Winter Crop Survey 2017 – Technical Findings

GDC Science Report

Written by Monique Daulton

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1.0 Introduction

The Environmental Services and Science Team from the Gisborne District Council has completed a survey of the winter crops grown throughout the Gisborne District for the 2017 winter season. The purpose of the survey is to identify the different types of winter crops that are being grown throughout the region that are intended for animal consumption, and the area that they cover. This data is then used to assist in the management of the region's physical resources with determining both water quality and water quantity parameters. This information will then be used to monitor waterways, help develop farm environment plans, and inform the farming community and general public on crop types and trends.

This survey is the third consecutive year that the winter crop survey has been completed. The winter crop survey is done in conjunction with the summer crop survey which is also completed annually to gain an understanding of the seasonal type of crops to determine any changes and/or trends across the different seasons.

The Environmental Services and Science team hopes to gain a better understanding of the significance of winter cropping in the region while locating any core areas that would be impacted by the Proposed Regional Freshwater Plan. This is of particular interest as there are new rules under the proposed Regional freshwater Plan that relate directly to intensive winter grazing.

1.1 Relationship to Gisborne District Council Freshwater Plan

The Proposed Gisborne Regional Freshwater Plan has new rules that relate directly to intensively farmed stock and winter intensive grazing. These new rules come under Section 5 of the plan which relate to water quality and discharges to water and land. The rules have/are to be implemented to ensure that any permanently flowing stream, lake or wetland or Outstanding Waterbody identified in Schedule 4 or regionally Significant Wetland identified in Schedule 3 of the plan (see appendix) are all protected from there associated values. The rules are as follows:

Rule 5.3.2

Diffuse discharges from dairy farming and intensively farmed stock activities lawfully established prior to the date of notification of this Plan.

Classification: Permitted Activity

a. From **1 May 2021**, **dairy farming and intensively farmed stock activities** shall have prepared and submitted to the Consent Authority a Farm Environment Plan in accordance with Schedule 11 and have commenced implementation of this Farm Environment Plan in accordance with best practice and provide those records to the Consent Authority. An annual report will be provided to the Consent Authority on the implementation of the Farm Environment Plan; except that
b. Where the area of **dairy farming or intensively farmed stock is less than 5 hectares**, a Farm Environment Plan is not required provided that the activity complies with the following standards:

i. Where the land slope is less than 15 degrees, no establishment of feed crops or irrigation of pasture is undertaken within 5 metres of the top of the bank of any permanently flowing stream, lake or wetland and within 10 metres of the top of the bank or edge of any Outstanding Waterbody identified in Schedule 4 or Regionally Significant Wetland identified in
Schedule 3;
ii. Where the land slope is between 15 and 25 degrees, no establishment of feed crops or irrigation of pasture is undertaken within 10m of any permanently flowing stream, lake or wetland;
iii. No feed crops are established on land with a slope greater than 25 degrees; and
iv. No cultivation occurs within 1 metre of drains

Rule 5.3.5

Activity: Diffuse discharges from stock access or grazing when winter intensive grazing is being undertaken.

Classification: Permitted Activity

a. **From 1 July 2017**, **stock are excluded from within** 5 metres of the top of the bank or edge of any permanently flowing or intermittent stream, lake or wetland and within 10 metres of the top of the bank or edge of any Outstanding Waterbody identified in Schedule 4 or Regionally Significant Wetland identified in Schedule 3 for the period 1 May to 30 September on all winter intensive grazing land of less than a 15 degree slope; and
b. **From 1 July 2017, stock are excluded from** 10 metres from the wetted bed of all permanent and intermittent streams and rivers, all lakes and the edge of all wetlands for the period 1st may to 30th September on all winter intensive grazing land of a 15 degree slope or greater.

Intensively Farmed Stock is defined in Section 2 of the Regional Freshwater Plan as:

1. Cattle or deer grazed on irrigated land or contained for break feeding of feed crops;
2. Dairy farming; and
3. Farming of more than 9 pigs per hectare of land

2.0 Methods

The 2017 winter crop survey was conducted between late May to early June. The survey began on 29th May and took 10 days to complete, finishing on the 14th June (was not completed on consecutive days due to staff members being busy or away). The Poverty Bay flats were surveyed first followed by the Te Karaka and Whatatutu area than out west to Motu/ Matawai, than down south to Tiniroto. The coast was than surveyed around Tolaga Bay, Tokomaru Bay than up North to Ruatoria and Tikitiki, going as far North as Whakaangiangi Road near Te Araroa. This survey was conducted at an earlier date from the previous winter crop surveys due to past recommendations that much of the crops had been eaten down to stubs and therefore hard to identify from June/July onwards. It is recommended by PGG Wrightson's that future winter crop surveys are carried out early June as that is the best recommended time to capture winter crops before being eaten out.

The data was gathered on a hand held tablet using Arc Collector software. This was collected by systematically driving throughout the region and manually recording observed crops, stock type, whether stock were being break-fed or grazed on the crop, the proximity of the crop to waterways, and if this proximity was a threat to the water quality.

Some of the crops were hard to identify by either being far away or have been eaten out. Photos were taken of these crops to help amplify and identify the image back in the office. The crops that could simply not be identified were classified as 'other'. Some of the crops categorised as 'other' could be identified back in the office by seeing which crop grew in that particular location in the summer

This particular method is the first time it has been used for the winter crop survey. The previous surveys were conducted by recording the crop types onto printed aerial maps and then being digitised back in the office using ArcMap.

2.1 Survey Area

The area surveyed is the same as the previous winter crop surveys. The same areas were surveyed to ensure accuracy when comparing results; this practice should be continued through future winter crop surveys. The surveyed area is shown in figure 1; divided into different localities in order to compare data between locations. These location are:

1. Motu/ Matawai
2. East/ Tolaga/ Tokomaru
3. East Cape/ Ruatoria
4. Tinoroto
5. Te Karaka/ Whatatutu
6. Poverty Bay Flats

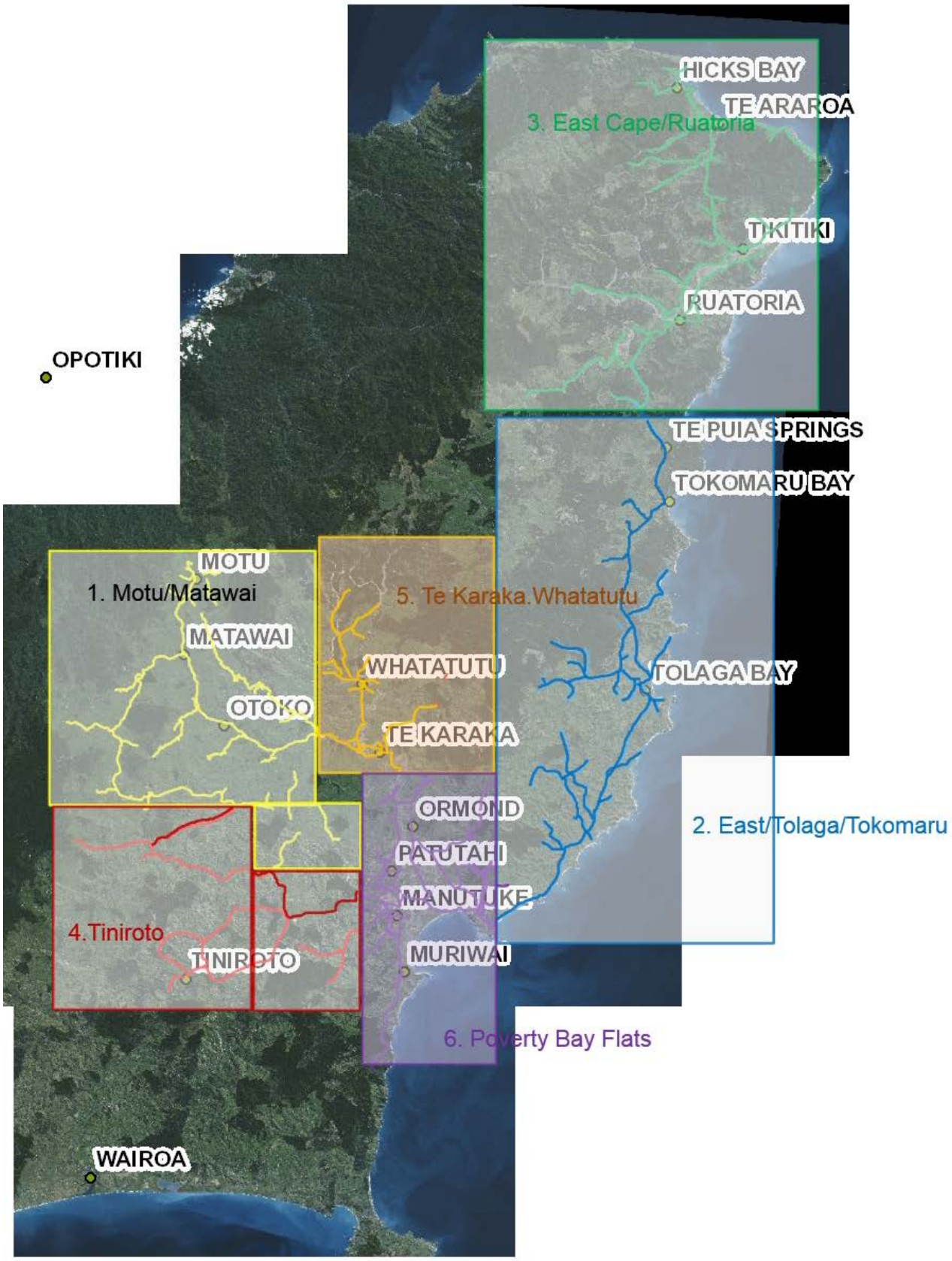

Figure 1. *Areas surveyed in winter crop survey, divided into different areas of the District.*

2.2 Crop Types

This survey used a similar format for crop types as previous years. Fodder crops identified were brassicas, lucerne, plantain, oats, and fodder beet. Brassica crops included Cauliflower/Broccoli, Kale, swedes, and turnips. A full list of crop types that were recorded can be seen in figure 2.

The identification of fodder crops were the same however gorse and maize stalk were not recorded as per previous years. These 2 crops were not recorded as they do not specifically relate to the winter crops grown in the Gisborne Region.

Pasture that had been recently planted or was being grazed was recorded, along with tilled land - categorised as 'To Be Planted', however this land will not be used for analysis as they do not relate to purpose of the Survey unless they have a water threat.

Crops that were difficult to identify due to them being too far away or eaten out were recorded as unknown, see figure 3 for an example of a crop that was classified as 'unknown'. Paddocks where only stalks and hoof prints remained as evidence of being a fodder crop, were also recorded as unknown crops. Plantain, chicory, and clover were often planted with a variety of grasses or together, so they were recorded as a mix: chicory mix, chicory/plantain, plantain mix, and clover mix.

