OTAGO REGIONAL COUNCIL

Infrastructure Strategy Development 2027-2057

Investment Logic Mapping

Context Paper

Flood protection, land drainage and river management infrastructure

10 September 2026

Otago Regional Council

Purpose of this paper

Why we are here

Otago Regional Council (ORC) is preparing the Infrastructure Strategy (IS) for the 2027 to 2057 period and updating the Asset Management Plan (AMP) for its flood protection, land drainage and river management infrastructure portfolio. Both will inform the 2027-2037 Long-term Plan. Section 101B of the Local Government Act 2002 requires the IS to cover at least 30 consecutive financial years. ORC is using Investment Logic Mapping (ILM) to create a single shared, evidence-based foundation for the IS and the AMP. The process retests the seven significant issues in the current IS 2024-2054 rather than assuming they remain the right problem definition.

The central question.

What is the most compelling evidence-based case for change for this portfolio over the next 30 years, and what public value should ORC seek from its response?

Why this specific ILM session was added to the IS development process

At workshop 1 on 27 August 2026 Council indicated general support for the draft problem and benefit statements but asked for more time with the IS process. Following that workshop, this facilitated ILM session was added so that Councillors can take part in the ILM process directly and can be confident their concerns are adequately addressed before the draft IS is written. The IS underpins the 2027-2037 LTP and due diligence is required.

What this paper covers

- The role and value of ILM and how to read an Investment Logic Map.
- How the draft ILM was developed and where this session sits in the process.
- The infrastructure asset portfolio summary
- The draft problem statements, benefits and strategic responses, with their weightings.
- The evidence behind the seven significant issues in the current IS 2024-54, carried into the process (Appendix A).
- The direction sought from Council today (10 September 2026.)

What it does not decide

- It does not replace technical analysis, options appraisal, affordability testing, engagement or Council decision-making.
- It does not approve levels of service (LoS), individual projects, funding or a preferred programme. Those decisions follow through the draft IS, the AMP and the LTP.
- The draft ILM represents staff work to date and is not the final output. The problem statements, benefits, strategic responses and weightings are open for Council to refine.

The role and value of Investment Logic Mapping

Investment Logic Mapping is the core technique of the Investment Management Standard (IMS), a structured method for testing the thinking behind an investment before significant money or effort is committed. It was developed by the Victorian Department of Treasury and Finance and is well established in New Zealand, including alongside Treasury Better Business Cases and across local government.

The ILM process is designed to

- Confirm that the investment need is clearly defined and validated with evidence
- test that the benefits of responding are of high value to Council and the community
- Explore whether the proposed responses are strategic, feasible and innovative
- Confirm that the solution can realistically be delivered within time, cost and resource expectations
- Surface risks, interdependencies and uncertainty early, before positions harden.

The key output is the Investment Logic Map, a single page picture of the investment story in plain language, linking problems to benefits, responses and solutions. For ORC, the finalised ILM becomes the strategic backbone of the IS 2027-2057 and the reference point for the AMP that delivers it.

This is the first ILM process ORC has run for this portfolio of assets. The workshops are short, structured and independently facilitated by an accredited IMS facilitator. No preparation is needed beyond reading this paper and the attached draft ILM, and arriving ready to test and refine the current thinking.

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Investment Logic Mapping overview

Investment Logic Mapping is a structured facilitation technique used to test whether the case for change is logical, evidence-based and sufficiently important before detailed solutions or expenditure are advanced. It turns complex evidence and staff and stakeholder knowledge into a concise investment story. An Investment Logic Map is read left to right.

Problems	Benefits	Responses	Solutions
Evidence-based cause and effect statements explaining what is happening and why it matters.	The improvements and public value expected if the effects are reduced, avoided or mitigated.	Broad strategic approaches capable of delivering the benefits, without jumping to projects.	The changes and asset directions that give effect to the responses, for later testing, costing and prioritisation.

Value for ORC

Shared direction Builds a common view of the case for change across the IS, asset management and governance.	**Transparent trade-offs** Makes relative priorities, evidence gaps, assumptions and uncertainty visible.	**Line of sight** Connects problems and benefits to future responses, programmes, measures and reporting.
Better decisions Keeps attention on outcomes and public value before projects or funding positions harden.	**Measurable success** Identifies benefit measures and the data needed to show whether the response works.	**Proportionate assurance** Creates a concise reference point for later options, affordability and delivery analysis.

The ILM workshop process and where this session sits

Step	Date and status	Purpose	Output
Problem and benefit definition, staff ILM workshop	28 July 2026. **Complete.**	Define and weight the core problems and the public value expected from addressing them. More than 50 issues were grouped into 13 themes and worked through cause and effect.	Three weighted draft problem statements and four weighted draft benefits.
Council workshop 1	27 August 2026. **Complete.**	Introduce the IS review. High-level test of the draft problem and benefit statements, and their link to the seven significant issues in the IS 2024-2054.	There was general support for the draft problem and benefit statements, however Council required deeper involvement in the IS development process and additional time to unpack the detail behind the ILM.
Response and solutions, staff ILM workshop	28 August 2026. **Complete.**	Retest the statements and weightings against the workshop 1 discussion with Council and develop the strategic responses and solution directions.	There were wording and weighting updates to the draft problems and benefit statements, as well as updates to the benefit measures. Draft response and solutions were developed. Draft map attached as Appendix B.
Council workshop 2, this facilitated session	Thursday 10 September 2026	Councillors work through the draft ILM in detail with the facilitator and staff. The intent is to refine the problem and benefit statements, their weightings and the strategic responses.	A refined ILM, and direction to staff to update the IS 2027-2057 and the 30 year forward works programme on it.

