Kauri Rescue: Community Engagement In A Citizen Science Biosecurity Project

Prepared For:

Kauri Rescue Trust

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Cover Photo: Kauri Rescue citizen scientists treated kauri using phosphite. *Marie McEntee*

1.0 Introduction

1.1 Background

Kauri Dieback

Kauri dieback is a disease affecting New Zealand kauri that is caused by individual trees becoming infected by the pathogen *Phytophthora agathidicida*. This organism lives in the soil and can be naturally transported in the environment by water. It infects kauri trees by entering the plant's vascular system through the roots and causes a range of symptoms, most noticeable trunk lesions that bleed a white sap, and yellowing of foliage. In advanced stages of infection the tree becomes defoliated before it dies from the inability to move water and nutrients around the plant through its vascular system.

The causative pathogen can also be moved through the environment by animals and humans moving through forest areas that have *Phytophthora agathidicida* and transporting it to new sites by inadvertently carrying soil, especially muddy soil. Humans can carry infected soil within and between forest areas on footwear and other equipment they take into forest areas and wild animals with large home ranges, especially pigs, can carry soil in their hooves. Because pigs also disturb soil while feeding they are potentially key vectors for the spread of kauri dieback.

Kauri trees do not have immunity to an infection of *Phytophthora agathidicida* and once infected, trees of all sizes begin to gradually lose vigour as the infection becomes established and spreads throughout its tissues. Tree death is inevitable and currently there are no available techniques to control *Phytophthora agathidicida* in the environment to prevent either its continued spread or infection of trees.

Left unchecked, *Phytophthora agathidicida* has the potential to cause the extinction of New Zealand kauri and the ecological collapse of remaining and recovering kauri forests throughout the natural range of kauri across the northern half of New Zealand's North Island and adjacent offshore islands.

Treatment

The principal response to slow the spread of kauri dieback in affected forest areas and reduce the likelihood of its spread between forest areas has been to restrict human visitors' access to affected forest areas. This has led to widespread forest closures. It has also led to the widespread installation of forest hygiene cleaning stations at forest entry points with the requirement that forest visitors clean and sterilise their footwear when both entering and leaving the forest. Once inside the forest, visitors are encouraged to stay on formed paths that are urgently being upgraded to prevent them becoming muddy.

Techniques to treat individual kauri trees infected with kauri dieback are also being developed and tested. One of these methods is the injection into the tree of a liquid solution of phosphite, a reduced form of phosphate, that acts as a biostimulant to promote the growth of roots. This technique is used in horticultural settings to treat avocado trees that are infected with a similar *Phytophthora* pathogen.

Infected kauri trees are treated by drilling small holes through the bark around the circumference of the trunk and inserting into each of these a spring loaded syringe that slowly injects the phosphite solution directly into the trees conductive tissues. This treatment does not directly attack *Phytophthora agathidicida*, rather it stimulates tree growth responses to outpace the developing infection. Post treatment, the injection holes are sealed with silicone.

Because of the widespread distribution of kauri dieback across New Zealand's kauri lands the response to kauri dieback is a function of the ownership of the land where infected kauri trees are located. The Department of Conservation manages very large areas of crown owned kauri forest and local authorities also control reserves and other areas of kauri forest in a patchwork of jurisdictions at both district and regional levels.

Significant areas of important kauri forest are also privately owned in both rural and suburban settings and these may adjoin publicly owned kauri forests. These forests contain some significant old growth kauri forest that are worthy of protection in their own right but they also form a potentially significant disease reservoir once kauri dieback is established within them.

While public authorities do have powers to be able to require kauri dieback management actions on all types of land, through the provisions of the Biosecurity Act, they do not have the resources, either financial or logistical, to be able to carry this out. Instead the response to kauri dieback has been based on public advocacy and education with enforcement only being used in extreme instances, such as blatant disregard for statutory forest closures.

Kauri Rescue

The challenge of how to effectively extend a kauri dieback advocacy, education and experimental tree treatment programme onto private land led to the establishment of a publically funded citizen science research project co-ordinated through Plant and Food, a Crown Research Institute. This project operated for three years from approximately the beginning of 2017 to the end of 2019.

The project drew together a project management group with representatives from Plant and Food, community advocates, tangata whenua, Auckland Council and the University of Auckland. Its skill base included plant pathology, social science, mātauranga Māori, technical field expertise and community advocacy.

The project established community outreach programmes using online and traditional face to face engagement to recruit, into the project, community members with affected kauri trees. This was advanced using the brand identity “Kauri Rescue” to communicate the intention to positively influence the outcome of kauri dieback through implementation of the experimental phosphite treatment of infected kauri trees on private property.

In return for providing a treatment opportunity to people for their infected kauri trees, the project collected data on the long term efficacy of the treatment programme by regularly monitoring the health of treated kauri trees. Additionally, people's connection to kauri trees and kauri forest were investigated through a survey, and their competency with the treatment methodology through interviews and workshops.

Following the successful completion of the research programme, Kauri Rescue entered a transition phase through 2020 during which funding was uncertain and intermittent. During this period it effectively operated as an unincorporated community organisation with previous professional inputs mostly becoming personal in-kind support.

Kauri Rescue established a formal structure at the end of 2020 when it was restructured as a Charitable Trust. This long term legal framework provided surety to funders and completed the transformation from being a limited term research project to being a permanent community organisation able to address the evolving challenges of kauri dieback on privately and communally owned land.

