Between the Domes Catchment

Showcase

Local Survey Results

Local Water Data

Wetland & Sediment Trap Information

Riparian Planting Information

THRIVING SOUTHLAND

environment SOUTHLAND REGIONAL COUNCIL Te Taiao Tonga

SCARLATTI Evaluation | Analytics | Insights

Befound

NIWA Taihoro Nukurangi

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Proudly created by:
Between the Domes Catchment | Thriving Southland | Environment Southland | Scarlatti | Befound Online | NIWA


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Keith Woodford info evening


Rapid assessment workshop

This booklet has been developed to share catchment survey results, which can be used as a baseline for the community.

Providing a deeper understanding of the catchment will help the Between the Domes Catchment Group with prioritisation of its effort over the next decade. For those seeking to better understand the area, it will provide an easily accessible resource.

The Between the Domes Catchment Group began in 2017, with a great cross section of people from different backgrounds. There are now more than 40 people in the group. The group area was refined in 2021 to allow for more specific projects within the smaller catchments. A large project around surveying the catchment and looking at local wetlands and how to develop these/increase effectiveness is coming to an end; with this booklet being a final product of this.

Our Purpose

Engage, Educate, Enhance. Engaging with the community & all those who live in it, while increasing environmental understanding for positive change.

Our Mission

Positively influencing good management practices community wide to ensure longevity of healthy landscapes, lifestyles and businesses to live and play in.

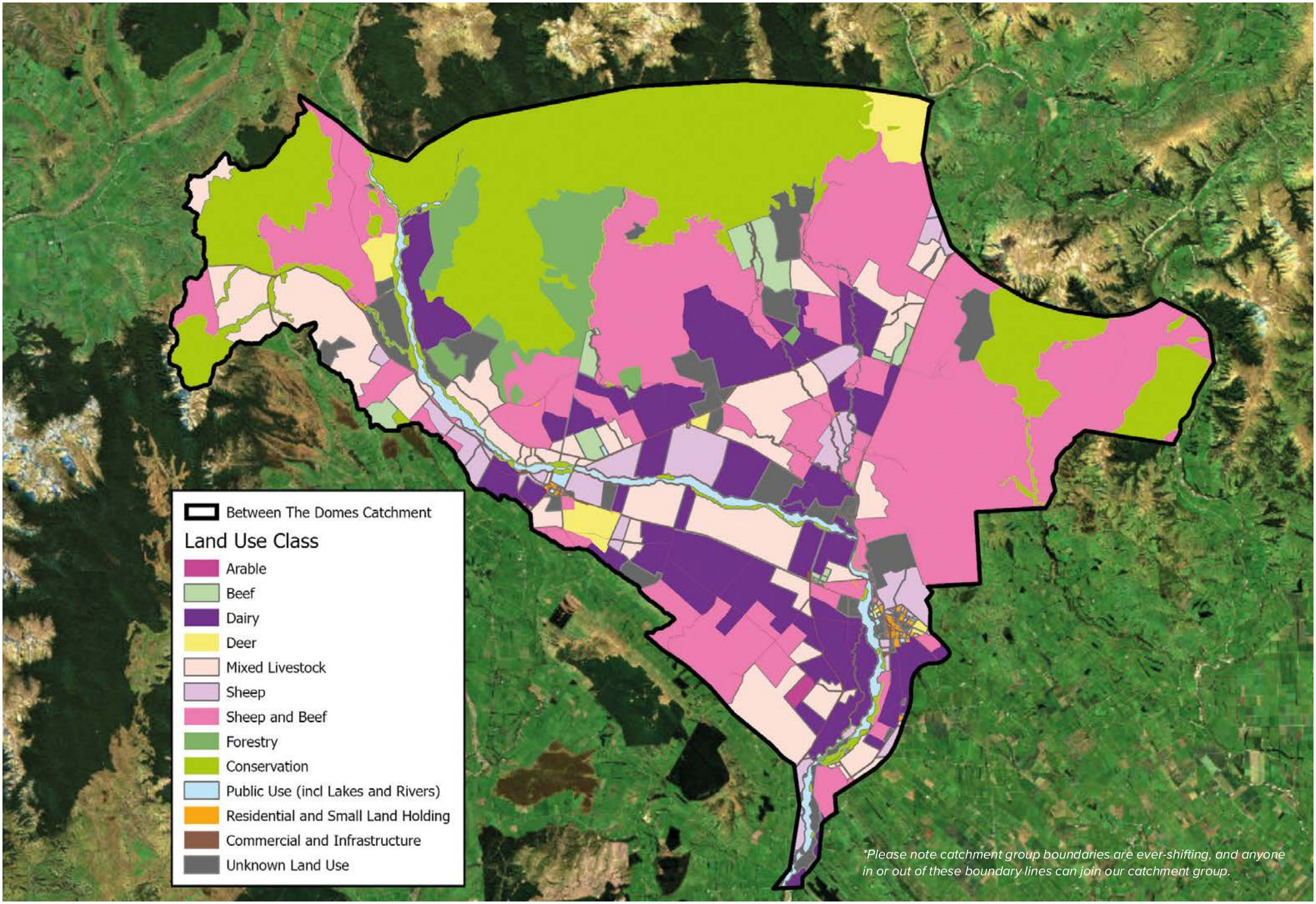
Our Values

- Intergenerational and custodial thinking for living on the land
- Transparency of farming systems and their impacts
- Connecting communities and people
- Pride in our surroundings and recreational opportunities
- Safe and secure community to live and play in

Want to join our catchment group?

Everyone is welcome. Email us or visit us on facebook for more info. Visit the Thriving Southland website to find all the catchment groups in the Southland region!

btdcatchment@gmail.com
Between-the-Domes-Catchment-Group
www.thrivingsouthland.co.nz/between-the-domes


Between The Domes Catchment
Land Use Class
Arable
Beef
Dairy
Deer
Mixed Livestock
Sheep
Sheep and Beef
Forestry
Conservation
Public Use (incl Lakes and Rivers)
Residential and Small Land Holding
Commercial and Infrastructure
Unknown Land Use
*Please note catchment group boundaries are ever-shifting, and anyone in or out of these boundary lines can join our catchment group.

BETWEEN THE DOMES

About Our Catchment

Between the Domes Catchment sits between West and Mid Dome, including the whole of the Five Rivers Plain from Eyre Mountains and Jollies Pass in the North, Gorge Hill in the West, Lintley in the East, to just past Josephville Hill in the South.

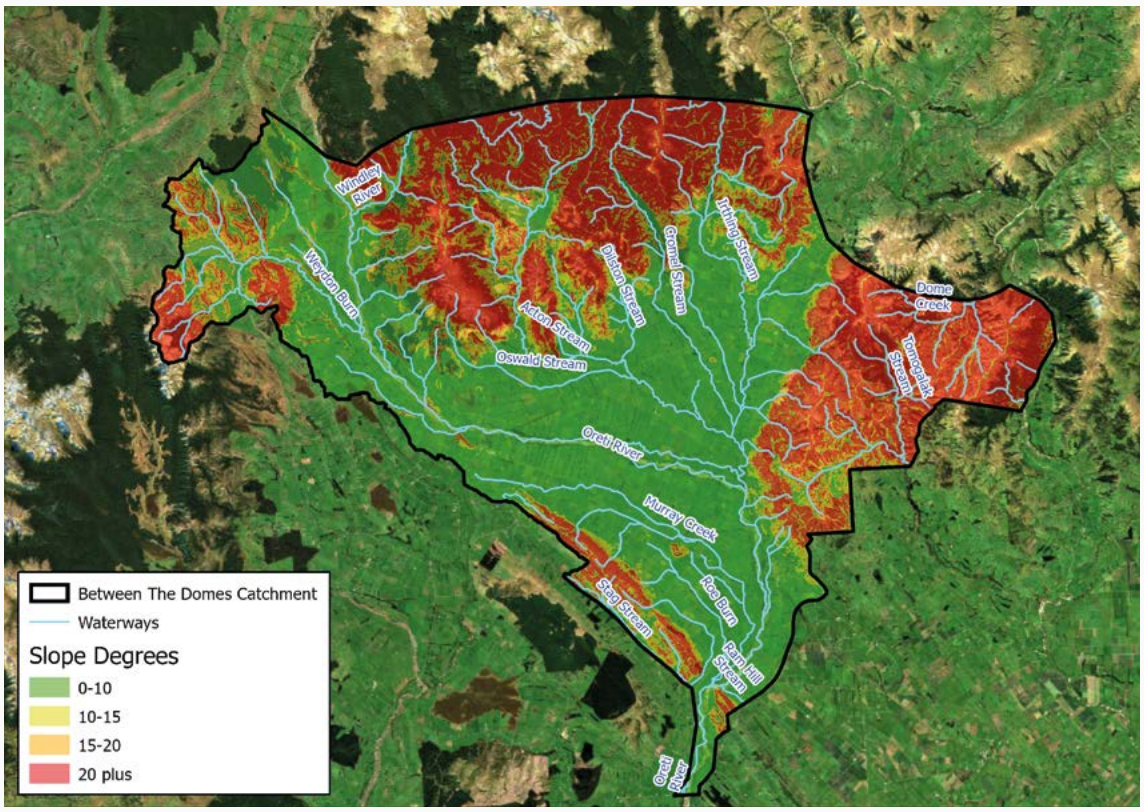
It is an area of diverse landscapes, from alpine tussock land through beech forest to river flats, with streams, rivers and wetlands.