Figure 2. *Crop Types Surveyed*

Barley	Leafy Turnip
Cauliflower/Broccoli	Lettuce/ Cabbage
Lucerne Mix	Lucerne
Chicory	Oats
Chicory Mix	Plantain
Chicory/Plantain	Plantain Mix
Fodder Beat	Swede
Forage Rape	Turnip
Kale/Chou Moellier	Other
Lupin	Clover
Unknown	
Clover Mix	

Figure 3. *Fodder Crop Stalks – can be difficult to identify if the leaf is not visible.*

3.0 Results

The results and discussion section compares trends and observations of major crop types. The same areas have been surveyed throughout all past winter crop surveys, therefore we can draw accurate conclusions when discussing any changes or trends in crop types throughout the Region.

The total area surveyed and recorded was 8211.58 ha. The areas of pasture (5298.51 ha), and areas to be planted (835.82 ha) were excluded to calculate the total area of winter crops as these areas are not cropped for winter fodder, which was 2077.25 ha. Pasture and areas to

be planted are only discussed and analysed in section 3.2, 3.3, 4.3.2, and 4.3.3, other than that there will be no further analysis of the data found for these particular crops during the winter crop survey as they do not specifically relate to the winter crops grown in the Gisborne Region. The total area (ha) and total number of sites of winter crops in the Gisborne Region can be seen in

figure 4,5 & 6.

Crop Type	Total area (ha)	Crop Type	Total area (ha)
Lettuce/Cabbage	140.54	Barley	0.00
Lucerne	62.661496	Cauliflower/Broccoli	138.88
Lucerne Mix	0.00	Chicory	192.12
Lupin	0	Chicory Mix	7.53
Oats	62.59477	Chicory/Plantain	8.26
Other	31.983456	Clover	3.97
Plantain	583.725195	Clover Mix	0.00
Plantain Mix	61.553609	Fodder Beet	60.03
Swede	0	Forage Rape	64.99
Turnip	38.799396	Kale/Chou Moellier	189.72
Unknown	231.121263	Leafy Turnip	198.78

Figure 4. *Total area (ha) of Crop Types identified in the 2017 Winter Crop Survey.*

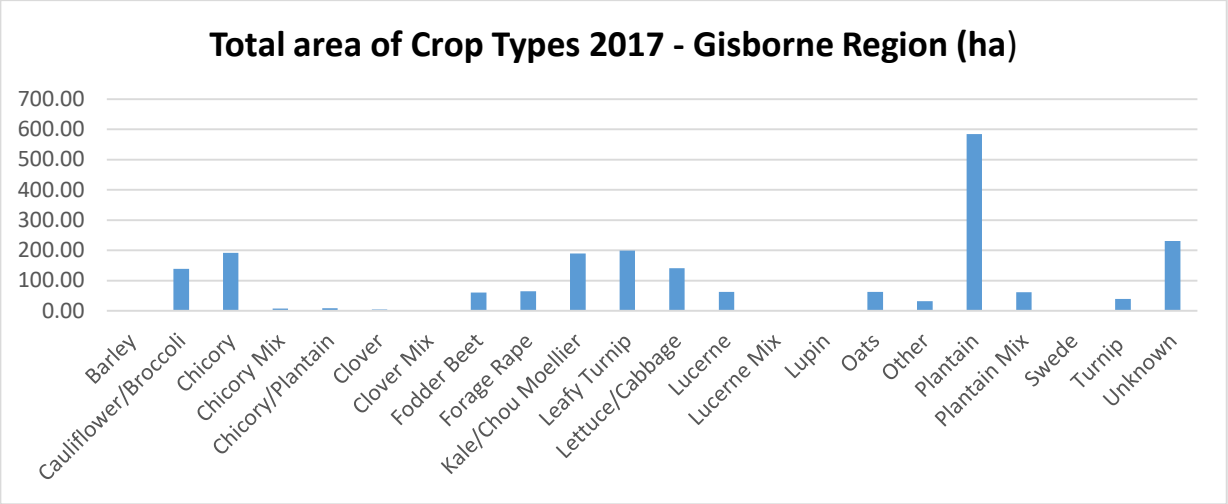

Figure 5. *Total area (ha) of Crop Types identified in the 2017 Winter Crop Survey.*

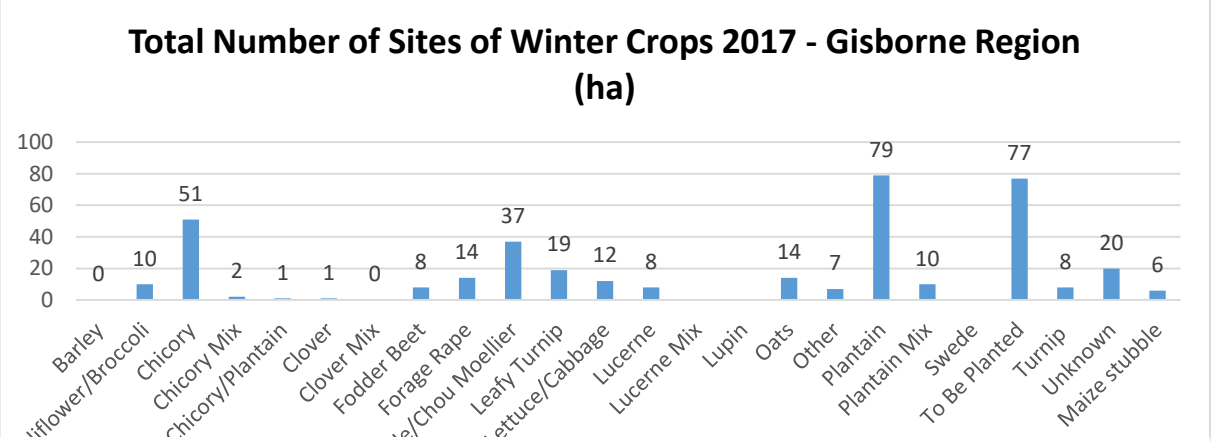

Figure 6. *Total number of sites of winter crops identified in the 2017 Wintery Crop Survey.*

3.1 Major Crop Types

The major crop types were determined by the total area they covered and the number of sites they were found at. The results section shows observations and trends of major crop types. Major crop types were determined by the total hectares and the total number of sites, major crops can be seen in figure 7.

Crop Type	Number of sites	Total hectares
Plantain	79	583.73
Unknown	20	231.12
Leafy Turnip	19	198.78
Chicory	51	192.12
Kale/ Chou Moellier	37	189.72

Figure 7. *Major Crops identified.*

3.1.2 Plantain & Plantain Mix

Plantain continues to be the most abundant crop type present in the Gisborne Region. Plantain accounts for 28% of all crops recorded in the Gisborne Region, covering 583.73 ha. Plantain Mix accounts for 3% of all crops recorded in the Gisborne Region, covering 61.55 ha. Plantain and Plantain Mix combined accounts for nearly a third of the total winter crops with 645.28 ha.

Observations and trends:

The area of Plantain and Plantain Mix have been compared to the previous year's surveys and trends have been observed. The trend for the area of Plantain has decreased from 805.81 ha in 2015 to 676.35 ha in 2016 to 583.73 ha in 2017, a total decrease of 27.56%, as seen in figure 8. The area of Plantain Mix has no obvious trend with an increase in area from 174.42 ha in 2015 to 334.82 ha in 2016 and then has decreased to 61.55 ha in 2017, as seen in figure 9.

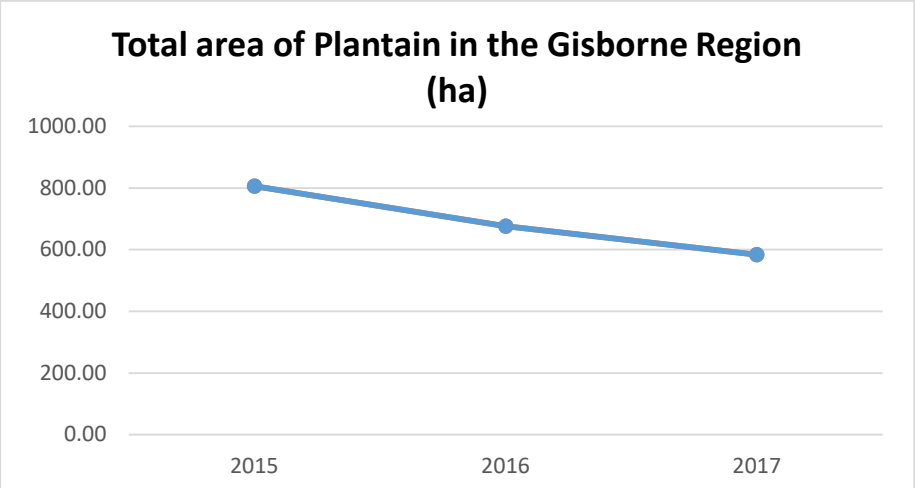

Figure 8. *Total area (ha) of plantain identified in the 2015, 2016 & 2017 Winter Crop Survey.*

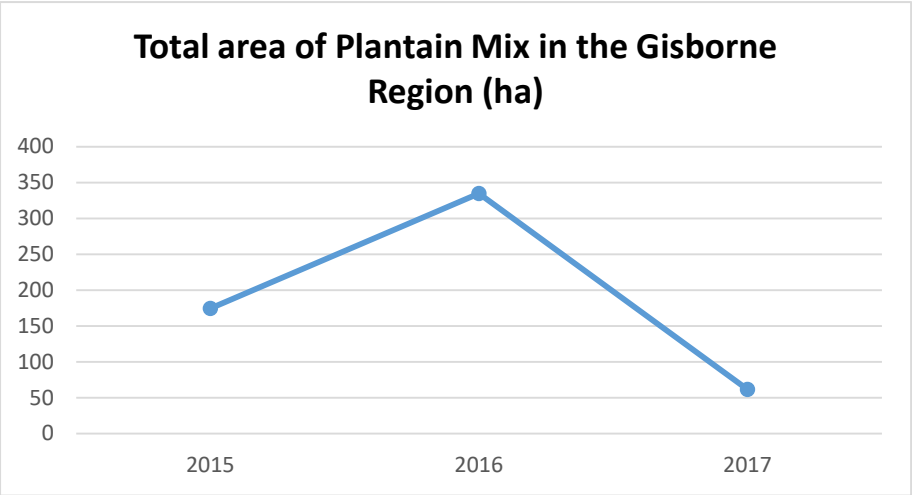

Figure 9. *Total area (ha) of plantain identified in the 2015, 2016 & 2017 Winter Crop Survey.*

3.1.3 Unknown Crops

Unknown crops is another common crop identified in the Gisborne Region. Unknown crops was found at fewer sites compared to the others listed but covered a large area of 231.12 hectares, making unknown crops the second most abundant crop type in the region. Unknown crops are crops that were too difficult to identify due to either the crop being too far away or have been eaten out and only stalks present.

