

# URBAN STOCK WATER RACES AND THE DILEMMA OF OBLIGATIONS

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## ABSTRACT

Stock water races exist primarily to supply drinking water to livestock as well as for secondary purposes of firefighting, irrigation and landscaping. The urbanisation of towns in the Canterbury region is leading to encroachment on these rural assets. Open water poses a drowning risk and pedestrian/road safety hazard but also provides ecological, biodiversity and aesthetic values. Consideration of the piping of open water channels needs to be made on a case-by-case basis and can create a dilemma in meeting the hierarchy of obligations of Te Mana o te Wai.

This paper outlines the outcomes of the NZ Transport Agency Waka Kotahi SH73 West Melton Improvements project in the Selwyn District that converted existing open stock water races to piped networks to address safety concerns and allow for associated traffic safety improvements. The paper focuses on stock water races; however, the philosophies apply to all open waterways. New Zealand has had tragedies and accidents involving open stock water races including the drowning of young children and car accidents. Piping stock water races eliminates the direct hazard to the community, yet the transition comes with pros and cons. Despite being artificial ecosystems, stock water races provide habitat for fish and macroinvertebrates. Riparian margins can be terrestrial habitats for lizards and birds. Piping stock water races disrupts these ecosystems, however, it can create room within the road corridor for stormwater treatment swales/basins and landscaped areas to offset these impacts.

The SH73 West Melton Improvement Project converted approximately one kilometre of an existing open stock water race into a piped network. Community facilities, including a primary school, shopping centre, church, tavern and recreational reserve, surround the site. This resulted in a direct interface between open water and pedestrians/traffic. The piping of the stock water races created space within the existing road reserve for traffic safety improvements (off-road shared user paths, road widening, kerbs, signalised intersections/crossings) as well as the construction of 420 metres of stormwater first-flush treatment swales and basins. The design improved the existing drainage regimes by removing untreated road runoff from soaking to ground or discharging to the open stock water race. The swales and basins were planted with *Aposdasmia similis* (Oioi), providing landscape, habitat and visual amenities while also reducing future maintenance. The project achieved great safety outcomes for the community, eliminating the interface with open water and providing room in the road corridor for traffic safety improvements and stormwater treatment.

Community safety around infrastructure is a key issue for local authorities. Authorities should consider changes required associated with the development of previously rural or low-density areas. The decision to convert stock water races to a piped network should be made on a case-by-case basis. Opportunities to retain open races should be adopted where possible to retain community connection with water and the surrounding environment.

## **KEYWORDS**

**Safety in Design, Nature-based solutions, Kaupapa Māori**

## **1 INTRODUCTION**

Stock water races exist primarily to supply drinking water to livestock as well as for secondary purposes of firefighting, irrigation, and landscaping. The urbanisation of towns in the Canterbury region is leading to encroachment on these rural assets. Open water poses a drowning risk and pedestrian/road safety hazard but also provides ecological, biodiversity and aesthetic values. Consideration of the piping of open water channels needs to be made on a case-by-case basis and can create a dilemma in meeting the hierarchy of obligations of Te Mana o te Wai.

This paper outlines the outcomes of the NZ Transport Agency Waka Kotahi SH73 West Melton Improvements project in the Selwyn District that converted existing open stock water races to piped networks to address safety concerns and allow for associated traffic safety improvements. The paper focuses on stock water races, however, the philosophies apply to all open waterways. New Zealand has had tragedies and accidents involving open stock water races including the drowning of young children and car accidents. Piping stock water races eliminates the direct hazard to the community, yet the transition comes with pros and cons. Despite being artificial ecosystems, stock water races provide habitat for fish and macroinvertebrates. Riparian margins can be terrestrial habitats for lizards and birds. Piping stock water races disrupts these ecosystems, however, it can create room within the road corridor for stormwater treatment swales/basins and landscaped areas to offset these impacts.

## **2 PROJECT BACKGROUND**

The SH73 West Melton Improvement Project was part of the NZ Upgrade Programme (NZUP), the Government's \$8.7 billion investment in growing communities nationwide (NZ Transport Agency, 2023). The project included:

- Traffic signals at the State Highway 73 (SH73) and Weedons Ross Road intersection with pedestrian crossing phases for improved safety.
- A new link road connecting Weedons Ross Road with West Melton Road.
- A new cul-de-sac on West Melton Road where it previously connected with Weedons Ross Road.
- A new roundabout at the intersection of the new link road with Weedons Ross Road (opposite Kingsdowne Drive).
- New shared paths for pedestrians and cyclists connecting key parts of the community.
- Changes to stock water races, stormwater and other utility services.

These changes have improved connections in the community to key facilities, like the community and recreation centre, the Domain, local shops, West Melton School, early childcare facilities, churches, and the tavern. It is now safer for the community to get around West Melton, whether people are walking, cycling, scooting, or driving. Figure 1 shows an overview map of the project.

## SH73 West Melton Intersection Improvements

### Key features

- A. Traffic signals at the SH73/Weedons Ross Road intersection with pedestrian crossings on all four legs of the intersection making it safer for pedestrians and cyclists to cross at the intersection.
- B. Piping of stockwater races to improve safety and allow widening of roads and shared paths.

- C. A cul-de-sac at the northern end of West Melton Road improving on-street parking (the current West Melton Road intersection with Weedons Ross Road would be too close to the new traffic signals).
- D. Weedons Ross Road (south of SH73) and West Melton Road widened and reshaped.
- E. A new link road between Weedons Ross Road and West Melton Road opposite Kingsdowne Drive (to the south of St Paul's Church).
- F. A new single lane roundabout at the intersection of the new link road and Weedons Ross Road opposite Kingsdowne Drive, with crossing points for pedestrians.



