LandWISE
Promoting Sustainable Production

2019

Future Proofing Vegetable Production

Milestone 3 Report

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Executive Summary

The milestone deliverables for the project to date are:

- Nutrient Budgets Combined in a Catchment Plan
    - A nutrient budget is defined as a written or typed document with calculations
    - Growers had not completed a nutrient budget before, and were supported in doing so using Overseer analysis of representative sample blocks in accordance with advice from Overseer Ltd.
    - The results of the Overseer sample analyses are summarised in the table below:

Grower	N Loss (Total)	Area Modelled (ha)	N Loss/ha
A	143	1.0	143
B	437	4.2	104
C	238	5.2	46
D	3433	23.2	148
CATCHMENT TOTAL	**4251**	**33.6**	**127**

    - Engagement with Overseer has meant that they are receptive to software changes to accommodate vegetable production as a viable land use in their programme, and they will be presenting a guidance on how to use Overseer for Vegetables at the LandWISE conference in May
- Crop Nutrient Budget Tool
    - A draft calculation spreadsheet has been prepared
    - It uses information from the new Nutrient Recommendations for Vegetable Crops

- Project Team Meeting(s)
    - Levin Growers Meeting 27th February
        - Receptive to and supportive of Horizons' plans to undertake water quality monitoring in the Arawhata catchment at 27 sites
        - Feedback given on trial design for different N products and application methods and experience with *Trichoderma*
    - Gisborne Project Team Meeting 27th March
        - Feedback on water monitoring in conjunction GDC and use of N fertiliser products and application
        - Engagement with Overseer modelling, plans to provide time and information to do analysis

- Support to Build Farmer and Catchment Capability and Capacity
    - Positive progress in council-grower relationships through project team meetings, and collaboration in the water quality monitoring programmes.
    - Enhanced understanding of fertiliser mixes and the need for soil testing to support precision prescription.
    - Engagement with the Overseer analysis process, and more in-depth understanding of nutrient cycles.

"So, I can adjust my fertiliser mix and lower the amount of K in my soil?"
– Grower C

- Nitrate Mitigation Trial Design
    - Not completed due to lack of hydrological information in Arawhata catchment
    - Experts reinforce the need for accurate N loading and stream flow information to build an effective bioreactor in the correct location
    - Water quality monitoring programme in collaboration with local Growers and Horizons Regional Council will provide cost effective N loading analysis for Arawhata
    - A field trial of alternative fertiliser types and application options has been designed. It will be located at the LandWISE MicroFarm while equipment is developed and tested, and fertiliser options are observed. Later it will be extended to Gisborne and Levin

Introduction

This milestone report covers the progress on Future Proofing Vegetable Production from January to March 2019. The actions undertaken to meet milestone deliverables are detailed under their respective headings. Where milestone deliverables have not been met, justification has been provided. Details of work flows are also provided at the end of the document to explain how remaining deliverables will be met.

Milestone Deliverables

Nutrient Budgets Combined in a Catchment Plan

Defining a Nutrient Budget

A nutrient budget was defined in the report written for milestone 2, as a written formal document that recorded the nutrient status of the soil, and estimated crop yield to determine the quantity of nutrient inputs required (fertiliser, compost, manure, crop residue). As identified in the baseline survey of nutrient management practices, none of the growers surveyed had a nutrient budget as defined above.

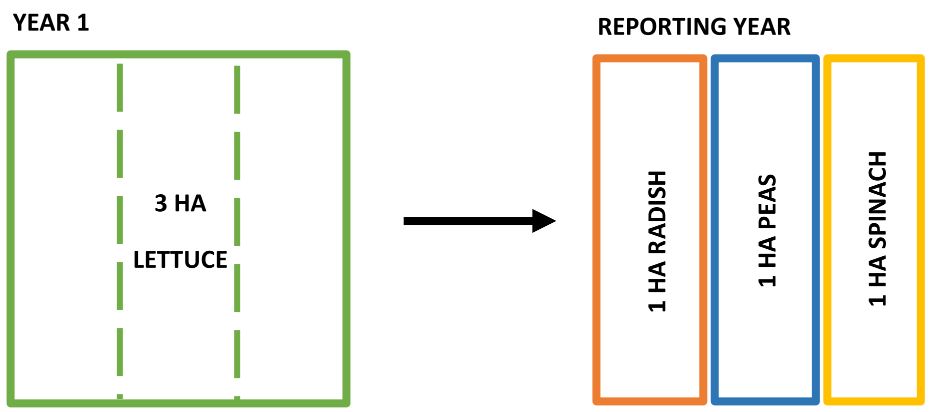
Farm nutrient budgets (proving a level of N loss less than the allocated limit) are required by Horizons One Plan in order to obtain a land use consent. OverseerFM (version 6.3.1) is a tool that generates a nutrient budget for a specified farm.