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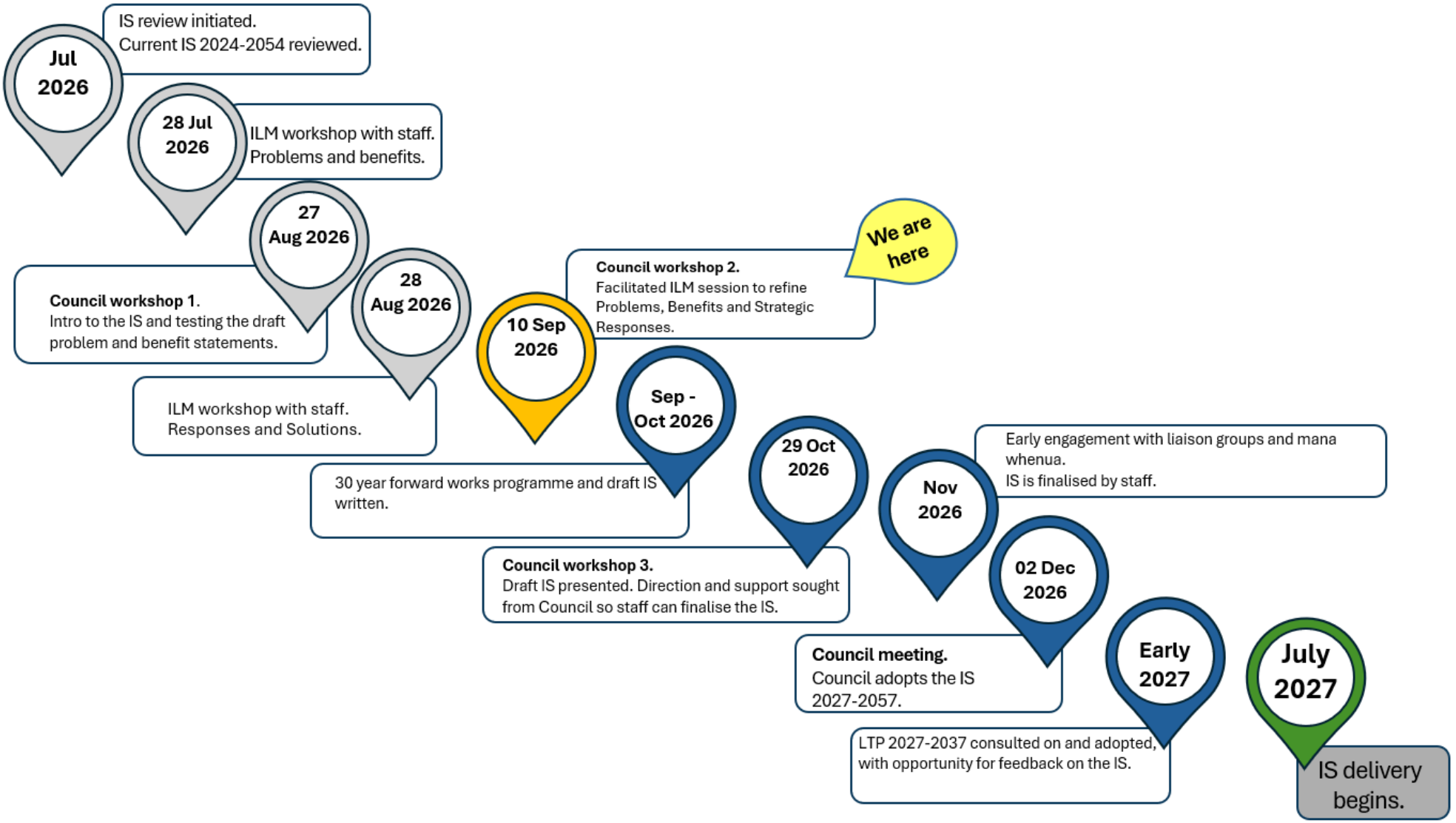
The Infrastructure Strategy development process and where this session sits



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The infrastructure the ILM tests

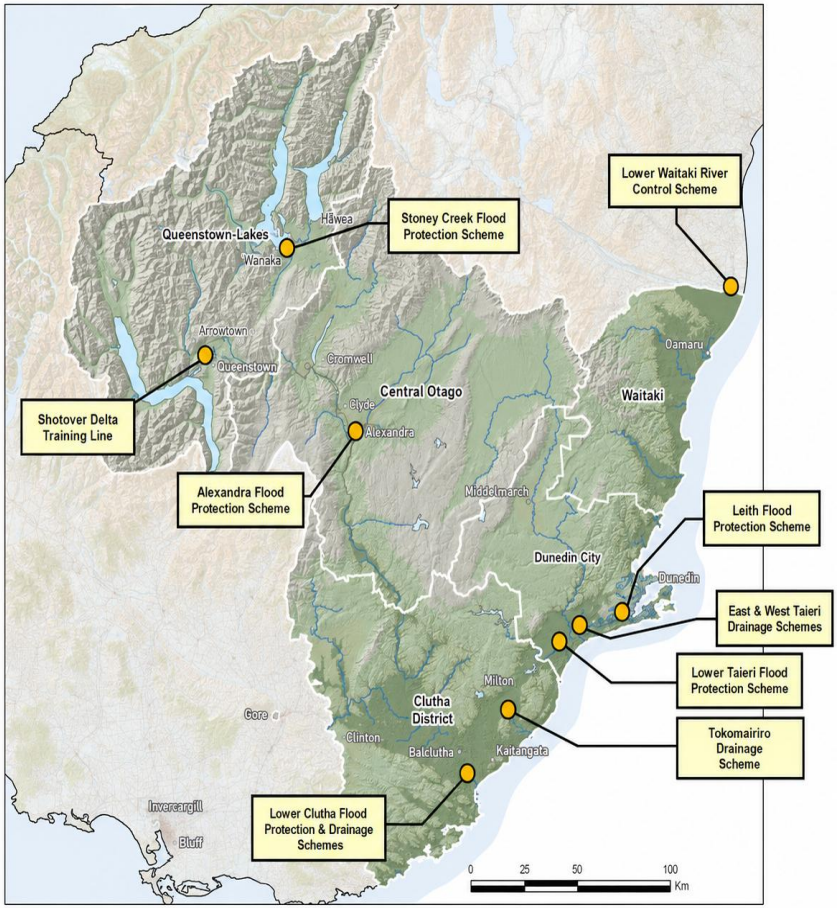
Otago covers approximately 32,000 square kilometres in the southern South Island. Within it, ORC owns and maintains flood protection, land drainage and river management *infrastructure* that provides protection (to an agreed standard) and drainage to around 43,000 hectares of urban and rural land.

This infrastructure exists to promote soil conservation and to mitigate the damage caused by floods and riverbank erosion, giving effect to Council's responsibilities under the Soil Conservation and Rivers Control Act 1941 and the Land Drainage Act 1908.

A defining feature is low-frequency, high-consequence performance: many assets are rarely tested to their design standard but must perform when communities need them.