Figure 1: Project overview map (NZ Transport Agency, 2023)

## 3 STOCK WATER RACES

### 3.1 BACKGROUND

Selwyn District Council (SDC) has a stock water race network in central Canterbury, which began operations over 120 years ago. SDC manages approximately 1,700 kilometres of stock water race network, run under three different schemes (Malvern, Paparua and Ellesmere). Stock water races exist primarily to supply drinking water to livestock as well as for secondary purposes of firefighting, irrigation, and landscaping (Selwyn District Council, 2024). Stock water races are also considered to have additional value for flood conveyance, ecological, cultural, heritage and amenity purposes.

Despite being artificial ecosystems, stock water races provide habitat for fish and macroinvertebrates. Riparian margins can be terrestrial habitats for lizards and birds.

SDC current position is to keep waterways open and a decision to pipe is made on a case-by-case basis. Piping stock water races disrupts the ecosystems, requires additional assets, creates additional maintenance tasks and can create safety issues at the inlets/outlets. SDC values the protection of habitats and biodiversity within water bodies, races, and drains and sees the benefit of connecting communities to water through enhanced accessibility.

### 3.2 HAZARDS

New Zealand has had tragedies and accidents involving open stock water races including the drowning of young children and car accidents. In recent history, this includes:

- 2018: A child drowned after falling into a stock water race in Rolleston, within the Selwyn District (Stuff, 2018).
- 2019: A child drowned after falling into a stock water race in Ashburton (NZ Herald, 2019).
- 2021: A driver crashed his car, nearly flipping into a stock water race in Lincoln, within the Selwyn District (Star News, 2021).

Several community facilities surround the SH73 West Melton Improvement Project site, including a primary school, shopping centre, church, tavern, and recreational reserve. This resulted in a direct interface of pedestrians and traffic with open water. It would be reasonable to foresee that children may not always have adult supervision while walking around the community. Communities need to retain a connection with water and the surrounding environment, but this should always consider safety.

## 4 WEST MELTON URBANISATION

West Melton is 20 kilometres west of Christchurch and was established as a farming district in 1863. There was no natural water supply, therefore, stock was provided for by the stock water race system built in the 1880s (West Melton Residents Association, 2023).

Figure 2 shows the West Melton School roll and Figure 3 shows the West Melton population, displaying the town's growth over the years.

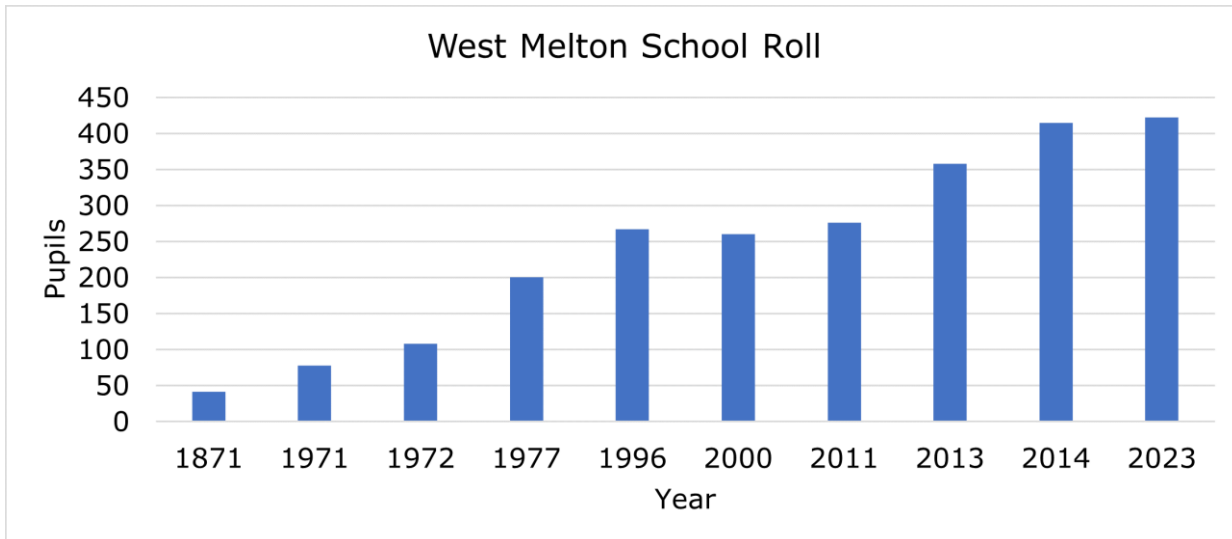


Figure 2: West Melton School Roll (West Melton, 2023)