Community Engagement

As part of a new tranche of funding provided to Kauri Rescue through the Biological Heritage National Science Challenge, within the Ngā Rākau Taketake – Saving our Iconic Trees

programme, this report summarises a forensic analysis of Kauri Rescue's community engagement over the five year period from its commencement in January 2017 through until May 2023 including:

- Three years as a citizen science research project
- One year as an unincorporated community organisation
- Almost 1.5 years as a charitable trust

This analysis uses Kauri Rescue's own community engagement data and has the objective of searching for patterns and trends that could inform both Kauri Rescue's ongoing development and the formation of similar community organisations that could address other biosecurity issues. There is already significant community engagement in biosecurity issues such as invasive predator control, however with increasing and emerging biosecurity threats the Kauri Rescue model could be an effective, widespread and rapid community response to other biosecurity issues including, for example, myrtle rust or possibly even *Caulerpa* seaweed.

1.2 Data Files

Data supplied by Kauri Rescue for the forensic analysis of their historic community engagement was included in three Excel spreadsheets received as attachments to email correspondence. Upon receipt, the three spreadsheets were duplicated and the originals were filed in a data archive to preserve their integrity. The duplicate copies of each spreadsheet were then used for the data analysis.

Each spreadsheet contained worksheets that contained the data records of one subpopulation of the overall population of people who engaged with Kauri Rescue, including:

- The community of the general public
- People who became project ambassadors
- People who became project participants with subpopulation segments of
    - Project participants with kauri dieback confirmed
    - Project participants with suspected kauri dieback under investigation
    - Project participants with suspected but unconfirmed kauri dieback

The worksheets each contained data in an array of spreadsheet cells where each spreadsheet column contained one data field and each spreadsheet row contained one data record. The details of each of the three spreadsheets and the results of their analysis are considered separately in the following sections.

Worksheets were populated with data either by manual entry or by a response received from a linked Google Form that could be completed and submitted to the receiving spreadsheet. Worksheet data received from a Google Form could then either be edited directly in the receiving spreadsheet or by amending the response on the Google Form and resubmitting the form data to the receiving spreadsheet.

1.3 Data Analysis

The contents of each data file has been described and the data it contains has then been descriptively analysed with results presented in tables and graphs. This is commonly frequency data that is presented as count totals and percentage frequency. Some time series and sequence data is also summarised where appropriate. For each data file, variables that contain population level information, for example date of engagement, have been analysed. Variables that only contain individual level data, for example names, have not been analysed.

The data files contain significant amounts of private personal information so no data that identifies either an individual person, or an individual street address has been presented in this report. Where individual data records are summarised, any personal information has been anonymised using a unique reference number. Other identifiable information, especially address details, have been reduced to area level location, such as suburb, city or region.

1.4 Network Analysis

In addition to the forensic analysis of Kauri Rescue's community engagement data presented in this report, an interactive Kumu network analysis has also been developed. However, because of its interactive nature this is presented separately. This report does include a diagram to summarise the different subpopulations of the total Kauri Rescue engagement population, their relationship to each other and the movement of people into and between them.

In order to develop the Kumu network analysis the data contained in all the spreadsheet worksheets had to be reassembled into one spreadsheet to capture the full journey that each person who engaged with Kauri Rescue took throughout their relationship with Kauri Rescue. This resulted in one spreadsheet row containing all the information for one person's engagement with all the Kauri Rescue subpopulations. Once reassembly of the data had been completed the correct alignment of data rows from different source spreadsheets was checked by comparing and matching principally name, address and date details.

2.0 Community

2.1 Introduction

The Kauri Rescue Community dataset was designed to capture the initial engagement of everyone who was recruited to Kauri Rescue from its inception until the cutoff for data to enter this forensic analysis in May 2022. People who then further developed their engagement with Kauri Rescue moved to also be included on other relevant spreadsheets with their original record of engagement remaining in the Community dataset. For many engagements, this dataset was the sole record of a person's contact with Kauri Rescue as they did not deepen their relationship with Kauri Rescue.

2.2 Data

Data File

The spreadsheet containing the data about the Kauri Rescue Community was titled "Community Contact Spreadsheet for Marie_may22". It contained one worksheet titled "Sheet1" that contained 23 data fields as spreadsheet columns and 926 data records as spreadsheet rows.

Data Records

Each data record recorded the details of one person who engaged with Kauri Rescue and the data fields for each record included:

- Initial contact form url - data records were entered into this sheet using a linked Google Form and this data field recorded the URL of the Google Form response that created each data record
- Timestamp - a record of the date and time that each Google Form response was received by the spreadsheet

- Date (initial contact) - the date of the first engagement by the person. Because some engagements were recorded manually and then entered into the spreadsheet later, using the linked Google Form, the date of the initial contact could predate the timestamp.
- First Name - the first name of the person
- Last Name - the surname of the person
- Email - the supplied email address of the person
- Phone Number - the supplied landline or mobile phone number of the person
- Flat - The first of four supplied contact address records for the person
- Street Address - The second of four supplied contact address records for the person
- Suburb - The third of four supplied contact address records for the person
- City / Region - The fourth of four supplied contact address records for the person
- Contact Channel - The engagement channel through which the person made contact
- Contact Purpose - A list of reasons that each person engaged with Kauri Rescue where more than one reason could be selected
- Purpose Notes - A data field where people could record notes about their engagement
- Response - A record of the initial Kauri Rescue response to each engagement
- Response Date - The date of the initial response to each engagement
- Action Taken - A record of any Kauri Rescue action that followed the initial response
- Date of Action - The date of any follow up action
- Recruitment Type - A record of whether the person wished to become a Kauri Rescue participant or ambassador where more than one recruitment type could be selected
- Symptoms Reported - A record of kauri dieback symptoms that each person wished to report they had observed on kauri trees on their property where more than one symptom could be selected
- Inspection/sample to be done by - A record of whether a site inspection or sample was to be undertaken by Kauri Rescue or the relevant council
- Unlabeled - A data field that had no column heading but which contained sundry notes
- Action - A data field that recorded sundry notes about subsequent follow up action

Data Density

Other than the Timestamp data field, no variable was 100% complete indicating that the Google Form that connected to this spreadsheet did not contain required data fields that people had to complete before submitting the form. Three variables were only missing one data point, one variable was missing three data points and two variables were missing four data points. Of a total of 21,298 potential data points the dataset contained 14,506 data points making it 68.1% complete.

