



**ERNSLAW ONE LIMITED**

# **Ernslaw One Limited**

## **North Island**



# **Environmental Monitoring**

## **Report**

### **2019**

## **1. Introduction**

The purpose of this report is to describe the range of environmental monitoring programmes that are undertaken in the North Island by Ernslaw One Limited (Ernslaw). Not all information/results regarding each monitoring programme will be described in this report but are available on request. This document acts to assist staff, SGS auditors and the public in understanding the range and type of environmental monitoring undertaken within the Ernslaw North Island estate.

## **2. Monitoring Strategy**

Ernslaw is committed to monitoring a range of environmental aspects of its operations and estate across the North Island. Monitoring is a valuable tool which ensures information is collected and can be assessed in order to evaluate change and progress toward desired outcomes. All monitoring within the North Island estate contributes toward Forest Stewardship Council® (FSC®) (FSC®C010424) certification.

## **3. What Ernslaw Monitors**

Ernslaw undertakes environmental monitoring the following areas:

1. Estate information
2. Regulatory/Voluntary compliance
3. Chemical usage and pest control
4. Storm events and response
5. Rear, threatened and endangered species
6. Ecological values
7. High Conservation Values
8. Forest health and biosecurity
9. Social-economics

## **4. Monitoring Programmes**

### **4.1 Estate Information**

Ernslaw regularly updates changes to the profile of the estate. These changes are reported annually in the Estate Plan and biennially in the Area Statement. Monitoring and updating these details reflect the changes in estate profile from harvesting, replanting and any other land management changes.