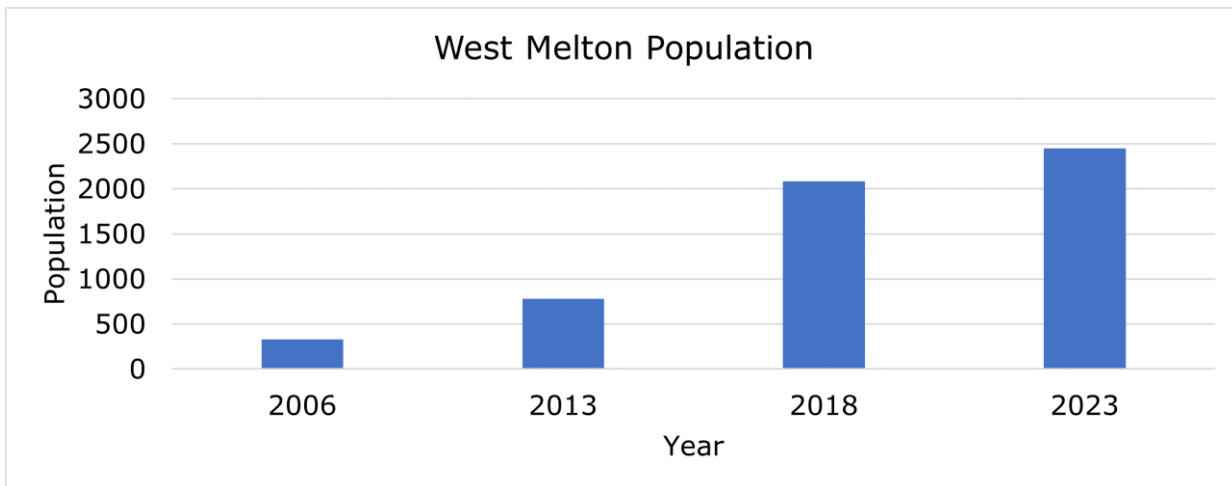
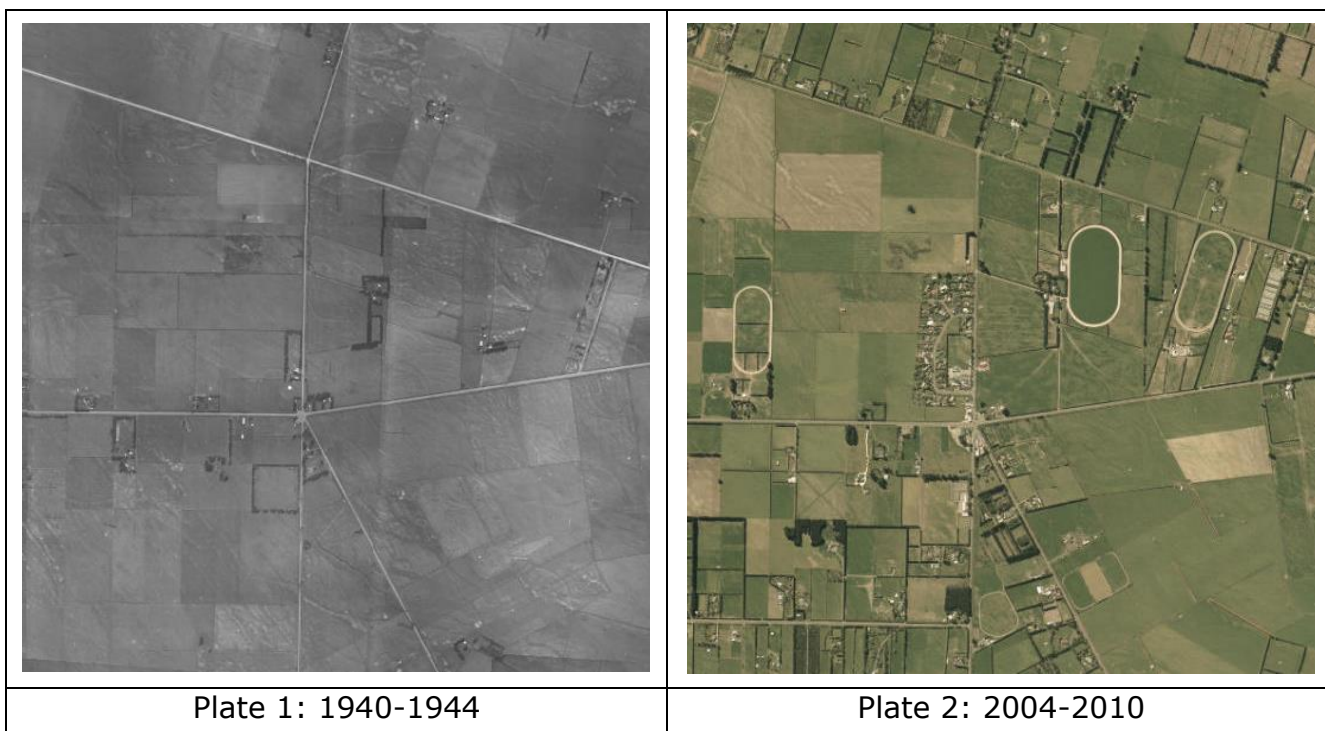


Figure 3: West Melton Population (StatsNZ, 2023)

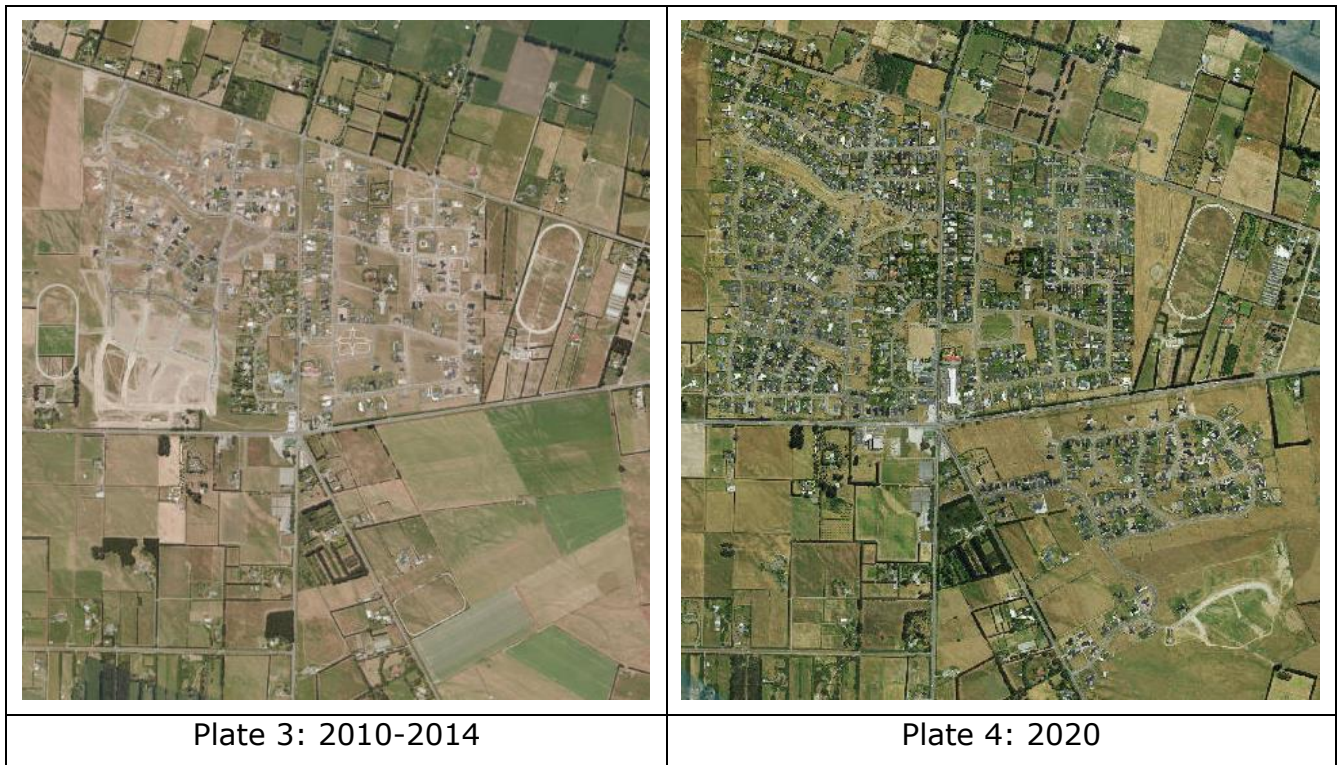
In 2007, West Melton saw the start of its urban expansion. Gainsborough and Halkett Grove subdivisions were the first developments to be built, followed by Preston Downs to the west of Gainsborough and Wilfield to the south of Gainsborough. One more subdivision and a southern extension of Wilfield are planned to be built. A retirement village, developed by Marama Te Wai Ltd, is to be built to the west of Preston Downs.