The single data sheet also contained 260 comments in individual data cells. All of these were “Responder updated this value” indicating that the person who submitted the Google Form to

create the data record subsequently amended their response. The spreadsheet did not record these edit changes so no information was available about the information contained in the original submission of the Google form.

2.3 Analysis

The Community data file included 23 variables however only 12 of these were included in the analysis. These were:

- Date (initial contact)
- Street Address
- Suburb
- Contact Channel
- Contact Purpose
- Response
- Response Date
- Action Taken
- Date of Action
- Recruitment Type
- Symptoms Reported
- Inspection/sample to be done by

The remaining 11 variables contained information that was specific to individual people including Initial contact form url (one data field) Timestamp (one data field), Name (two data fields), Contact Information (four data fields) and person specific information (three data fields). The "Street Address" and "Suburb" contact information variables were concatenated and analysed as "Location" data and all three "Date" variables were combined with the "Response" and "Action Taken" variables and analysed as "Engagement" data. The "Symptoms Reported" and "Inspection/sample to be done by" variables were analysed as "Dieback" data resulting in the Community data being analysed for seven attributes including:

- Date (initial contact)
- Contact Channel
- Contact Purpose
- Recruitment Type
- Location
- Engagement
- Dieback

Date of Contact

The variable "Date (initial contact)" was 99.7% complete for the 926 data records in the Community data file. The range of this variable was ordered chronologically and the number of occurrences in each month was counted and graphed to reveal the pattern of Community engagement over time, including the cumulative number of Community engagements.