OverseerFM has not been used to model nutrient management in Intensive Vegetable Farms before, however, it has been utilised in this project to understand the potential losses from these systems and prepare growers for its use as a regulatory tool. As in accordance with meeting One Plan N loss targets OverseerFM has been used to model sample blocks representative of typical vegetable cropping rotations – with the potential to apply this across the catchment where management inputs are consistent with the sample scenarios. Overseer Ltd have indicated that due to the complexity of their growing operations, Vegetable Growers would only need to model a representative block from their farm, rather than detail their entire system.

Justification for Modelling a Representative Area

Each grower that was visited had a uniquely complex system, with multiple crops, varying rotations, and staggered planting and harvest dates – all within relatively small areas (smallest block(s) being 0.1 ha). This meant that capturing all the nutrient, and crop information for the farm would be extremely difficult, and as mentioned in the report for milestone 2, was valued at $30,000 to complete an Overseer year-end analysis for one grower. As a result, it was decided that a single block/paddock would be chosen to model from each grower – which as will become evident – was split further as recording 2 successive years (and their associated crops) meant further blocking was necessary to capture variation.

Figure 1. Example of Block Separation in Year 1 Required to Capture Reporting Year Crops in Overseer.



Modelled Areas

4 growers were chosen for Overseer analysis, as 1 grower was unavailable during the surveying period, and another was undertaking separately contracted Overseer analysis. These growers are summarised below in Table 1.

Table 1. Comparison of Growing Operations with the Sample Crops and Area used for Overseer.

Grower	Crops Grown on Farm	Crops Modelled	Area Modelled (effective ha)
A	Beetroot (fresh and processing), Spinach, Pasture	Beetroot (fresh and processing), Spinach, Pasture	1.0
B	Broccoli, Cauliflower, Cabbage, Potatoes, Onions, Radish, Parsley, Pak Choy, Rhubarb, Spring Onions, Spinach, Lettuce	Broccoli, Cauliflower, Cabbage, Spinach	4.2
C	Broccoli, Cauliflower, Cabbage, Onions, Celery, Spinach, Lettuce	Onions, Lettuce, Cabbage, Broccoli	5.2
D	Onions, Potatoes	Onions, Potatoes	23.2

Nitrogen Leaching Loss Results

The average nitrogen loss from the sampled area is 127kg/ha (a total of 4251kg over 33.6 hectares) - see Table 2. Whilst the total farm area is not yet known for these growers (and changes from year to year as leased land changes) – this average could theoretically be extrapolated for growers' total cropped area as the areas sampled are generally representative of typical rotations.

Table 2. Summary of N Loss Results from Overseer Exercise.

Grower	N Loss (Total)	Area Modelled (ha)	N Loss/ha	Total Farm Area (ha)
A	143	1.0	143	13.7
B	437	4.2	104	-
C	238	5.2	46	-
D	3433	23.2	148	-
CATCHMENT TOTAL	**4251**	**33.6**	**127**	-

General Overseer Comments

The exercise of modelling intensive vegetable cropping scenarios in Overseer has raised a number of questions and concerns which will be discussed with the technical team in the near future. These include but are not limited to:

- Low N removal by harvested product (compared with the N concentrations in Nutrient Management for Vegetable Crops in NZ (Morton & Reid, 2018)).
- Minimal impact on N loss when fertiliser inputs markedly increase
- Lack of suitable input units e.g. fresh weight or volume of vegetables (how yield is currently recorded)

In addition to engaging with Overseer to understand their capacity to adapt or improve the software for vegetable cropping, they will be attending our conference in May, and presenting their advice on using Overseer for Vegetable Production.

Soil Test Values

Talking with growers while collecting data inputs for the analysis also revealed that the quality of fertiliser recommendations to growers is unclear. Soil test values from growers were consistently excessively high in P as is seen in the table below, yet fertiliser applications of P seemingly have not been reduced to accommodate for this.

Table 3. Soil Nutrient Values as Presented from Soil Lab Test Results.

Grower	Block	Year	P (Olsen P)	K (QT)	S (Sulphate-S)	Calcium (QT)	Sodium (QT)
A	Home 3	2017	**148**	24	2	17	6
		2018	**152**	28	-	21	5
	Home 2	2015	**126**	-	-	-	-
	Bruce Road Front	2017	**124**	27	5		
	Boulton Road Front	2017	**114**	20	6	12	3
B	Block 4	2018	**204**				
C	T Front Left	2017	**172**	31	98	23	6
	Home Back Right	2017	**189**	24	11	23	4
	T Back West	2017	53	21	9	15	5
OPTIMUM RANGE(S)			**35 – 70**	**12 – 15**	**7 – 12**	**10 – 15**	**1 – 10**

Values in red indicate soil nutrient level is higher than the optimum range. The **optimum ranges** quoted by the laboratories ranged from **35 to 70**, as Olsen P values increase, P loss via runoff also increases.; hence there is a significant risk of losses, and adverse impact on the environment.