On 4 September 2010, Canterbury was hit by a 7.1 magnitude earthquake centred in the Selwyn District. This was followed by the 22 February 2011, 6.3 magnitude earthquake. The west side of Christchurch saw an increased demand for housing as families relocated from the red-zoned areas. This has seen a large portion of land made available for housing development, resulting in a considerable increase in population.

Plates 1-4 are historic aerial imagery of West Melton from 1940 to 2020. The start of its urban expansion can be seen in the 2010-2014 imagery.







*Plates 1-4: West Melton historic aerial imagery (Canterbury Maps, 2024)*

## 5 TE MANA O TE WAI

Te Mana o te Wai is a concept that refers to the fundamental importance of water and recognises that protecting the health of freshwater protects the health and well-being of the wider environment. It protects the mauri of the wai. Te Mana o te Wai is about restoring and preserving the balance between the water, the wider environment, and the community (Ministry for the Environment, 2022).

Te Mana o te Wai has been part of the National Policy Statement for Freshwater Management since 2014, however, The NPS-FM 2020 strengthens and clarifies Te Mana o te Wai by providing stronger direction on how Te Mana o te Wai should be applied when managing freshwater.

The six principles are:

1. Mana whakahaere: the power, authority, and obligations of tangata whenua to make decisions that maintain, protect, and sustain the health and well-being of, and their relationship with, freshwater.
2. Kaitiakitanga: the obligations of tangata whenua to preserve, restore, enhance, and sustainably use freshwater for the benefit of present and future generations.
3. Manaakitanga: the process by which tangata whenua show respect, generosity, and care for freshwater and for others.
4. Governance: the responsibility of those with authority for making decisions about freshwater to do so in a way that prioritises the health and well-being of freshwater now and into the future.
5. Stewardship: the obligations of all New Zealanders to manage freshwater in a way that ensures it sustains present and future generations.
6. Care and respect: the responsibility of all New Zealanders to care for freshwater in providing for the health of the nation.

There is a hierarchy of obligations in Te Mana o te Wai that prioritises:

1. First, the health and well-being of water bodies and freshwater ecosystems.
2. Second, the health needs of people (such as drinking water).
3. Third, the ability of people and communities to provide for their social, economic, and cultural well-being, now and in the future.

## **5.1 DILEMMA OF OBLIGATIONS**

The piping of stock water races can create a dilemma in meeting the hierarchy of obligations of Te Mana o te Wai.

The first obligation of Te Mana o te Wai is not met by piping stock water races as it disrupts the health and well-being of water bodies and freshwater ecosystems by removing in-stream habitats and terrestrial habitats (riparian margins). However, piping stock water races can create room in the road corridor for stormwater treatment and shared user paths that may otherwise not be present. Nature-based stormwater treatment devices such as first-flush swales and basins can create terrestrial habitats. Stormwater treatment and shared user paths protect the health and well-being of the wider environment. Shared user paths provide more active transport options, thus providing opportunities to reduce carbon emissions.

The second obligation prioritises the health needs of people (such as drinking water). For stock water, this could be interpreted as the health needs of livestock. Piping of stock water races does not impact the primary function of stock water races.

The third obligation prioritises the ability of people and communities to provide for their social, economic, and cultural well-being, now and in the future. This would include the safety of the communities. Open water poses a drowning risk and pedestrian/road safety hazard. Piping stock water races eliminates the interface with open water and can create room in the road corridor for traffic safety improvements and shared user paths.

Piping stock water races can be interpreted as prioritising the third obligation over the first. This highlights the importance of weighing up the pros and cons of piping stock water races. Opportunities to retain open stock water races should be adopted where possible to retain habitats and community connection with water and the surrounding environment. In the situation of West Melton, the proximity of the stock water races was a risk to community safety, and the urbanisation of the area put pressure on this interface.

Opportunities to retain open stock water races can be adopted via:

- Enhancing stock water races through parks and reserves via plantings, naturalised alignments and creation of riffle and pool sequences.
- Using riparian planting to create pedestrian separation.

## **6 EXISTING CONDITIONS**

### **6.1 STOCK WATER NETWORK**

The project area is within the Paparua Water Race Scheme, as shown in Figure 4. The existing stock water network within the project area consisted of open water races along Weedons Ross Road, SH73 and West Melton Road. The open water races were linked via culverts beneath SH73 and Weedons Ross Road. The flows were split via two stoplog gates, controlling the water levels. There were also two stock water ponds at the entrance to Kingsdown Drive, which were for aesthetic and amenity functions.