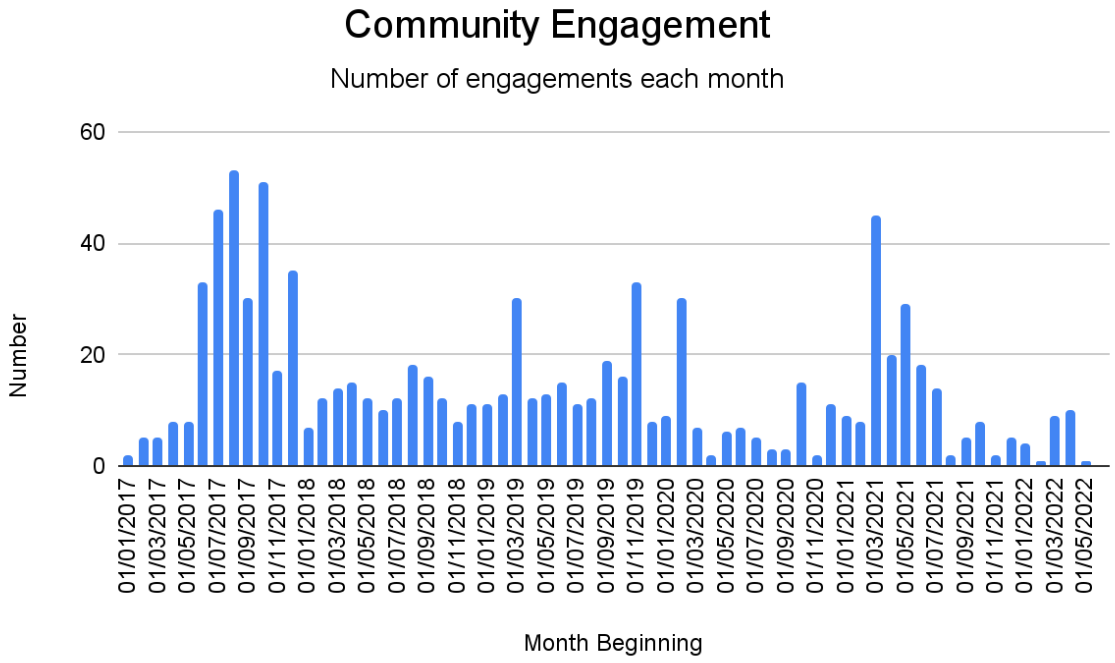

Figure 2.1: Number of Community engagements each month from Jan 2017 to May 2022

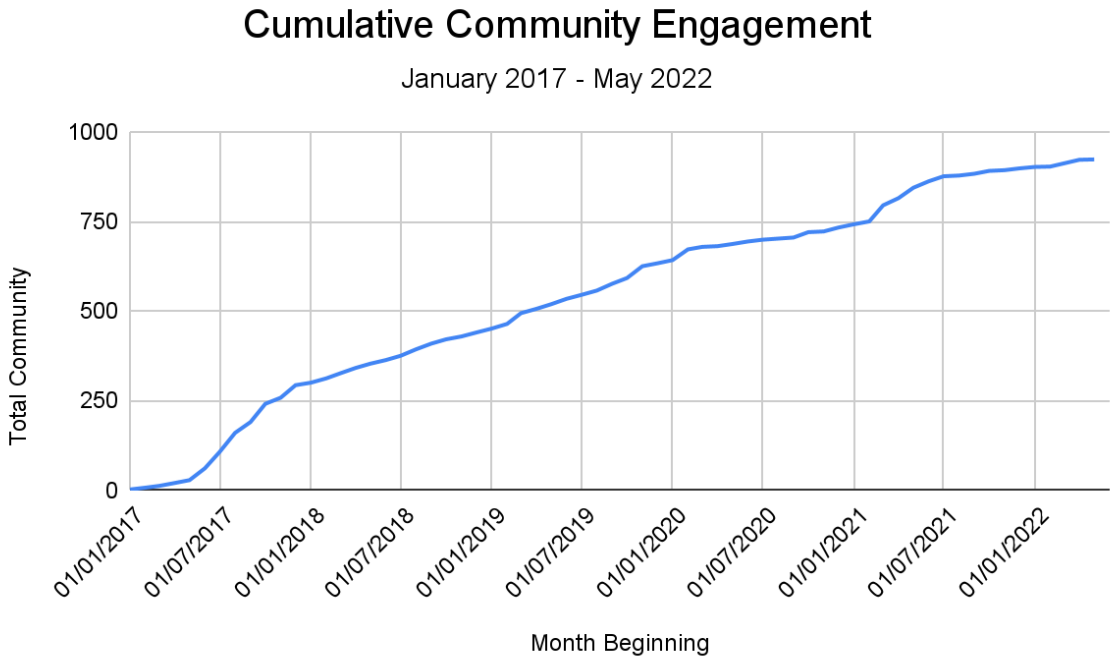

Figure 2.2: Cumulative number of Community recruited from January 2017 to May 2022

Community engagement data included the 64 month period from 21 January 2017 to 14 May 2022. Monthly Community engagement varied between one and 53 engagements per month with an average of 14.4 engagements per month. The monthly maximum of 53 Community engagements occurred in the single calendar month of August 2017.

Contact Channel

The variable "Contact Channel" was 99.9% complete for the 926 data records in the Community data file. There were six different responses for this variable and the number of occurrences of each of these was counted, tabulated and graphed.

Table 2.1: Frequency of Community recruitment through different Contact Channels.

Contact Channel			
Total Contacts	925		
%age Total Community	99.9%		
Contact Channel	**Contacts**	**Percent**	**Cumulative**
Event	399	43.1%	43.1%
Website	334	36.1%	79.2%
Team Member	93	10.1%	89.3%
Social Media	63	6.8%	96.1%
Council	20	2.2%	98.3%
Email	16	1.7%	100.0%
TOTAL	925	100.0%	

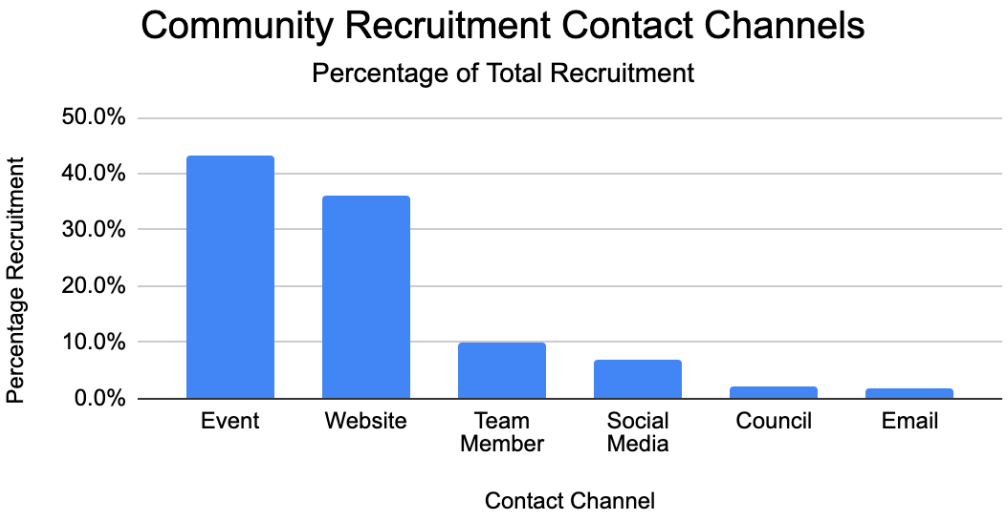

Figure 2.3: Percentage of total Community recruited through Contact Channels

These contact channels can be combined into higher level groups to show that 53.1% of Community contacts were from personal face to face engagements (Team Member and Event) and 44.6% of Community contacts were from digital engagements (Website, Social Media and Email). A further 2.2% of Community contacts were referrals from a Council.

Contact Purpose

The variable "Contact Purpose" was 99.9% complete for the 926 data records in the Community data file. There were six different contact purposes recorded and the frequency of each of these was counted and tabulated. Many of the data records included multiple contact purposes and in total the 926 data records recorded 1,069 individual contact purposes.

Table 2.2: Frequency of different Community recruitment Contact Purposes.

Contact Purpose			
Total Contacts	925		
%age Total Community	99.9%		
Contact Purpose	**Contacts**	**Percent**	**Cumulative**
Site inspection	391	36.6%	36.6%
Newsletter subscription	284	26.6%	63.1%
Volunteer offer	208	19.5%	82.6%
Request for engagement	147	13.8%	96.4%
General interest	28	2.6%	99.0%
Media	11	1.0%	100.0%
TOTAL	**1,069**	**100.0%**	

The most common Contact Purpose was "Site Inspection" (36.6%) and the second most common was "Newsletter Subscription" (26.6%) suggesting that people who engaged wanted to stay in touch with Kauri Rescue rather than engage just once. The Contact Purpose, "Request for Engagement" was listed as 13.8% of all Contact Purposes and if this is interpreted as being a Contact Purpose similar to "Site Inspection" then 50.4% of Community engagements identified a Contact Purpose where they sought a direct personal interaction with Kauri Rescue. "Volunteer offer" was the third most common Contact Purpose and these engagements were likely moved to the Ambassador dataset.