The infrastructure portfolio includes the following assets:

Flood protection Mitigates the impact of floods	**Land drainage** Drains low-lying land	**Localised river management infrastructure** Controls erosion and alignment
Floodbanks	Pump stations	Rock buttresses
Pump stations	Gravity outfalls	Training lines
Gates and locks	Open drains	Groynes
Spillways	Culverts and bridges	Trees (for bank stability and erosion control)
Ponding and floodways		
Culverts and bridges		
Flood walls		
Rock work		
Debris traps		
Trees (for bank stability and erosion control)		



Location of ORC flood protection, drainage and river control infrastructure

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The Draft Investment Logic Map

Refer to Appendix B for the complete single-page draft Investment Logic Map, showing the linkages from Problems to Benefits and through to Responses and Solutions, as well as a change log detailing updates to the draft Investment Logic Map following Council workshop 1 (27 August 2026).

Draft problem statements

Problem statements set out (as cause and effect) what is happening and why it matters. Each carries a weighting reflecting its share of the overall case for investment. The weightings were retested after workshop 1. The change log in Appendix B records the changes.

	Draft problem statement	Weight	What sits behind it
1	**Changing land use and unclear roles are increasing infrastructure pressures and uncertainty about risk and scheme limits.**	35%	Development and land use change are adding pressure on the schemes, while the Council has limited influence over where growth occurs. The Council, territorial authorities, agencies and landowners share responsibility for flood risk, and the split is not always clear. Communities do not consistently understand the residual risk they carry or the protection the schemes are designed to provide. Evidence considered at the workshop included stormwater pressure around Outram and Mosgiel, growth in the number of people and properties protected by schemes, and the planning interfaces between the Council and territorial authorities. Pressures increase both the demand placed on the schemes and the consequences if a scheme underperforms.
2	**Legacy assets and gaps in whole-of-life planning increase cost pressures and shift funding burdens and risk to future generations.**	35%	The schemes include substantial infrastructure built over roughly 150 years, much of it under historic design standards and funding arrangements that are no longer available. Significant renewals lie ahead, flood banks cannot be insured, scheme reserves are finite, and recovery from flood events has repeatedly displaced planned work. Deferring investment, or relying on reactive funding, transfers cost and unresolved risk to future ratepayers. The staff ILM workshops treated this as both an asset management challenge and a question of long-term affordability and fairness between generations.
3	**Gaps in asset condition, infrastructure performance and hazard information limit confidence in risk and investment decisions.**	30%	Historic construction records are incomplete, condition information is still being formalised for assets such as pumps and culverts, defects have been identified in bridges and structures, and knowledge of climate, flood, seismic and coastal hazards continues to evolve. The schemes are rarely tested at their full design standard, yet they must perform when significant events occur. This as an enabling problem as it does not create risk by itself, but it directly affects how well investment can be prioritised and how well the risk carried by communities is understood.

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Draft benefits

Benefits are the improvements Council and the community should see if the problems are addressed. Their weightings are apportioned from the problem weightings, so the two sets move together. Each benefit carries a draft measure of success so progress can be realistically measured.

	Benefit	Weight	Draft measure of success
1	**Reliable infrastructure performance at an efficient whole-of-life cost**	40%	Percentage of infrastructure systems verified as capable of meeting agreed LoS. Percentage of lifecycle spend that is planned and risk-based.
2	**Lower infrastructure-related risk and greater resilience to changing hazards and climate**	30%	Percentage of high-risk assets with treatment completed or programmed.
3	**Communities understand infrastructure limits, residual risk and responsibilities, enabling informed decision-making**	15%	Percentage of affected communities understanding infrastructure risk, limits and responsibilities.
4	**Improved environmental outcomes and natural river function through infrastructure investment and management**	15%	Percentage of relevant interventions delivering agreed environmental and river-function outcomes.

Draft strategic responses

Strategic responses are the broad approaches for delivering the benefits sought. Each weighting reflects the share of the benefits that the response carries. The solution column of the ILM records the organisational changes and asset directions that give effect to the responses. The IS and the AMP define the specific programmes and projects that follow from it.

Strategic response	Weight	What it means in practice	Benefits it delivers
Deliver risk-prioritised lifecycle renewal and resilience investment	40%	Funded, risk-based lifecycle and resilience programmes that direct investment to the highest priority renewals and resilience upgrades.	Benefit 1, 2, 4
Strengthen infrastructure intelligence and risk-based decision-making	25%	Consistent scheme performance, condition, risk and LoS assessment, supported by stronger asset information, monitoring and modelling.	Benefit 1, 4
Integrate adaptive infrastructure, land-use and river-system planning and management	25%	Clear infrastructure roles and responsibilities, infrastructure considered early in land-use and river planning, and room for adaptive and nature-based approaches ***where viable.***	Benefits 2, 3, 4
Grow meaningful engagement for informed risk and investment decisions	10%	Sustained engagement on risk, LoS and investment choices, supported by accessible public information.	Benefit 3

The seven significant issues and their relevance to the ILM

The current IS 2024-2054 is built around seven significant issues, shown in the adjacent wheel. They are intentionally presented as a connected set, as the response to any one of them changes the level of risk carried by the infrastructure, the communities behind it and the lifelines dependent on it. Risk exposure therefore sits at the centre as the common denominator.

All seven issues were carried into the ILM process as evidence, tested through cause and effect, with each being traceable into the draft problem statements, as shown in the table below. The full evidence and context of each issue is detailed in Appendix A.

The seven significant issues in the IS 2024-2054.

Significant issue	Key evidence recorded in the current IS and recent assessments (full detail in Appendix A)
Risk exposure. Carried through all three problems	Repeated Otago flood events, November 2019, February 2020, January 2021, July and August 2022, September 2023, October 2024 and July 2026, with Cyclone Gabrielle in February 2023 as the national reference point. Modern practice assesses performance beyond the design standard, up to the Probable Maximum Flood, and designs infrastructure to fail safely when exceeded.
Infrastructure condition. Carried into problems 2 and 3	Assets built over roughly 150 years with incomplete construction records. A 2017 assessment rated 85 percent of floodbanks across the Lower Taieri, Lower Clutha and Alexandra schemes in very good to average condition. 2018 inspections found 49 percent of in-service bridges in poor or very poor condition, and 2025 inspections identified 160 defects requiring structural repair or maintenance, 7 of which are critical and 26 high priority. The oldest pump station, Waipori, dates to 1929.
Natural hazards. Carried into problem 3	The ORC Natural Hazards Exposure Analysis 2025 found the highest exposure is to river and lake flooding and liquefaction, with more than 30,000 people and buildings in areas potentially subject to each. Most flood exposure sits in the Dunedin City district, including the floodplains covered by the Leith and Lower Taieri schemes.