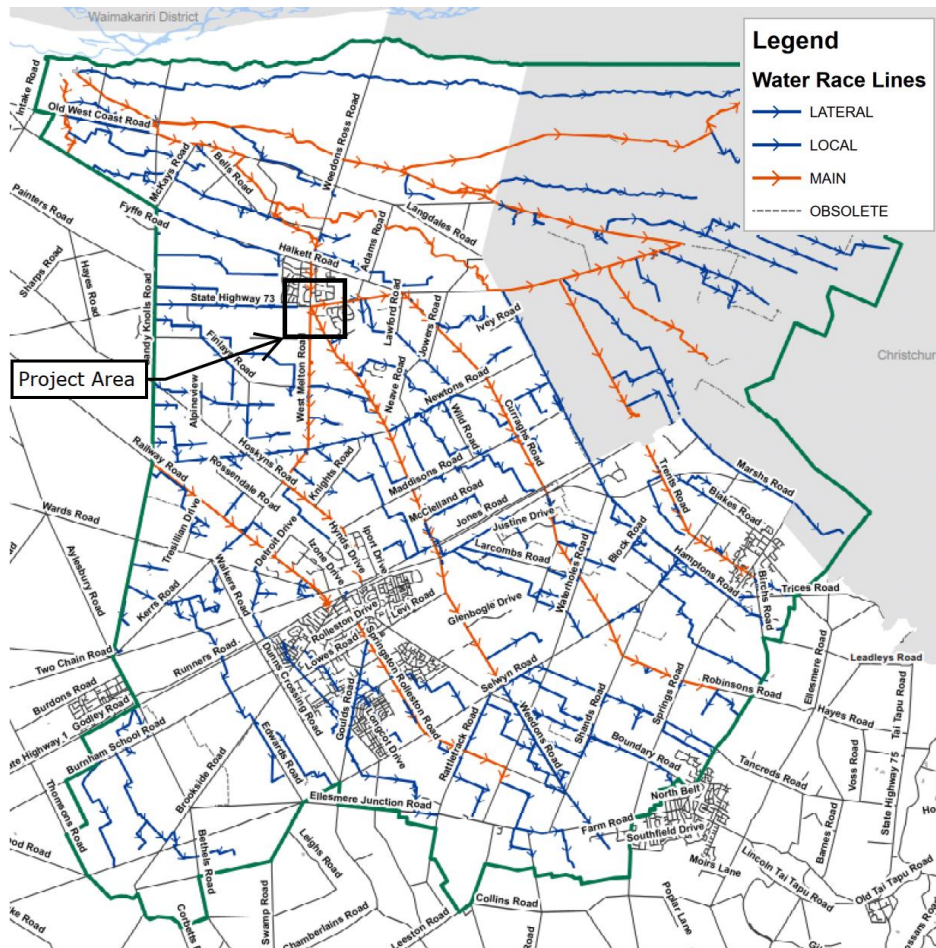


Figure 4: Paparua Water Race Scheme

The existing network had several safety issues, including:

- Open stock water races directly in front of the shopping centre, West Melton School and church with limited fencing.
- The outlet to the existing box culvert under SH73 was directly behind the back of the kerb with no buffer zone.
- Open stock water races directly adjacent to SH73, Weedon Ross Road and West Melton Road. The open stock water race had 1:1 batters and no kerbs or safety barriers.
- Stock water race culverts adjacent to SH73 with no mountable headwalls.
- Timber stoplog gates with manual adjustment and no fall protection for operation and maintenance personnel.
- A large number of pedestrian and vehicle movements creating a direct interface with open water.

Flow gauging of the stock water race upstream of SH73 was completed during winter flows. A flow rate of 168 L/s was measured. The maintenance and operations contractor estimated the flow would be approximately 1/3 of the expected summer flow demands. The flow split across the water races was estimated as 50% Weedon Ross Road, 20% West Melton Road, and 30% SH73.

Plates 5-10 shows photos of the existing stock water race network prior to works.





Plate 5: Existing outlet to box culvert under SH73



Plate 6: Existing stoplog gate



Plate 7: Existing open stock water race adjacent to SH73



Plate 8: Existing debris grille on Weedons Ross Road





Plate 9: Existing 900 mm steel Armco pipe inlet

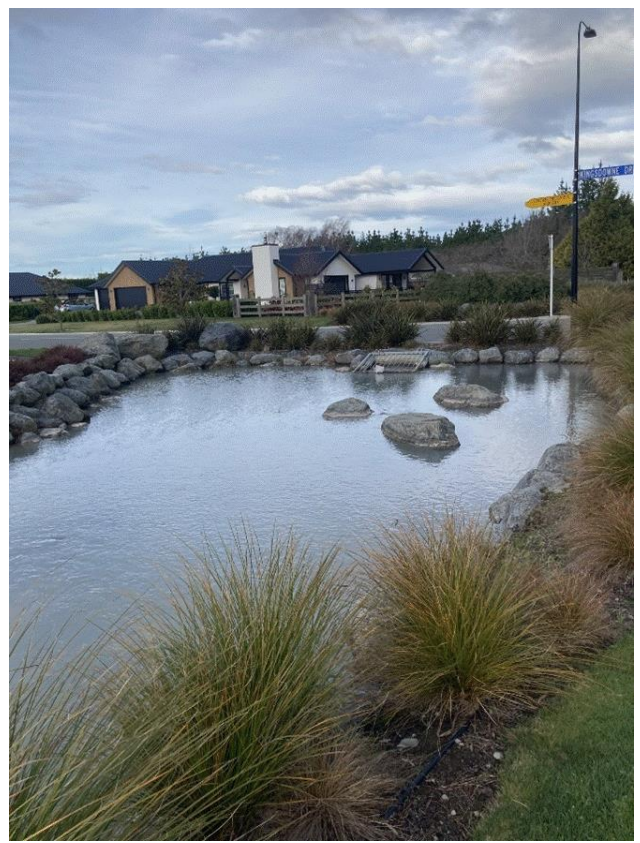


Plate 10: Existing Kingsdowne Drive stock water ponds

*Plates 5-10: Existing stock water network*

## 6.2 STORMWATER NETWORK

The existing stormwater water network within the project area consisted of sump to soak pit systems along parts of SH73 and West Melton Road. Weedons Ross Road, north of SH73, is serviced by a pit and pipe network connection to Rotherham Drive, which discharges to a soakage basin. The remaining project area is drained via sheet flow into stock water races or grassed roadside channels. There was no stormwater treatment prior to discharge other than the soakage basin and any informal filtering in grass channels.