Recruitment Type

Of the total of 926 Community engagement data records, 622 records (67.2%) recorded at least one "Recruitment Type". There were only two different responses available for this variable and the frequency of occurrence of each was counted and tabulated.

Table 2.3: Frequency of different Community Recruitment Types.

Recruitment Type			
Total Recruitment	622		
%age Total Community	67.2%		
Recruitment	**Frequency**	**Percent**	**Cumulative**
Participant	403	43.5%	43.5%
Ambassador	211	22.8%	66.3%
Participant, Ambassador	7	0.8%	67.1%
Ambassador, None	1	0.1%	67.2%
No Recruitment	304	32.8%	100.0%

Community engagements in the Recruitment Type data also reflected a strong wish to have a direct personal interaction with Kauri Rescue as 44.3% of engagements listed "Participant" either solely (43.5%) or together with "Ambassador" (0.8%). This is a close approximation of the potential 50.4% of engagements that indicated this type of engagement in the Contact Purpose data. "Ambassador" (23.7%) was chosen by Community engagements at approximately half the frequency of "Participant".

Location

To analyse the "Location" of Community engagements the Community data record address details were concatenated and then reduced to a "suburb" location level. Of the total of 926 Community data records, 646 records (69.8%) included sufficient physical address information to allow a suburb to be determined.

Suburbs were then combined to reduce duplication. For example records of Little Huia and Huia were combined to be Huia. Locations within the Auckland region were kept separate for suburb, while locations outside Auckland were combined into regional locations, such as Whangarei. International records occurred from Australia and the United States of America.

Table 2.4: Locations from where Community were recruited.

Locations of Community Recruitment			
Location	**Community**	**Percent**	**Cumulative**
Titirangi	292	45.2%	45.2%
Laingholm	31	4.8%	50.0%
Oratia	17	2.6%	52.6%
Whangarei	16	2.5%	55.1%
Karekare	15	2.3%	57.4%
Piha	14	2.2%	59.6%
Henderson	10	1.5%	61.1%
Awhitu	10	1.5%	62.7%
Kaukapakapa	10	1.5%	64.2%
Glen Eden	9	1.4%	65.6%
Huia	8	1.2%	66.9%
Waiheke Island	8	1.2%	68.1%
Parau	7	1.1%	69.2%
Te Henga	7	1.1%	70.3%
Waimauku	7	1.1%	71.4%
Glenfield	6	0.9%	72.3%
Te Atatu	6	0.9%	73.2%
Waiatarua	6	0.9%	74.1%
Warkworth	6	0.9%	75.1%
Remuera	5	0.8%	75.9%
Waitakere	5	0.8%	76.6%

A total of 120 locations were recorded from where Community engagements originated. Only locations from where more than five Community engagements originated have been tabulated. Overall, Community engagement was principally concentrated in the Auckland suburb of Titirangi (45.2%) with a further 128 Community engagements (19.8%) originating from 11 adjacent and nearby locations closely associated with the Waitakere Ranges. Therefore, 65% of Community engagements for whom Location data was available originated from 10% of recorded locations. The remaining 35% of Community engagements originated from 90% of locations, an average of just 2.1 Community engagements per Location. The relative dominance of Community engagement from Titirangi is striking when the frequency of Community engagement from different tabulated locations is illustrated graphically.

Figure 2.4: Percentage of total Community recruited from main locations

Engagement

Of the total of 926 Community data records, 922 records (99.6%) recorded a specific Kauri Rescue response action that initially followed the person's engagement with Kauri Rescue. Many of these data records included multiple response actions and in total the 922 data records recorded 1,612 initial response actions. Additionally, the data file also recorded further followup engagement actions taken by Kauri Rescue following the initial response action.

Table 2.5: Frequency of initial Response Actions implemented.

Initial Response Action		
Action	**Frequency**	**Percent**
TOTAL	1,612	100%
Passed to	754	81.8%
Added to newsletter database	742	80.5%
Inspection booked	116	12.6%

Of the 922 data records that recorded a specific initial response action, 754 (82.3%) included the details of the person being "Passed on" to at least one, and sometimes several individual Kauri Rescue team members, although there is no information about what the receiving Kauri Rescue team member did with the information. Additionally, 742 (81.0%) response actions recorded the person being added to the Kauri Rescue newsletter database and 116 (12.7%) recorded that kauri dieback inspections were booked. The data file does not record if these inspections were completed or what they found.

Following the initial response action, 360 data records (38.9%) record a follow up response action. These records varied in their nature including some that recorded the person was "recruited as an Ambassador".

For 916 of the 922 data records (99.3%) that recorded an initial response action and for 211 of the 360 follow up response actions (58.6%) the date of response was also recorded. Therefore, the date of the initial contact is followed by the date of the initial Kauri Rescue response action and the date of the followup response action to create a timeline of engagement between the person and Kauri Rescue. These sequences of dates have been tabulated and summarised to analyse the Kauri Rescue response to Community engagements.

Table 2.6: Frequency of Response times, in days, from date of initial contact.