Climate change. **Carried into problem 3**	The 2019 National Institute of Water and Atmospheric Research (NIWA) regional analysis projects extreme rare events becoming more severe, average annual flows increasing and larger floods. The depth of a current 1 in 100-year, one hour rainfall event is projected to increase by about 35 percent by 2090 under Representative Concentration Pathway (RCP) 8.5, i.e., the high emissions scenario. About 7,462 hectarss of land relying on this infrastructure sits less than one metre above current mean sea level, and shoreline retreat at the Clutha delta is already occurring.
Legislation and regulatory. **Carried into problem 1**	Resource management reform, proposed climate adaptation legislation, emergency management reform and the proposed National Policy Statement for Natural Hazards Decision-Making will affect how the portfolio is run. The National Policy Statement for Infrastructure took effect in January 2026.
Settlement trends and land use change. **Carried into problem 1**	Urban development is increasing demand on drainage infrastructure to manage stormwater, notably at Outram in West Taieri and around Mosgiel in East Taieri. ORC and Dunedin City Council are jointly rolling out the Future Development Strategy which outlines strategic directions for the city's growth and development for the next 30 years.
Funding. **Carried into problem 2**	Scheme reserves part-fund response and recovery and can be depleted by major events. The current IS plans for reserves to carry the council share of eligible event repair costs, up to 40 percent, with the National Emergency Management Agency (NEMA) subsidising 60% above its threshold. Floodbanks cannot be insured and are self-insured through reserves.

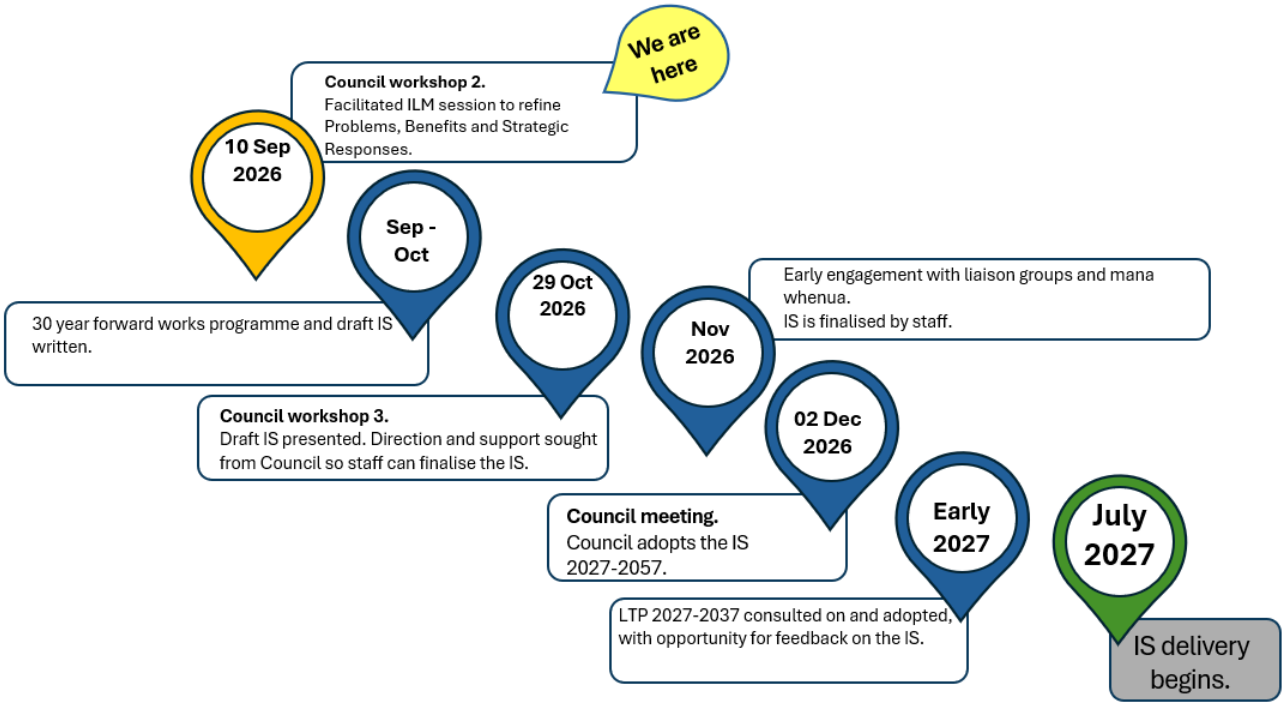
What we are asking of Council at this session

1. **Participate in the facilitated interactive ILM process to:**
   - Refine the problem and benefit statements, together with their weightings and performance measures.
   - Refine the strategic responses.

2. **Direct staff to update the IS 2027-2057 and the 30 year forward works programme on the refined ILM.**

Next steps

Direction from this session is carried into the ILM and the draft IS. The draft IS and the 30 year forward works programme are presented at the Council workshop on 29 October 2026. Early engagement with the scheme liaison groups and mana whenua follows in early November 2026. The final IS is presented to Council for adoption on 02 December 2026, and the 2027-2037 LTP is consulted on and adopted by 30 June 2027.



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Appendix A : The seven significant issues, evidence and context

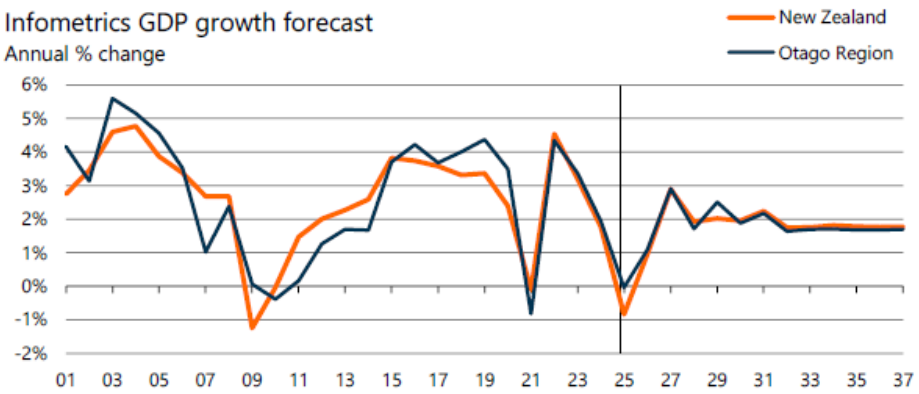
This appendix reproduces the evidence and context recorded against each of the seven significant issues in the current IS 2024-2054, as compiled for the ILM staff workshops in July 2026. It is the factual base the draft problem statements were tested against.