The existing network had several safety and environmental issues, including:

- Deep dish kerb and channel along Weedons Ross Road and West Melton Road, including in front of West Melton School and West Melton Domain.
- Ponding of water on shoulders due to lack of formal stormwater infrastructure.
- Informal discharge points relying on infiltration and bypass.
- Discharge of untreated stormwater to soak pits and stock water races.

Plates 11-16 are photos of the existing stormwater systems prior to works.





Plate 11: Existing sump to soak pit system

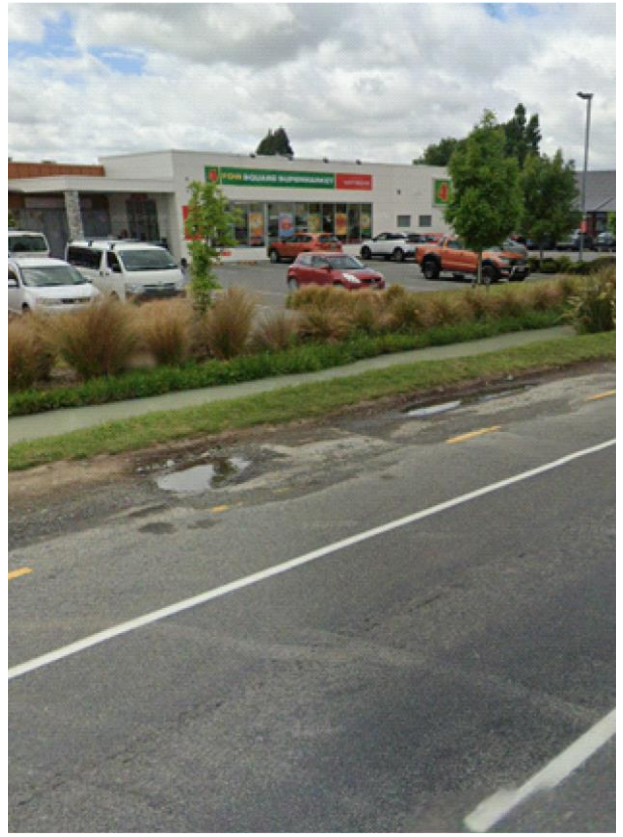


Plate 12: Ponding of water on shoulders



Plate 13: Sheet flow to Weedons Ross Road water race



Plate 14: Pit and pipe network with deepish kerb and channel on Weedons Ross Road





Plate 15: Sheet flow to SH73 water race



Plate 16: Weedons Ross Road grassed roadside channel

*Plates 11-16: Existing stormwater network*

### **6.3 ECOLOGICAL CONDITION**

A site investigation was undertaken to evaluate the present terrestrial habitats and their suitability for native fauna and flora within the project area (AECOM, 2021). The investigation included:

- Recording incidental bird sightings and habitat suitability for native lizards.
- eDNA Fish sampling in the three water races.
- Macroinvertebrate sampling in the three water races.

#### **6.3.1 TERRESTRIAL HABITAT**

There were no indigenous habitat types associated with the project area. Terrestrial habitats were restricted to exotic and planted native species, associated with amenity landscaping, gardens and shelterbelts. Native riparian planting was also evident along the water races. Other vegetated areas were restricted to scattered exotic trees and mown exotic grassland associated with pasture and amenity areas. As all habitat types were exotic-dominated, their ecological value is low. However, these habitats may provide habitat for native fauna.

#### **6.3.2 TERRESTRIAL FAUNA**

During the site investigation, no indigenous lizards were identified as incidental observations. However, suitable habitats, including the terrestrial vegetation described above and riparian areas associated with stock water races, could support widespread and adaptable species such as the southern grass skink. This species occurs in modified landscapes, including rural and urban areas around Christchurch. It is considered likely



that southern grass skink could occur within identified terrestrial and riparian habitat areas. Due to the threat status (At Risk - Declining) of the southern grass skink, if present, it would be considered to have a high ecological value.

No specific bird survey was undertaken, but five common bird species were recorded incidentally. The only native bird identified was the grey warbler (*Gerygone igata*), the remaining being introduced species.

### 6.3.3 IN-STREAM HABITAT

The in-stream habitat of the three open water races within the project area consisted of:

- Weedons Ross Road: The channel was largely uniform with limited in-stream habitat for much of its length. Most bankside vegetation had been sprayed with pesticide, leaving bare soil and managed mown grass berms. The artificial pools associated with the entrance to Kingsdowne Drive provided more diverse habitat with the addition of rocky boulders and a riffle and pool sequence. Amenity planting through the boulders included a mix of native sedges and grasses, including red tussock grass, silver tussock, speckled sedge, and harakeke flax.
- SH73: The channel was largely uniform with limited in-stream habitat for much of its length. Most bankside vegetation had been sprayed with pesticide, leaving bare soil and managed mown grass berms. Riparian vegetation was limited to occasional eucalyptus trees, which provided limited shading to the channel.
- West Melton Road: The channel was largely uniform with limited in-stream habitat for much of its length. However, the bankside vegetation included planted native shrubs and exotic grasses and forbs.

eDNA analysis of the three samples identified two native fish (Longfin eel and Upland bully) and the introduced brown trout are potentially present in the water races. During construction of the project works, close to 120 fish were caught and relocated including upland bully, longfin and short-fin eels, and brown trout.

An ecological survey of the Paparua Water Race Scheme in 2022 by EOS Ecology also detected Kākahi (freshwater mussels), which have a treat status (At Risk – Declining), during eDNA analysis of the Weedens Ross Road and West Melton Road open water races (EOS Ecology, 2022).