TOTAL AREA

92,566 hectares

WATERWAY LENGTHS

640km



**Please note catchment group boundaries are ever-shifting, and anyone in or out of these boundary lines can join our catchment group.*

BETWEEN THE DOMES

Catchment Survey

The Between the Domes Catchment Group conducted a survey through Survey Monkey (an online platform) which was run from December 2021 to January 2022.

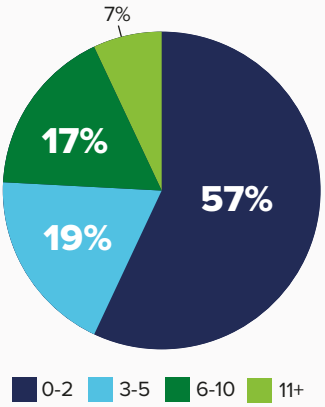
There were a total of 71 respondents. The purpose of this survey was to better understand the farmers in the catchment group; where they are currently, where they want to be in the future, and what they would like some help with.

Land Use Information

Most of the respondents are sheep and beef farmers - **55% sheep** and **49% beef**.

Respectively **31%** and **30%** of respondents undertake some **dairy** and **dairy support** farming.

How many permanent staff do you have most times of the year?



Staff

Most respondents usually have **two or fewer permanent staff** during the year.

Larger farms tend to have a higher number of permanent staff. However, most farms of up to 500 ha are still only relying on two or fewer permanent staff.

Topography

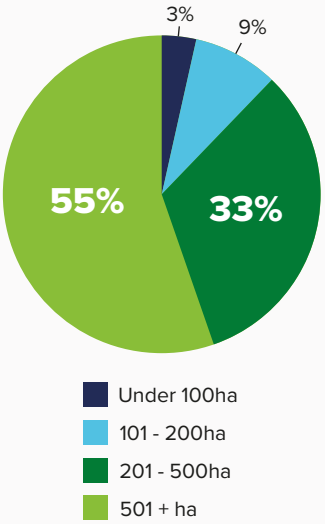
82% of farms have at least **some flat terrain**, and **54%** have **some rolling terrain**.

There appears to be a tendency for farms with rolling and steep terrain to be used for sheep and beef farming, while dairy and dairy support farming typically have flat lands.

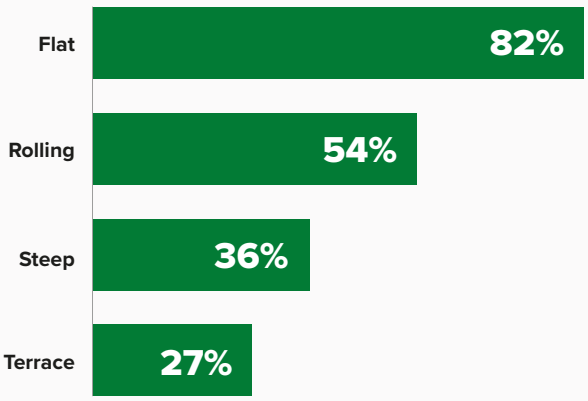
Most farms are elevated (60% of respondents indicate the lowest point on their farm is 201m above sea level or more).

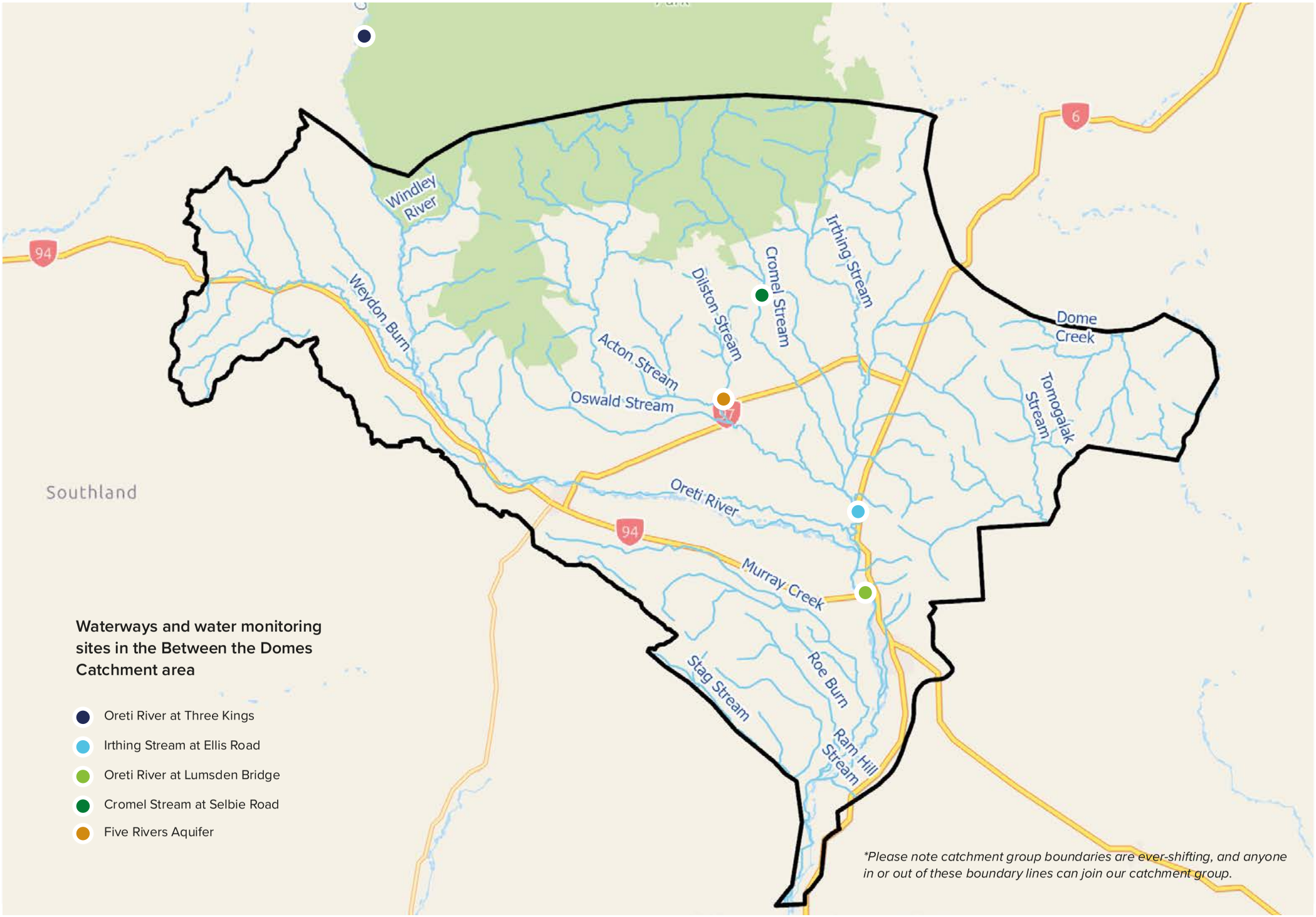
However most farms have a minimal change in elevation (57% of respondents indicate their highest point is between 201 and 500m above sea level).

What is the total area of your farm?



What topography does the farm have?



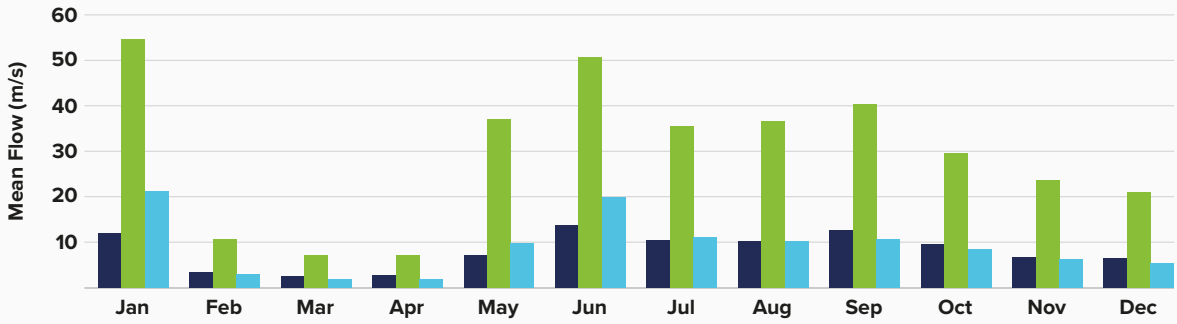

Windley River
Weydon Burn
Dilston Stream
Cromel Stream
Irthing Stream
Acton Stream
Oswald Stream
Dome Creek
Tomogalak Stream
Oreti River
Murray Creek
Stag Stream
Roe Burn
Ram Hill Stream
Southland
94
6
Waterways and water monitoring sites in the Between the Domes Catchment area
Oreti River at Three Kings
Irthing Stream at Ellis Road
Oreti River at Lumsden Bridge
Cromel Stream at Selbie Road
Five Rivers Aquifer
*Please note catchment group boundaries are ever-shifting, and anyone in or out of these boundary lines can join our catchment group.