Regional Context

Economy and growth

Otago's economy grew faster than the national average over the past decade, averaging 2.9% a year between 2016 and 2025 against 2.5 percent nationally. Growth is forecast to slow, with both Otago and New Zealand projected to grow at 1.9% a year between 2025 and 2035.

Chart 1



Construction, professional services and health have been the key drivers of regional growth over the past decade and are expected to continue leading it, with retail and hospitality following on the back of population and tourism growth. Agriculture, forestry and fishing was Otago's second largest industry in 2025 and is forecast to keep growing, but to slip to fifth largest by 2037, overtaken by health, professional services, hospitality and rental services. Construction is forecast to remain the region's largest industry.

Growth matters directly to this portfolio, as more people and property behind the schemes raises the consequence of failure, and urban development changes runoff behaviour. Pressure is already visible where drainage schemes are being asked to manage urban stormwater, notably at Outram in West Taieri and around Mosgiel in East Taieri. Otago Regional Council and Dunedin City Council jointly developed a Future Development Strategy detailing out how Dunedin will accommodate housing and business land over the next 30 years

Recent events and a changing hazardscape

Otago has experienced repeated flood events in recent years, most notably in November 2019, February 2020, January 2021, July and August 2022, September 2023, October 2024 and more recently the July 2026 deluge. Nationally, Cyclone Gabrielle in February 2023 demonstrated what extreme events do to flood protection infrastructure and the communities behind it and has sharpened public interest in how schemes perform.

NIWA's 2019 analysis of projected climate change for Otago found that changes to the region's future climate are likely to be significant: extreme, rare events are projected to become more severe, average annual river flows are expected to increase, and floods are expected to become larger.

Some impacts are already observable. In the Lower Clutha delta, shoreline retreat and coastal erosion are already damaging the southern training line at the Koau mouth, which in turn affects the culverts draining the Puerua River and the drainage performance of the scheme.

The modern approach to flood risk management takes greater account of residual risk: how schemes perform beyond their design standard, up to the Probable Maximum Flood or Maximum Credible Event, and how infrastructure can be designed to fail safely when a super design event arrives.

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Significant Issues

1. Risk exposure

Risk exposure sits at the core of the significant issues because the response to every other issue ultimately changes the risk associated with operating this infrastructure, and with it the resilience of the communities it protects. Several factors can erode the standard a scheme was designed to deliver. Climate-driven changes in rainfall intensity and duration, changes in community tolerance and vulnerability, geomorphological change such as sediment build-up reducing channel capacity, and improved hydrological understanding revising what a design event actually looks like.

Evidence and context

- Otago flood events in November 2019, February 2020, January 2021, July and August 2022, September 2023, October 2024 and July 2026, with Cyclone Gabrielle (February 2023) as the national reference point.
- Growing community interest in scheme performance, vulnerability and resilience following these events.
- Modern practice assesses performance beyond design standard, up to Probable Maximum Flood or Maximum Credible Event, and designs infrastructure to fail safely when exceeded.
- Communities need to be part of longer-term decisions about risk tolerance, levels of service and the costs in relation to both.

2. Infrastructure condition

The portfolio has been constructed over roughly 150 years, and construction records for some older infrastructure either do not exist or fall short of today's standards. Floodbanks alone have several potential failure modes, overtopping, slope and foundation instability under flood, non-flood and seismic conditions, and seepage through the bank or its foundation. Running assets beyond their intended life raises operating costs and failure risk and removes the lead time needed to design fit-for-purpose replacements.

Evidence and context

- A 2017 assessment rated flood bank condition at 1,288 points across the Lower Taieri, Lower Clutha and Alexandra schemes; 85 percent were in very good to average condition.
- 2018 inspections of 31 in-service bridges found 49 percent in poor or very poor condition, with 16 bridges having less than five years of remaining life. 2025 inspections of 32 in-service bridges identified 160 defects requiring structural repair or routine maintenance, 7 critical, 26 high priority, 58 medium priority and 69 low priority.
- 2019 inspections of 75 structures on the Water of Leith and Lindsay Creek found most in moderate condition, with 20 structures requiring attention within five years and three requiring urgent attention.
- The oldest pump station, Waipori, dates from 1929. Condition data for pump stations and the 369 culverts is being formalised and verified.

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3. Natural hazards

Otago's environment ranges from flat coastal lowlands and intensively used floodplains to steep, sparsely populated mountain country. The region is consequently exposed to a broad range of natural hazards such as flooding, landslides, debris flows, seismic activity, coastal erosion, tsunami, storm surge and wind. Such hazards threaten the flood protection, drainage and river management infrastructure itself, not only the communities behind it.

Evidence and context

As detailed in the ORC Natural Hazards Exposure Analysis 2025, the highest exposure for the hazard types considered is for river and lake flooding, and liquefaction. Totals of greater than 30,000 people and buildings, including more than 10,000 residential dwellings, are located in areas identified as potentially subject to each of these hazards. There is a notable spatial overlap between flooding and liquefaction exposure, because flood-prone areas typically comprise geologically recent sediment deposits which may also be susceptible to liquefaction.