# ERNSLAW ONE LIMITED

## Ernslaw One Limited, Timbergrow Limited and Forestland Investments

Group	Region	Working Circle	Forest	Tenure	Council	Mapped Area (ha)	Stocked Area by species (ha)				AWR (ha)	Productive area (ha)
							Prod	D.fr	Other spp.	Total		
Ernslaw One Limited	Gisborne	Mangatu	Mangatu	CFL	GI	12,535	8,283	214	240	8,737	270	9,007
		Waipapa	Waipapa	LH	GI	3,519	1,837	0		1,838	159	1,997
		Mangatu Total				16,054	10,120	215	240	10,575	429	11,003
		Mata	Mata	FH	GI	7,973	5,870	1	2	5,873	14	5,886
		Ruatoria	Hills	CFL	GI	452	281		5	286	8	294
			Littleworths	CFL	GI	1,100	718			718	60	778
			Mackays	CFL	GI	442	300		5	306	14	322
			Mangaoporo	CFL	GI	861	590		6	596	49	645
			Manu	CFL	GI	1,156	793		15	808	5	813
			Matahiti	CFL	GI	265	207			207	0	207
			Mulanys	CFL	GI	749	491			491	2	493
			Rauponga	CFL	GI	26	23			23		23
			Rip	CFL	GI	3,493	2,311	85	7	2,404	171	2,575
			Stevensons	CFL	GI	162	129			129	2	132
			Taitai	CFL	GI	1,106	761		3	764	94	857
			Whakaangiangi	CFL	GI	1,857	1,397		8	1,406	63	1,469
		Ruatoria Total				11,867	8,002	85	49	8,136	471	8,607
		Tokomaru	Carters	CFL	GI	276	208			208	1	209
			Hauturu	CFL	GI	1,311	932			932	103	1,035
			Huiana	CFL	GI	1,063	608		5	613	219	833
			Makomako	CFL	GI	2,124	1,618		34	1,652	46	1,697
			Mangawhero	CFL	GI	718	363			363	39	402
			Matanui	CFL	GI	253	89			89	26	115
			Owhena	CFL	GI	1,299	782		10	792	166	958
			Pouturu	CFL	GI	371	279		3	282	22	304
			Puketoro	CFL	GI	229	133		9	142	18	160
		Tokomaru Total				7,644	5,012		61	5,073	640	5,713
		Gisborne Total				43,538	29,004	301	352	29,657	1,554	31,210
	Southern	Whangapoua	Whangapoua	CFL	TC	10,582	7,109		52	7,161	332	7,493
		Kaitiaki	Kaitiaki	CFL	RU	11,048	8,209	230	92	8,531	405	8,936
		Kumeroa	Kumeroa	FH	TR	1,079	944			944		944
		Manuka	Aokautere	FH	PH	699	463			463	0	463
			Himatangi	FH	MW	105	94			94		94
			Parawanui	FH	RA	195	29			29	145	174
			Pukehou	FH	RA	70	64			64	2	65
			Shannon	FH	HH	625	282		13	295	2	297
		Manuka Total				1,694	933		13	946	148	1,094
		Rangitikei	Harakeke	CFL	WG	487	429			429	4	433
			Harakeke	LH	WG	59	42			42	13	55
			Santoff	CFL	RA	1,372	1,075		4	1,079	15	1,095
			Santoff	LH	RA	2,764	2,153		11	2,163	34	2,197
			Tangimoana	LH	MW	836	603			603	1	604
		Rangitikei Total				5,522	4,303		15	4,317	67	4,384
		Te Namu	Te Namu	FH	RA	3,772	2,905		1	2,906	0	2,906
		Titoki	Titoki	FH	TR/CHS	8,397	6,615	1	3	6,619	293	6,912
		Tree Farm	Tree Farm	FH	RA	461	376			376	42	418
		Waimarino	Waimarino	FH	RU	3,918	1,849			1,849	500	2,349
			Waimarino	LH	RU	10,203	4,233	2	4	4,239	457	4,696
		Waimarino Total				14,122	6,082	2	4	6,088	957	7,045
		Southern North Island Total (incl. Whangapoua)				56,695	37,475	233	180	37,888	2,245	40,133
		North Island Total				100,232	66,479	534	532	67,545	3,799	71,343
	South Island	Aparima	Avondale	FH	SO	2,946	196	2,266		2,462	1	2,463
			Barnhill	FH	SO	1,414		1,186		1,186	0	1,186
			Gowan Hill	FH	SO	4,302		2,739		2,744	8	2,752
		Aparima Total				8,663	196	4,191		5,392	9	5,401
		Blue Mountains	Beaumont	FH	CL	3,238	297	2,216	44	2,557	51	2,608
			Conical Hill	FH	CL	1,797	508	838	9	1,355	188	1,543
			Dusky	FH	CL	2,057	496	1,190	11	1,697	24	1,723
			Pukerau	FH	CL	254	218			218	15	233
			Ranikoburu	FH	CL	4,579	1,917	1,655	23	3,595	242	3,836
			West Tapanui	FH	CL	819	3	609	6	618	34	653
		Blue Mountains Total				12,743	3,439	6,508	93	10,040	535	10,575
		Clutha	Bungtown	FH	CL	479		390		390		390
			Dunkeld	FH	CL	1,284	531	395		926		926
			Glenelg	FH	CL	1,065		926		927		927
			Halwyn	FH	CL	957	108	593	148	849	2	851
			Morven	FH	CL	1,284		991		991	3	994
		Clutha Total				5,071	639	3,296	149	4,084	5	4,089
		Marlborough	Sweet Stream	FH	MB	915	708			708	155	863
			Wether Hill	FH	MB	514	449			449		449
			Wallopal Downs	FH	MB	470	416			416	3	420
		Marlborough Total				1,899	1,573			1,573	159	1,732
		Naseby	Naseby	FH	CO	2,523	11	805	1,094	1,909	159	2,069
		Southern Island Total				30,899	5,858	16,800	1,340	23,998	887	24,885
		Ernslaw One Limited Total				131,131	72,337	17,334	1,872	91,543	4,685	96,229
Timbergrow Ltd	Gisborne	Hawke's Bay	Merrima	FH	HB	724	499			499	17	517
		Tolaga	Moonlight	FH	GI	4,055	3,443	1	2	3,446	60	3,506
			Uawa	FH	GI	1,176	785		41	826	31	858
			Waiatu	FH	GI	5,326	2,721		1	2,722	70	2,793
			West Ho	FH	GI	1,838	870			870	509	1,379
		Tolaga Total				12,395	7,819	1	44	7,864	671	8,535
		Gisborne Total (incl. Hawke's Bay)				13,119	8,318	1	44	8,363	688	9,051
		Marlborough	Renwick	FH	MB	1,385	1,107	57	20	1,184	2	1,186
			Netherwood	FH	MB	1,299	828	7		834	2	836
			Tordarroch	FH	MB	3,480	2,612	134	15	2,761	7	2,768
		Marlborough Total				6,164	4,547	198	35	4,780	11	4,791
		Timbergrow Ltd Total				19,283	12,865	200	79	13,143	699	13,842
Forestland Investments	Gisborne	Waiteata	Waiteata	FH	GI	894	152			152	577	728
		Forestland Investments Total				894	152			152	577	728

\*Area Statement as at 30 June 2019

## 4.2 Regulatory and Voluntary Compliance

Ernslaw monitors regulatory compliance against the applicable statutory obligations (NES-PF/resource consents). Regional audits are completed annually, one of these is always Whangapoua forest as a requirement of the resource consent and two other regions are audited on a rotational basis. These audit reports track compliance over time against regulatory requirements but also the company's Environmental Management System (EMS) and NZFOA Environmental Code of Practise (ECOP) which is the forest industry's best environmental practise guidelines.

Additionally, operational audits are regularly completed by staff to ensure contractor operations are meeting contract and operational specifications.

*\*See Environmental Audit Reports*

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## 4.3 Chemical Usage

Ernslaw's chemical monitoring system records annual usage (active ingredient and area applied to) within the estate. In addition to herbicides, vertebrate pesticides and other chemicals are recorded in order to meet FSC requirements regarding derogations for highly hazardous pesticides. Below is the list of pesticides used within the Ernslaw estate.