Water Data

Waterflow

	Oreti River at Three Kings	Oreti River at Lumsden Bridge	Irthing Stream at Ellis Road
Mean flow (m/s)	8.4	29.7	9.5
Minimum flow (m/s)	4.0	9.5	2.9
Maximum flow (m/s)	33.6	199.9	74.4
Mean average water temp (°c)	9.5	11.2	-

Note: this is based on annual 2021 data from Environment Southland

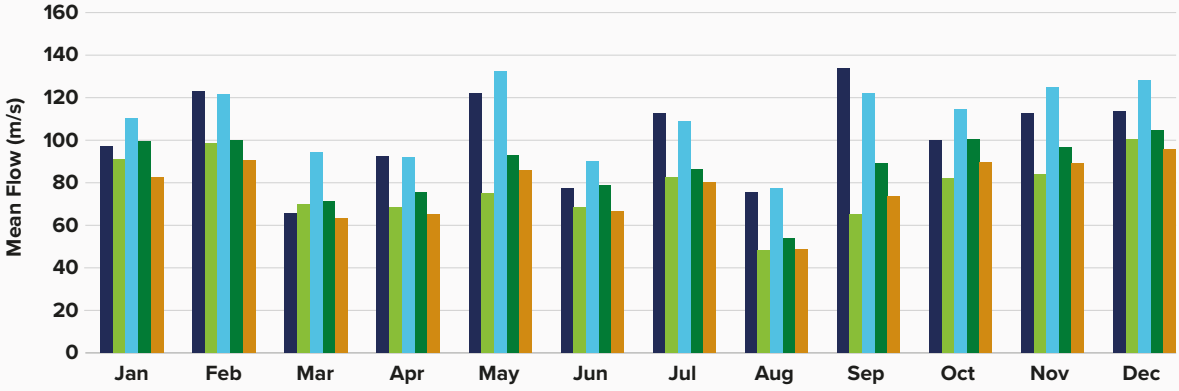


Mean water flow across 2011 Oreti River at Three Kings · Oreti River at Lumsden Bridge · Irthing Stream at Ellis Road

Rainfall

	Oreti River at Three Kings	Oreti River at Lumsden Bridge	Eyre Forest	Cromel Stream at Selbie Road	Five Rivers Aquifer
Mean annual rainfall (mm)	1228	938	1320	1051	936
Minimum annual rainfall (mm)	930	725	983	829	710
Maximum annual rainfall (mm)	1439	1139	1618	1231	1126

Note: this is based on annual 2021 data from Environment Southland



Monthly Rainfall

Oreti River at Three Kings · Oreti River at Lumsden Bridge · Eyre Forest · Cromel Stream at Selbie Road · Five Rivers Aquifer

WATER DATA

Water Quality

Water quality is impacted by point source and load which is the accumulation of inputs across the wider catchment. Soil type, geology and hydrology can all play a part as well as land use. Data from Land Air Water Aotearoa (LAWA) has been used for this report.

Interested in doing some water quality testing on farm?
There are many options; chemical water testing, macroinvertebrate tests, eDNA sampling and many more options.

** see monitoring points on page 8*

	Measurement	Oreti River at Three Kings*	Oreti River at Lumsden Bridge*	Irthing Stream at Ellis Road*	Cromel Stream at Selbie Road*
E. coli	5 year median (n/100ml)	10	40	62	11
	Quartile	Best 25%	Best 25%	Best 50%	Best 25%
	Band	A	B	D	A
Clarity	5 year median (n/100ml)	4.82	3.68	3.70	4.97
	Quartile	Best 25%	Best 25%	Best 25%	Best 25%
	Band	A	A	A	A
Ammoniacal Nitrogen	5 year median (n/100ml)	0.005	0.005	0.005	0.005
	Quartile	Best 25%	Best 25%	Best 25%	Best 25%
	Band	A	A	A	A
Nitrate Nitrogen	5 year median (n/100ml)	0.027	0.7	1.75	0.009
	Quartile	Best 25%	Worst 25%	Worst 25%	Best 25%
	Band	A	A	B	A
Dissolved Reactive Phosphorus	5 year median (n/100ml)	0.002	0.002	0.002	0.002
	Quartile	Best 25%	Best 25%	Best 25%	Best 25%
	Band	A	A	A	A
Macro-invertebrates	MCI	109.5	112.7	120	121
	MCI Band	C	B	B	B
	Taxonomic Richness	20	13	19	18
	EPT Richness (%)	52	55	58	52

Note: Data in the above table is from LAWA and is correct at time of printing - September 2022

Water Quality Monitoring: Land Air Water Aotearoa (LAWA) (lawa.org.nz) is the most up to date national database which connects people with New Zealand's environmental monitoring data.

LAWA has adopted a colour coding traffic light (blue to red) system to aid interpretation of data that corresponds to the status as determined in the National Policy Statement for Freshwater. Refer to LAWA website for further details - www.lawa.org.nz/explore-data/river-quality.

WATER DATA

Definitions

E. coli

E. coli (Escherichia coli) is a type of bacteria commonly found in the gut of warm-blooded animals and people. *E. coli* naturally occurs in freshwater and is not usually harmful in itself. However, high concentrations of this bacteria exceeding water quality guidelines indicate faecal contamination which can be harmful to humans.

Clarity

Water clarity refers to the ability of light to travel through water and has two important aspects: light penetration and visual clarity. Light penetration is important as it controls the amount of light in the water needed for aquatic plants to grow. Water clarity may be reduced when there is an increase in suspended sediment or how much algae is in the water.

Ammoniacal Nitrogen

Covers two forms of nitrogen: ammonia and ammonium. Animal waste (particularly from humans and farmed animals such as sheep and cows) is the major source of ammoniacal nitrogen in New Zealand waterways. If ammoniacal nitrogen reaches very high concentrations it can become toxic under certain temperature and pH conditions.

Nitrate Nitrogen

A highly soluble form of nitrogen that is both a nutrient and, in excess quantities, a toxic substance. Nitrate is a plant fertiliser, however, due to its high solubility in water, it is one of the most common contaminants in rural and urban areas.

Dissolved Reactive Phosphorus

This is a measure of the dissolved (soluble) phosphorus compounds that are readily available for use by plants and algae. Dissolved reactive phosphorus concentrations are an indication of a water body's ability to support nuisance algal or plant growths (algal blooms).

Macroinvertebrate Community Index (MCI)

MCI is used as an indicator of stream ecological health. Higher MCI scores indicate better stream conditions. The national bottom line for MCI is 90.

Taxonomic Richness

Taxa richness is considered a very coarse indicator of stream health, which is measured by counting the number of different species of invertebrates present in a sample. The benthic invertebrate community typical of pristine conditions has a high variety of species or "taxa". In general, high taxa richness is considered good, although mildly impacted (nutrient-enriched) rivers can have higher taxa richness than pristine streams and rivers.

EPT Richness

EPT stands for *Ephemeroptera* (mayfly), *Plecoptera* (stonefly) and *Trichoptera* (caddisfly) which are macroinvertebrates that are sensitive to water pollution. Because these species are generally found in streams with good water quality, their abundance can give us an idea about how healthy a stream is.

The percentage of EPT-taxa (or %EPT) is most commonly calculated by counting the total number of mayfly, stonefly and caddis fly taxa in a sample, then dividing that number by the taxa richness and multiplying by 100. A high percentage of EPT taxa indicates good stream health. However, in some New Zealand streams there are naturally few mayflies, stoneflies, or caddis flies present.

80% of our waterways are in the best 25% for water quality*

*Data extracted from LAWA, this is focusing on key components reported in our booklet rather than the whole dataset.

WATERWAYS

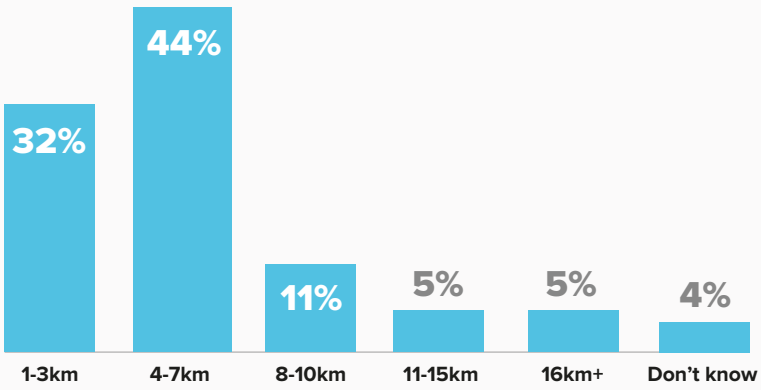
Survey Results

What waterways run through your property?

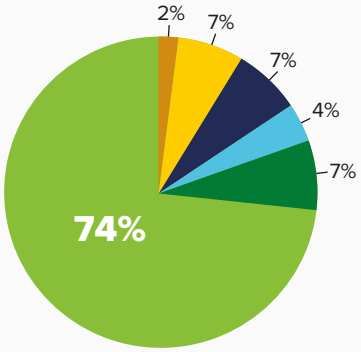
Waterways	# of respondents listing this waterway
Oreti River	14
Acton Stream	9
Irthing Stream	8
Murray Creek	5
Cromel Stream	4
Mataura River	4

Note: these were the top 6 waterways to go through survey respondents properties and of these respondents 12 said they don't know the names of the waterways/tributaries.

What is the total length of the named or permanently flowing waterways flowing through the property?



Of the estimated length of the named waterways on your farm, what % do you estimate is fenced to exclude stock?



Fenced Waterways

74% of respondents with named or permanently flowing waterways on their property have **fenced 81 to 100%** of them to exclude stock.

Only 2% had none of their waterways fenced off.