Observations and trends:

The area of unknown crops have been compared to the previous winter crop surveys and trends have been observed. Unknown crops recorded have increased in area from 2015 to 2016 and then decreased this survey in 2017 by 214.32 hectares as seen in figure 10**.** This decrease in area could be due to the survey being completed earlier in the winter than the previous 2 surveys, with less crops being eaten out and therefore easier to identify.

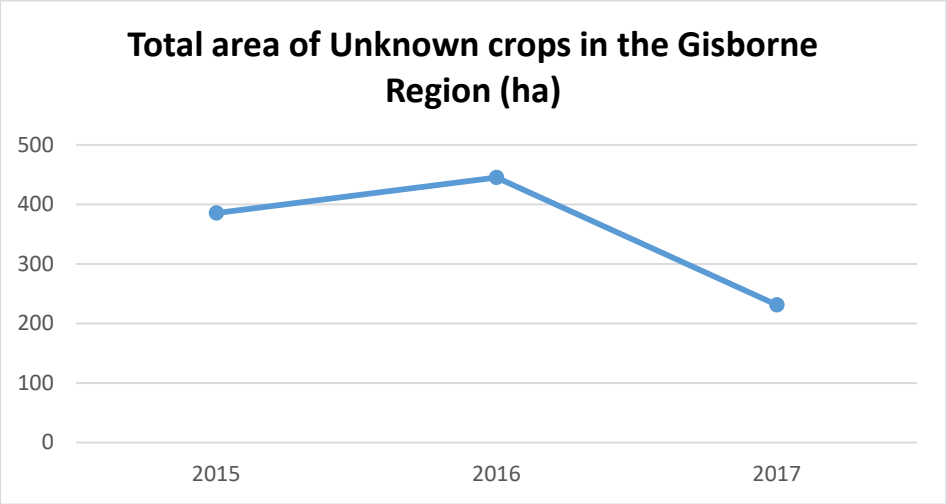

Figure 10. *Total area (ha) of Unknown crops identified in the 2015, 2016 & 2017 Winter Crop Survey.*

3.1.4 Leafy Turnip

Leafy turnip is another common crop identified in the Gisborne Region. Leafy turnip was also found at fewer sites compared to the others listed but covered a large area of 198.78 ha, making leafy turnip the third most abundant crop type in the region.

Observations and trends:

The area of leafy turnip crops have been compared to the previous winter crop surveys and trends have been observed. Leafy turnip has increased in area each year this survey has been carried out, increasing from 0 ha recorded in 2015 to 113.63 ha in 2016 to 198.8 ha this survey in 2017 as seen in figure 11.

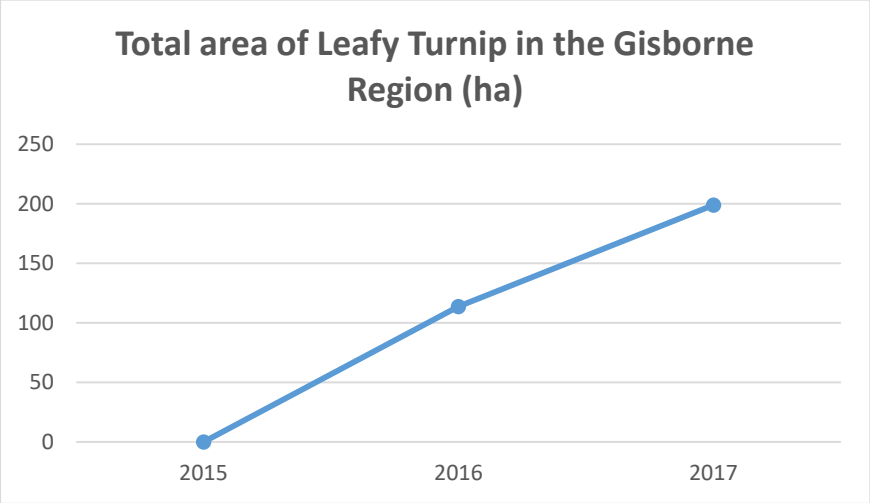

Figure 11. *Total area (ha) of Leafy Turnip identified in the 2015, 2016 & 2017 Winter Crop Survey.*

3.1.5 Chicory & Chicory Mix

Chicory is another common crop identified in the Gisborne Region. The area of chicory recorded covered 192.12 ha at a total 51 sites, making it the fourth most abundant crop in the region. 7.53 ha of chicory mix was also recorded, combined with chicory covers 199.7 ha.

Observations and trends:

The area of chicory crops have been compared to the previous winter crop surveys and trends have been observed. Chicory has no obvious trend with decreasing in area from 137.69 ha in 2015 to 90.83 ha in 2016, to increasing in area to 138.9 ha this survey in 2017, as seen in figure 12**.** Chicory mix also has no obvious trend with increasing in area from 25.25 ha in 2015 to 37.66 ha in 2016, to decreasing in area to 7.53 ha this survey in 2017, as seen in figure 13.

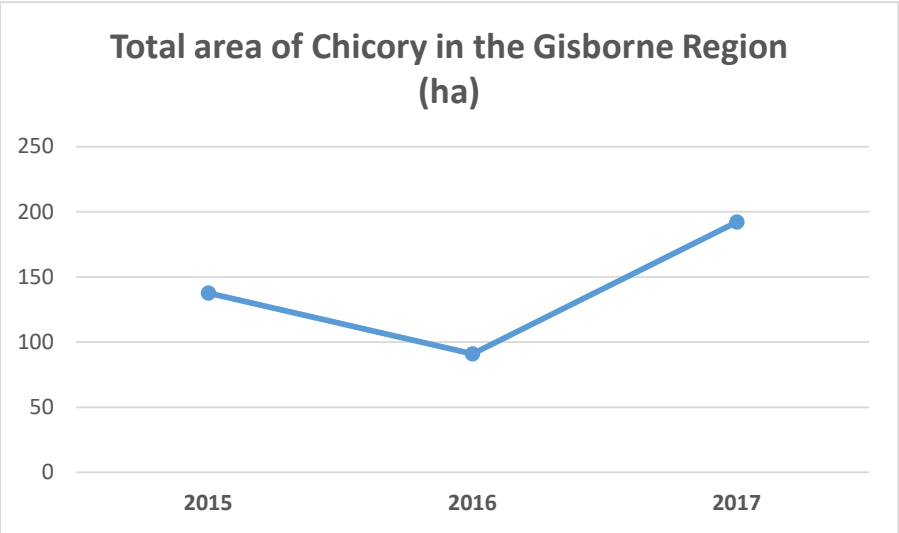

Figure 12. *Total area (ha) of Chicory crops identified in the 2015, 2016 & 2017 Winter Crop Survey.*

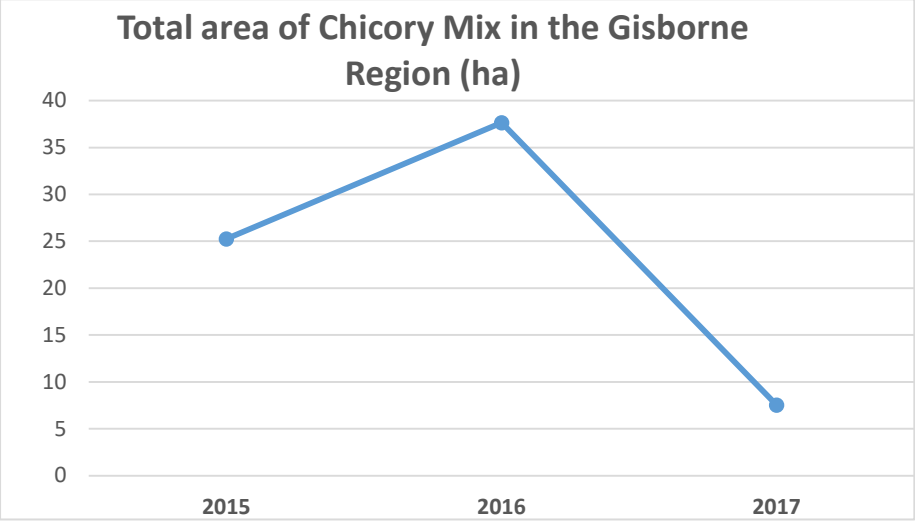

Figure 13. *Total area (ha) of Chicory mix crops identified in the 2015, 2016 & 2017 Winter Crop Survey.*

3.1.6 Kale

Kale is another common crop identified in the Gisborne Region. The area of kale recorded covered 202.76 ha at a total of 37 sites, making it the fifth most abundant crop in the region.

Observations and trends:

The area of Kale/Chou Moellier has been compared to the previous winter crop surveys and trends have been observed. Kale/Chou Moellier again has no obvious trend with decreasing in area from 252.16 ha in 2015 to 15.37 ha in 2016, than increasing to 189.72 ha this survey in 2017, as seen in figure 14.

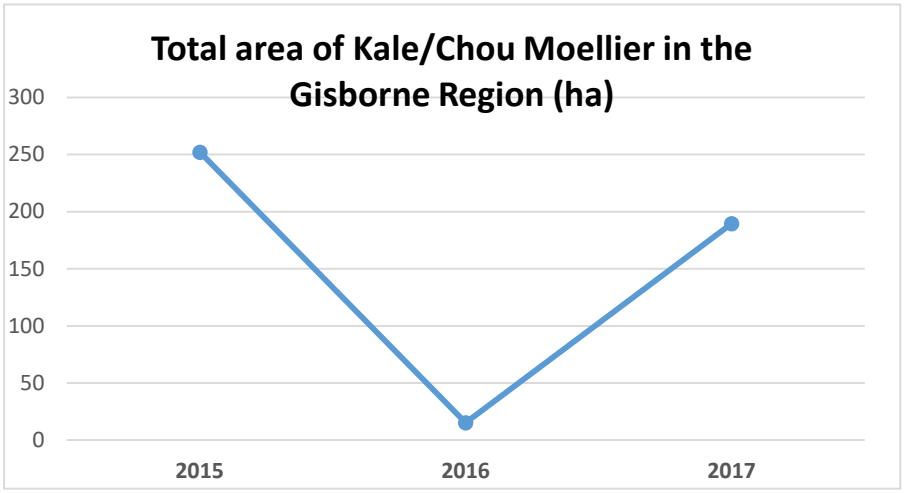

Figure 14. *Total area (ha) of Chicory mix crops identified in the 2015, 2016 & 2017 Winter Crop Survey.*

3.1.7 Minor Crop Types

Minor crops were identified as crops that has low site numbers and area (ha). The site and area information can be seen figure 15. Fodder beat, forage rape, lucerne, oats, other, turnip, and chicory/plantain mix had the lowest site numbers and areas of all the winter fodder crops. Chicory mix and plantain mix also had low site numbers and areas recorded, these 2 crops were addressed in section 3.1.2 and section 3.1.5.