Type of Pesticide	Commercial Name of Pesticide	Active Ingredient	Reason for use
Fungicide	Cuprous oxide	Cuprous oxide	Control of <i>Dothistroma pini</i>
Herbicide	Gardoprim	Terbuthylazine	Post plant release from gorse
Herbicide	Glyphosate 450	Glyphosate	Pre-plant spray, roadside spray
Herbicide	Tordon Brushkiller	Triclopyr + picloram	Roadside spraying
Herbicide	Green Glyphosate 510	Glyphosate	Pre-plant spray, roadside spray, drill and poison
Herbicide	Hexol	Hexazinone	Post plant release spray
Herbicide	Meturon	Metsulfuron-methyl	Pre-plant spray
Herbicide	Terbuthylazine	Terbuthylazine	Post plant release spray, Roadside spraying
Herbicide	Valzine 500 Valzine Extra	Hexazinone + Terbuthylazine	Post plant release spray
Herbicide	Velpar 20G	Hexazinone	Post-plant release spray
Herbicide	Versatill	Clopyralid	Post-plant release spray
Animal Pesticide	1080	Sodium fluoroacetate	Possum control
Animal Pesticide	Feratox	Potassium Cyanide	Possum control
Herbicide	Tordon	Triclopyr + Picloram	Roadside spraying

*\*See Annual Chemical Usage Report*

Ernslaw continues to provide funding into industry cooperative research programmes in order to develop alternatives to highly hazardous chemicals. Pest control, biological control and reduction of chemical usage are the main research topics.

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## **4.4 Chemical Alternatives – biological control**

Ernslaw is in partnership with Waikato Regional Council (WRC) to trial a biological control (Lace bug) to control the plant pest Woolly Nightshade. A release site has been set up within Whangapoua



forest. Ernslaw has worked closely with WRC to develop Biological Control Agent Release Guidelines to ensure that Ernslaw is compliant with FSC-STD Indicator 6.8.2 and 6.8.3 both in terms of release approval, monitoring and reporting. WRC has committed to providing Ernslaw with an annual report to ensure compliance is achieved.

*\*See Biological Control reports*

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## **4.5 Storm Events and Response**

High intensity storm events have the potential to damage forest infrastructure (roads/landings) as well as environmental values and public property beyond the forest boundary. Monitoring and reporting of such events is vital toward gaining a better understanding of the events as a means to understand their occurrence and better manage their impacts in the future.



Collecting information on storm intensity, impact and remedial work provides information regarding the capability of forest infrastructure to withstand storm events. Over the last 5 years a number of high intensity rain events have affected various forests within the Ernslaw estate. Generally, forest infrastructure has responded very well to these events and the major impact has been slope failures resulting in debris flows. Ernslaw's Storm Event Plan in combination with the Assura software ensures that post-storm event

monitoring of forest infrastructure (culverts, debris traps etc) is undertaken and that damage and any required remedial work is carried out quickly and recorded.

*\*See storm and incident reports.*

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#### **4.6 Rear, Threatened and Endangered Species**

Ernslaw carries out a number of monitoring programmes aimed at protecting and enhancing North Island brown kiwi recovery.



##### **4.6.1 Whangapoua forest - biodiversity block**

Starting in 2007, Ernslaw (partnered with Project Kiwi Trust) has been engaged in managing a 1432ha biodiversity block aimed at the recovery of the North Island brown kiwi. The purpose of the programme is to quickly build the kiwi population and the current management strategy employed to achieve this includes a trapping programme, captive rearing and release of juvenile kiwi. Monitoring of the kiwi population and pest trap catch numbers benchmark progress toward the

aims of the project.

*\*See Annual Report Whangapoua Forest Biodiversity Block 1 July 2017- 30 June 2018 for further detail.*

##### **4.6.2 Waimarino forest – Aramahoe Ecological Reserve**

Partnered with Horizons Regional Council and Ngaporo Waimarino Forest Trust, Ernslaw is working to protect and enhance indigenous forest habitat and grow the North Island kiwi population by 10% every three years. Additional aims include enhancing environmental awareness and providing a learning platform for schools regarding conservation. The key project areas are pest control and monitoring, kiwi recovery, bird population monitoring, promotion and conservation education.

*\*See Kiwi population assessment Aramahoe reserve 2018 & Waimarino Forest Kiwi Population Census 2018.*

##### **4.6.2 Mangatu Forest – Native Bat Survey**

In 2018 a native bat survey was undertaken in Mangatu forest in the Gisborne region. The survey was designed assess bat colony distribution throughout the forest and review current management protocols to protect bats. Survey results showed that current forest management have enabled one or more long-tailed bat colonies to persist within the production forestry environment. This is valuable information as Mangatu forest begins second rotation. Following the review of current management protocols, several improvements were added to the existing protocol to ensure native bats are sufficiently protected during forestry operations.

*\*See Mangatu Forest Native Bat Survey: Forest Management Guidance 2018.*

##### **4.6.3 Species Management Plans**

Staff and contractors are encouraged to report any sightings of rear, endangered and threatened species. Specific sighting are relayed to the environmental planner who updates the Ernslaw GIS (ecological management areas layer).



Species Management Plans are applied to the forest area where rare, endangered and threatened species are known to be present, these management plans provide staff and contractors with the necessary information required to manage operations alongside these species.

*\*Species Management Plans available on request*

#### 4.6.4 Naturewatch – Biodiversity in plantation forestry



Ernslaw has adopted the Inaturalist NZ biodiversity platform which is designed to create a single platform for foresters to collate and record biodiversity observations. Using the mobile application, sightings of native flora and fauna are uploaded directly from a smart phone onto the Inaturalist NZ – biodiversity in plantation forestry portal. Ernslaw is currently working to expand this option to contractors as well. This platform acts as a key instrument for industry to showcase the range of biodiversity that exists alongside forestry operations throughout the country.