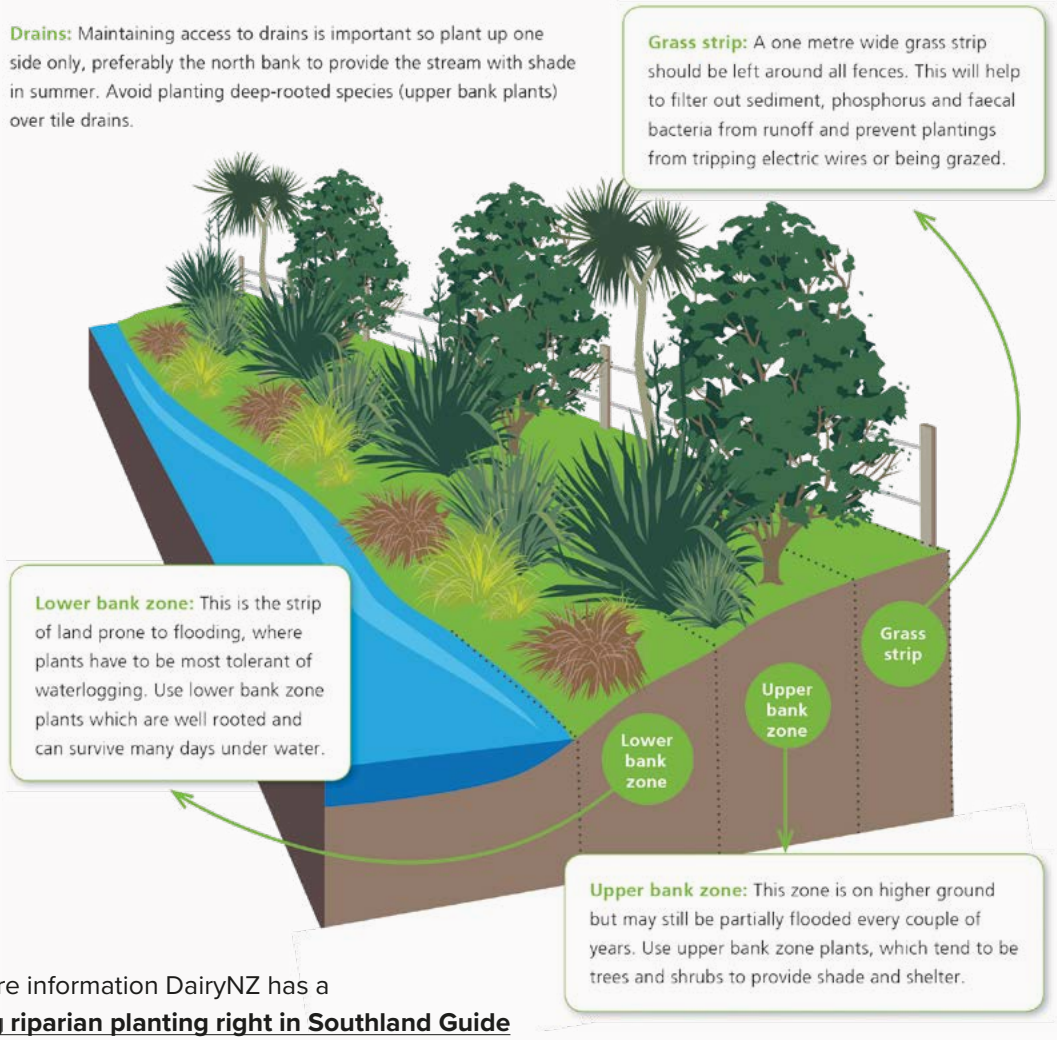
WATERWAYS

Riparian Planting

Plants function like a sieve, helping to filter out sediment and nutrients before they enter waterways.

Stabilising riparian plants help prevent land erosion and increase the habitat for native wildlife (source: *dairynz*).

We are lucky to have several great nurseries locally, including the Lumsden Community Nursery, a native plant nursery run by the Northern Southland Reforestation Trust. Get in touch with the team for advice on planting and access to high quality, locally grown plants suitable for riparian planting projects.

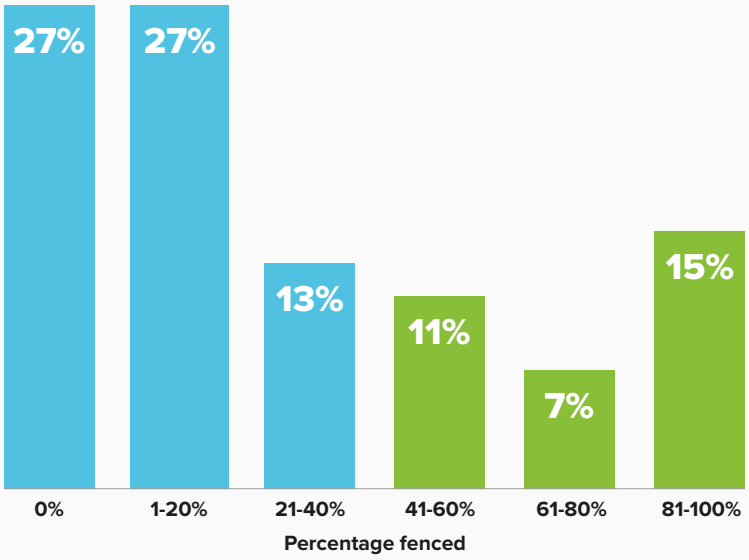


For more information DairyNZ has a **Getting riparian planting right in Southland Guide**

RIPARIAN PLANTING

Survey Results

What percentage of fenced waterways are riparian planted?



To date

77% of respondents who have undertaken riparian planting **have planted natives**; most respondents planted a mix of grass, native and exotic plants.

Respondents spent between **$1,000 and $200,000** over the last 3 years on riparian planting.

The total spent over that period was around **$242,000**, with an average of over $12,100 per respondent *(omitting the $200,000 investment one farm spent).*

Most of the respondents have none, or only a small portion (1-20%) of fenced waterways that are riparian planted.

Future riparian planting

62% of respondents are planning to do riparian planting in the next 3 years.

89% of respondents planning to do riparian planting would like to plant natives.

Those who plan to do riparian planting and have a budget are preparing to spend between **$1,500 and $60,000**.

The total estimated spent, for those who plan to do riparian planting and have a budget, will be **$239,500**, with an average of over $26,000 per respondent.

WATERWAYS

Wetlands

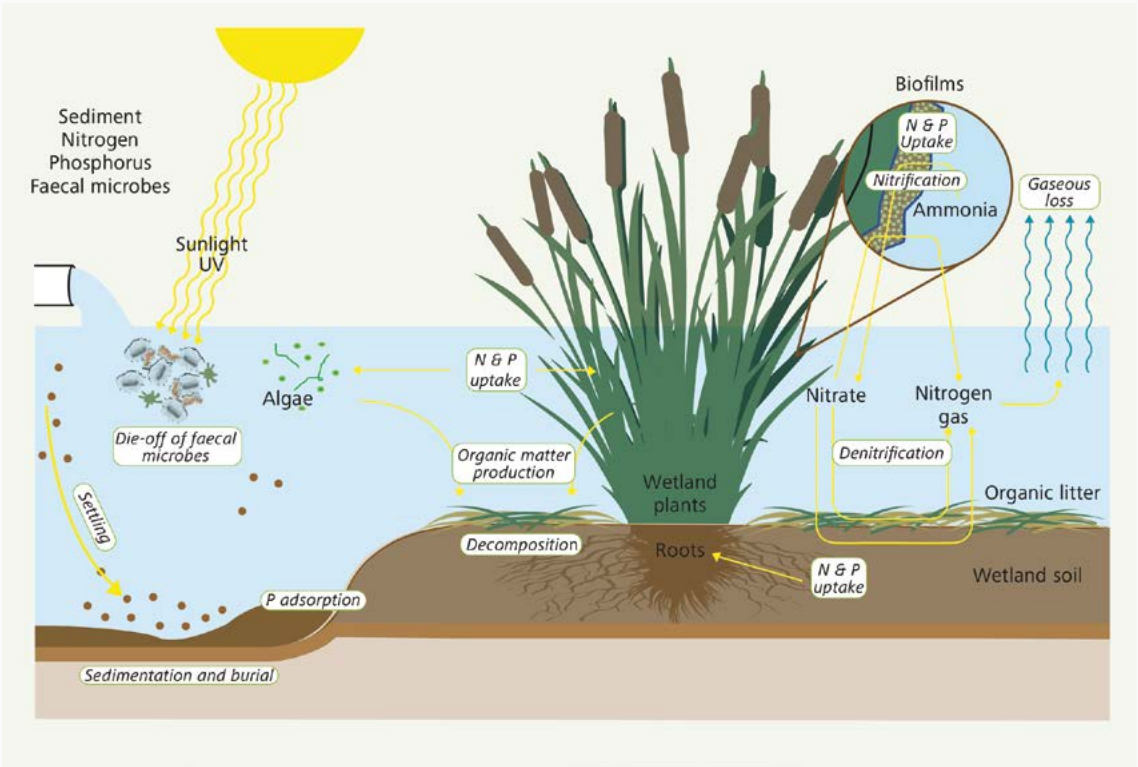
What is a wetland?

Although once thought of as mosquito-filled swamps or bogs, wetlands actually perform many valuable functions.