The P values in Table 3 are well above optimum values, and concerningly are increasing in some cases – see Home 3 under Grower A. Soil P values will inevitably increase if fertiliser inputs remain as they are – the fertiliser blends that growers are using appear to be identical despite different crops having different requirements, and blocks having varying soil nutrient status.

Fertiliser inputs for Grower C are the same for each block, and each crop, and is a blend of different fertiliser products totalling a nutrient analysis of:

N	**P**	**K**	**S**	**Mg**	**Ca**
9.78	4.24	14.4	10.1	2.67	4.08

Multiplying this analysis by the application rate, the fertiliser P input is 19kg/ha/yr. At this rate the soil's inorganic mineral pool is gaining 26kg/ha/yr, and only 3.3kg/ha/yr is being removed (as product and runoff). Thus, Olsen P values on this block are likely to increase if management does not change.

Furthermore, Grower C indicated that the K in the mix was too high for some crops and was surprised to find that the blend he was using could be adjusted with the same (or different) products to maintain an exact optimum nutrient analysis.

Nitrogen Budget Tool for Vegetables

We have developed a basic nutrient budget tool as an MS Excel workbook. Data entry is via one tab, seeking information about the crop and anticipated yields, soil test results, and final crop yield and residues retained in the paddock.

Vegetable Nitrogen Balance Draft: 31 March 2019

Crop Information							PrePlant Soil Test						Post-Harvest Soil Test						Harvest Data	
ID#	Paddock	Plot	Crop	Planted	Est Yield	Soil Texture	Soil Test Depth	Soil Moistur	Rootzone Compacted	Lab Test Mineral	Lab Test Ammonia-N	Quick Test Strip N	Soil Test Depth	Soil Moisture	Rootzone Compacted6	Lab Test Mineral-N	Lab Test Ammonia	Quick Test Strip N	Actual Yield	Crop Residues
			Select from List	ha	t/ha	Select from List	cm	Select from List	Select from List	ug/g	ug/g	mg/L	cm	Select from List	Select from List	ug/g	ug/g	mg/L	t/ha	t/ha
1	Home	3	Cabbage (Winter)	3.6	100	Sand	15	Dry	Some effect	4	6	20	20	Moist	Limiting	2	8	20	98	6.8
2	Road	1	Beetroot Roots	4.4	30	Sandy clay loam	15	Moist	Not at all	16	3	25	15	Moist	Not at all	12	2	20	35	4.5
3	Back	1	Broccoli (Winter)	4	90	Sandy clay loam	15	Wet	Limiting	30	2	50	20	Wet	Limiting	15	2	25	16	80
4	Side	Late	Lettuce (Winter)	2.2	36	Silty clay loam	15	Dry	Some effect	23	4	50	15	Dry	Some effect	12	4	25	24	10
5	Top	4	Potatoes (Winter Table)	8	50	Silt loam	15	Dry	Limiting	9	2	25	20	Dry	Limiting	4	2	20	45	4
6	Bottom	W	Lettuce (Winter)	2.3	36	Silty clay loam	15	Dry	Some effect	22	1	50	15	Dry	Some effect	6	4	20	29	5
7			Cabbage (Winter)	2	100	Clay loam	15	Dry	Not at all	4	5	10	20	Dry	Not at all	4	5	15	80	17
8			Spinach	1.5	20	Loam	15	Dry	Limiting	2	1	25	15	Dry	Limiting	2	1	20	18	2
9			Silverbeet	1.8	20	Sandy loam	15	Dry	Some effect	3	3	25	20	Dry	Some effect	3	3	50	12	7.5

Figure 2. Data input worksheet in draft Nutrient Budget calculator

Calculations convert both laboratory soil test and in-field QuickTest Nitrate results into available N in the paddock. Information drawn from the new "Nutrient Management for Vegetable Crops" (Reid and Morton, 2019) is used to estimate nitrogen needs and nitrogen content of harvested crop and residues.

Crop Summary											
ID #	Crop	Estimated Yield	N required per tonne Yield	N required for Estimated Yield	Product N%	Estimated N removed	Actual Yield	N removed in Crop	Crop Residues	Residue N%	N in Residues
		t/ha	kgN/ha/t	kgN/ha	%	kg N/ha	t/ha	kg N/ha	t/ha	%	kg N/ha
1	Cabbage (Winter)	100	2.72	272	0.28	280	98	274.4	6.8	0.28	1.904
2	Beetroot Roots	30	3.6	108	0.27	81	35	94.5	4.5	0.3	1.35
3	Broccoli (Winter)	90	1.94	174.6	0.41	369	16	65.6	80	0.28	22.4
4	Lettuce (Winter)	36	4.7	169.2	0.24	86.4	24	57.6	10	0	0
5	Potatoes (Winter Table)	50	5.6	280	0.73	365	45	328.5	4	0	0
6	Lettuce (Winter)	36	4.7	169.2	0.24	86.4	29	69.6	5	0	0
7	Cabbage (Winter)	100	2.72	272	0.28	280	80	224	17	0.28	4.76
8	Spinach	20	4.75	95	0.49	98	18	88.2	2	0	0
9	Silverbeet	20	3.5	70	0.29	58	12	34.8	7.5	0	0