\*See <https://inaturalist.nz/>

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#### 4.7 Ecological Values

As required under the National Standard for Certification of Plantation Forest Management in New Zealand, at least 5% of the total Management Unit shall be managed to retain or restore to the condition of natural forest. Additionally, a minimum of 10% of the forest area in each ecological district/region shall be managed to retain or restore to the condition of natural forest. Ernslaw currently exceeds the 5% indicator with over 16,000ha (19%) protected as formal reserve and retained as natural forest.

The table below describes the percentage per ecological district.

Ecological District	Reserve Area (ha)	Total area (ha)*	Percentage (%)
Colville	1,500.8	7,913.4	19.0
Eastern Hawkes Bay	772.3	6,975.0	11.1
Foxton	819.7	4,850.0	16.9
Heretaunga	117.3	518.3	22.6
Manawatu Gorge South	354.1	850.7	41.6
Manawatu Plains	21.2	422.4	5.0
Matemateaonga	4,500.4	7,785.2	57.8
Motu	907.5	7,230.4	12.6
Pukeamaru	273.1	2,117.8	12.9
Puketoi	82.5	943.3	8.8
Rangitikei	658.1	2,907.1	22.6
Tongariro	774.8	9,455.0	8.2
Waiapu	5,307.0	33,381.4	15.9
<b>Total</b>	<b>16,088.7</b>	<b>85,528.7</b>	<b>18.8</b>

\*Total area = planted area + AWR + infrastructure

The National Standard provides an ecological equivalence procedure where percentage shortfalls occur in specific ecological district/region. Pest control and restoration works are currently undertaken in the Manawatu Plains, Tongariro and Puketoi ecological districts where reserve shortfalls are experienced.

#### 4.9 High Conservation Value forest (HCV)

Ernslaw has undertaken an assessment and consultation process to identify and classify HCV areas within the North Island estate. HCV areas are critical areas in a landscape which need to be appropriately managed in order to maintain or enhance the high conservation values. Following the assessment and consultation process Ernslaw has currently classified a total of 1099 hectares as HCV area. Specific management and monitoring plans have been developed to maintain the values of these areas. Local experts are consulted in the development of these plans. Ernslaw will continue to re-assess and consult on areas which have the potential to be classified as HCV.

\*See Ernslaw One Ltd HCV Management Plan

#### 4.10 Stream Health Monitoring

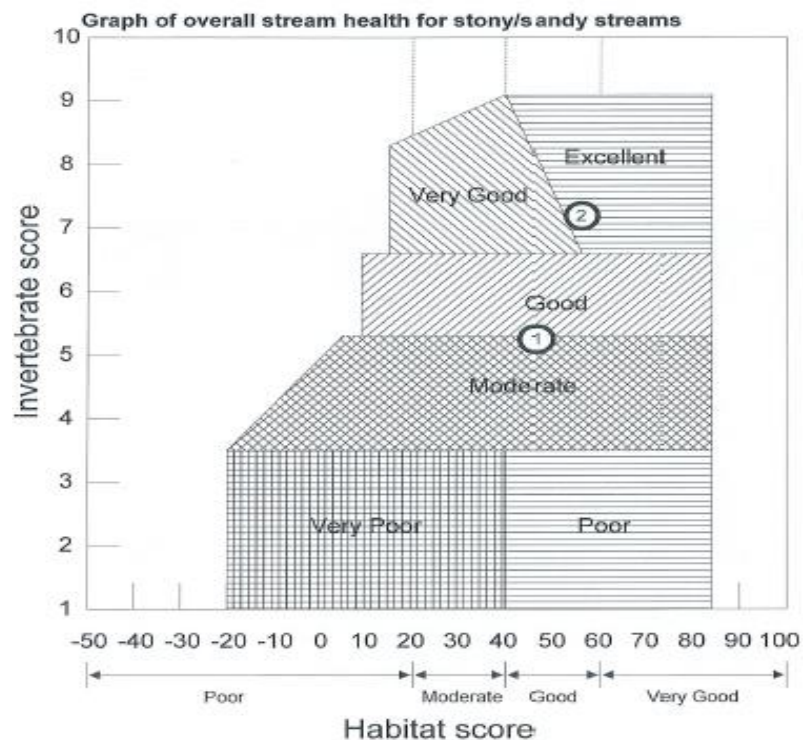
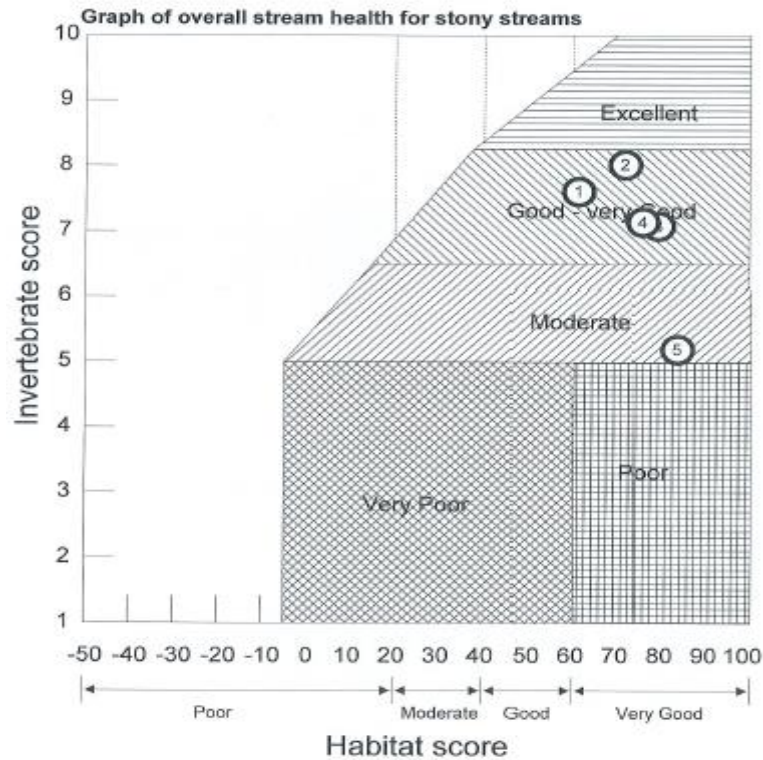
Ernslaw has been monitoring the effects of harvesting operations on stream health in Whangapoua forest for more than 20 years. Ernslaw contracts NIWA to undertake this programme which includes annual monitoring with the result presented in a biennial report. This comprehensive monitoring programme is unique due its long-term nature and the data set is regarded highly internationally.