Wetlands act like the kidneys of the earth, cleaning the water that flows into them. They trap sediment and soils, filter out nutrients and remove contaminants; can reduce flooding and protect coastal land from storm surge; are important for maintaining water tables; they also return nitrogen to the atmosphere. *(source: DOC).*

Constructed wetlands

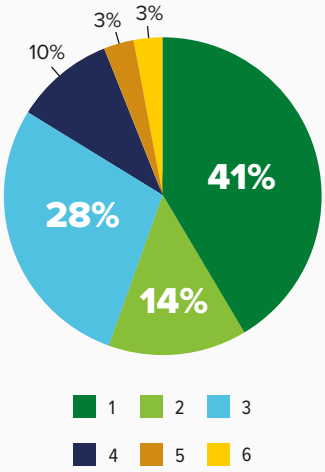
Constructed wetlands remove contaminants through a combination of physical, chemical and biological processes. A constructed wetland aims to provide an environment in which these processes are optimised to maximise treatment rates. *(source: DairyNZ).*



WETLANDS

Survey Results

Of those who have wetlands on their property, how many wetlands do you have?



Number of wetlands

43% of the total respondents have **at least one wetland on their farm**.

41% of those who answered the question had only one wetland.

50% of those who answered the question had wetland(s) covering 5 ha or less.

57% of the total respondents indicated they have no wetlands on their farm.

43% of respondents have at least one wetland on their farm

Protection of wetlands

Of those who answered this question, **73% said that 100% of their wetlands were protected from stock**.

34% of the respondents who have wetland(s) on their farms said they have been **enhanced with plantings.**

Only four people indicated they had installed or re-established any wetland in the last 3 years. The estimated cost ranged from $3,000 to $20,000 with an average of $13,250 per respondent.

Of those who answered the question, **23% plan to install or re-establish wetland(s) in the next 3 years**. Only seven people provided estimated cost for this, ranging from $3,000 to $100,000. The total estimated cost from all those who responded was $230,000!

WETLANDS

Sediment Traps

Sediment in drains and streams is largely made up of soil (clay, silt and sand) and gravel.

A sediment trap is an area where the runoff from a paddock will collect and settle for sufficient time to allow any sediment in suspension to drop out before the water drains away through an overflow or spill way.

Any measure that spreads water out and slows down the flow, will allow sediments to drop out.

Prevention is key

Erosion causes sediment to run into a catchment. It's best to prevent clay in particular from being exposed to runoff in the first place.

Use minimum tillage or no tillage cultivation practices to retain topsoil.

Select cropping paddocks carefully, limiting cropping on steep slopes and in low lying areas such as gullies and swales.

Avoid over grazing. Grass cover can provide land with erosion protection from water flows from up to 2 metres per second!

Identify potential erosion risk areas and stabilise them before they move.

Establish deeper rooting trees to ensure longer term stability of unstable areas.

Building a sediment trap

Talk to Environment Southland to help with design advice and if a consent may be required.

The size of a sediment trap will be influenced by the size of the catchment area; soil type and soil aggregate size, the slope of the catchment and the severity of significant rainfall events.

Retain natural vegetation cover where possible at the inlet to the sediment trap as this will filter runoff as it enters the trap. This could be exotic or native grasses and sedges.

Don't create steep banks as they will be more prone to erosion.

Sediment traps will need to be cleaned out – make sure you have the space along one side, suitable access and the fencing and planting allows for this.

(Source: Landcare Trust)

Survey Results

Sediment Traps

43% of respondents indicated they have a **permanent sediment trap.**

There is a total of **110 sediment traps** across the properties of the respondents, with an average of 4.2 per property.

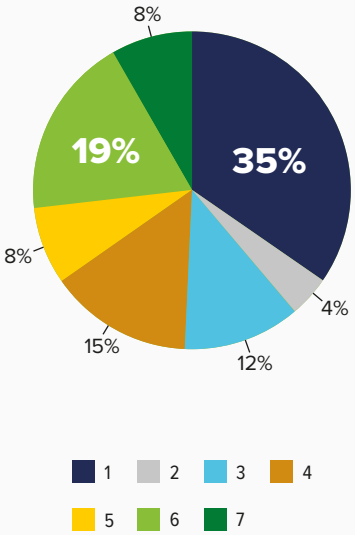
Seven respondents said they have installed permanent sediment traps in the last 3 years.

Five respondents spent between $1,000 and $10,000; the total spent in this group was $27,000, for an average of $5,400 per respondent.

26% of respondents are planning on installing **permanent sediment traps in the next 3 years**. The total projected spend in this group is $70,000, for an average of $11,667 per respondent.

57% of respondents have no permanent sediment traps.

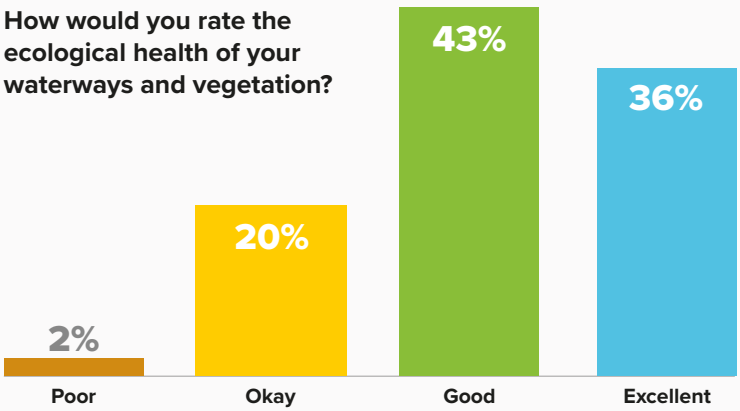
Of those who have permanent sediment traps, how many do you have?



Ecological Health

79% of respondents rate the ecological health of their waterways and vegetation as **good or excellent**.

How would you rate the ecological health of your waterways and vegetation?



NIWA REPORT

Pollution Mitigation

NIWA were contracted to provide advice to the Between the Domes Catchment Group (BDCG) on the most appropriate and effective approaches for diffuse pollution mitigation that would lead to environmental gain in a cost effective manner.

This assessment would include relevant edge-of-field or sub-catchment scale mitigation options (i.e., consider use of multiple mitigation actions in a catchment), and provide high-level indicative costs for wetland or other mitigation options, to reduce contaminants of national concern such as suspended sediment, nutrients (particularly nitrogen and phosphorus) and faecal bacteria.

Context

In this context, the National Policy Statement – Freshwater Management (NPS-FM, New Zealand Government 2020) provides guidance to regional councils and the general public on ensuring that natural and physical resources are managed to preserve the health and wellbeing of water bodies and freshwater ecosystems. We note that trends in nutrient levels in the Oreti River (the major river in the BDCG catchment area) are considered very likely to be degrading.

Executive summary

Sites on seven farms were assessed to determine their potential to mitigate contaminants of diffuse origin. These assessments were carried out by NIWA for the BDCG in association with Thriving Southland. The assessment process included evaluating the candidate sites in terms of potential for constructing wetland and sediment ponds, restoration of existing natural wetlands, and riparian planting.

Relevant site characteristics were documented using information collected during site visits with clients on 7 April 2022. The most appropriate mitigation actions were identified and prioritised, considering factors such as feasibility, risk of adverse outcomes, water quality and biodiversity benefits, relative costs and site visibility.

This report provides details and assessment information for each site, along with conceptual designs or site modifications likely to enhance diffuse pollutant attenuation. This information will be used to prioritise a smaller number of sites (2-3) for which more detailed conceptual plans will be developed.

NIWA Taihoro Nukurangi

The information included in this and the following (pages 21-29) was prepared by NIWA. You can read the full report here: www.thrivingsouthland.co.nz/understanding-and-improving-catchment-project

NIWA REPORT

Pollution Mitigation

Method

Each site was assessed for priority pollutants based on the authors scientific judgement, with input from the landowners and those members of the catchment group who were present.

For instance, where runoff from the catchment was dominated by subsurface inputs, nitrogen and, to a lesser extent, phosphorus were considered priority pollutants, with sediments and faecal inputs largely unimportant.

Conversely, in a catchment where inputs were dominated by surface flows in erodible soils, sediments were considered the priority pollutant. Secondary pollutants were included in brackets.

A decision matrix table is included at the end of this report. It was used to assist with prioritising sites for environmental enhancement. Ratings for different categories were assigned a score of 1-5, with higher being better, although it is worth stating that the ratings were largely subjective, based on the authors' experience and input from the group members who visited each site.

Categories include the suitability of any remediation action proposed (clear path of action, feasibility and risk), and any potential water quality and biodiversity benefits. Site visibility (i.e., the site is able to be seen by the general public and demonstrate practical steps being undertaken by BDCG and the community to attenuate pollutants and enhance the environment) was identified by those attending the site evaluations as a consideration when selecting sites for upgrading.

Likely relative costs for re-development of each site are also considered in the rating matrix. Sites requiring extensive earthworks and planting are likely to incur higher costs than sites requiring less extensive work.

Mitigation options are likely to include:

Restoration of existing wetlands.

Construction and use of sub-catchment scale wetlands (i.e., treating more than a single farm).

Establishment of new strategically located small to medium scale wetlands or other similar mitigations (e.g., 1-5 ha in size).

Small scale wetlands or edge-of-field mitigations (e.g., <1 ha in size) dealing with tile drainage and sediments arising from paddocks.

NIWA REPORT

Pollution Mitigation

Recommendations

All of the sites visited were good prospects for remedial action. We used a qualitative assessment matrix (Table 4-1) encompassing feasibility, risk, water quality and biodiversity benefits, relative costs and visibility as a demonstration project to prioritise sites for more detailed assessment going forward.