- The majority of exposure to river and lake flooding is located within the Dunedin City district, where 39 of 117 community areas are classed as having a high exposure. This includes the floodplains receiving flood mitigation from the Leith and Lower Taieri schemes. Population and buildings within the protected areas of the schemes are considered potentially exposed, as these areas could still flood in a super-design event or a failure of flood protection infrastructure.
- The majority of exposure to slope stability hazards, landslide, rockfall and alluvial fan, is located within the Queenstown Lakes and Dunedin City districts, with much of it in the urban areas of Queenstown, Dunedin and Wānaka.
- The majority of exposure to seismic hazards, active faulting and liquefaction, is located within the Dunedin City district, where the highest exposure is for the urban areas of Dunedin and Mosgiel.
- Exposure to coastal hazards, storm surge, tsunami and coastal erosion, is much less relative to the other hazard types, with up to approximately 500 people and 1,100 buildings exposed for each of storm surge and tsunami.
- The exposure of 90 critical community facilities has been assessed for each hazard type. The greatest exposure is to river and lake flooding, 23 facilities, and liquefaction, 35 facilities, with some exposure also to active fault, landslide and alluvial fan hazards.

Table 2: Natural hazards exposure summary for the Otago Region, showing the estimated count and percentage of those elements within Otago potentially exposed to impact from the named natural hazard types.

Hazard type	Population exposed		Buildings exposed				Critical Community Facilities (CCF)		Count of community areas in each exposure class					Count of community areas in region
	Count	Percent of population in region	Count (all buildings)	Percent of total buildings in region	Count (Dwellings)	Percent of total dwellings in region	Count	Percent of total CCF in region	Very Low	Low	Moderate	High	Very High	
River and lake flooding	38,778	16.1	33,898	16.1	12,776	14.4	23	25.6	121	26	45	99	60	351
Liquefaction	46,047	19.1	43,029	20.4	17,459	19.7	37	41.1	142	18	45	68	78	351
Active Faults	21,949	9.1	20,096	9.5	8,371	9.4	10	11.1	203	19	21	68	40	351
Landslide	8,038	3.3	6,592	3.1	2,844	3.2	3	3.3	225	14	51	41	20	351
Alluvial fan	5,473	2.3	5,904	2.8	1,996	2.3	3	3.3	272	10	18	38	13	351
Rockfall	1,234	0.5	1,056	0.5	377	0.4	0	0	290	14	29	14	4	351
Tsunami	504	0.2	1,130	0.5	266	0.3	0	0	327	4	7	12	1	351
Storm surge	504	0.2	1,122	0.5	230	0.3	0	0	325	7	8	10	1	351
Coastal Erosion (Waitaki)	37	0	111	0.1	19	0.0	0	0	346	1	3	1	0	351

Estimated exposure across Otago by natural hazard type.

Table 3: Natural hazards exposure summary for the Otago Region, showing the 'Top 10' urban areas or rural settlements with highest exposure for each hazard type, identified and ordered by the estimated population exposed to the hazard within that urban area/settlement. The population exposed within each urban area/settlement is indicated by the cell shading (see legend). Coastal erosion hazard is not included in the table, as there is insufficient data to provide a region-wide comparison across the full Otago coastline.

Hazard type							
River and lake flooding	Liquefaction	Active Faults	Landslide	Alluvial fan	Rockfall	Tsunami	Storm surge
Mosgiel	Dunedin	Dunedin	Dunedin	Queenstown	Queenstown	Pounawea	Dunedin
Dunedin	Mosgiel	Mosgiel	Wanaka	Dunedin	Dunedin	Taieri Mouth	Waikouaiti
Oamaru	Wanaka	Alexandra	Warrington	Wanaka	Arrowtown	Purakaunui	Purakaunui
Queenstown	Queenstown	Wanaka	Queenstown	Roxburgh	Wanaka	Brighton	Pounawea
Balclutha	Milton	Lake Hawea	Mosgiel	Palmerston	Roxburgh	Waikouaiti	Taieri Mouth
Outram	Balclutha	Roxburgh	Moeraki	Waikouaiti	Aramoana	Karitane	Waitati-Doctors Point
Milton	Outram	Kaitangata	Roxburgh	Glenorchy	Purakaunui	Waitati-Doctors Point	Brighton
Luggate	Kingston	Waihola	Brighton	Arrowtown	Lake Roxburgh	Kaka Point	Karitane
Glenorchy	Glenorchy	Allanton	Karitane	Kingston	Oamaru	Kaitangata	Kakanui
Waihola	Brighton	Queenstown	Waitati-Doctors Point	Harington Point	Moeraki	Kakanui	Moeraki

Legend
Population exposed
>5,000
1000-5000
500-1000
100-500
20-100
≤20

Urban areas and rural settlements with the highest exposure by hazard type. Source for both, ORC Natural Hazards Exposure Analysis 2025.

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4. Climate change

Otago's climate is changing. Rising temperatures bring changes in precipitation and wind patterns, increasing the intensity and frequency of rainfall events, raising river flows and driving sea level rise and coastal erosion. These changes put growing pressure on the portfolio and challenge the levels of service it can provide. The uncertainty around the rate of change requires an adaptive approach. Over time, infrastructure will need to be relocated, modified or created.

Evidence and context

- The 2019 NIWA regional analysis projects significant change for Otago. Extreme, rare events become more severe, average annual river flows increase, and floods become larger.
- Annual rainfall is expected to increase slightly by mid-century, 0 to 10 percent, with the increase spanning 10 to 20 percent at the end of the century and larger increases in the west of the region. Seasonally the largest increases are projected during winter, with 20 to 40 percent increases expected by 2090 under RCP8.5[1].
- Extreme, rare rainfall events are projected to become more severe under all four climate change scenarios. The depth of a current 1 in 100 year, one hour duration rainfall event is projected to increase by approximately 35 percent by 2090 under RCP8.5.
- Approximately 7,462 hectares of land relying on this infrastructure sits less than one metre above current mean sea level.
- Rising sea and groundwater levels affect drains and pump stations in the Lower Clutha and West Taieri, where drainage is already fully pumped.
- Shoreline retreat at the Clutha delta is already occurring, and the current IS signals near-term adaptation decisions there.