Since 2002 Ernslaw has been monitoring stream turbidity and PH at 12 sites within Waimarino forest with data supplied to Horizons Regional Council. Data has been collected on a quarterly basis and this historic data set provides solid indicators towards understanding the effects of forestry operations on some aspects of stream health.



In 2016 Ernslaw began a stream health monitoring programme within the Gisborne region. Using the NIWA designed Stream Health Monitoring and Assessments Kit (SHMAK), the programme consists of a number of long-term trend sites designed to benchmark stream health pre-harvest, during harvest operations and then through the recovery into the next rotation.

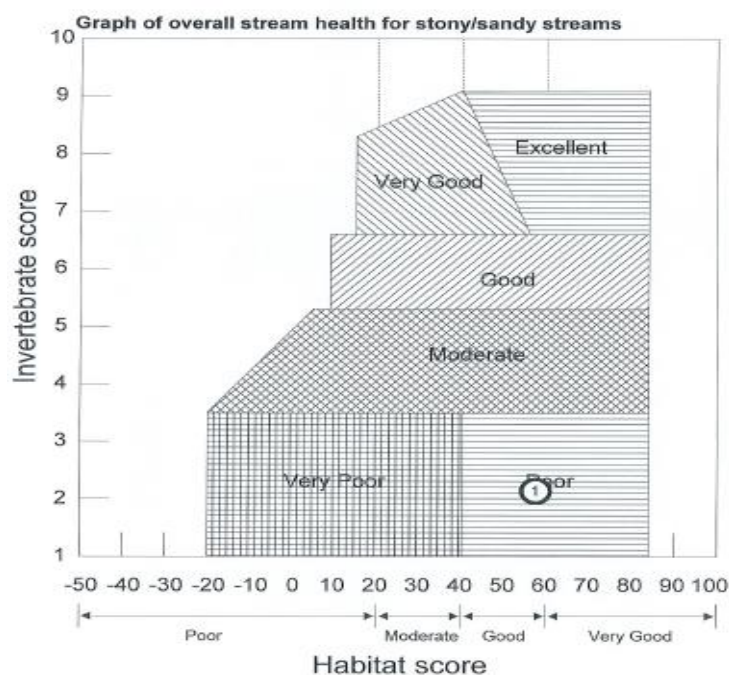
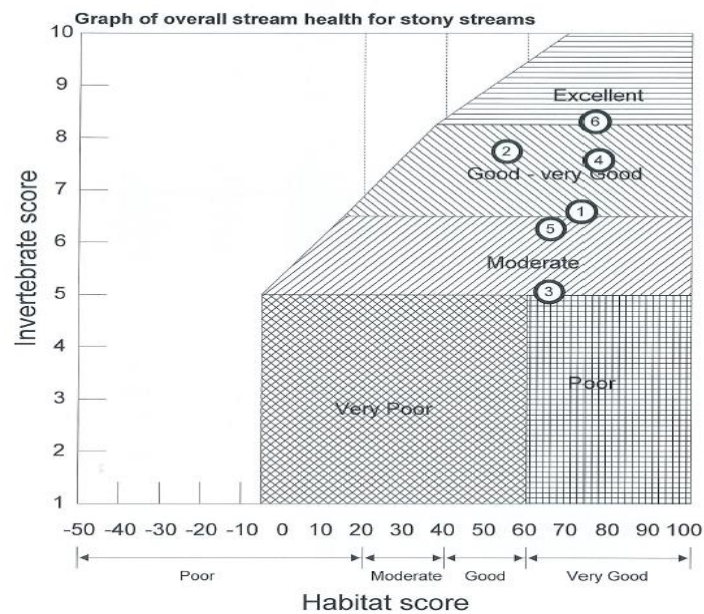
In 2019 Ernslaw extended the SHMAK programme to include Titoki and Te Namu forests and gather data regarding the state of stream health prior to earthwork and harvesting activities.