Based on this assessment, we recommend that sites 2, 4, 6 and 7 be considered by the group as potential demonstration project candidate sites.

Applying equal weighting to all criteria, the four candidate sites proposed had similar overall scores. They include two green field (new development) sites where wetland and pond construction were recommended (Sites 2 and 7).

Excavation requirements and associated construction costs are likely to be higher for these sites, especially if construction activities require a resource consent.

Use of sites 4 and 6 would require restoration of pre-existing wetland areas which retain varying amounts of wetland vegetation. Construction costs are likely to be much lower for these two sites, although weed management will likely need to be undertaken for some time to ensure re-planting is successful.

We recognise that BDCG may apply additional criteria and may weight criteria differently when choosing sites for mitigation works.

	Main action proposed	Clear path of action*	Feasibility*	Risk*	Water quality benefits*	Biodiversity benefits*	Relative cost*	Visibility as demonstration site*	Overall Score*	Rank
Site 1	Pond/wetland creation and riparian planting	3	2	2	3.5	4	2	2	18.5	**7**
Site 2	Constructed wetland linked to tile drains	5	5	5	4	3.5	2	2	26.5	**3=**
Site 3	Riparian planting and wetlands on incoming drains	3	4	4	3	2.5	3	2	21.5	**5**
Site 4	Wetland planting and minor earthworks	5	5	4	3	4	4	2	27	**2**
Site 5	Wetland planting	4	3.5	2.5	1	4	4	2	21	**6**
Site 6	Wetland planting	5	5	5	2.5	3.5	4	5	30	**1**
Site 7	Constructed wetland	5	4	3	3.5	4	2	5	26.5	**3=**

Table 4-1. **Scored 1-5, with higher score being better*

NIWA RECOMMENDATIONS

Site 1 - Constructed Wetland

The farm owner, Greg Drummond has confirmed the catchment area for the proposed constructed wetland is ~30 ha. As the farm is primarily a cropping farm, nutrient leaching rates from the catchment are expected to be relatively high. Undergrounding the incoming drain will reduce surface-flows and associated sediment and particulate phosphorus inputs to the wetland. The field in which wetland construction is proposed is 0.58 ha in area, although due to existing drainage lines and wet pasture areas, the available area is 0.50 ha (~1.7 % of contributing catchment, **Figure 1**). In Southland conditions we would expect the wetland to provide total nitrogen removal of between 18 and 30% of incoming levels based on these areas. Total phosphorus removal would likely fall between 24 and 44%, depending on its form.

The proposed wetland should be constructed in two cells with a width to length ratio of between 4:1 and 10:1 to optimise flow. The edges of the wetland are gently curved to give a more natural shape.

The wetland will need to be excavated deeper than the final operating depth, allowing for some freeboard as well as a layer (15 -20 cm) of soil (50:50 top soil and subsoil mix) which will sit in the base of the wetland for planting the wetland plants into.

We recommend that the shallow areas of the wetland be planted with the native bullrush, raupo (Typha orientalis), as this will provide abundant leaf litter required for denitrification. The edges of the wetland can be planted with a variety of herbaceous native riparian species such as Carex, flax and toitoi to enhance their natural appearance and biodiversity values. Taller shrubs and trees can be planted on the outer edge of the bunds and surrounding areas.

Within the wetland, non-planted deeper areas (0.5-1.0 m) at the inlet of both cells and the outlet of cell 1 are used to encourage flow to spread across the full width of the wetland, avoiding “dead” zones in the corners. A conceptual diagram showing plants locations and depths is shown in **Figure 3**.

Drummond Farm potential wetland location

Figure 1 - The proposed wetland areas. The proposed wetland is divided into two cells outlined in yellow. Inflow, outflow and inter-cell connections are shown as dashed yellow arrows. Zones outlined in blue are deeper areas (1-1.5 m) for improved flow distribution and capture of any residual solids. The red hatched triangle is an area identified by the farmer as not available for wetland construction.

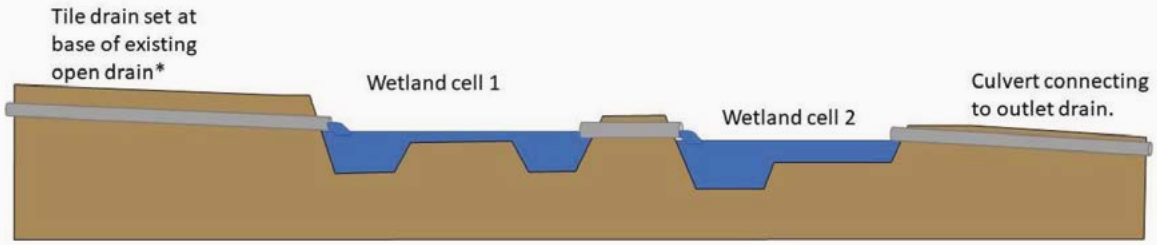


Figure 2 - Conceptual "falls" from existing drain into wetland cell 1 and throughout the system. Depths and relative sizes of deep and shallow areas not to scale.

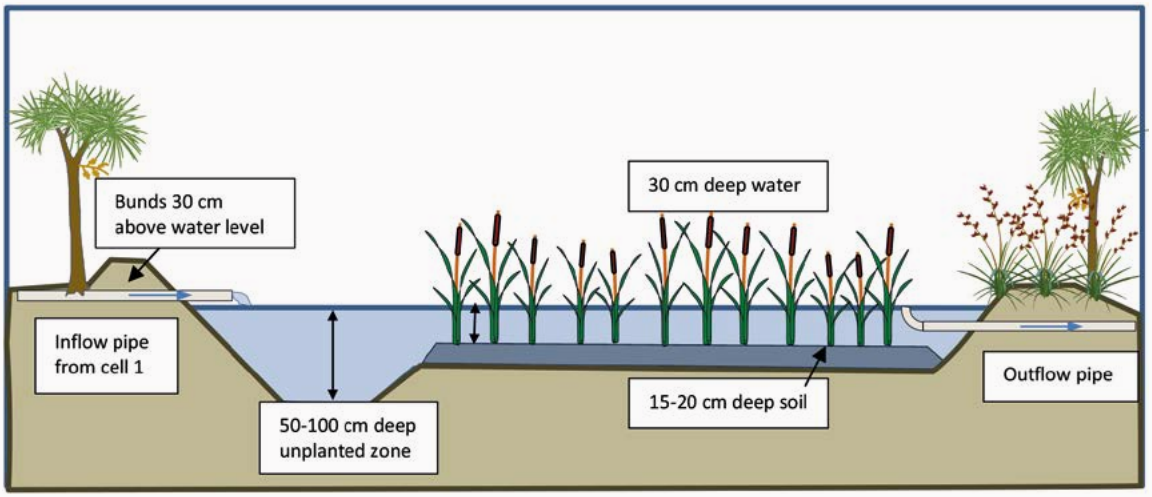


Figure 3 - Relative wetland zone depths. Longitudinal section through cell 2. (Not to scale).

We encourage all those involved in wetland construction and planting to consult the Constructed Wetland Practitioners Guide (Tanner et al. 2022), freely available for download from the internet.

NIWA RECOMMENDATIONS

Site 2 - Wetland Planting

The original concept proposed by NIWA, building on concepts outlined by the farm owner, was to enhance the existing wetland by creating bunds across the flow path, flowing down beside Stagg Creek.

As noted in the main body of the report, this is likely to require regional council approval/ consenting. On further consideration, given the large area of the wetland relative to its contributing catchment, we think that earthworks in the wetland are not necessary, and planting alone will provide a suitable, more cost-effective outcome. Therefore we have limited our advice to recommendations on key wetland species and appropriate water depths for their establishment in this area.

The “key” wetland plants, are those larger robust species which tend to dominate wetlands and their riparian zones, and which once established will have a good chance of holding their own against the weeds.

A large sized wetland with variable water depths such as this is likely to develop various diverse niche habitats that are suitable for inclusion of a wide range of native species, including rarer species that are not commonly available from wetland suppliers.

A major challenge for this site will be managing invasive weeds sufficiently to enable establishment of natives (**Figure 4 and Figure 5**). In particular, broom, gorse and blackberry in the drier areas and willows in the wet areas will require careful management.

Information on suitable control methods for these pest weed species is available on the Environment Southland Pest Hub website.

In drier areas, planting of taller-growing native tree saplings may best be carried out using the gorse and broom as nurse species. Establishment of a canopy of taller growing native trees should eventually shade out these woody shrub species.

In wetter, low elevation areas pasture grasses and common herbaceous weeds are likely to be the main problem. Use of grass-specific selective herbicides or careful spot spraying may be required to establish further wetland plantings. In all cases, care should be taken to only use herbicides suitable for use near waterways.

Establishment of dense growths of robust riparian species, such as harakeke (native flax), around the wetland will help keep weeds from invading from the margins.

Funding Options

Funding may be available to protect existing wetlands or restoration work on private land.

Ask your local DOC office or regional council about current funding available to assist with stream restoration or riparian protection.

QEII Trust helps private landowners to protect significant natural and cultural features on their land, in perpetuity, through open-space covenants. Contact them for legal protection advice and possible funding for fencing.