Fodder Beet	60.03257
Forage Rape	64.98708
Lucerne	62.6615
Oats	62.59477
Other	31.98346
Turnip	38.7994
Chicory/Plantain	8.261779
Chicory Mix	7.526392
Plantain Mix	61.55361

Figure 15. *Area of Minor Crop Types (ha.)*

3.1.8 Commercial Winter Crops

There a number of commercial crops grown in the winter months of the Gisborne Region. These commercial crops include cauliflower and broccoli and lettuce and cabbage. These crops have been categorised into two different groups with Broccoli and Cauliflower categorised together and Lettuce and Cabbage categorised together. There was a total area of 138.88 hectares of Cauliflower and a total area of 140.54 hectares of Broccoli observed at the time of the Survey. These crop categories combined contribute to 14% of the total crops recorded in the Region with 279.42 ha**.** Both of these commercial crop categories have grown significantly with 0 ha of cauliflower/broccoli being recorded in 2015, 6.77 ha in 2016, and 138.88 ha in 2017. Lettuce/Cabbage has increased from 0 ha recorded in 2015, to 52.78 ha in 2016, to 140.54 ha in 2017. The total area for these winter commercial crops in all three of the winter crop surveys can be seen in figure 16 and figure 17.

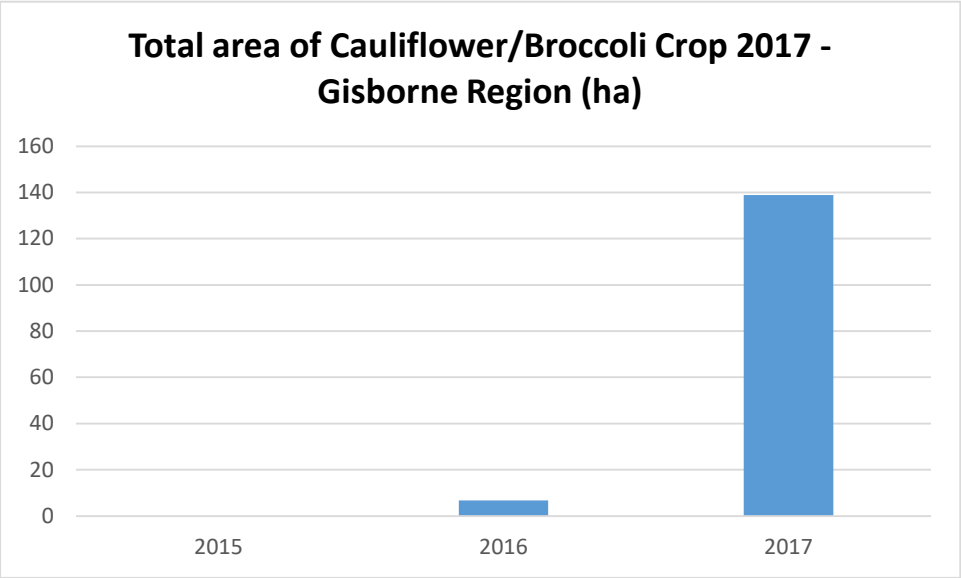

Figure 16. ***T****otal area (ha) of Cauliflower/Broccoli crops identified in the 2015, 2016 & 2017 Winter Crop Survey.*

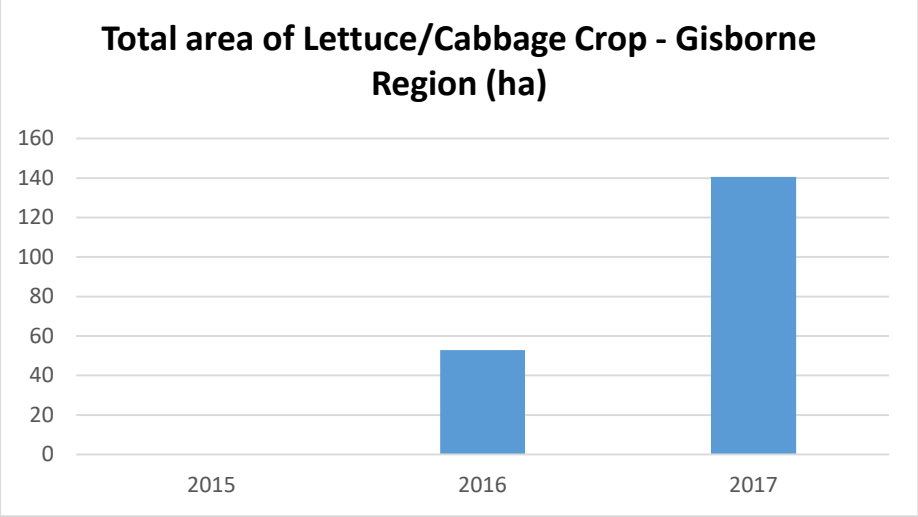

Figure 17. *Total area (ha) of Lettuce/Cabbage crops identified in the 2015, 2016 & 2017 Winter Crop Survey.*

3.2 Break-fed

The total area being break-fed was 73.79 ha. Break-feeding is defined as a system of controlling the feeding of grazing by dividing their paddock with movable fences, as seen in figure 18 & figure 19. Crop types that were being break-fed were forage rape with 23.28 ha, fodder beet with 15.09 ha, pasture with 14.46 ha, Kale with 8.94 ha, Leafy Turnip with 8.81 ha, and Chicory with 3.2 ha, as shown in figure 20. It is possible that some of the unknown crops identified were break-fed which could have potentially increased the total area. It is important that break-fed crops are identified as they can have an effect on water quality in any near-by waterways.

Figure 18. *An example of cattle being break-fed in the Gisborne Reaion.*

Figure 19. *An example of cattle being break-fed in the Gisborne Region.*

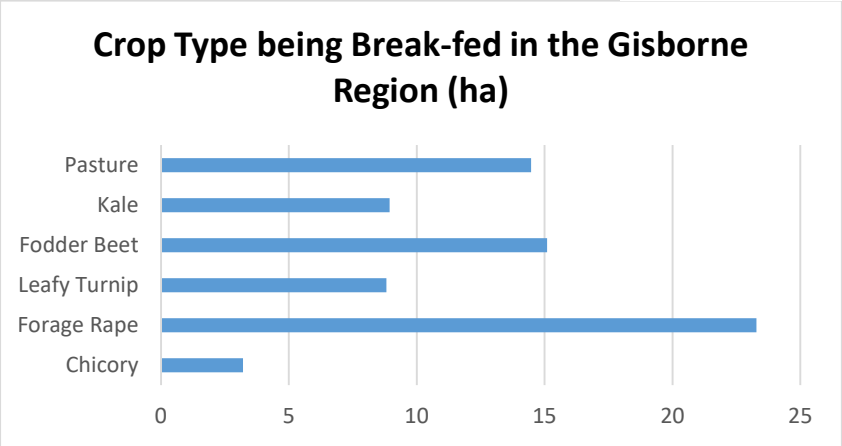

Figure 20. *Crop type being break-fed in the Gisborne Region 2017.*

The location that had the most break-fed crops was East Cape/Ruatoria. East Cape/Ruatoria area had a total of 33.19 ha of break-fed crops, this was followed by Motu/Matawai with 12.88 ha, Poverty Bay Flats with 12.38 ha, Tiniroto with 9.82 ha, and East/Tolaga/Tokomaru with 5.52 ha, as seen in figure 21.

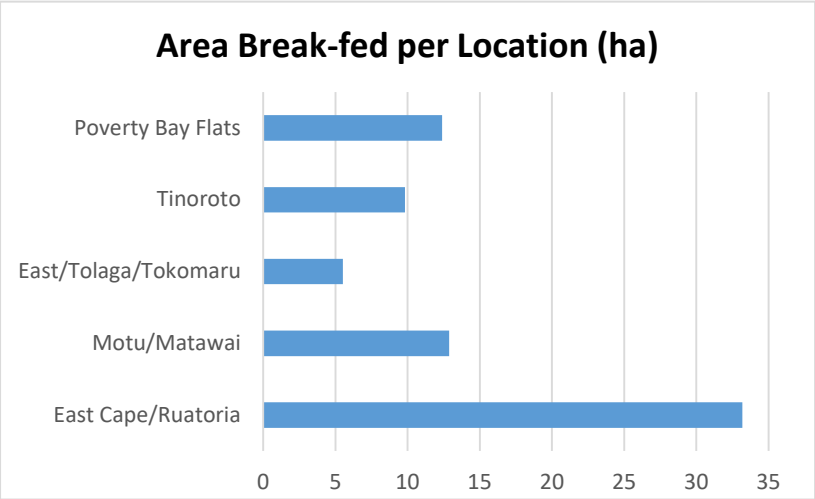

Figure 21. *Area break-fed per location (ha) in 2017.*

In comparison to the previous Winter Crop Surveys, there has been a significant decrease of crops being break-fed. In the 2015 survey there was 534.60 ha of break-fed crops recorded, in 2016 180.50 ha recorded, and in this year's 2017 survey as mentioned 73.79 ha was recorded. The area of each individual crop being break-fed throughout all surveys can be seen in figure 22. This large decrease in total area could potentially have occurred due to the survey being carried out earlier in the year in June rather than in July/August/September when the previous 2 surveys were completed. Weather conditions is likely to have also affected this decrease as it was a very wet winter, increasing the potential pugging damage to crops as soils become waterlogged, therefore stock aren't break-fed until drier conditions.