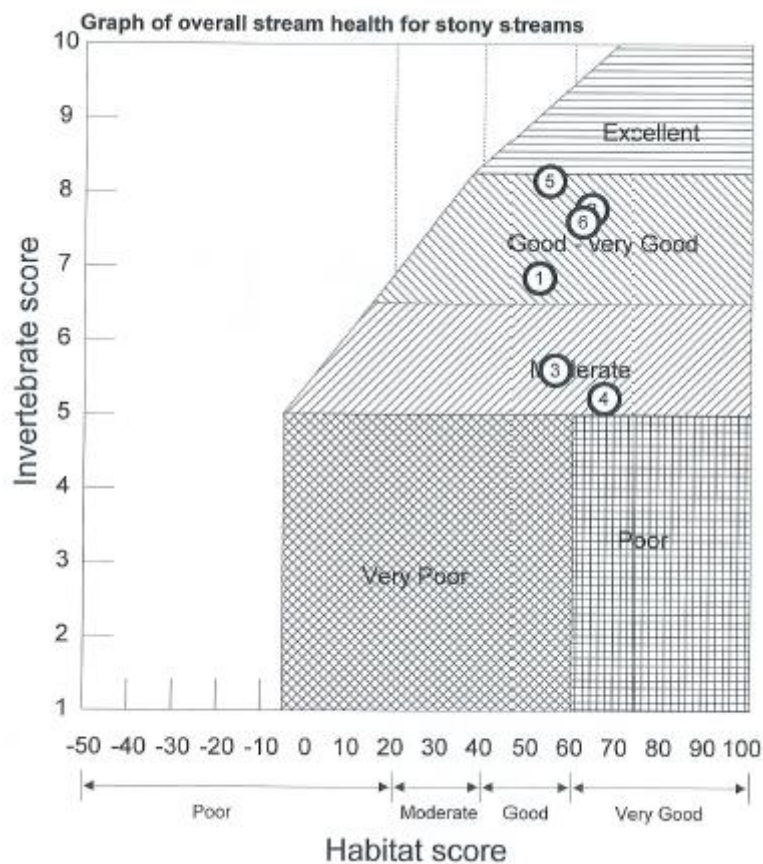
Forest	Site	Graph Point	Year	Season	Habitat	Invertebrate	Periphyton	Comment
Mata	Pouturu	1	2017	Summer	61.5	7.61	8.1	
Mata	Pouturu	2	2018	Summer	72	8.02	8.6	
Mata	Pouturu	3	2016	Winter	76	7.14	8.3	
Mata	Pouturu	4	2017	Winter	83.5	5.19	9.4	
Mata	Pouturu	1*	2018	Winter	46.5	5.25	8.2	Graph 2 Major storm event (June)
Mata	Pouturu	5	2019	Summer	79.5	7.08	9.7	
Mata	Pouturu	2*	2019	Winter	56.0	7.19	7.6	Graph 2

\* = change in stream bed characteristics following storm event





Forest	Site	Graph Point	Year	Season	Habitat	Invertebrate	Periphyton	Comment
Mata	Ihungia	1	2017	Summer	73.2	6.59	7.7	
Mata	Ihungia	2	2018	Summer	55	7.74	9.4	
Mata	Ihungia	4	2016	Winter	77.3	7.57	8.67	
Mata	Ihungia	5	2017	Winter	65.8	6.26	10	
Mata	Ihungia	1*	2018	Winter	57.5	2.14	7.8	Major storm event (June)
Mata	Ihungia	3	2019	Summer	65.5	5.06	10	
Mata	Ihungia	6	2019	Winter	76.4	8.31	8.5	



