, excellent, highly resilient	Within design channel alignment and bed levels, little vegetation	Wide berm, healthy, uniform density, height, and root mass
2	Good	Minor bed or bank erosion, few woody weeds within design channel	Minor bank erosion, rubbish
3	Adequate, fit for purpose, moderate	Moderate bed erosion, debris or vegetation restriction, mainly within design channel alignment	Good berm width, minor disease or insect damage, some weed infestation
4	Poor	Parts need realignment, significant erosion or bed build-up or vegetation restriction	Berm somewhat vulnerable, significant silt build-up
5	Inadequate, very poor	Well outside of design channel alignment, large areas of debris or vegetation obstructions	Very narrow berm, major bank erosion, significant weed infestation

Table 5 shows the overall scoring for the rivers assessed 2020 to 2023.

Table 5: Fairway and berm condition assessments by river

Percentage of fairway and berm in each category

River or scheme	1	2	3	4	5
Kaikoura (16km)	50%	16%	23%	7%	4%
Conway (4km)	35%	34%	16%	12%	2%
Hanmer (8km)	11%	9%	23%	25%	31%
Waiau Rotherham (15km)	13%	23%	21%	23%	19%
Waiau Town (9km)	13%	27%	27%	26%	7%
Lower Flats Waiau (6km)	5%	25%	18%	35%	17%
Waiau Bourne (4km)	20%	30%	22%	28%	0%
Waiau Spotswood (6km)	18%	27%	19%	28%	8%
Upper Pahau (3km)	0%	8%	30%	37%	26%

River or scheme	1	2	3	4	5
Lower Pahau (11km)	5%	6%	18%	36%	36%
Lower Hurunui (fairway only, 13km)	9%	75%	10%	5%	0%
Kowai North Branch (7km)	7%	10%	21%	33%	29%
Kowai (6km)	6%	13%	44%	32%	4%
Ashley (21km)	34%	28%	26%	13%	0%
North Rakaia (26km)	23%	34%	29%	11%	3%
Lower Rakaia (60km)	16%	13%	28%	26%	17%
Selwyn/Waikirikiri (39km)	5%	16%	47%	21%	11%
Ashburton (155km)	44%	24%	22%	9%	2%
Lower Hinds (35km)	1%	17%	54%	27%	1%
Upper Hinds (55km)	6%	20%	55%	11%	8%
Rangitata (41km)	14%	22%	32%	15%	17%
Ōrāri-Waihī-Temuka (58km)	13%	27%	39%	13%	8%
Ōpihi (105km)	20%	24%	26%	17%	7%
Pareora (16km)	5%	18%	52%	22%	3%
Waihao River (10km)	6%	22%	46%	22%	4%
Twizel (3km)	1%	0%	64%	25%	10%
Penticotico (2km)	10%	27%	36%	10%	18%
Lower Waitaki (fairway only, 65km)	12%	39%	33%	16%	0%
Overall average (799km)	20%	23%	32%	17%	8%

A fairway and berm assessment will be programmed for those rivers where it is appropriate (as shown in table 6 below).

Table 6: Remaining rivers to have fairway and berm assessments completed

River	Priority	Length to be assessed (km)
Waimakariri, Eyre, Cust	High	105
Lower Waitaki (berms)	Med-high	56
Kaiapoi	Med	8
Otaio	Low	46
Total		215

4 Drain and watercourse condition assessments

4.1 Kaikoura Drainage scheme

In 2020, e2 Environmental was engaged to carry out a condition assessment of the Kaikoura Drainage scheme as part of the Kaikoura schemes review. Overall, the assessment covered channels, structures, planting, erosion and deposition, and fish passage. The current objectives of the scheme relate to the drainage function only and not the other aspects assessed, such as adequacy of riparian planting. The scheme was given an overall rating of moderate. This is reflective of the overall scheme serving a rural catchment with and designed primarily to provide drainage function with relatively low levels of service on much of the scheme.

The following table details the percentages of assets (by length) and their associated rating.

Table 7: Percentage of Kaikoura Drainage Scheme channels for each condition rating in each part of the assessment

	1 Very Good	2 Good	3 Moderate	4 Poor	5 Very Poor
Drainage Channel	1%	14%	30%	51%	4%
Bridge/ Culvert	8%	35%	32%	26%	0%
Riparian planting	2%	9%	19%	43%	26%
Scour/ erosion	73%	9%	9%	8%	0%
Deposition	80%	10%	8%	0%	2%
Erosion protection	0%	6%	85%	9%	0%
Fish passage	19%	71%	6%	3%	1%
Overall rating	1%	8%	58%	33%	0%

Other drainage schemes have not had a documented condition assessment, though there is frequent monitoring for obstructions, which informs the day-to-day work priorities.

5 Culverts, floodgates, floodwalls and other structures

Environment Canterbury manages 305 culverts and floodgate structures. Culverts with flapgates and floodgate structures are inspected frequently for blockages, in particular when there are heavy rain warnings relevant to each catchment.

About 50% of the culverts had a CCTV inspection several years ago, which informed the works programme for remediation. All are due for reinspection.