Initial Response			
Total Initial Responses	922		
%age Total Community	99.6%		
Response Time (Days)	**Frequency**	**Percent**	**Cumulative**
-30	2	0.2%	0.2%
-22	1	0.1%	0.3%
-10	1	0.1%	0.4%
-1	4	0.4%	0.9%
0	332	36.3%	37.2%
1	92	10.1%	47.2%
2	71	7.8%	55.0%
3	73	8.0%	63.0%
4	62	6.8%	69.7%
5	59	6.4%	76.2%
6	16	1.7%	77.9%
7	23	2.5%	80.4%
8	19	2.1%	82.5%
9	17	1.9%	84.4%
10	3	0.3%	84.7%

Response Time (Days)	Frequency	Percent	Cumulative
11	16	1.7%	86.4%
12	15	1.6%	88.1%
13	12	1.3%	89.4%
14	2	0.2%	89.6%
15	14	1.5%	91.1%
16	6	0.7%	91.8%
17	4	0.4%	92.2%
18	2	0.2%	92.5%
20	2	0.2%	92.7%
21	2	0.2%	92.9%
22	2	0.2%	93.1%
23	2	0.2%	93.3%
24	4	0.4%	93.8%
26	3	0.3%	94.1%
27	3	0.3%	94.4%
29	1	0.1%	94.5%
30	4	0.4%	95.0%
31	6	0.7%	95.6%
32	1	0.1%	95.7%
34	9	1.0%	96.7%
35	1	0.1%	96.8%
37	1	0.1%	96.9%
40	2	0.2%	97.2%
47	2	0.2%	97.4%
57	7	0.8%	98.1%
61	4	0.4%	98.6%
63	5	0.5%	99.1%
67	3	0.3%	99.5%
69	1	0.1%	99.6%
124	1	0.1%	99.7%
188	1	0.1%	99.8%
370	1	0.1%	99.9%

Eight data records recorded an initial response on a date before the person's date of initial contact suggesting these are recording errors. For records where the initial response date followed the date of initial contact the average initial response action followed the date of contact by 6.8 days with 75% of responses being completed in five days, and 90% of responses being completed in 15 days. Three responses exceeded 100 days and the maximum response time was 370 days. These could be actual occurrences, or they could be due to a date being incorrectly entered into the data file.

Table 2.7: Frequency of follow up Action times, in days, from date of Response.

Followup Action			
Total Followup Actions	360		
%age Total Community	38.9%		
Action Time (Days)	**Frequency**	**Percent**	**Cumulative**
-118	1	0.5%	0.5%
-83	1	0.5%	0.9%
-18	1	0.5%	1.4%
0	156	73.9%	75.4%
1	9	4.3%	79.6%
2	1	0.5%	80.1%
3	3	1.4%	81.5%
4	2	0.9%	82.5%
5	1	0.5%	82.9%
6	3	1.4%	84.4%
7	1	0.5%	84.8%
9	2	0.9%	85.8%
10	2	0.9%	86.7%
11	2	0.9%	87.7%
12	5	2.4%	90.0%
14	1	0.5%	90.5%
15	2	0.9%	91.5%
17	2	0.9%	92.4%
20	1	0.5%	92.9%
21	1	0.5%	93.4%
24	1	0.5%	93.8%
30	1	0.5%	94.3%
45	1	0.5%	94.8%
71	1	0.5%	95.3%
80	1	0.5%	95.7%
89	1	0.5%	96.2%
96	1	0.5%	96.7%
127	3	1.4%	98.1%
159	1	0.5%	98.6%
163	1	0.5%	99.1%
231	1	0.5%	99.5%
276	1	0.5%	100.0%

Three followup response actions were also recorded as predating the initial response action. The average recorded followup response action followed the initial response action by 9.3 days

with 75% of followup responses being completed in one day and 90% of responses being completed 15 days after the initial response. Maximum followup response time was 276 days.

Dieback

Of the total of 926 Community engagement data records, 279 (30.1%) recorded either kauri dieback Symptoms or a kauri dieback Inspection/sample. A total of 262 engagement records (28.3%) recorded that kauri trees on their property were exhibiting symptoms of kauri dieback and a total of 406 symptoms were reported including "Canopy decline" (44.1%) and "Basal bleeds" (39.9%) that were recorded at a similar frequency. "Dead trees" made up 15.5% of reported symptoms.

Table 2.8: Frequency of different Dieback symptoms reported.

Symptoms Reported			
Total Symptoms Reports	262		
%age Total Community	28.3%		
Symptoms	**Frequency**	**Percent**	**Cumulative**
Canopy decline	179	44.1%	44.1%
Basal bleeds	162	39.9%	84.0%
Dead trees	63	15.5%	99.5%
Lichen / moss / algae	2	0.5%	100.0%
TOTAL	**406**		

Table 2.9: Frequency of allocation of Dieback Checks.

Dieback Checks			
Total Dieback Checks	245		
%age Total Community	26.5%		
Check to be done by	**Frequency**	**Percent**	**Cumulative**
Relevant Council	231	91.7%	91.7%
Kauri Rescue	21	8.3%	100.0%
TOTAL	**252**		

The Community engagement dataset recorded a total of 252 kauri dieback checks in the "Inspection/sample to be done by" data field on 245 data records. Overwhelmingly, 91.7% of these checks were allocated to the "Relevant Council" and only 8.3% were allocated to "Kauri Rescue". The dataset does not record the nature of the checks, which could have been visual checks of tree health, or more specific soil tests for *Phytophthora agathidicida*, if these checks were completed, who completed them or what they found.

The majority (81.7%) of the Community engagement records that recorded kauri dieback symptoms also recorded an “inspection/sample to be done by”. However, from the total of 262 engagement records that reported kauri dieback symptoms, 34 of these (13.0%) did not record any kauri dieback checks while 17 of the 245 engagement records (6.9%) that did record kauri dieback checks did so without any kauri dieback symptoms being recorded.