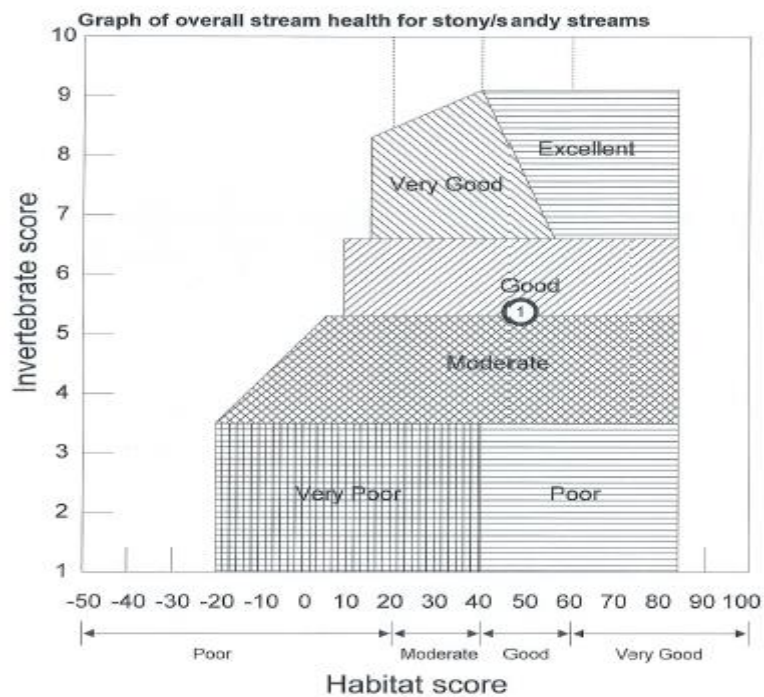
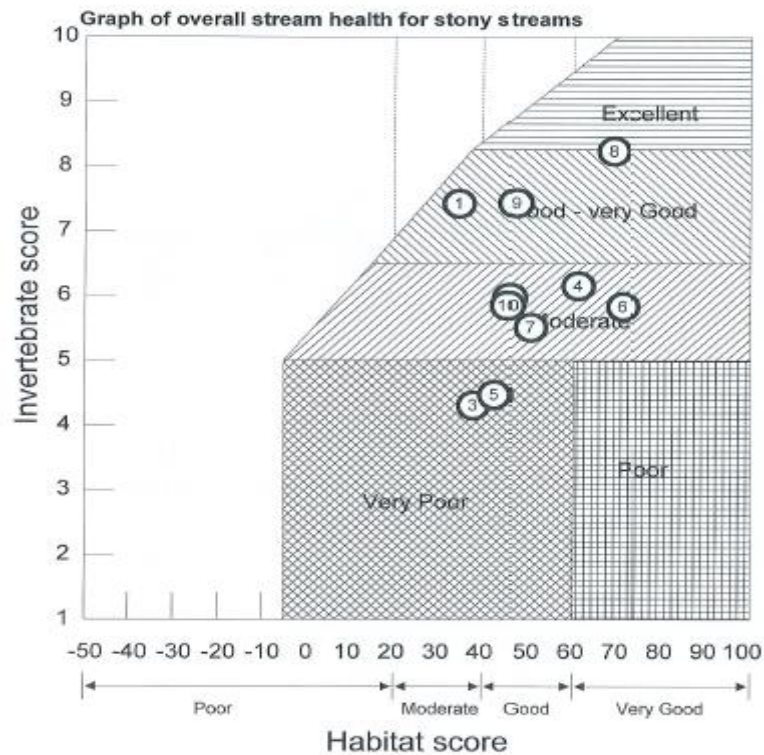
Forest	Site	Graph Point	Year	Season	Habitat	Invertebrate	Periphyton	Comment
Mata	Gas	1	2017	Summer	52.3	6.84	9.4	
Mata	Gas	2	2018	Summer	64	7.77	9.7	
Mata	Gas	3	2017	Winter	56	5.6	9.4	
Mata	Gas	4	2018	Winter	67	5.22	10	Major storm event (June)
Mata	Gas	5	2019	Summer	62	7.6	10	
Mata	Gas	6	2019	Winter	54.5	8.15	9.4	





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Additionally, upstream/downstream monitoring will be undertaken at specific structures in streams i.e. culvert crossing. This monitoring will provide valuable data regarding the effects and timeframe these structures have on stream health within the Gisborne region.







Forest	Site	Graph Point	Location	Year	Season	Habitat	Invertebrate	Periphyton	Comment
West Ho	Box Culvert	1	Upstream	2016	Winter	34.7	7.42	7.8	
West Ho	Box Culvert	2	Downstream	2017	Summer	46	5.97	9.1	
West Ho	Box Culvert	3	Downstream	2018	Summer	38	4.31	8.5	
West Ho	Box Culvert	5	Downstream	2016	Winter	42.75	4.47	9.9	
West Ho	Box Culvert	6	Downstream	2017	Winter	71.3	5.83	9.7	
West Ho	Box Culvert	7	Downstream	2018	Winter	50.5	5.51	9.1	
West Ho	Box Culvert	9	Upstream	2017	Summer	47.3	7.43	6.3	
West Ho	Box Culvert	10	Upstream	2018	Summer	45.5	5.85	6.3	
West Ho	Box Culvert	12	Upstream	2017	Winter	56.6	6.74	7.7	
West Ho	Box Culvert	*1	Upstream	2018	Winter	48.5	5.37	8.2	Major storm event (June)
West Ho	Box Culvert	8	Downstream	2019	Winter	69.2	8.23	10	
West Ho	Box Culvert	4	Downstream	2019	Summer	61.2	6.15	8.2	
West Ho	Box Culvert	13	Upstream	2019	Winter	54.0	6.07	9.4	
West Ho	Box Culvert	11	Upstream	2019	Summer	33.5	6.41	7.0	

\* = change in stream bed characteristics following storm event

## Periphyton scores: what they mean for your stream

(N.B. These comments will generally apply only to streams with stony beds as these provide the most suitable habitat for periphyton. See comments on 'No periphyton'.)