Figure 3. Crop Summary worksheet from Draft Nutrient Budget calculator

Calculations are presented in a Summary tab which ultimately shows the nitrogen status at start and finish and the amount of N that is unaccounted for.

Vegetable Nitrogen Balance Draft: 31 March 2019

Crop Details						PrePlant Soil N				Fertiliser		Plant N				PostHarvest Soil N			Nitrogen Balance				
	Paddock	Plot	Crop	Planted Area (ha)	Est Yield (t/ha)	Lab Test N (ug/g)	Quick Test N (mg/L)	Available N at Planting (kg N/ha)	N required for Estimated Yield (kg N/ha)	Fertiliser N Required (kg N/ha	Total N Applied (kg N/h	Actual Yield (t/ha)	N in Harvested Crop (kg N/ha)	Crop Residues (t/ha)	N in Field Residues (t/ha	Lab Test Soil N (kg N/ha)	Quick Test Soil N (kg N/ha	Total Paddock N (kg N/h	N Start (kg N/ha)	N Added (kg N/ha)	N Removed (kg N/h	N Remaining (kg N/ha	N NOT ACCOUNTED FOR (kg N/ha)
1	Home	3	Cabbage (Winter)	3.6	100	25.35	16.35	25.35	272	246.7	245	98.00	274.4	6.80	1.9	33.80	25.71	33.80	25.35	245	274.4	1.9	-6
2	Road	1	Beetroot Roots	4.4	30	39.90	29.17	39.90	108	68.1	66	35.00	94.5	4.50	1.4	29.40	23.33	29.40	39.90	66	94.5	1.4	10
3	Back	1	Broccoli (Winter)	4	90	84.00	82.03	84.00	174.6	90.6	100	16.00	65.6	80.00	22.4	59.50	54.69	59.50	84.00	100	65.6	22.4	96
4	Side	Late	Lettuce (Winter)	2.2	36	62.78	58.13	62.78	169.2	106.4	100	24.00	57.6	10.00	0.0	37.20	29.06	37.20	62.78	100	57.6	0.0	105
5	Top	4	Potatoes (Winter T	8	50	27.23	22.92	27.23	280	252.8	250	45.00	328.5	4.00	0.0	19.80	24.44	24.44	27.23	250	328.5	0.0	-51
6	Bottom	W	Lettuce (Winter)	2.3	36	53.48	58.13	58.13	169.2	111.1	110	29.00	69.6	5.00	0.0	23.25	23.25	23.25	58.13	110	69.6	0.0	99
7	0	0	Cabbage (Winter)	2	100	14.85	8.25	14.85	272	257.2	250	80.00	224.0	17.00	4.8	19.80	16.50	19.80	14.85	250	224.0	4.8	36
8	0	0	Spinach	1.5	20	8.10	27.00	27.00	95	68.0	68	18.00	88.2	2.00	0.0	8.10	21.60	21.60	27.00	68	88.2	0.0	7
9	0	0	Silverbeet	1.8	20	14.67	25.47	25.47	70	44.5	46	12.00	34.8	7.50	0.0	19.56	67.92	67.92	25.47	46	34.8	0.0	37

Figure 4. Summary Report from the draft Nutrient Budget calculator

We have yet to test the tool with growers. Our first step is seeking a review from experienced fertiliser industry people to validate assumptions made. The tool will be included in proposed workshops in coming months.

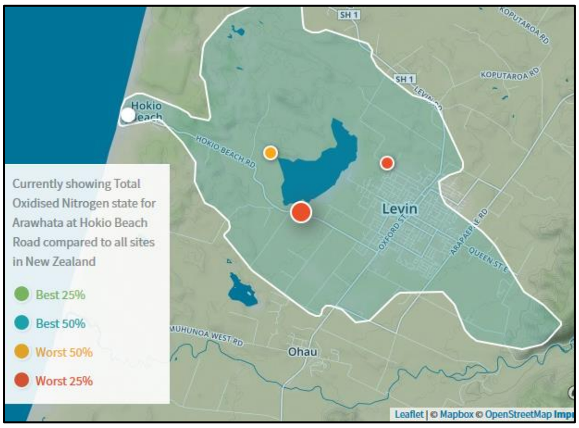
Nitrate Mitigation Trial Design

Research shows bioreactors can be a very effective tool for nitrate removal. In some cases, 96-99% nitrate removal efficiency of intercepted flow and 81-98% of the load being reported. Gisborne District Council (GDC) have themselves trialled a woodchip bioreactor in their wastewater treatment system with results showing around 90% removal. With an abundant supply of woodchip in the region, it is an option that GDC are keen to investigate as a mitigation strategy for intensive vegetable growing systems.