All of the culverts and floodgate structures were included in an evaluation of fish passage and included in a prioritisation programme for fish passage upgrades. Two floodgates have been replaced, one on a tributary of the Waihao River, and at Leggits culvert, on the Waikuku Stream (into the Ashley/Rakahuri). A further five floodgates are programmed to be replaced with fish friendly gates in September 2023.

Environment Canterbury manages 4 floodwalls, 3 retaining walls and 2 flood barriers of various sizes and types, which have been subject to their own inspections on an ad hoc basis. In general, they are in good or adequate condition, with the exception of a short floodwall in the Ōrāri-Waihī-Temuka scheme that is in poor condition, where options for replacement are being explored.

The Waihao Box has not had a specific recent condition assessment but had a significant upgrade of the nose section in 2013.

Table 8 Summary of types of assessment by scheme

				Scheme type				Condition Assesment	
	Area	**River/Tributary**	**Design flood size (cumecs)**	**Flood protection**	**Erosion protection**	**Fairway clearance**	**Drainage**	**"Stopbank condition assement "**	**"Fairway and berm assesment "**
Comprehensive River Schemes	North	Waimakariri Eyre Cust	4730	x	x	x	x	✓	x
	South	Opihi CCS	3460	x	x	x	x	✓	✓
		Orari-Waihi-Temuka	1200/150/720	x	x	x	x	✓	✓
	North	Ashley	2400 (3000)	x	x	x		✓	✓
		Kaikoura Rivers + Drainage		x	x	x	x	✓	✓
	Central	Ashburton River	1350/850/550	x	x	x		✓	✓
		Selwyn River	560	x	x	x		x	✓
	South	Rangitata River	1500	x	x	x		x	✓
		Pareora	500	x	x	x	x	✓	✓
		Waihao Wainono Combined	975	x	x	x	x	✓	✓
	Central	Upper Hinds	164	x	x	x		✓	✓
		Lower Hinds	164	x	x	x		✓	✓
Localised River Schemes with urban benefit and/or stopbanks	North	Waiau Town Area	N/A (MAF 1020)	x	x	x		✓	✓
		Hanmer West - Chatterton River	120	x	x	x	x	✓	✓
		Sefton Ashley	N/A	inf			x	TBC	N/A
		Kowai Leithfield	Not defined	x	x	x		✓	✓
	Central	Rakaia Double Hill	Not defined	x	x	x		x	N/A
		Dry Creek	Not defined	x	x	x		✓	N/A
	South	Washdyke Creek	280	x	x	x		✓	N/A
		Seadown Drain	coastal overtopping	x			x	✓	N/A
		Saltwater Creek	85	x		x		✓	N/A
		Penticotico	52	x	x	x		✓	✓
		Twizel River	113/255	x	x	x		✓	✓
Large Schemes with no flood protection	South	Lower Waitaki River	N/A (MAF 1200)		x	x		N/A	✓
	Central	Lower Rakaia	N/A (MAF 2500)		x	x		N/A	✓

Table 8 Summary of types of assessment by scheme, continued

Localised River Schemes - Erosion protection only	North	Conway River			x	x		N/A	✓
		Waiau Rotheram			x	x		N/A	✓
		Lyndon			x	x		✓	N/A
		Lower Flats Waiau			x	x		N/A	✓
		Waiau Bourne	N/A (MAF 1020)		x	x		N/A	✓
		Waiau Spotswood	N/A (MAF 1020)		x	x		TBC	✓
		School Creek				x		N/A	N/A
		Upper Pahau			x	x		N/A	✓
		Lower Pahau			x	x		N/A	✓
		Lower Hurunui				x		N/A	Fairway only
		Kowai North Branch			x	x		N/A	✓
		Sefton Town				x		N/A	N/A
	Central	Little River Wairewa				x		N/A	x
		North Rakaia	N/A MAF 2500		x	x		N/A	✓
		Cleardale			x	x		N/A	N/A
		Mt Harding Creek			x	x		N/A	N/A
		Staveley S.W Channel				x		N/A	N/A
	South	Upper Waitaki Rivers				x		N/A	N/A
		Taitarakihi Stream				x		N/A	N/A
		Otaio River			x	x		N/A	x
		Esk Valley			x	x		N/A	N/A
		Makikihi River			x	x		N/A	N/A
		Omarama Stream		inf	x	x		N/A	N/A
Large Drainage Schemes	Central	Ashburton Hinds					x	N/A	N/A
		Halswell River Drainage		inf			x	N/A	N/A
		Te Waihora/Lake Ellesmere					x	N/A	N/A
Small Drainage Schemes	Central	Prices Valley					x	N/A	N/A
		Greenstreet Creek					x	N/A	N/A
		Buttericks Rd Drain					x	N/A	N/A
		Chertsey Rd Drain					x	N/A	N/A
	South	Kapua Drain					x	N/A	N/A
		Seadown Road Drain					x	N/A	N/A

Environment Canterbury
Regional Council
Kaunihera Taiao ki Waitaha

Taking action together to shape a thriving and resilient Canterbury, now and for future generations.

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