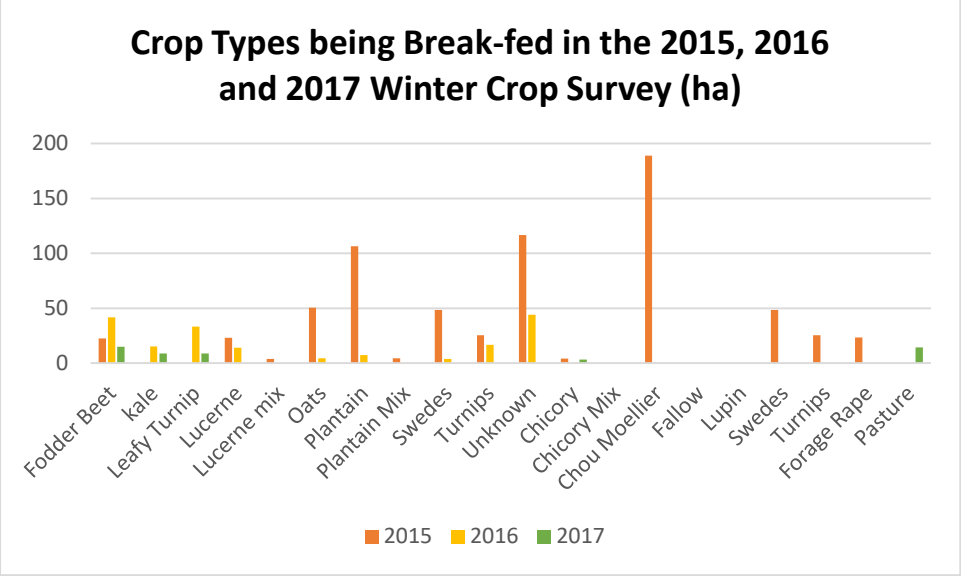

Figure 22. *Crop types being break-fed in the 2015, 2016 & 2017 Winter Crop Survey.*

3.3 Threat to Water

Crops were categorised as having either a low, moderate, or high water threat. This method was used for the first time to try better categorise crops that have actual or potential water threats. Crops categorised with no water threat were fenced, and/or not break-fed or

intensively grazed, and/or away from any water courses. Crops categorised with a moderate water threat were either or have the potential to be break-fed or intensively grazed but fenced near a water course. Crops categorised with a high water threat were or likely to be break-fed or intensively grazed within a distance of less than 5m from a permanent watercourse outlined in the freshwater plan, as seen in figure 23 & 24. All crops recorded have been categorised with a water threat and are analysed including pasture, and to be planted.

Figure 23. *Example of a potential high water threat with crop and no fences identified in the Gisborne Region.*

Figure 24. *Example of a potential high water threat with crop and no fences identified in the Gisborne Region.*

The total area of crops that were categorised to have a low water threat was 7123.076 ha, this accounts for 86.74% of all crops recorded. This can be seen in figure 25, note pasture was not included in the graph as it is a large figure, of 5063.17 ha.

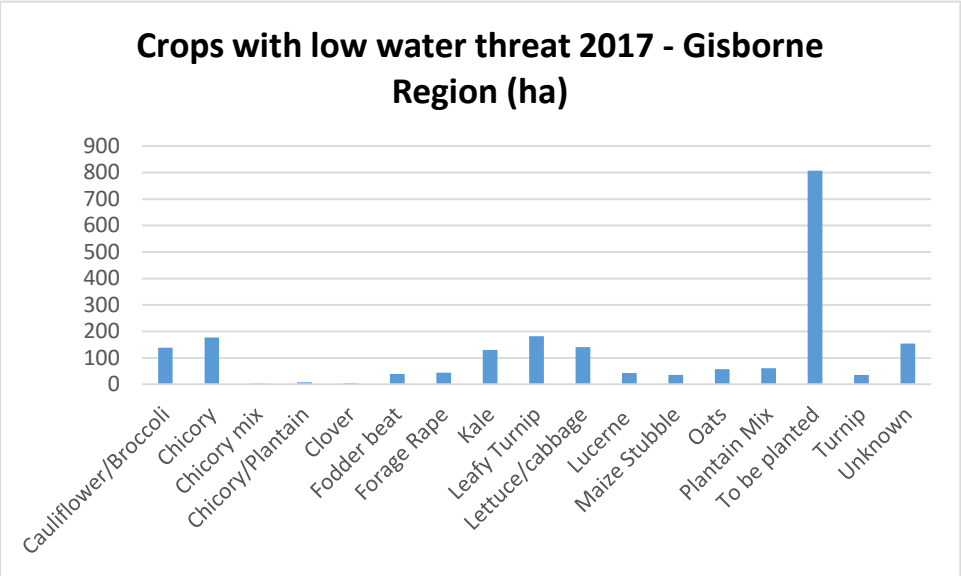

Figure 25. *Crops recorded with a low water threat in the 2017 winter crop survey.*

A total of 385.05 ha of crops were recorded with a moderate water threat, this accounts for 4.69% of all crops recorded. Finally, 33.92 ha of crops were recorded with a high water threat, this accounts for 0.41% of all crops recorded. The total area of moderate and high water threats identified for each crop can be seen in figure 26, and figure 27.

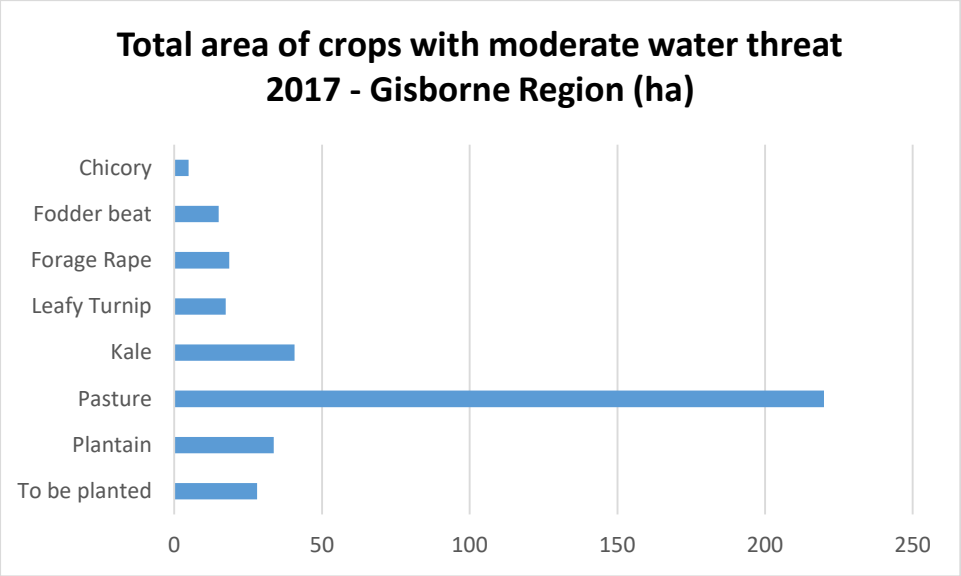

Figure 26. *Crops recorded with a moderate water threat in the 2017 winter crop survey.*

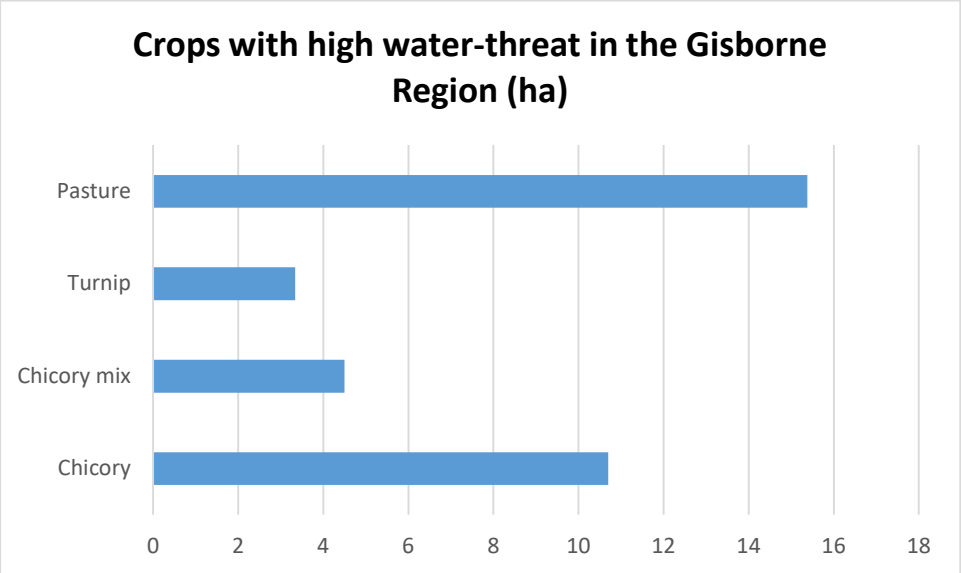

Figure 27. *Crops recorded with a moderate water threat in the 2017 winter crop survey*

The total area of break-fed crops that have a water threat was 34.23 ha. This accounts for 46.40% of all break-fed crops, including crops with both a moderate and high water threat. For the whole region there was only one break-fed crop categorised with a high water threat. This crop was pasture and covered 0.77 ha, it was categorised with a high water threat due

to cows being break-fed next to a stream that was not fenced. There was 33.47 ha of crops that were break-fed that have a moderate water threat, including 14.95 ha of Forage Rape, 9.57 ha of Fodder Beat, and 8.94 ha of Kale. These break-fed crops were categorised with a moderate water threat as they were break-fed near a fenced watercourse.

3.4 Location

3.4.1 Poverty Bay Flats

The total surveyed area for the Poverty Bay Flats area was 3156.66 ha. The total area of pasture (1685.06 ha), and area to be planted (620.68 ha) were excluded to calculate the total area of winter crops, which is 850.91 ha, making this the area with the largest amount of crops in the District. The crop types found in this area can be seen in figure 28. The major crop type found in this region was plantain with 188.05 ha. Leafy Turnip was the second most abundant crop in this area with 145.57 ha recorded, followed by lettuce and cabbage with 140.54 ha, and cauliflower/broccoli with 138.90 ha. Minor crops found in this area included chicory, chicory/plantain mix, clover, forage rape, kale, Lucerne, oats, 'other', plantain mix, and unknown crops.

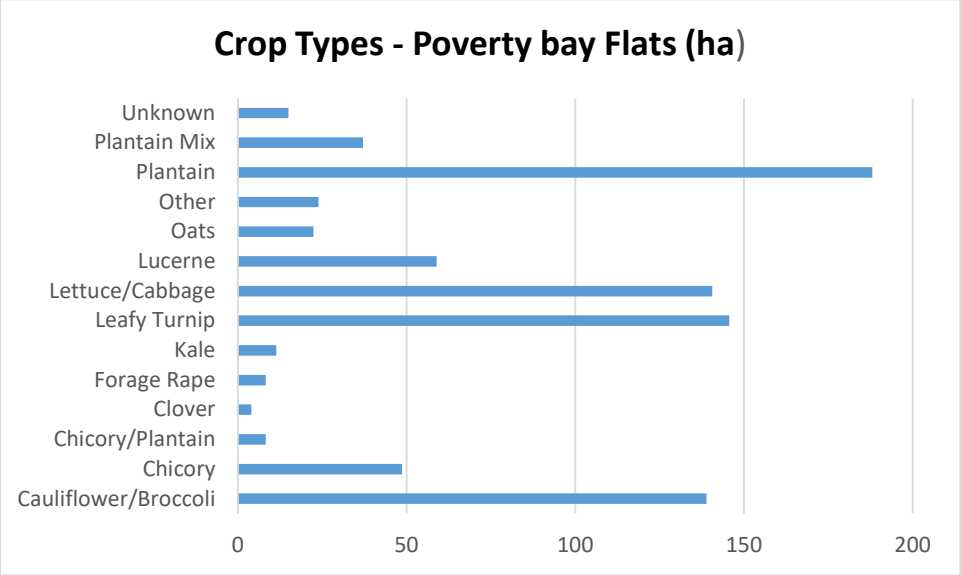

Figure 28. *Crop Types recorded on the Poverty Bay Flats in ha.*

3.4.2 East/Tolaga/Tokomaru

The total area surveyed for the East/Tolaga/Tokomaru area was 2219.69 ha. The area of pasture (1709.60 ha) were excluded to calculate the total area of winter crops, which was 302.28 ha, making this the second largest area of crops in the District. The total area of crop types found in this area can be seen in figure 29. The major crop type found in this region was plantain. Plantain was significantly larger than any other crop type found in the region with a total area of 127.56 ha. Unknown crops were the second most abundant crop type in this region with a total area of 74.46 ha. Chicory is the third most abundant with a total area of

62.97 ha. The remaining crops of chicory mix, fodder beet, forage rape, kale/chou moellier, and plantain mix were found in much lower quantities.