Literature reviews, conferences and talking to experts about bioreactors have provided a common message: that the hydrology of the surrounding soil and in the bioreactor itself must be correct, and the microbes will take care of the rest. The hydrology of the system must first ensure that the bioreactor is located in the correct position in the landscape to capture nitrate laden water. The design of the bioreactor, in particular its size, must be sufficient to ensure the detention time is adequate for the nitrate removal process to occur. For this, information on flow and nitrate levels are required.

The biggest challenge for installing bioreactors in the Arawhata and Taruheru/Waipaoa catchments is the lack of information currently available to select sites and design specifications for efficient and effective systems. Detailed information is required around flow and nitrate levels across time to determine the detention time required for nitrate removal to occur and therefore the required size of the bioreactor.

Horizons Regional Council and Gisborne District Council are both engaged and committed to improving water quality monitoring in their catchments. While nitrate monitoring of water is recommended to be measured every 15mins, with full water quality tests costing around $200, it is expensive. Arawhata has a known nitrate issue. There is one water quality monitoring point in the Arawhata catchment; at the end of the stream before it enters Lake Horowhenua, see Figure 5. Monitoring at this site was temporarily stopped but has resumed in the last month.



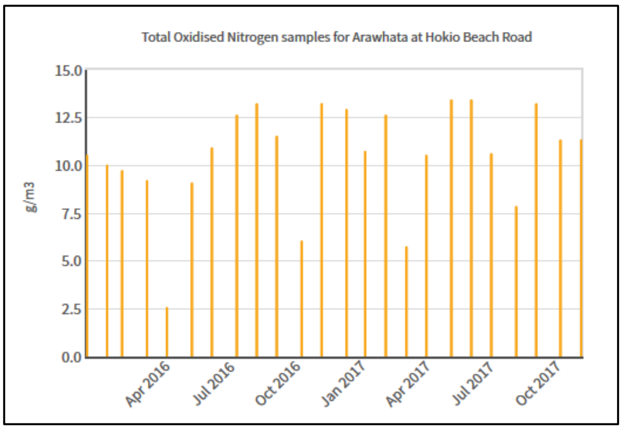
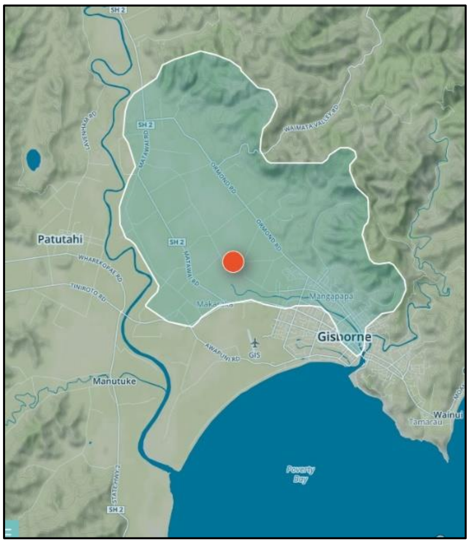


Figure 5: Water monitoring site at Hokio Beach Road on the Arawhata Stream (left), total oxidised nitrogen samples from January 2015 to October 2017 (Source: LAWA).

GDC have two water monitoring sites for State of the Environment that are relevant for the intensive horticulture area of the poverty bay flats. GDC have seen an increase in nitrate levels in their monthly monitoring sites since March 2017, see Figure 6. The latest data shows a similar trend across 2018 (results not shown).



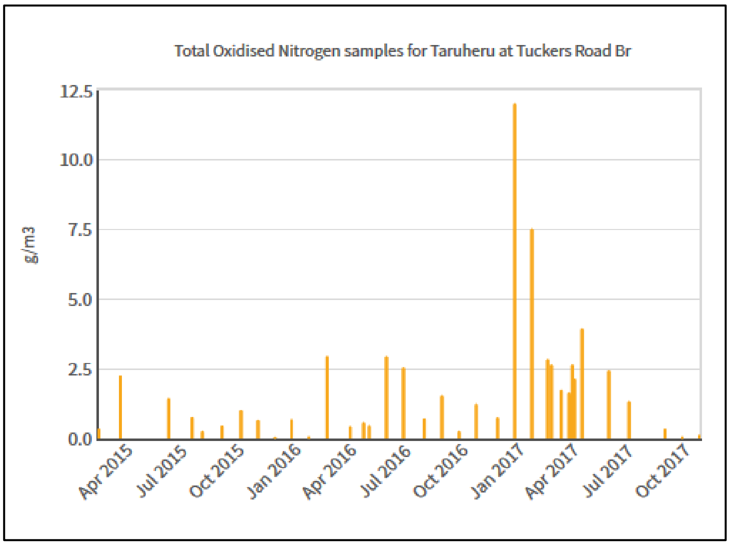


Figure 6: Water monitoring site at Tuckers Road Bridge on the Taruheru River, one of GDC's SOE monitoring sites (left), total oxidised nitrogen samples from April 2015 to October 2017 (Source: LAWA).