## 7 CASE-BY-CASE DECISION

The decision to pipe the stock water within the project area was made after consideration of the pros and cons, as shown in Table 5. Piping the stock water races provided numerous benefits and enabled investment to create a safer community.

Table 5: Piped stormwater network

Pros	Cons
Traffic safety improvements	Loss of terrestrial habitat
Pedestrian safety improvements	Loss of in-stream habitat
Operations and maintenance safety improvements	Loss of community connection with water
Increased active transport options	

Provision of stormwater treatment	
Creation of habitats in swale, basin, and landscape plantings	
Existing terrestrial habitat types were considered to be low ecological value	
Limited existing instream habitats	
Traffic safety improvements	

## 8 CONSTRUCTED DESIGN

### 8.1 STOCK WATER NETWORK

Modifications to the stock water network were constructed as part of the intersection upgrade and new link road. Works included:

- The existing 900 millimetre (mm) diameter stock water pipe, which runs along the eastern side of Weedons Ross Road (north of SH73), was replaced and extended north to Westview Crescent to accommodate road widening and shared user paths.
- The existing 550 mm (H) x 1100 mm (W) box culvert, which crossed under SH73, was replaced with a siphon system to provide compliant pipe cover under SH73. A flow splitter chamber was constructed south of SH73 to control flows to the receiving stock water races.
- The existing open stock water race along the south side of SH73 was piped to accommodate roading widening, shared user path and stormwater treatment first-flush swales and basin.
- There were open stock water races extending along the eastern side of West Melton Road and Weedons Ross Road. These two races were combined and piped down the centre of West Melton Road. A flow splitter chamber was constructed adjacent to the new link road, and a pipe ran across the link road to split flows back into the two open stock water races.
- The open stock water race at the Weedons Ross Road/Kingsdowne Drive intersection had been modified to create a water feature (ponds) at the entrance to the subdivision. The footprint of the constructed roundabout at this intersection overlapped with these ponds. The ponds were removed and replaced with stormwater treatment first-flush basins.

Plates 17-22 are photos of the constructed stock water network, and Figure 5 shows the extent of the piped stock water network.





Plate 17: Piped stock water network inlet on Weedons Ross Road



Plate 18: Shared user path above piped stock water on Weedons Ross Road



Plate 19: Shared user path and first-flush swales on SH73. Stock water piped along fence line.



Plate 20: Mountable headwall on SH73



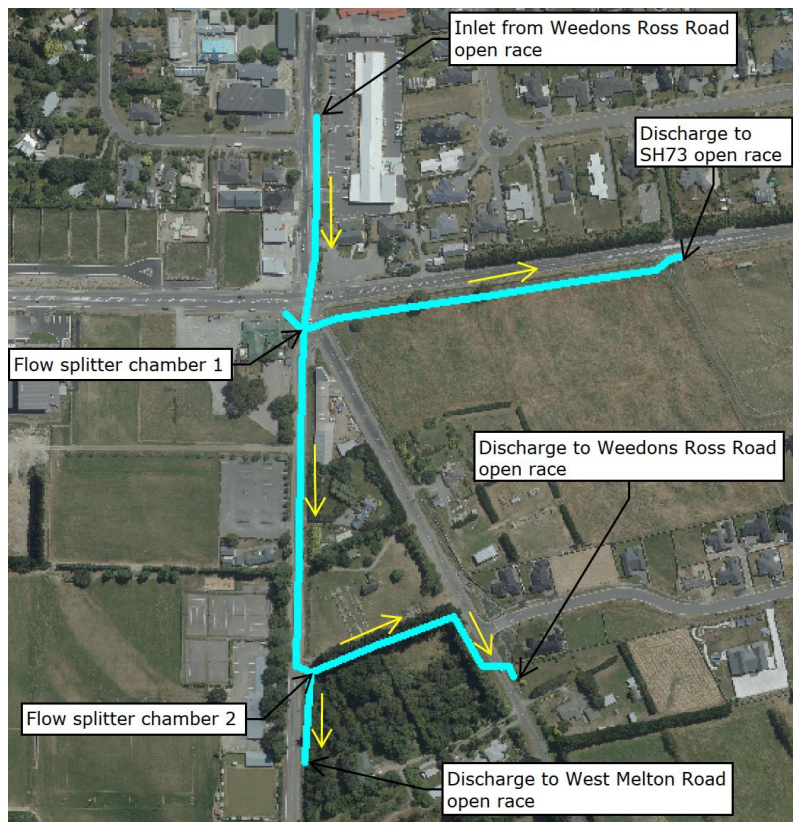


Plate 21: Flow splitter chamber at SH73/Weedons Ross intersection



Plate 22: Stock water piped down the centre of West Melton Road

*Plates 17-22: Constructed stock water network*



*Figure 5: Piped stock water network*



## 8.2 STORMWATER NETWORK

Modifications to the stormwater network were constructed as part of the intersection upgrade and new link road. Works included:

- SH73 west of the intersection: New pit and pipe networks crossing SH73 with direct soakage to ground. No treatment was provided prior to discharge due to a negligible increase in impervious area and insufficient space available.
- SH73 east of the intersection: New pit and pipe networks crossing SH73 discharging to first-flush treatment swales. The design improved the existing drainage regime by removing direct soakage to ground and discharge to the open stock water race.
- Weedons Ross Road, north of SH73: Replacement of deep-dish kerb and channel with standard kerb and channel.
- Weedons Ross Road, south of SH73: Two new pit and pipe networks discharging to first-flush basins at Weedons Ross Road/SH73 and Weedons Ross Road/Kingsdowne Drive intersections. The design improved the existing drainage regime by removing discharge to the open stock water race.
- West Melton Road south of SH73: New pit and pipe network discharging into a first-flush basin on the south-east corner of West Melton Road and the new link road. The design also improved the existing drainage regime by removing existing direct soakage to ground and discharge to the open stock water race.
- Link Road: New pit and pipe network discharging to a first-flush swale on the south side of the road.

Plates 23-26 are photos of the constructed stormwater network.