Figure 4 - View of wetland area from the south looking northwest towards Stagg Creek.
Dense growths of rushes and sedges are present in the centre of the wetland. In the background, a dense dark green band of broom is visible growing along the stop-bank and tall riparian willows mark the edge of Stagg Creek, Willows are starting to invade within the wetland, and weeds such as gorse and broom are common in drier zones.

Figure 5 - View of Saunders farm wetland from the north towards Stagg Creek.
This area is drier and is largely covered in invasive broom.

NIWA RECOMMENDATIONS

Site 3 - Wetland Swale

Enhancement of the wetland swale and pond on the Patterson farm can be achieved by addition of native wetland sedges (*Carex* species) within the swale along with purei (*Carex secta*) harakeke (native flax), toetoe and/or shrub species in the riparian margins.

Taller shrubs and trees could also be included if this was compatible with farming operations. Suitable species lists are provided in Table 1.

The shallow areas of the swale have some existing vegetation which could be enhanced with interplanting with key wetland sedge species, as well as riparian planting around the edges **(Figure 7)**.

Benching along the edges of the deeper ponded areas will enable the establishment of a band of fringing emergent vegetation **(Figure 8)**.

Immediately after planting, in-wetland plants are at risk of being pulled out by pukeko, or damaged by other waterfowl. Plants that have been “grown-up” into larger pots are more difficult for pukeko to up-root, and thus are often worth the extra expense. Larger plants can be planted at 1 m spacings, whereas smaller plants should be planted closer (0.5-0.75 m spacing).

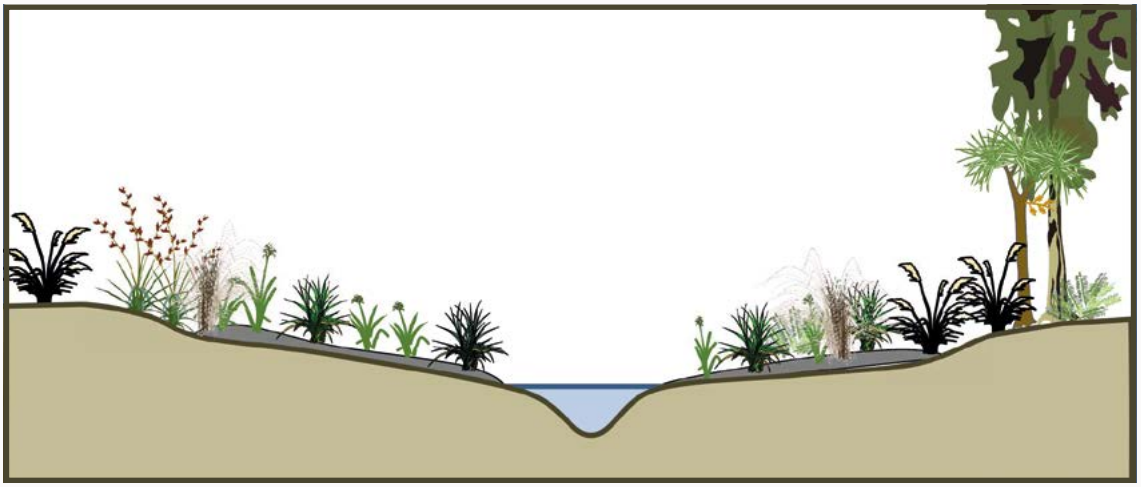


Figure 7 - Restoration planting in the shallow zone and riparian areas of the swale. The left side represents planting of the swale without larger trees. The right side represents planting with taller growing native trees.

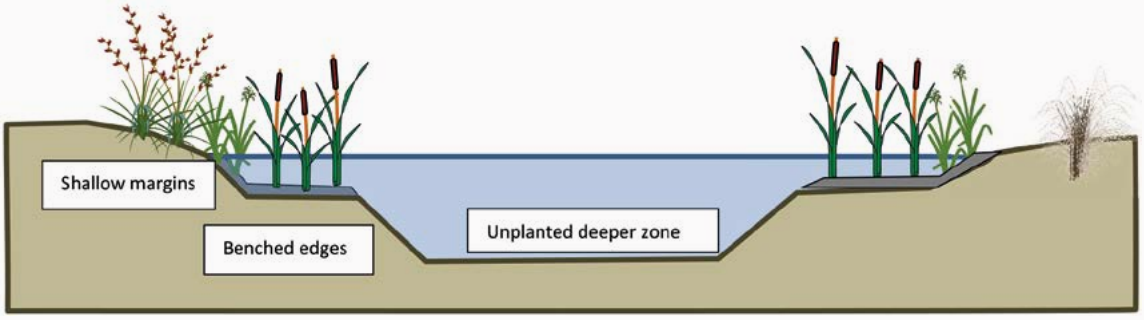


Figure 8 - Potential benching and riparian planting along edges of deeper pond zones.

NIWA RECOMMENDATIONS

General Planting Guide

Scientific name	Common Name	Depth Zones
Main species – Shallow wetland zone		
Carex virgata	Rautahi / Cutty Grass	Dry ground - 0.3 m deep
Carex secta	Purei	Dry ground - 0.3 m deep
Shallow Edges		
Carex geminata	Rautahi / Cutty Grass	Dry ground - 0.1 m deep
Carex lessoniana	Rautahi / Cutty Grass	Dry ground - 0.1 m deep
Deeper Wetland Zones		
Eleocharis sphacelata	Spike rush	0.2 - 0.3 m below water surface. *(This plant prefers deeper water than noted here, but initial propagules struggle initially in deeper water. Plant in this shallower zone and, once established, it will spread to deeper areas.)*
Typha orientalis	Raupo	0.1 - 0.5 m below the water surface. *(Plant initial propagules at 0.1-0.3 m. Once established it will spread to deeper areas.)*
Drier Riparian Zones		
Austroderia richardii	Toetoe	Occasionally wet/damp ground
Cordyline australis	Cabbage Tree	Occasionally wet/damp ground
Phormium tenax	Swamp Flax / Harakake	Occasionally wet/damp ground
Chionochloa rubra	Red Tussock	Occasionally wet/damp ground
Melicytus ramiflorus	Mahoe	Dryer margins
Plagianthus regius	Ribbonwood	Dryer margins
Myrsine australis	Mapu / Red Matipo	Dryer margins
Other dry margin species		
Libertia ixiodes	NZ Iris	Dryer margins
Astelia fragrans	Bush lily	Dryer margins
Blechnum fluviatale	Kiwakiwa	Dryer margins
Phormium cookianum	Mountain Flax	Dryer margins
Muehlenbeckia axillaris	Creeping pohuehue	Dryer margins
Coprosma propinqua	Mingimingi	Dryer margins
Veronica (Hebe) salicifolia	Koromiko	Dryer margins
Sophora microphylla	South Island Kōwhai	Dryer margins

Note: Occasional species may only be available from specialist native plant nurseries. Spike Rush may be difficult to source. It is worth talking to your local nursery about plant supply during the planning stage, to avoid disappointment.

SURVEY RESULTS

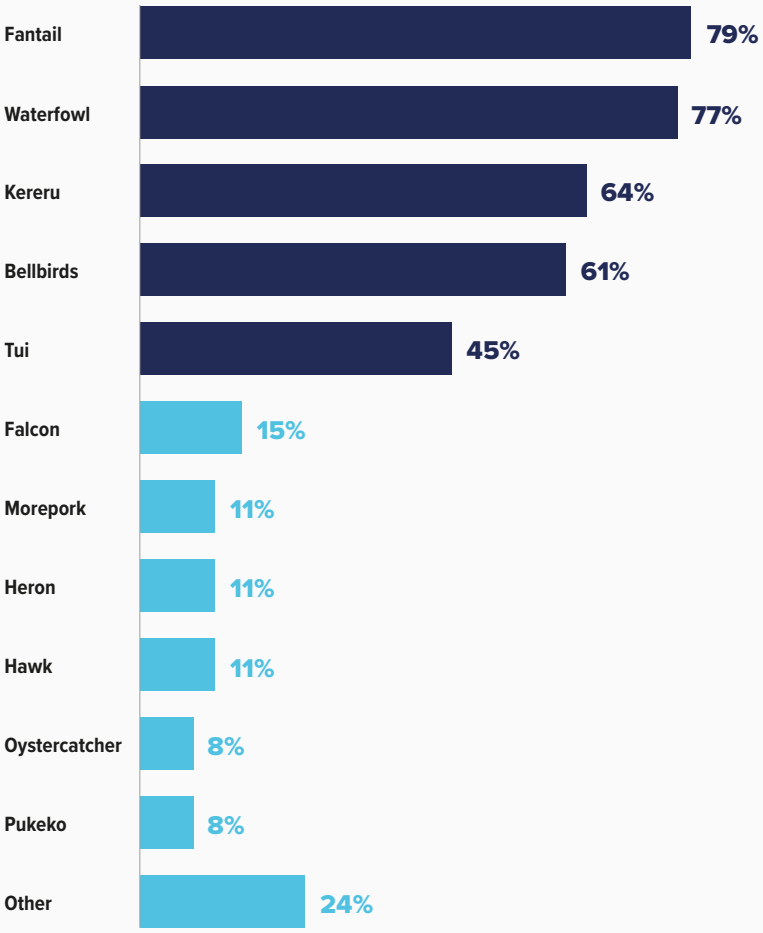
Biodiversity

Biodiversity refers to the variety of plant and animal life in a particular habitat.