Combining more intensive water monitoring by councils and 'citizen' science by the growers throughout both catchments, we hope to begin to understand and build awareness in these catchments while building a dataset.

In the Arawhata catchment, Horizons have identified 23 sites to monitor, see **Error! Reference source not found.**. Initially, full monitoring of all 23 sites twice, once at high flow and once at low flow. The sites are strategically placed to monitor drainage water moving from top to bottom through the catchment. This will give a better understanding of nitrate levels of drainage water entering the intensive vegetable growing area, the contribution of drains throughout the catchment and the contribution of dairy farm at the bottom of the catchment. With one monitoring point at the end of the Arawhata stream, we are currently unable to identify critical areas to work with. If we know where nitrate is entering the systems, we can target our mitigation tools more wisely. We are currently working with GDC to formalise a monitoring system for the intensive horticulture area of the Taruheru catchment.

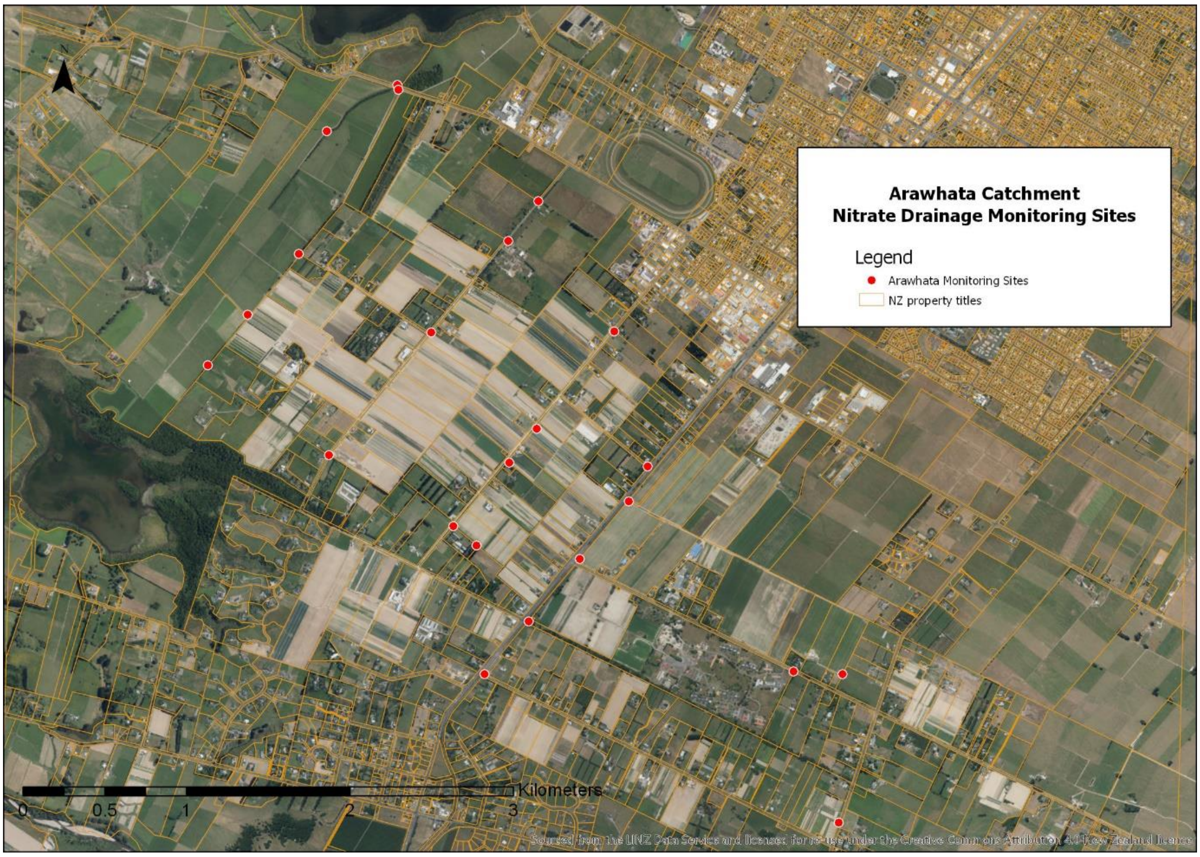


Figure 7. Proposed monitoring sites (red dots) for measuring nitrates in drainage water by Horizons Regional Council and vegetable growers in the Arawhata Catchment