*1 - *Representative Concentration Pathways (RCP) are the standard set of future greenhouse gas scenarios used in climate modelling, adopted by the Intergovernmental Panel on Climate Change and used by NIWA for its 2019 Otago projections. The number is the amount of extra heat trapped in the atmosphere by 2100, measured in watts per square metre. Four were modelled, RCP2.6, RCP4.5, RCP6.0 and RCP8.5.*

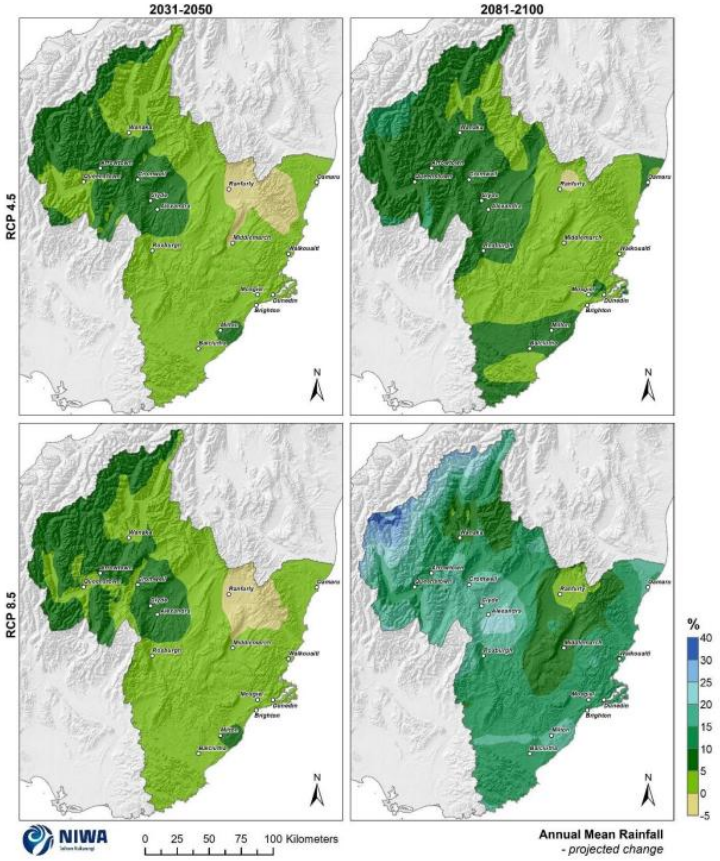

Figure 4-2: Projected annual mean rainfall changes by 2040 and 2090, under RCP4.5 and RCP8.5. Climate change scenarios: RCP4.5 (top panels) and RCP8.5 (bottom panels). Time periods: mid-century (2031-2050; "2040" – panels on left) and end-century (2081-2100; "2090" – panels on right). Changes relative to 1986-2005 average, based on the average of six global climate models. Results are based on dynamical downscaled projections using NIWA's Regional Climate Model. Resolution of projection is 5km x 5km.

Projected annual mean rainfall changes by 2040 and 2090 under RCP4.5 and RCP8.5. Source, NIWA regional climate projections for Otago, 2019.

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5. Legislation and regulatory

The schemes were designed and built across 150 years and reflect the values and knowledge of their time. Most were developed in an era when economic growth was the primary focus. Community values and the legislation that regulates environmental standards and performance have changed and will keep changing across the life of the IS.

Evidence and context

- Drivers identified include resource management reform and the proposed climate adaptation legislation, implementation of the Regional Policy Statement and Land and Water Regional Plan, district plan reviews, emergency management reform and the strengthening of critical infrastructure resilience, the proposed National Policy Statement for Natural Hazards Decision-Making, the inquiry into community-led managed retreat, and periodic review of the Flood Protection Management Bylaw 2022.
- The National Policy Statement for Infrastructure took effect in January 2026 and now sits alongside these drivers.
- Change also brings opportunity. Renewals can deliver fish passage, wetlands and other co-benefits, consistent with Te Mana o te Wai and ki uta ki tai.

6. Settlement trends and land use change

Settlement trends and land use change place pressure on existing infrastructure to keep performing, and in some places put more people, their health and their livelihoods at risk should infrastructure underperform or fail. Different flow patterns and greater stormwater runoff can affect drainage scheme performance, and land use change can require the level of flood mitigation to be lifted.

Evidence and context

- Urban development is increasing demand on land drainage schemes to manage stormwater, notably at Outram in West Taieri and around Mosgiel in East Taieri.
- The Leith scheme sits close to the central city, university and polytechnic, which creates public interest in access and amenity alongside flood protection, particularly from Forth Street to the harbour.
- ORC and Dunedin City Council jointly developed a Future Development Strategy covering 30 years of housing and business land capacity, reviewed three-yearly.
- The Taieri River Improvement Act 1920 constrains works on East Taieri that would affect West Taieri.