As a general rule - the more diversity, the healthier that environment. Most activities that promote biodiversity have other positive spin offs. For instance, planting a shelterbelt – particularly of native varieties – provides a habitat and food for birds and insects, while also keeping stock cool or warm and preventing soil erosion (source: Beef and Lamb).

Respondents are seeing a wide range of native birds regularly - the catchment is supporting a varied and plentiful birdlife.

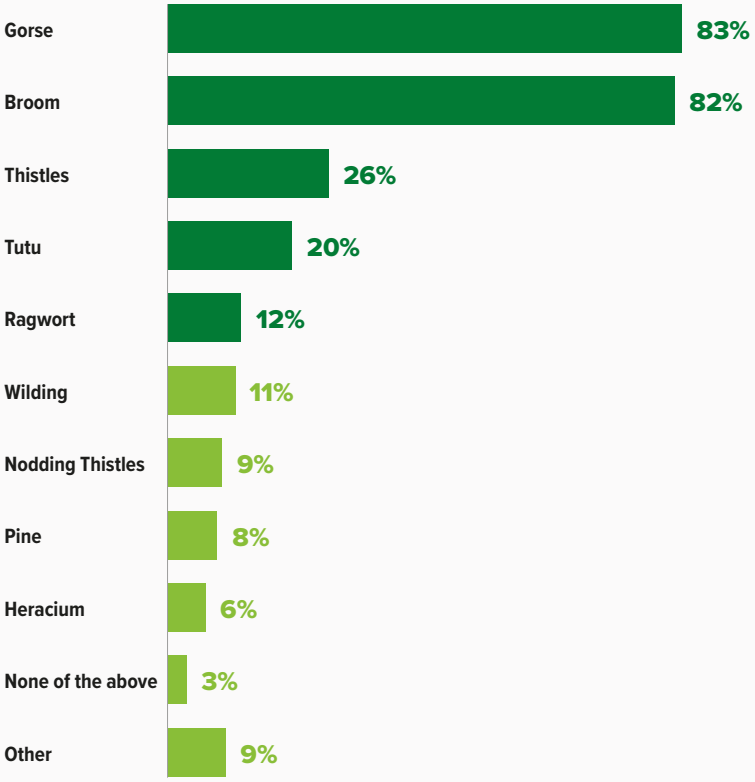
What types of native birds do you regularly see?



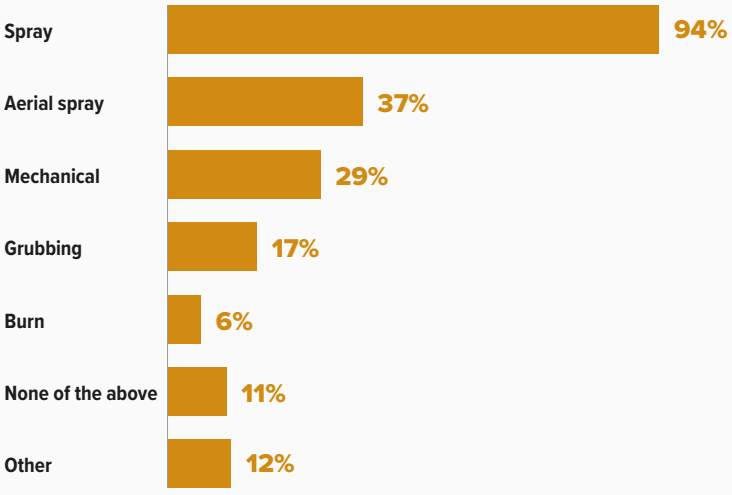
SURVEY RESULTS

Weeds and pest plants

What are the main weeds and pest plants you observe on your land?



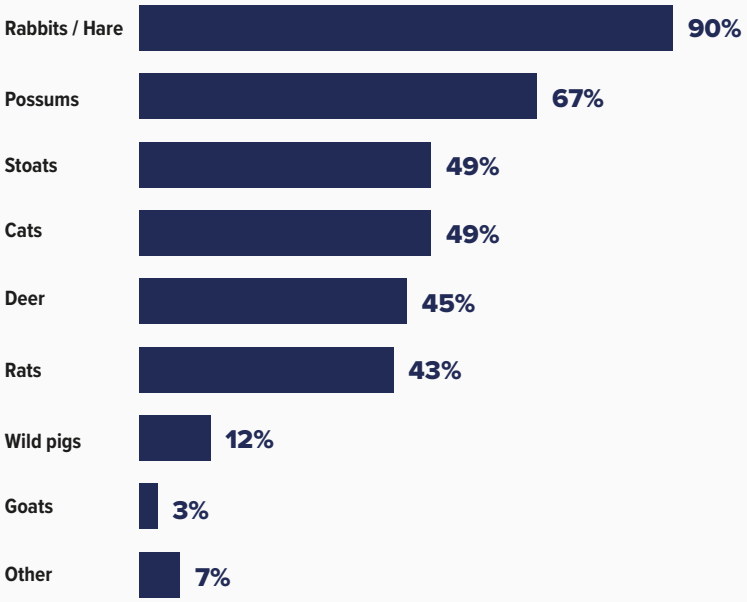
How are you currently controlling weeds and pest plants?



SURVEY RESULTS

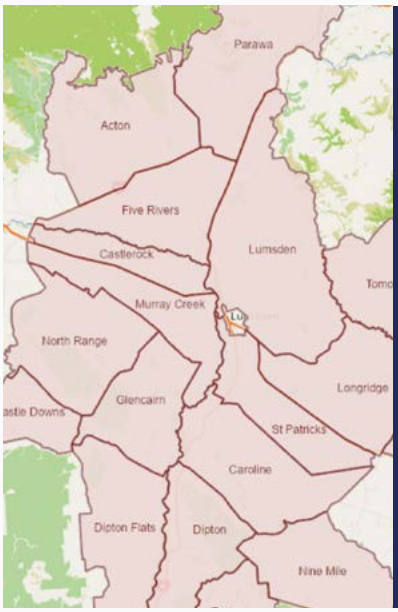
Animal pests

What are the main animal pests you face?



Pest Control

74% of respondents have a pest control plan in place.



Fact

The damage by possums by grazing pastures and spreading Bovine Tuberculosis costs NZ farmers about $35 million every year *(Source: predator free nz).*

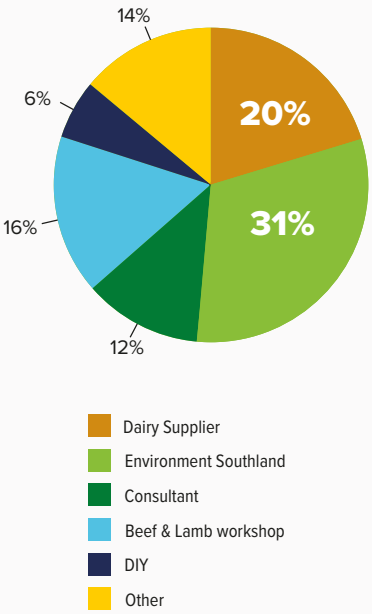
Did you know?

You may be in a Possum Control Area – maintained and set up by Environment Southland. If you want to join or set one up contact the Environment Southland Biosecurity Team (0800 76 88 45).

SURVEY RESULTS

Environment

If you have a FEP, where is your FEP from?



Nutrient Management / Farm Environmental Plans / Greenhouse Gases

55% of respondents have an up-to-date **nutrient management plan** (35 people).

78% of respondents have a **completed or partial FEP**.

23/32 of those who answered the question said they got their **FEP for free** and 4/32 did not know how much it cost. Of those who paid for their FEP, **4/5 spent between $2,000 and $10,000**.

Only 31% of respondents (20 people) said they know their greenhouse gas emissions number.

SURVEY RESULTS

Future Focus

From our survey

58% of respondents would be interested in attending a workshop on water monitoring.

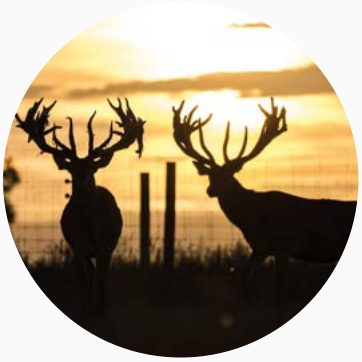
34% of respondents would be interested in receiving information about **plantings and planning**. Of those who plan to do riparian planting in the future, 11/20 don't know what budget they will dedicate or need.

27% of respondents would be interested in receiving information about the **creation, enhancement or planning of wetland or sediment traps**.

30% of respondents would be interested in getting more information on **creating or implementing a nutrient management plan**.

27% of respondents (17 people) are interested in receiving information on creating or implementing a **Farm Environmental Plan (FEP)**.

51% of the respondents (34 people) said they would be interested in joining a workshop about the factors driving **climate change and mitigation options**.



Useful Information

Thriving Southland

Environment Southland

Land and Water Aotearoa (LAWA)

NIWA - Climate, Freshwater & Marine Science

DairyNZ - Riparian Management Southland

DairyNZ - Wetland Practitioner Guide

Department of Conservation (DOC) - Wetlands

Landcare Trust NZ – Sediment Traps

Beef and Lamb NZ - Biodiversity

Predator Free NZ

He Waka Eke Noa – calculate your GHG number

Join our catchment group

Everyone is welcome. Email us or visit us on facebook for more info. Visit the Thriving Southland website to find all the catchment groups in the Southland region!

btdcatchment@gmail.com

Between-the-Domes-Catchment-Group

www.thrivingsouthland.co.nz