To build awareness and engagement amongst growers we are setting up a ‘citizen science’ approach using nitrate quick test strips and an app to record results. A nitrate quick test strip costs about $1. Step 1 is to assess the nitrate quick test strips against standard sampling and laboratory testing. Horizons are using the test strips when the collect samples for the lab, which will allow us to compare the results. Once we have seen these results and have confidence that the strips are adequate, the growers will be provided with the strips and an app. The ArcGIS app, Survey123, will be used to record results. This will be a form where the site, flow and results of the test strip can be entered and sent straight to a database. Growers have indicated they are keen to support this initiative and we have requested they monitor the sites with quick test strips during and after significant rain events. This will allow us to begin to understand when nitrates are being lost.

Once we have gathered more information, we are looking to work with Manaaki Whenua - Landcare Research to design a bioreactor as a way to remove nitrate from drainage water. There are a number of different bioreactor designs, walls and beds. However, until we understand the volume of water and the levels of nitrate in the drainage water that are require treatment, it is impossible to design an effective bioreactor.

Teralytic Probes

An additional activity we have undertaken is testing Teralytic soil nutrient probes in conjunction with Potatoes NZ and local growers. These electronic probes have been installed in potato paddocks and every 15 minutes are collecting data at three depths through the soil profile. Data includes soil N, P and K, water content and conductivity.

We are one of three places globally to access this new equipment and have experienced some difficulties due to teething problems with communications gateways.

Data is now visible, but not easily captured for analysis. We continue to observe and hope a repeat test in alternative crops can be run over winter. In particular, we are interested in the nitrate and soil moisture data during larger rain events.

Figure 8.Installing a Teralytic probe at a Levin paddock

Alternative Nitrogen Fertiliser Types and Application Methods

We have been working with Lincoln University to design and run a trial using Trichoderma. In the process, we identified Trichoderma is most effective with urea-based fertilisers, but growers are mostly using nitrate products.

Growers are nervous to adopt new practices and have encountered problems using urea fertilisers on fresh vegetables. We are still investigating that as some are finding dilute urea solutions very useful and safe.

We have investigated soil applied, rather than foliar applied, urea fertiliser options and have designed a trial /demonstration. Because it will need significant oversight and development, we have chosen to begin this work in Hastings at the LandWISE MicroFarm. This trial is expected to be started before the LandWISE Conference in May but is dependent on accessing transplants in time.

Support to Build Farmer and Catchment Capability and Capacity

Key activities include ongoing conversation with growers and providing information as required. Opportunities for engagement include time spent interviewing farmers to obtain Overseer input data, planning water testing, and before and after events such as the Potatoes NZ field day.

We have put emphasis on explaining to farmers the significance of fertiliser equipment assessments and are planning further support prior to the main planting and fertilising in spring.

We identified a gap in understanding of compound fertiliser options and are helping growers develop knowledge to better select appropriate mixes. We are looking to develop and run workshops on interpreting soil test results and fertiliser planning in the next months.

We have continued to act as a link between regional councils and farmers, meeting with each individually and together. We find this allows a higher quality of conversation with fears and concerns being more openly expressed. Bringing the parties together typically resolves any issues we have identified. In general farmers and councils have good communications and work together to assess problems and seek opportunities for improvement.

We have encouraged council water quality monitoring staff to engage directly with farmers when visiting the catchment to ensure engagement and to include farmer local knowledge in site selection. This is happening in both Arawhata and Gisborne. Farmers have approached us for more test strips for water quality testing. These were ordered from the USA and are due to arrive.

Farmers are contacting council staff directly on many related topics such as to get support for proposed wetland designs and options and how to better understand impacts and distribution of nitrates in the various catchments.

Project Team Meeting(s)

Two field days were held to update project members, and other invited parties on the progress so far with potential trials, and results from past milestone work. The first of these field days was held in Levin on the 27th of February, a grower's meeting was held first, where 6/7 contacted local growers attended. The booklet produced as a handout for growers is attached in Appendix 1.

The feedback received from the Levin project team meeting was very valuable – trial design ideas were refined, and machinery operation information was shared, allowing us to tailor our future work in the right areas with proper consideration of constraints. Past experience in trying *Trichoderma* was also shared.

Another project team meeting was held in Gisborne on the 27th of March, where growers from Cedenco and Leaderbrand2 attended, as well as Gisborne District Council. This allowed for some encouraging collaboration where nitrate monitoring in farm water bodies (drains, tile outlets) was discussed in order to better understand the source of nitrate spikes in the Taruheru stream. GDC also acknowledged the need to corroborate their monthly nitrate samples with appropriate hydrological information (such as local rainfall, soil water balance, and the length of lag phase from the vadose zone to waterways).