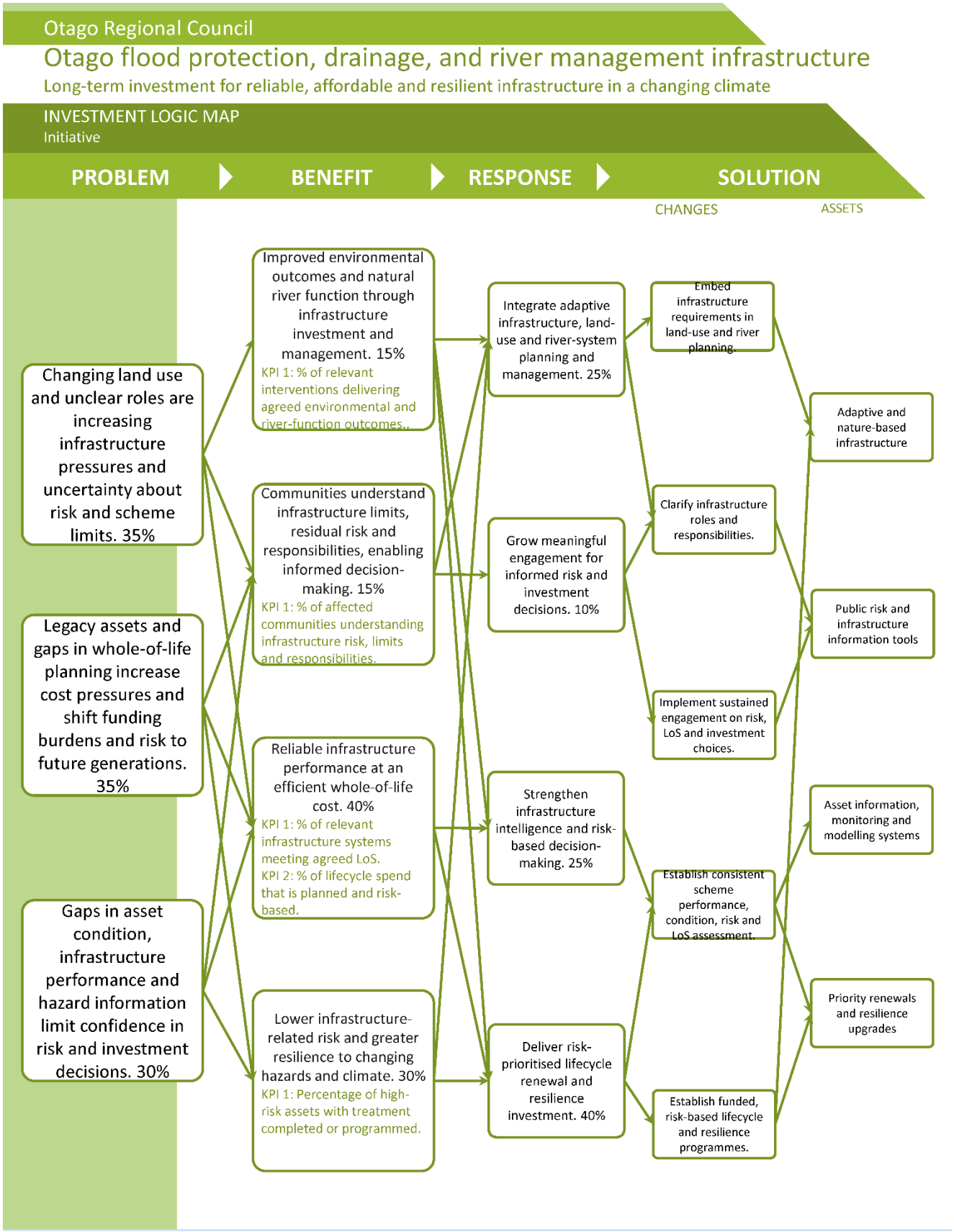
7. Funding

The financial impact of natural hazard events depends on their scale, duration and location, none of which can be predicted, which makes recovery funding difficult to provide for at short notice. Otago's recent run of events has produced overlapping recovery programmes that are funded, often, at the expense of planned work. Renewals of major assets carry large funding needs, although assets such as floodbanks deliver intergenerational benefit over exceptionally long lives.

Evidence and context

- Scheme reserves built up over time part-fund response and recovery and can be depleted by major events. The current IS plans for reserves to carry the council share of eligible event repair costs, up to 40 percent, with the National Emergency Management Agency (NEMA) subsidising 60% above its threshold (0.002 percent of net capital value).
- Floodbanks cannot be insured and are self-insured through scheme reserves. Above-ground assets such as pumps carry material damage cover with a $100,000 excess for flood damage.
- ORC secured Crown funding under the Climate Resilience shovel-ready programme. A December 2022 sector co-investment case to central government has not yet succeeded, and funding continues to be pursued in this space.

Appendix B : Draft Investment Logic Map v0.3, 31 August 2026, and change log



Investor:	Titus Naidoo, Otago Regional Council	Version no:	0.3
Facilitator:	Erik Barnes	Initial Workshop:	28/07/2026
Accredited Facilitator:	Yes	Last modified by:	Erik Barnes, 31/08/2026
		Template version:	5.0

Changes to the draft ILM following Council workshop 1

At workshop 1 on 27 August 2026 Council was presented with the draft problem and benefit statements. The staff ILM workshop on 28 August worked the feedback through and completed the response and solution columns on the investment logic map.

The table below logs the changes between what was presented at Council workshop 1 and the updated draft ILM v0.3 presented in this paper. The revised statements and weightings are presented for Council to refine further at this session (10 Sept 2026).

ILM element	Draft ILM v0.1, 27 Aug 2026 (As per Council Workshop 1)	Draft ILM v0.3, 31 Aug 2026 (Current version)	What changed?
Problem 1	45%. Changing land use and unclear council, agency and landowner roles leave communities unclear on risk and scheme limits.	35%. Changing land use and unclear roles are increasing infrastructure pressures and uncertainty about risk and scheme limits.	Reworded to emphasise the pressure on the infrastructure. The weighting moved from 45 to 35 percent. The change gives more weight to the condition and information gaps in the evidence.
Problem 2	35%. Legacy assets and gaps in whole-of-life planning undermine affordability and shift costs and risk to future generations.	35%. Legacy assets and gaps in whole-of-life planning increase cost pressures and shift funding burdens and risk to future generations.	The council workshop 1 asked about affordability for whom. The statement was reworded for clarity. The weighting remains unchanged.
Problem 3	20%. Asset condition and hazard information gaps limit confidence in decisions about scheme performance and risk.	30%. Gaps in asset condition, infrastructure performance and hazard information limit confidence in risk and investment decisions.	Reworded to place emphasis on the infrastructure in general, rather than just schemes. Infrastructure performance added to the scope. The weighting changed from 20 to 30 percent. The team view was that the condition and information weighting was too low against the evidence.
Benefit 1	45%. Reliable scheme performance at an efficient whole-of-life cost. One measure.	40%. Reliable infrastructure performance at an efficient whole-of-life cost. A second measure added, percentage of lifecycle spend that is planned and risk-based.	Benefit weightings are apportioned from the problem weightings, so this follows the problem changes. Scheme wording standardised to infrastructure.
Benefit 2	25%. Lower long-term risk exposure and greater resilience to changing hazards and climate.	30%. Lower infrastructure-related risk and greater resilience to changing hazards and climate.	Wording refocused on infrastructure-related risk following the workshop review. Weighting follows the problem weightings reapportionment. The measure was replaced with one that can be scored from existing inspection and risk information.
Benefit 3	15%. Communities understand scheme risks, limits and responsibilities and can participate in informed decisions.	15%. Communities understand infrastructure limits, residual risk and responsibilities, enabling informed decision-making.	Scheme wording standardised to ‘infrastructure’. The weighting remains unchanged.
Benefit 4	15%. Improved environmental condition and natural river function.	15%. Improved environmental outcomes and natural river function through infrastructure investment and management.	Wording clarified so the benefit is tied to infrastructure investment and management. Weighting unchanged.
Strategic responses	Not yet developed.	Four weighted responses, 25, 25, 40 and 10 percent.	Developed at the 28 August staff ILM workshop.
Solutions	Not yet developed.	Organisational changes and asset directions recorded on the ILM.	Developed at the 28 August staff ILM workshop.

			The IS and AMP define the programmes and projects that follow.