Score	Rating	Typical periphyton community	Typical conditions associated with this type of periphyton
8 to 10	Very good	Thin film of brown algae (diatoms) or black film (blue-green algae) that gives rocks a slimy feel and is quite difficult to scrape off. Occasional patches of thicker brown or black growth (sometime solid jelly-like nodules).	Clean streams with steady water flow, low concentrations of nutrients and plenty of invertebrates, particularly mayflies, caddisflies or stoneflies.
6 to 7.9	Good	Thin but more noticeable 'mat' of mostly brownish or black algae, easily scraped off rocks with a thumbnail, or a green film.	Clean streams with steady water flow but with slightly higher nutrient concentrations - possibly as a result of diffuse run-off. A wide range of invertebrates, often including many that need high quality water to survive, such as mayflies and stoneflies.
4 to 5.9	Moderate	A thicker brown mat, again easily scraped off rocks. Some thicker black algae may be present, also possibly some green tufts or short filaments.	Slightly more enriched conditions (i.e. increased nutrients available in the water) but still a good flow of water in the stream. The enrichment could be due to diffuse inputs from the land or some other farm input (e.g. cattle in the stream). This type of periphyton growth could also be seasonal e.g. in late summer low (slower) flows and warm temperatures. Snails and caddisfly larvae often thrive on such growth. Mayflies and stoneflies tend to be less common. This level of periphyton growth is generally not a problem, but could be responsible for a reduced invertebrate score. Check 'Stream monitoring form B. Recent farm conditions and activities' for any notes about upstream disturbances.
2 to 3.9	Poor to moderate	A very thick accumulation of brown algae and/or green filaments, the latter mostly short. The light brown algae may appear almost whitish. Possibly the odd tuft of long trailing green filaments.	Enriched conditions indicative of low flows, increasing water temperatures and/or diffuse or point-source inputs upstream. In the presence of thick mats of algae, caddisfly larvae, snails and midge larvae often dominate the invertebrate community. This could also be seasonal, e.g. typical of summer low flows, especially in areas where the underlying rock is quite high in nutrients (e.g. mudstone, siltstone, recent volcanics). The invertebrate score will almost certainly be reduced. Check 'Stream monitoring form B. Recent farm conditions and activities' for notes about upstream disturbances.
Up to 1.9	Very poor	Mostly long trailing green/brownish filaments, perhaps some patches of thick brownish growth including filaments, or very short green algae.	Very enriched conditions and often seasonal, particularly in areas where the underlying rock is naturally high in nutrients (e.g. mudstone, limestone). Heavy growth of green algae is a normal seasonal occurrence in some areas (e.g. Hawkes Bay). Very thick layers of filamentous growth can smother the habitat favoured by invertebrates such as mayflies, stoneflies and many caddisflies. The invertebrate score will almost certainly be reduced. Check 'Stream monitoring form B. Recent farm conditions and activities' for notes about upstream disturbances. Note that under the right conditions, green algae 'blooms' can develop even in pristine streams. However these growths are temporary and the species forming the blooms may be different from those found in enriched conditions.
No score	No overall rating	No algae: clean stones. No hint of sliminess on stones.	There are several explanations for a lack of visible periphyton in streams. <ul style="list-style-type: none"> <li>* The stream bed is unsuitable. Periphyton does best on stable stony substrates. It's rarely seen on mobile sand and silt beds.</li> <li>* The water velocity is consistently too fast to allow periphyton to colonise.</li> <li>* A recent flood scoured off most of the periphyton growth.</li> <li>* There is not enough light.</li> </ul>

*\*Data available on request*

## 4.11 Forest Health/Pest Management

As a member of NZFOA, a sample of the Ernslaw estate is monitored annually by the Crown Research Institute Scion in order to assess any forest health risks or biosecurity incursions.



Early detection of a number of forest health diseases and/or biosecurity incursions is vital in order to minimise damage and manage the potential for risk of further spread.

*\*See forest health survey results.*

#### 4.12 Socio-economic Monitoring

During 2016 Ernslaw carried out a social survey of the entire contractor workforce (north and south island). The aim of the survey is to better understand the demographic of the workforce as well provide contractors an opportunity to share their thoughts about some key areas of their daily work life (health, safety and environment). Ernslaw partnered with a local high school student who used the project as part of their final year's requirements. The report was completed in late 2016.

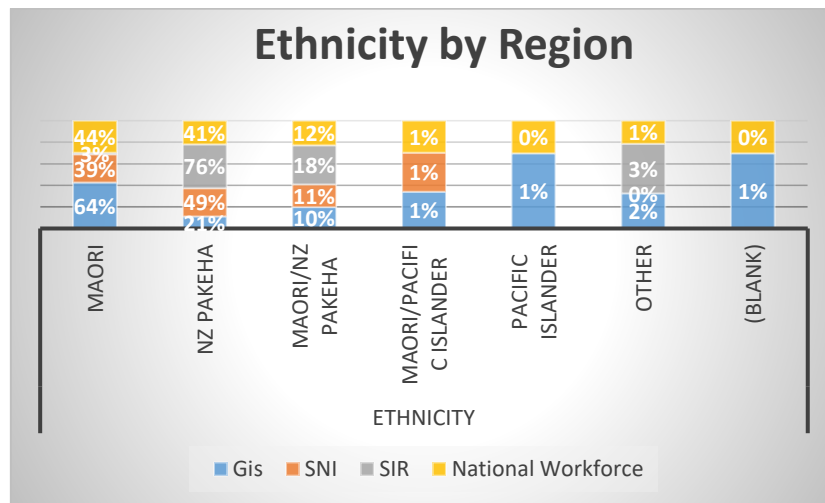


Table: Contractor ethnicity by region

*\*See Social Survey report for further detail*

For additional information regarding the environmental monitoring programmes described above please contact Ernslaw One Limited.

**Phone: +64 (0)6 867 9179**