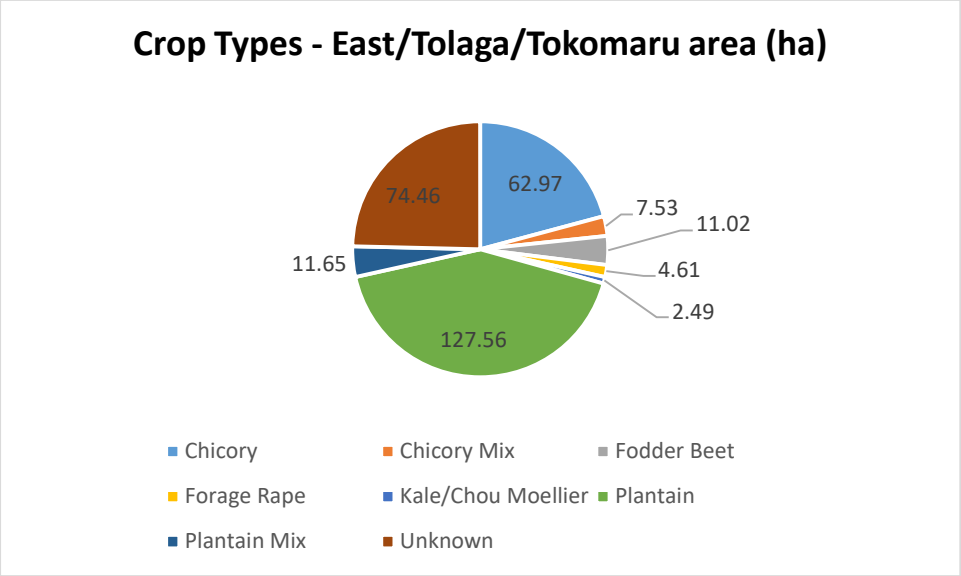

Figure 29. *Crop Types recorded in the East/Tolaga/Tokomaru area in ha.*

3.4.3 Motu/Matawai

The total area surveyed for the Motu/Matawai area was 456.36 ha. The area of pasture (169.69 ha) was excluded to calculate the total area of winter crops, which was 286.68 ha, making this the third largest area of crops in the District. The total area of crop types found in this area can be seen in figure 30. The major crop type found in this region was Kale/Chou Moellier, which was 147.87 ha. The second most abundant crop type was leafy turnip with a total of 44.40 ha. Other crop types found in the region were unknown with 28.51 ha, turnip with 23.33 ha, plantain with 18.70 ha, chicory with 12.53 ha, oats with 4.68 ha, lucerne with 3.77 ha, and forage rape with 2.89 ha.

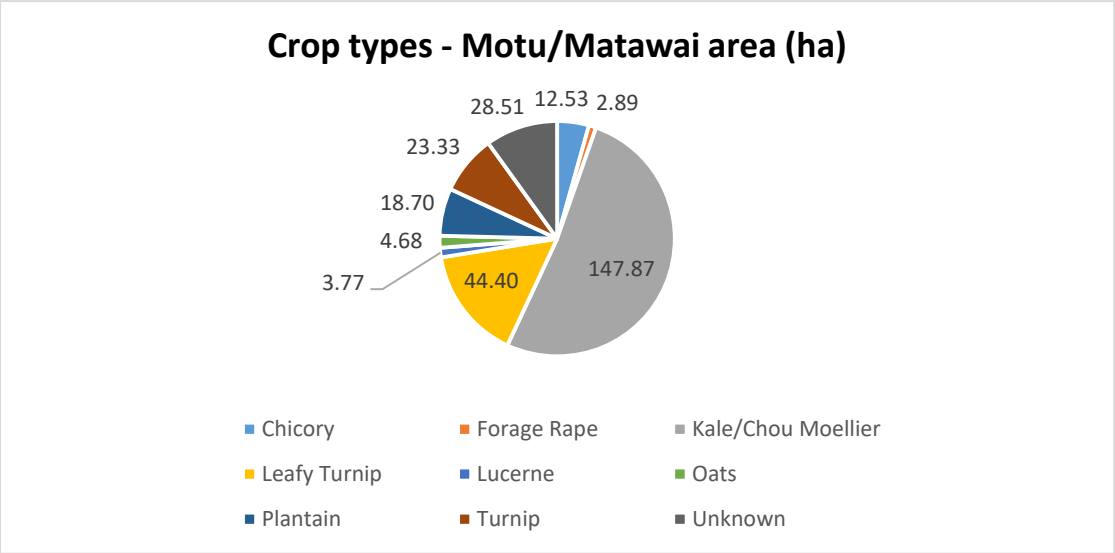

Figure 30. *Crop Types recorded in the Motu/Matawai area in ha.*

3.4.4 Tiniroto

The total area surveyed for the Tiniroto area was 325.32 ha. The area of pasture (42.42 ha) were excluded to calculate the total area of winter crops, which was 282.90 ha, making this the fourth largest area of crops in the District. The total area of crop types found in this area can be seen in figure 31. The major crop type found in this region was plantain with a total area of 141.89 ha. The second most abundant crop in the region was unknown with a total of 34.94ha, closely followed by the third most abundant crop of forage rape with a total of 34.48 ha. Other fodder crops found in the area were kale/chou moellier (27.93ha), chicory (24.23 ha), turnip (15.47 ha), and oats (3.96ha).

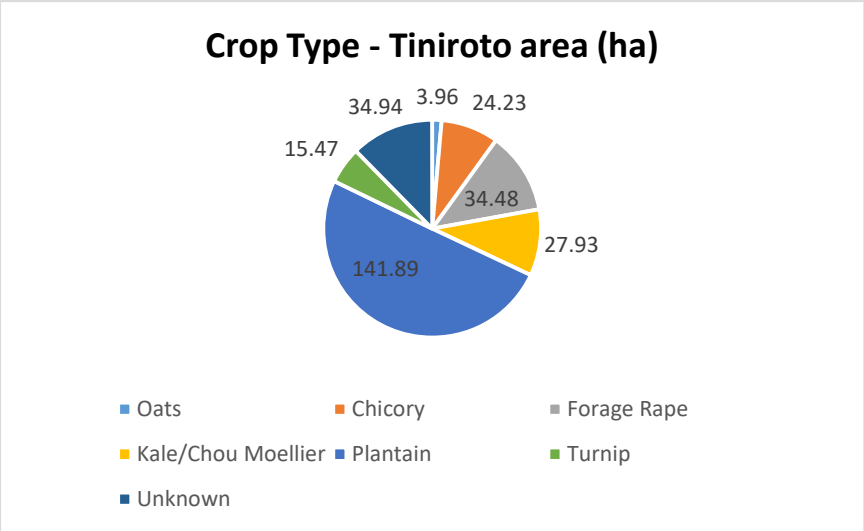

Figure 31. *Crop Types recorded in the Tiniroto area in ha.*

3.4.5 East Cape/Ruatoria

The total surveyed area for the East Cape/Ruatoria region was 1688.61 ha. The area of pasture (1406.34 ha) were excluded to calculate the total area of winter crops, which was 282.28 ha, making this the fifth largest area of crops in the District. The total area of crop types found in

this area can be seen in figure 32. The most abundant crop in this area is plantain with 96.00 ha, followed by unknown crops with 72.24 ha. Fodder beet is the third most abundant crop with 49.01 ha. The remaining crops of forage rape, leafy turnip, plantain mix, and chicory were found in much lower quantities.

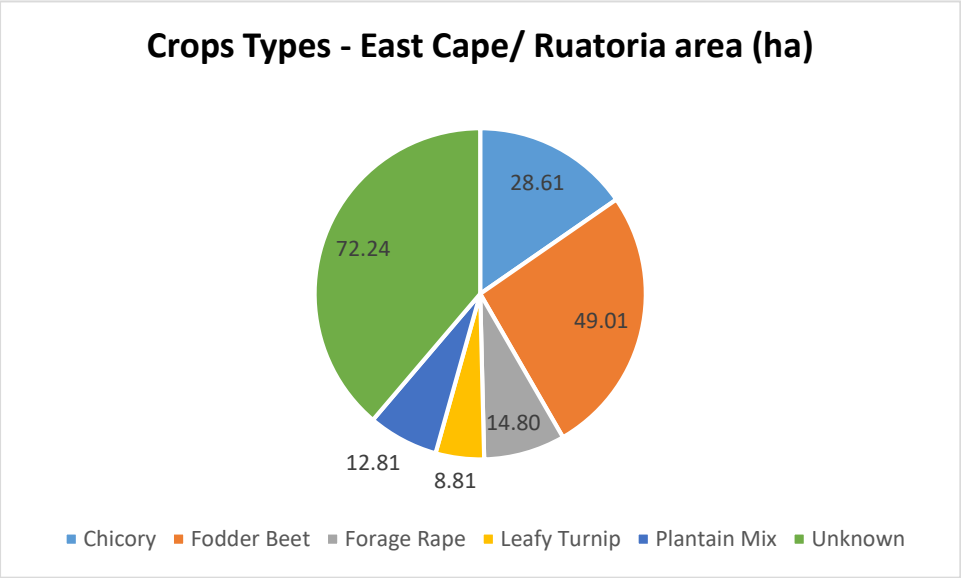

Figure 32. *Crop Types recorded in the East Cape/ Ruatoria area in ha.*

3.4.6 Te Karaka/Whatatutu

The total area surveyed for the Te Karaka/Whatatutu area was 341.60 ha. The area of pasture (267.01 ha), and to be planted (2.37 ha) were excluded to calculate the total area of winter crops, which was 72.22 ha, making this the area with the least amount of crops in the District. The total area of crop types found in this area can be seen in figure 33. The major crop type found in this region was oats with a total area of 31.56 ha. The second most abundant crop type was chicory with a total of 15.10 ha, closely followed by plantain being the third most abundant crop at 11.53 ha. 5.98 ha of unknown crops were also observed in this region.