2.4 Discussion

The pattern of Community engagement revealed by the graph of cumulative engagements identifies a number of phases in the development of Kauri Rescue from its establishment as a research project until the cutoff date for data to enter this forensic analysis. During this period Kauri Rescue has taken three main structural forms including:

- A research project between approximately 1/1/17 and 31/12/19
- A transitional unincorporated community organisation between 1/1/20 and 31/12/20
- A charitable trust from 1/1/21 to the data cutoff on 31/5/22

These three periods can be readily identified from the graph of cumulative community engagement where the slope of the graph changes abruptly. However, within these three periods different phases of development with characteristically different rates of community engagement can also be identified as follows:

- Phase 1: "Project - Establishment" - 1/1/17 - 31/5/17
    - Average rate of Community engagement was 5.6 per month
- Phase 2: "Project - Expansion" - 1/6/17 - 31/12/17
    - Average rate of Community engagement accelerated to 37.8 per month
- Phase 3: "Project - Operation" - 1/1/18 - 31/12/19
    - Average rate of Community engagement settled to 14.2 per month
- Phase 4: "Transition" - 1/1/20 - 31/12/20
    - Average rate of Community engagement slowed to 8.3 per month
- Phase 5: "Charity"- 1/1/21 - 31/5/22
    - Average rate of Community engagement increased to 11.2 per month

The Charity phase also showed an initial acceleration of community engagement rate from 8.3 per month during the Transition phase to 22.0 per month for the first seven months of the Charity phase before slowing dramatically to the lowest rate of 4.7 per month for the remaining 10 months of the phase period.

Therefore, the Charity phase broadly resembles the Expansion and Operation phases of the Project period albeit in both cases the rate of community engagement was lower. This "restarting" of community engagement activities after a period of quiescence during the Transition phase shows the same level of community engagement that was recorded following the initial launch of Kauri Rescue could not be achieved. This was possibly also a result of both restrictions and people's caution associated with the Covid-19 pandemic.

Across the whole period, the Contact Channels that generated Community engagements were dominated by Events (43.1%) and Website (36.1%) with all face to face engagement channels generating 19.1% more engagements than digital channels. However, during the Charity phase, this pattern of engagement reversed with digital channels generating 44.2% more engagements than face to face engagements. Relative to digital channels, engagement through face to face engagement channels fell 50% during the Charity phase compared to the whole period. This marked reduction of engagements through the most effective mix of engagement channels is likely why the Charity phase did not achieve the same rate of community engagement as was achieved in earlier phases and the impacts of the Covid-19 pandemic was likely a significant cause of this, although the data sets contained no information to be able to investigate this.

The Contact Purpose data indicates that people who did engage with Kauri Rescue wanted to be actively involved in what was happening. They wanted to stay informed through newsletters, they wanted to help with what Kauri Rescue was doing but mostly they wanted their engagement to give them some help with trees on their property that they saw were being affected by kauri dieback and were dying.

The dominance of contact purposes (50.4%) that sought either a site inspection or another form of engagement suggests that the people who did engage with Kauri Rescue saw what was being offered to them as hope in an otherwise hopeless situation and an avenue through which they could at least "do something" to address the disease that was affecting their trees. This is reinforced by the Recruitment Type data where 410 out of 622 (65.9%) engagements selected recruitment types that indicated they wished to become Participants in the Kauri Rescue programme.

People also appeared to be well informed about kauri dieback and its effect on their trees as over a quarter of community engagements reported kauri dieback symptoms, especially canopy decline and basal bleeds. Concerningly, almost one in every six kauri dieback symptoms reported was of dead trees suggesting that many people who engaged with Kauri Rescue did so having witnessed advanced stages of kauri dieback on their property.

However, it is surprising that over 90% of kauri dieback checks that engagements sought were allocated to the "Relevant Council". While local councils had the resources and funding to undertake technical investigations, such as soil tests, this type of response carries with it the risk that Kauri Rescue could be perceived as being a de-facto Council organisation despite it promoting itself as a community organisation. It is also notable that almost one in seven people who engaged with Kauri Rescue and did report symptoms of kauri dieback apparently did not have an inspection or sample allocated either to the relevant Council or Kauri Rescue.

Kauri Rescue was very much grounded in its local community and centred around its focus of activity as 45.2% of engagements originated from the single Auckland suburb of Titirangi situated in the foothills of the Waitakere Ranges that have been seriously impacted by the spread and effects of kauri dieback. Fully 65% of Kauri Rescue community engagements originated from locations associated with the Waitakere Ranges whereas beyond this key focus area other locations only recorded an average of 2.1 community engagements each.

People who did engage with Kauri Rescue found a responsive organisation that reacted in a timely manner as 99.6% of community engagements received an initial response to their engagement within an average of a week, and often sooner. This generally included being added to the Kauri Rescue newsletter database to ensure they received ongoing communications. Beyond this, more than one in three people who engaged with Kauri Rescue received a further response within an average of 10 days after the initial response.

While some people did have "Inspections Booked", the most common initial Kauri Rescue response was that the person's name and contact details were "Passed on" but the Community engagement dataset does not specifically record either what came of the inspections that were booked or what the person who received the information did with it. It is highly likely that people who received these types of response to their engagement were enrolled in the Participant dataset but with these Kauri Rescue subpopulations being managed using separate data files there is no simple way to make this linkage between a person's engagement with Kauri Rescue, them requesting a site inspection, a site inspection being booked and them entering the pool of engagements who became participants who began treating trees.