Plate 23: First-flush basin at SH73/Weedons Ross Intersection



Plate 24: First-flush swales adjacent SH73





Plate 25: First-flush swales adjacent new link road



Plate 26: First-flush basin at the entrance to Kingsdowne Drive

*Plates 23-26: Constructed stormwater network*

### **8.2.1 STORMWATER TREATMENT**

The geometric design of the intersection upgrade resulted in increases in impervious areas. Stormwater treatment was provided for all increases in impervious areas, as well as treatment of existing impervious areas where feasible. Treatment was provided via first-flush swales/basins designed to treat the first 25 mm of rainfall.

The swales and basins were planted with *Aposdasmia similis* (Oioi), providing landscape, habitat, and visual amenities while also reducing future maintenance.

### **8.3 SAFETY IN DESIGN**

The project allowed for safety in design elements to be incorporated into the stock water and stormwater network. These elements increased the safety of operations and maintenance personnel as well as motorists and pedestrians.

#### **8.3.1 FLOW SPLITTER CHAMBERS**

Two flow splitter chambers were constructed at the SH73/Weedons Ross Road intersection and West Melton Road/Link Road intersection to split flows between the water races. The chambers consist of 1800 x 1800 mm cast in-situ concrete chambers with penstock valves. The penstock valves are controlled manually via valve boxes cast into the chamber lids. The design is future-proofed for an upgrade to an actuated system by providing sufficient clearance on chamber lids for fixing an actuator pedestal, and provision of two 100 mm ducts for electrical and telemetry cables. McBarns access covers with hinged grates below were installed to provide sufficient maintenance access and visual inspection of penstock

valves and water levels. The chamber lids were designed to be cast separately so that they are removable for major maintenance works (such as penstock replacement).

Design of an actuated control system for the penstock valves was considered by SDC; however, was not adopted due to the following reasons:

- Penstock valve position only requires adjusting on a sessional basis and for required shutdowns.
- Valve actuators would be located above ground on pedestals attached to the chamber lid. A cage would likely be required around the chambers to protect them from public interference.

### **8.3.2 INLETS AND OUTLETS**

Safety grilles were installed on all inlets and outlets to the new piped stock water network. Stock water pipes ranged from 525 to 1000 mm diameter, with the longest branch length being 650 metres. It is important to install safety grilles on long, large diameter pipe networks to keep people and animals away from danger.

The outlet to the SH73 water race also had a mountable headwall installed due to the high-speed environment.

### **8.3.3 STORMWATER SWALES AND BASINS**

Stormwater treatment swales and basins were planted with *Aposdasmia similis* (Oioi) to avoid creating additional mowing maintenance tasks for NZTA and SDC.

## **9 CONCLUSIONS**

The SH73 West Melton Improvement Project converted approximately one kilometre of an existing open stock water race into a piped network. Community facilities, including a primary school, shopping centre, church, tavern, and recreational reserve, surround the site. This resulted in a direct interface with pedestrians and traffic with open water. The piping of the stock water races created space within the existing road reserve for traffic safety improvements (off-road shared user paths, road widening, kerbs, signalised intersections/crossings) as well as the construction of 420 metres of stormwater first-flush treatment swales and basins. The design improved the existing drainage regimes by removing untreated road runoff from soaking to ground or discharging to the open stock water race. The swales and basins were planted with *Aposdasmia similis* (Oioi), providing landscape, habitat, and visual amenities while also reducing future maintenance. The project achieved great safety outcomes for the community, eliminating the interface with open water and providing room in the road corridor for traffic safety improvements and stormwater treatment.

Community safety around infrastructure is a key issue for local authorities. Authorities should consider changes associated with the development of previously rural or low-density areas. The decision to convert stock water races to a piped network should be made on a case-by-case basis. Opportunities to retain open races should be adopted where possible to retain community connection with water and the surrounding environment.

### **ACKNOWLEDGEMENTS**

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## REFERENCES

AECOM (2021) *Resource Consent Application - State Highway 73 / Weedons Ross Road Intersection Improvement Ecology Report*, 1-8.

Canterbury Maps (2024) *Canterbury Maps Viewer*. Available at: <https://mapviewer.canterburymaps.govt.nz/> (accessed 2 March 2024).

EOS Ecology (2022) *Paparua Water Race Scheme: 2022 Ecological Surveys*, 1.

Ministry for the Environment (2022) *Clause 1.3: The fundamental concept of Te Mana o te Wai and its use in the NOF*. Available at: <https://environment.govt.nz/publications/guidance-on-the-national-objectives-framework-of-the-nps-fm/clause-1-3/> (accessed 2 March 2024).

New Zealand Transport Agency (2023) *SH73 West Melton Improvements*. Available at: <https://www.nzta.govt.nz/projects/sh73-west-melton-improvements/> (accessed 2 March 2024).

NZ Herald (2019) *One person dead after falling into water in Ashburton*. Available at: <https://www.nzherald.co.nz/nz/one-person-dead-after-falling-into-water-in-ashburton/AJDPOV4Z2ZAIPXBQPCBUJMMKWY/> (accessed 2 March 2024).

Selwyn District Council (2024) *Water Races*. Available at: <https://www.selwyn.govt.nz/services/water/water-race> (accessed 2 March 2024).

Star News (2021) *Boozed driver retrieves car then crashes into ditch*. Available at: <https://www.odt.co.nz/star-news/star-districts/star-selwyn/boozed-driver-retrieves-car-then-crashes-ditch> (accessed 2 March 2024).

StatsNZ (2018) *West Melton*. Available at: <https://www.stats.govt.nz/tools/2018-census-place-summaries/west-melton> (accessed 2 March 2024).

Stuff (2018) *11-month-old dies after falling into water race in Rolleston*. Available at: <https://www.stuff.co.nz/the-press/news/107493612/child-critically-injured-after-nearly-drowning-in-rolleston> (accessed 2 March 2024).

West Melton Residents Association (2023) *150 Years of History*. Available at: <https://westmelton.org.nz/150-years-of-history/> (accessed 2 March 2024).