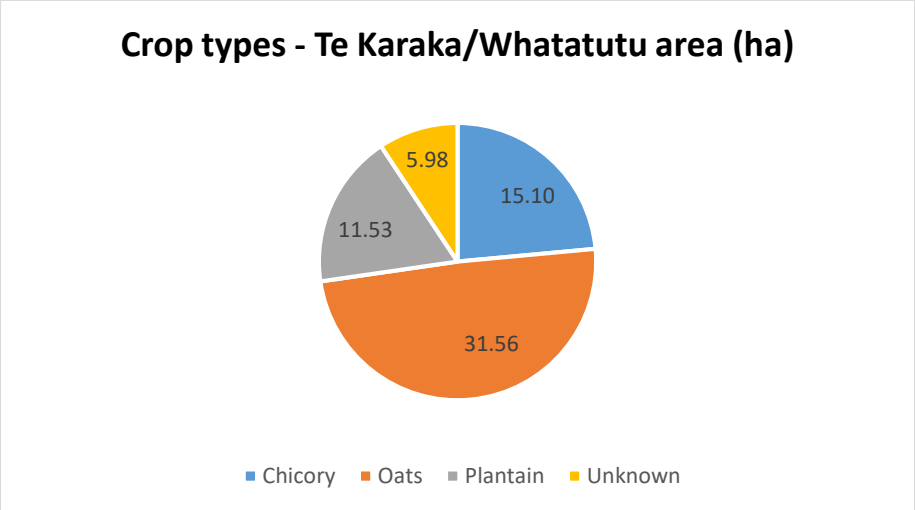

Figure 33. *Crop Types recorded in the Te Karaka/ Whatatutu area in ha.*

4.0 Discussion

4.1 Survey Area

As previously stated in **section 2.0** this 2017 winter crop survey is the third survey to be conducted in the Gisborne Region. The survey area is outline in figure 1 in section 2.2. These areas cover all visible cropping areas that can be seen by the road throughout the Region. Although the localities are delineated in section 2.2, it was sometime difficult to distinguish which location the crop belonged to, especially at the boundary between two locations. The survey area was also limited by public road access, therefore the survey does not cover the entire Gisborne region as it only surveys crops visible from the road. Using the Councils drone, or any other variation of remote sensing could be used to overcome this limitation however this would be much more expensive and potentially more time consuming. It is recommended that the same areas should be surveyed each winter, to keep trends as accurate as possible.

4.2 Survey Method

As stated in section 1.0, this was the first year that the winter crop survey was done using a different data collection method. Traditionally, the crop survey is completed by systematically driving through the region and manually recording crops onto aerial maps. This information was then digitised using ArcMap to visualise and to calculate the area of the crops.

The new data collection method involved using a hand held tablet rather than recording on aerial maps. This worked by 1 person driving a vehicle, while another person identified and recorded the crops. The software used to collect the crop data was Arc Collector. Using Arc Collector we were able to edit the GIS layer from the previous crop survey. Editing the previous layer allowed the survey to be completed a lot faster as most crops remained the same as the previous year. If the crop type had changed but the paddock shape remained the same, we could easily change the crop type without drawing in a new paddock every time. This method also reduced the time of the survey as the digitising was done in the field so no further work needed to be completed after the survey. The summer crop Survey 2016/2017 also followed this data collection method, thus being the second time this method has been used but the first time for the winter crop survey.

Digitising the data not only reduced the time of the survey, it also increases the accuracy of the results. That is because of the ability to use a smaller scale, allowing a detailed description of crop boundaries, by increasing the view of the paddocks and removing features such as patches of bush, houses, sheds, shelter belts, river edges, and other obstructions.

The survey time could also be reduced by excluding non-winter crops, such as pasture, and ‘to be planted’. 3595.06 ha of pasture and 210.18 ha of ‘to be planted’ area was recorded. It is very difficult to draw the line of which pasture to record and what not to record, in this year’s survey pasture was only recorded if it was grazed, or new that could potentially have a water threat. Going forward it is recommended only recording pasture, maize stalk, and tilled land (to be planted) that has a water threat to save time.

The 2017 winter crop survey was conducted between the 29th May and the 14th June. The survey took a total of 10 days to complete, these days were not consecutive due to staff members being away or busy. All 3 of the winter crop surveys have been conducted at different times throughout the winter. The 2015 Survey was conducted in August and September, while the 2016 survey was conducted in July and August. The time of the winter crop survey significantly impacts the results, as the survey only supplies a 'snapshot' of what crops are present during the time of the survey. Fodder crops are planted and eaten out at different times of the year due to either weather or money factors. Best practice going forward would be to have consistency of when the survey is conducted to get a more conclusive result. PGG Wrightson advised Council staff that the best time of the year to carry out the winter crop survey is early June, prior to the crops being eaten out and therefore difficult to identify.

4.3 Crop Trends and Characteristics

The total recorded area (ha) of winter crops in the Gisborne Region in 2017 is 5878.53 ha. The area of pasture (3595.06 ha), and area of tilled land, categorised as 'to be planted' (210.18 ha) were excluded to calculate the total area of 2283.47 ha. This total area consist of both commercial and fodder crops. Maize stalk and gorse was not recorded in this survey as they do not specifically relate to the winter crops grown in the Gisborne Region.

Over the three Winter Crop Surveys conducted the total area of fodder crops throughout the Region has varied. In 2015 2282.34 ha of fodder crops were recorded, this is not including any commercial crops. In 2016 there was a reduction of fodder crops with 2087.09 ha recorded, this is including commercial crops. Between 2016 and 2017 there has been an increase of 196.38 ha winter crops grown throughout the Region. The increase in fodder crops is most likely a result of a wet winter, with a lower availability of feed, increasing the need for fodder crops.

4.3.1 Major Crops

Major crops in the Gisborne Region are plantain, unknown crops, leafy Turnip, chicory, and kale/chou moellier, as identified in section 3.1. Plantain has been the most abundant crop in the Gisborne Region throughout all surveys. Plantain is a popular feeding crop, an alternative to pasture which provides high dry matter yields, with high levels of protein and energy, with good cool season growth. Plantain mix was also recorded in the survey, it is combined with plantain for analysis, accounting for nearly a third of total winter crops recorded. Plantain mix is made up of plantain with white and red clover. Plantain was most common in the Poverty Bay Flats and Tiniroto area. Plantain mix was most common on the Poverty Bay Flats

Unknown crops is the second most abundant crop in the Gisborne Region. Unknown crops are crops that could not be identified due to them either being eaten out to stalk or they were too far away to be correctly identified. In some cases, crops that were too far away were identified by using a magnified photo taken in the field, however this could not be applied to all cases. The large area of unknown crops decreases the accuracy of the winter crop survey as it does not provide a true representation of winter crops growing in the Gisborne region. The total area of unknown crops has declined each survey, the total area in the 2017 survey

is likely to have declined as it was conducted earlier in the winter with less crops being eaten out. Unknown crops was most common in the East/Tolaga/Tokomaru area and East Cape/ Ruatoria area.

Leafy Turnip is the third most abundant crop identified in the Gisborne Region for the 2017 Winter Crop Survey. Leafy turnip is grown as a supplement to pasture production from mid-summer to early winter. It is a fast-establishing high quality feed, making it very attractive to crop growers. The total area of leafy turnip is likely to have increased between each survey due to again the time the survey was carried out, as it is most suited to the autumn grazing season. Leafy turnip was most common on the Poverty bay Flats.

Chicory and chicory mix combined is the fourth most abundant crop in the Gisborne Region for the 2017 Winter Crop Survey. Chicory is a perennial herb crop providing a high-quality feed with good protein levels. Chicory mix is made up of chicory and clovers. Chicory was most common on the Poverty Bay Flats and in the East/Tolaga/Tokomaru area. Chicory mix was only present in the East/Tolaga/Tokomaru area.

Kale is the fifth most abundant crop in the Gisborne Region for the 2017 Winter Crop Survey. Kale is a traditional winter feed crop which provides high quality feed during winter that is usually single-grazed from about late May to late August (De Ruiter et al., 2009). Kale was most common in the Motu/ Matawai area.

4.3.2 Pasture

There was 3595.06 ha of pasture recorded in the Gisborne Region in the 2017 Winter Crop Survey. Pasture has been excluded in any total area calculations other than if it posed a moderate or high water threat. 211.51 ha of pasture had a moderate threat while 15.38 ha of pasture had a high water threat. The remaining 3368.17 ha of pasture was not analysed. Going forward there really needs to be a clear structure of what pasture to record and what not to record so that results can be compared accurately.

4.3.3 To Be Planted

There was 210.18 ha of ‘to be planted’ recorded in the 2017 Winter Crop Survey. To be planted refers to any tilled land that is likely to be planted in the near future. This crop category has been excluded in any total area calculations other than if it posed a moderate or high water threat. There was 27.98 ha of area ‘to be planted’ that had a moderate water threat. Tilled land was also recorded to compare any seasonal trends of land use. Again going forward there really needs to be a clear structure of what area of tilled land should be recorded so that results can be compared accurately.

4.3.4 Commercial crops

There has been a large increase of commercial winter crops in the Gisborne Region. Commercial crops consist of lettuce, cabbage, cauliflower and broccoli, these crops to date have only been grown on the Poverty bay Flats. All of these crops were grown by Leader Brand, one of New Zealand’s largest and most diversified horticulture and fresh food businesses. It is the largest grower, packer and shipper of broccoli, lettuce and fresh

sweetcorn in New Zealand (Robertson, 2015). The increase of total area of winter commercial crops has likely to have occurred due to either Leader Brand focusing on and planting more of these crops this winter or they planted them earlier due to a mild winter.

4.3.5 Minor Crops

Minor crops in the Gisborne region include fodder beet, forage rape, Lucerne, oats, other, turnip and chicory/plantain mix, as identified in section 3.1.7. Chicory mix and plantain mix are also minor crops however these have been discussed under the major crops section alongside chicory and plantain. All of these listed crops have been minor crops throughout the 3 winter crop surveys that have been conducted. Some of the crops total area has increased while others have decreased but with no notable change other than turnip. Turnips total area has decreased in size from 111.63 ha in 2016 to 38.80 ha in this 2017 winter crop survey. The listed crops are likely to be minor due to cost and/or not suited to winter conditions with waterlogged soils.