Increasing awareness of the project to a wider audience has been achieved through presenting at the Fertiliser and Lime Research Centre Conference in February and at a Potatoes NZ field day in February.

An invited talk, a presentation and a poster were all presented at the annual FLRC conference. A presentation, 'environmental challenges facing intensive horticulture', was asked to be presented which covered a lot of material from the Future Proofing Vegetation Production project. A paper titled 'opportunities to remove nitrates from drainage water under intensive vegetable production' was presented focusing on the options for woodchip bioreactors and wetlands in Arawhata. A poster was displayed showing the test results of fertiliser spreader calibrations completed with growers and a series of questions for the experts on appropriate standards for fertiliser equipment used in intensive vegetable systems. All of the talks gained a positive response and some valuable input for the project.

Presentations on the Future Proofing Vegetable production project have been invited to be given at Horticulture New Zealand's "Our Food Future" conference in July at Mystery Creek and the Potatoes NZ conference later this year.

Meeting Remaining Milestone 3 Deliverables

Bioreactor design

Water monitoring in the catchments will provide more information to inform bioreactor designs. Nitrate monitoring of water should ideally be a continuous monitoring system, taking measurements every 15 minutes. Continuous monitoring systems have been used prior to the installation of bioreactors in other projects to ensure the design specifications are adequate. However, this intensive monitoring is expensive and outside the budget of this project. We will collect and assess the information and its suitability to inform the bioreactor design. Working with Landcare on a design and input from bioreactor experts will be key to this process.

Overseer Nutrient Budgets l

Work will continue on developing Overseer nutrient budgets with growers. Growers in Levin will receive continued support to produce nutrient budgets for their systems. Gisborne growers have been invited to work with us to look at modelling an area of their systems to allow them to gain an insight into the tool, is capabilities and limitations. A meeting is planned with Overseer staff to discuss the application of Overseer to intensive vegetable growing systems.

Nitrogen Budget Tool for Vegetables

We will spend time with industry experts and with growers checking the utility and value of the tool we have built. It is at the stage where its purpose and use is apparent and quality feedback can be obtained. We expect it to undergo constant revision as people try it and more is learned about the use of the calculator and the assumptions and data that support it.

Next Steps for Milestone 4

1. Workshops in Arawhata and Gisborne

To be arranged. The content to be included is:

- The recently released Nutrient Management Guidelines for vegetable production
- Soil testing and soil test analysis with expert soil scientist Jeff Morton
- Crop nutrient budget tool

2. Field days in Arawhata and Gisborne (may be in spring)

- Fertiliser calibration demonstration – a practical demo with a direct placement applicator and the calculator.

3. Workshop/field days in another region

Plans to run fertiliser calibration workshops in Gisborne testing the impact of different products, and fill levels on application rate.

4. Presentations at the LandWISE conference

Invited speaker Brad Bernhard to speak on his PhD work focussing on nitrogen fertiliser optimisation using liquid urea and Y-Drop systems. Pip McVeagh to present on bioreactors and the treatment train. Rebecca Eivers to present on constructed wetlands and Brandon Goeller to present on bioreactors.

5. Project team meeting

To be arranged as progress deems it necessary

Appendices

Appendix 1

Booklet produced for Potatoes NZ field day and grower update meetings, appended.

Appendix 2

Nutrient Loss Results from Overseer

Grower A

CREATED 17 Mar, 2019, 7:23PM | MODIFIED 28 Mar, 2019, 9:53AM | VISIBILITY My Org

v6.3.1: N/ha: 143 P/ha: 0.2 GHG/ha: 2.8K

SYNCED V6.3.0: NO RESULTS RENAME AUDIT LOG COMMENTS (0) SHARE DELETE COPY

Grower B

CREATED 17 Mar, 2019, 7:24PM | MODIFIED 25 Mar, 2019, 2:00PM | VISIBILITY My Org

v6.3.1: N/ha: 104 P/ha: 0.4 GHG/ha: 4.3K

SYNCED V6.3.0: NO RESULTS RENAME AUDIT LOG COMMENTS (0) SHARE DELETE COPY

Grower C

CREATED 17 Mar, 2019, 7:24PM | MODIFIED 25 Mar, 2019, 2:02PM | VISIBILITY My Org

v6.3.1: N/ha: 46 P/ha: 0.3 GHG/ha: 1.6K

SYNCED V6.3.0: NO RESULTS RENAME AUDIT LOG COMMENTS (0) SHARE DELETE COPY

Grower D

CREATED 25 Mar, 2019, 1:35PM | MODIFIED 25 Mar, 2019, 5:06PM | VISIBILITY My Org

v6.3.1: N/ha: 148 P/ha: 0.3 GHG/ha: 4.5K

SYNCED V6.3.0: NO RESULTS RENAME AUDIT LOG COMMENTS (0) SHARE DELETE COPY