4.4 Location

The Poverty Bay Flats is the most intensively cropped area in the Gisborne Region during the winter season. The alluvial soils of the plains are derived from the soft mudstones and siltstones of the hill country, mixed with volcanic ash, and are among the most fertile and productive in the country (Statistics New Zealand, 1999). The Flats also have an ideal winter for cropping with mild winters and average rainfall. These conditions make it ideal for both cropping and these results have shown in both the summer and winter crop survey. The Poverty Bay Flats is also the only area in the Region where commercial crops are grown, increasing the total hectares. East/Tolaga Bay/Tokomaru Bay area is the second largest area of cropping in the Gisborne Region. This area also has ideal conditions for winter cropping with highly productive and versatile soils, derived from river-deposited sediments from the hill country, mixed with volcanic ash (Gisborne District Council, 2004). Motu/Matawai area as well as the Tiniroto have a harsher climate with colder winter's resulting in less desirable growing conditions for winter cropping. Despite this factors winter cropping is still prominent in these areas with crops being planted in summer when the soil is warmer and drier to provide feed for stock in the winter months. The East Cape/Ruatoria has a smaller total area of winter cropping perhaps due to isolation and money factors. Te Karaka/Whatatutu also has a small amount of winter cropping for unidentified reasons.

4.5 Water threat

There were several water threats posed by crops in the Gisborne Region. Water threats can occur from activities such as broken, flimsy fences enabling stock to wander, inadequate provision of troughs for stock and the use of streams or drains as drinking water, stock crossing waterways on the way to graze adjoining paddocks, or fences were positioned close to waterways. Break-feeding stock can also cause a major threat to the quality of water when fodder crops are grown right to the edge of rivers and streams with no fences to keep stock away from waterways.

As discussed in section 3.3, any actual or potential water threats were noted down and categorised into either a low, moderate, or high water threat. All moderate and high water threats were noted down and dealt with back in the office. Identifying water threats posed by crops is a very important component to the winter crop survey, as the Gisborne Regional Freshwater Plan has new rules that relate directly to intensively farmed stock and winter intensive grazing. Although the majority of crops did not pose a water threat there was still 437.31 ha that did, thus including both moderate and high threats. Most of the water threats were posed from non-fenced waterways with cattle grazing in or next to a stream with no fence. Going forward it would be best to advise property owners with any water threats identified from crops on their property and remind them of the new rules set out in the plan and the importance of keeping stock out of waterways.

4.6 Limitations and benefits

The winter crop survey provides multiple benefits to the region. The survey's benefits include the identification of major, common, and minor crop patterns, identification of water threats, assist with farm environment plans, and informing the public on crop trends in the Region. It is particularly beneficial as there are new rules under the proposed Regional Freshwater Plan, outlined in section 1.1 that relate directly to intensively farmed stock and winter intensive grazing. The winter crop survey also provides economical information regarding the Gisborne region as commercial crops and agriculture have significant contributions to the region's economy.

Despite the benefits there are several limitations of the Winter Crop Survey. The main limitation is the visibility of crops as the survey only includes crops visible from public roads. Fodder crops cannot therefore be identified if they are too far away or blocked by obstructions, thus not giving a true representation of the area and patterns of crops throughout the region. Another limitation for the survey is incorrect crop identification. Some feeding crops can be difficult to identify if they have just been planted, or if they have been eaten out. Some crops can also look the same ie kale and rape, and with different staff doing the survey each year it can be very easy to identify similar looking crops incorrectly. When crop identification was difficult, photos were taken and then analysed in the office. If the crop could not be identified it was recorded as 'other'.

5.0 Conclusion

The 2017 Winter Crop Survey was conducted between the 29th May and the 14th June. This was the third winter crop survey to be completed for the Gisborne Region. The winter crop survey is an information gathering exercise with the purpose of identifying the different types of winter crops that are being grown throughout the region that are intended for animal consumption, and the area that they cover. During the survey, the crop type along with several other factors were recorded. These factors included livestock, whether stock were break-fed or grazed on the crop, and whether the crop posed a water threat or not. The data was also recorded and categorised into which area it was in, the different areas being the Poverty Bay Flats, East/Tolaga/Tokomaru, Motu/Matawai, Tiniroto, East Cape/Ruatoria, and Te Karaka/Whatatutu. This data is then used to assist in the management of the region's

physical resources which links back to the section of the Proposed Freshwater Plan that refers to intensely farmed crops.

There was a total of 2077.25 ha of winter crops recorded for the 2017 winter crop survey, excluding the total area of pasture (5298.51 ha) and to be planted area (835.82 ha). Fodder crops identified in this survey include cauliflower/broccoli, chicory, chicory mix, chicory/plantain, fodder beat, forage rape, kale/chou moellier, leafy turnip, lettuce/cabbage, Lucerne, oats, plantain, plantain mix, swede, and turnip. Of these crops plantain was the most prominent as it covered a significantly larger area compared to the remaining crop types. The other major crop types were unknown, leafy turnip, chicory, and kale/chou moellier. 279.42 ha of commercial winter crops of lettuce/cabbage and cauliflower/broccoli were also recorded. Minor crops consisted of fodder beet, forage rape, Lucerne, oats, other, turnip, chicory/plantain, chicory mix, and plantain mix. The crop type's trend and characteristics has differed throughout the 3 winter crop surveys that have been conducted. The Poverty Bay Flats continues to be the area with the largest amount of winter crops in the District. Plantain has also remained to be the most common crop type, while unknown crops remains to be the second most common crop. Commercial crops has increased in area, while the minor/common crops recorded remained reasonably the same with some slight increases or decreases. 437.31 ha of the winter crops posed a water threat which has increased from the 2016 crop survey. The total area of break-fed crops has decreased in total area significantly between each survey, this being perhaps due to the earlier timing it was conducted. As further winter crop surveys are conducted further trends in winter crops grown throughout the region will be able to be identified.

6.0 References

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7.0 Appendix 1

	Hectares																				
	Gisborne Region	Gisborne Region	Gisborne Region	Poverty Bay Flats	Poverty Bay Flats	Poverty Bay Flats	Te Karaka/ Whatatutu	Te Karaka/ Whatatutu	Te Karaka/ Whatatutu	Motu/ Matawai	Motu/ Matawai	Motu/ Matawai	Tiniroto	Tiniroto	Tiniroto	East/Tolaga /Tokomaru	East/Tolaga /Tokomaru	East/Tolaga/ Tokomaru	East Cape/ Ruatoria	East Cape/ Ruatoria	East Cape/ Ruatoria
Crop	**2015**	**2016**	**2017**	**2015**	**2016**	**2017**	**2015**	**2016**	**2017**	**2015**	**2016**	**2017**	**2015**	**2016**	**2017**	**2015**	**2016**	**2017**	**2015**	**2016**	**2017**
Barley	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cauliflower/Broccoli	0.00	6.77	138.88	0.00	6.77	138.88	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Chicory	137.69	90.83	192.12	133.49	80.89	48.69	4.20	7.97	15.10	0.00	0.00	12.53	0.00	0.00	24.23	0.00	1.98	62.97	0.00	0.00	28.61
Chicory Mix	25.24656	37.66305	7.526392	6.82	20.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	18.42	0.00	0.00	0.00	0.00	7.53	0.00	17.39	0.00
Chicory/Plantain	0.00	0.00	8.26	0.00	0.00	8.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Clover	0.00	0.00	3.97	0.00	0.00	3.97	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Clover Mix	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fodder Beet	27.88	41.71	60.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.26	25.66	11.02	17.62	16.05	49.01
Forage Rape	0.00	0.00	64.99	0.00	0.00	8.21	0.00	0.00	0.00	0.00	0.00	2.89	0.00	0.00	34.48	0.00	0.00	4.61	0.00	0.00	14.80
Kale/Chou Moellier	252.1577	15.37339	189.7161	0.00	0.00	11.42	0.00	0.00	0.00	99.22	0.00	147.87	7.81	0.00	27.93	82.92	0.00	2.49	62.21	15.37	0.00
Leafy Turnip	0.00	113.63	198.78	0.00	6.05	145.57	0.00	14.55	0.00	0.00	49.16	44.40	0.00	4.06	0.00	0.00	39.82	0.00	0.00	0.00	8.81
Lettuce/Cabbage	0.00	52.78	140.54	0.00	52.78	140.54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lucerne	301.94	97.95	62.66	49.89	22.93	58.89	87.68	0.00	0.00	8.94	0.00	3.77	0.00	0.00	0.00	0.00	0.00	0.00	155.42	75.02	0.00
Lucerne Mix	16.42	43.42	0.00	0.00	0.00	0.00	1.05	0.00	0.00	0.00	4.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.37	38.97	0.00
Lupin	3.73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.73	0.00	0.00
Oats	177.53	60.89	62.59	59.77	6.67	22.40	83.61	16.61	31.56	0.00	0.00	4.68	0.00	0.00	3.96	30.00	31.60	0.00	4.15	6.01	0.00
Other	14.75	0.00	31.98	6.02	0.00	23.94	0.00	0.00	8.04	0.00	0.00	0.00	0.00	0.00	0.00	8.73	0.00	0.00	0.00	0.00	0.00
Pasture	393.44	4788.21	5298.51	108.38	1322.32	0.00	110.47	275.56	267.01	13.73	111.30	169.69	10.98	8.02	42.42	42.03	1674.27	1709.60	107.85	1396.73	1406.34
Plantain	805.81	676.35	583.73	364.37	114.13	188.05	22.19	114.13	11.53	46.45	53.39	18.70	50.27	76.47	141.89	133.23	162.08	127.56	189.31	156.16	96.00
Plantain Mix	174.42	334.82	61.55	42.99	154.56	37.09	4.83	13.08	0.00	26.30	0.00	0.00	2.24	36.52	0.00	76.78	26.53	11.65	21.28	104.13	12.81
Swede	69.08	68.55	0.00	0.00	0.00	0.00	35.81	0.00	0.00	33.27	68.55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
To Be Planted	0.00	365.14	835.82	0.00	0.00	0.00	0.00	0.00	2.37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	365.14	207.80	0.00	0.00	0.00
Turnip	30.01	111.63	38.80	17.03	0.00	0.00	0.00	0.00	0.00	12.98	88.86	23.33	0.00	22.76	15.47	0.00	0.00	0.00	0.00	0.00	0.00
Unknown	385.3331	445.4422	231.1213	2.79807	81.97	15.00	57.61	19.22	5.98	164.45	191.48	28.51	0.00	64.06	34.94	148.95	84.93	74.46	11.52	3.79	72.24
Total	2815.42	7351.16	8211.58	791.55	1869.33	850.91	407.44	461.13	341.60	405.35	567.18	456.36	89.72	211.89	325.32	532.90	2412.01	2219.69	588.45	1829.62	1688.61