3.0 Ambassadors

3.1 Introduction

Some people who engaged with Kauri Rescue were recruited to be Kauri Rescue Ambassadors. Details of these people were recorded in the Ambassadors dataset while the record of their initial engagement with Kauri Rescue remained in the Community dataset.

It is understood that those people who chose to deepen their relationship with Kauri Rescue to become an Ambassador were principally motivated to help Kauri Rescue to deliver its programme objectives, although some of them were also Kauri Rescue Participants who actively treated kauri dieback infected trees on their land. Kauri Rescue Ambassadors may also have helped other Participants to treat trees during community treatment "working bee" events.

3.2 Data

Data File

The spreadsheet containing the data about Kauri Rescue Ambassadors was titled "Ambassadors spreadsheet for Marie_may22". It contained one sheet titled "Sheet1" that contained 21 data fields as spreadsheet columns and 192 data records as spreadsheet rows.

Comparison of the data fields in this Ambassadors spreadsheet with the data fields in the Community Contacts spreadsheet indicated that generally, each data record for a person on the Ambassadors spreadsheet was formed by copying that person's data record from the Community spreadsheet and pasting it into the Ambassadors spreadsheet before manually overwriting the Column A data field "Initial contact form url" from the Community spreadsheet as the Ambassador spreadsheet "Volunteer offer" data field.

Data Records

Each data record recorded the details of one person who was recruited by Kauri Rescue as an Ambassador and the data fields for each record included:

- Volunteer offer - a Kauri Rescue data entry field to record the person's offer of volunteer help, such as "Treatment team", "door knocking" or "Stalls" and sometimes recorded with a location such as "Treatment team Kaukapakapa" or "North Coromandel help"
- Timestamp - a record of the date and time that each Google Form response was received as copied from the Community Spreadsheet
- Date (initial contact) - the "Date (initial contact)" data field copied from the Community Spreadsheet
- First Name - the "First Name" data field copied from the Community Spreadsheet
- Last Name - the "Last Name" data field copied from the Community Spreadsheet
- Email - the "Email" data field copied from the Community Spreadsheet
- Phone Number - the "Phone Number" data field copied from the Community Spreadsheet
- Flat - the "Flat" data field copied from the Community Spreadsheet
- Street Address - the "Street Address" data field copied from the Community Spreadsheet
- Suburb - the "Suburb" data field copied from the Community Spreadsheet
- City / Region - the "City / Region" data field copied from the Community Spreadsheet
- Contact Channel - the "Contact Channel" data field copied from the Community Spreadsheet
- Contact Purpose - the "Contact Purpose" data field copied from the Community Spreadsheet
- Purpose Notes - the "Purpose Notes" data field copied from the Community Spreadsheet
- Response - the "Response" data field copied from the Community Spreadsheet
- Response Date - the "Response Date" data field copied from the Community Spreadsheet
- Action Taken - the "Action Taken" data field copied from the Community Spreadsheet
- Date of Action - the "Date of Action" data field copied from the Community Spreadsheet
- Recruitment Type - the "Recruitment Type" data field copied from the Community Spreadsheet
- Unlabeled - the "Symptoms Reported" data field copied from the Community Spreadsheet
- Unlabeled - the "Inspection/sample to be done by" data field copied from the Community Spreadsheet

Data Density

The Date (initial contact), First Name, Contact Channel and Contact Purpose data fields were all 100% complete. Three variables were only missing one data point, two variables were missing two data points and one data field was missing three data points. Of a total of 4,032 potential data points the dataset contained 2,918 data points making it 72.4% complete.

Only one data record in the Ambassador spreadsheet did not contain a "Timestamp" data entry indicating this data record was manually entered directly to the Ambassador spreadsheet. Entries in other data fields for this data record also varied from the data record for the same person in the Community spreadsheet. However, this direct entry Ambassador spreadsheet data record was also a repeat record in this spreadsheet for the person where the first data record for the person was a copy and paste of their data record in the Community spreadsheet.

The single data sheet also contained 18 comments in individual data cells. All of these were "Responder updated this value" indicating that the person who submitted the Google Form to create the original data record in the Community Contact Spreadsheet subsequently amended their response.

3.3 Analysis

The Ambassador data file included 21 variables however only 10 of these were included in the analysis. These were:

- Volunteer offer
- Date (initial contact)
- Street Address
- Suburb
- Contact Channel
- Contact Purpose
- Response
- Response Date
- Date of Action
- Recruitment Type

The remaining 11 variables contained information that was not specific to Ambassador recruitment including Timestamp (one data field), Name (two data fields), Contact Information (four data fields) and person specific information (four data fields). The "Street Address" and "Suburb" data fields were concatenated and analysed as "Location" data and the "Date" data

fields were also combined with the "Response" data field and analysed as "Engagement" data resulting in the Ambassador data being analysed for seven attributes including:

- Date (initial contact)
- Contact Channel
- Contact Purpose
- Recruitment Type
- Location
- Volunteer offer
- Engagement

Date of Contact

The data field "Date (initial contact)" was 100% complete for the 192 data records in the Ambassador data file. The full range of this variable was ordered chronologically and the number of occurrences that fell in each calendar month was counted and graphed to reveal the pattern of Ambassador recruitment over time. This monthly Ambassador recruitment data was also compiled to illustrate the pattern over time of the cumulative number of Ambassadors recruited. By then converting the cumulative recruitment of Ambassadors to a monthly percentage of total Ambassador recruitment, a comparison could be made with the cumulative percentage engagement pattern of the Kauri Rescue community.

Figure 3.1: Number of Ambassadors recruited each month from March 2017 to March 2022

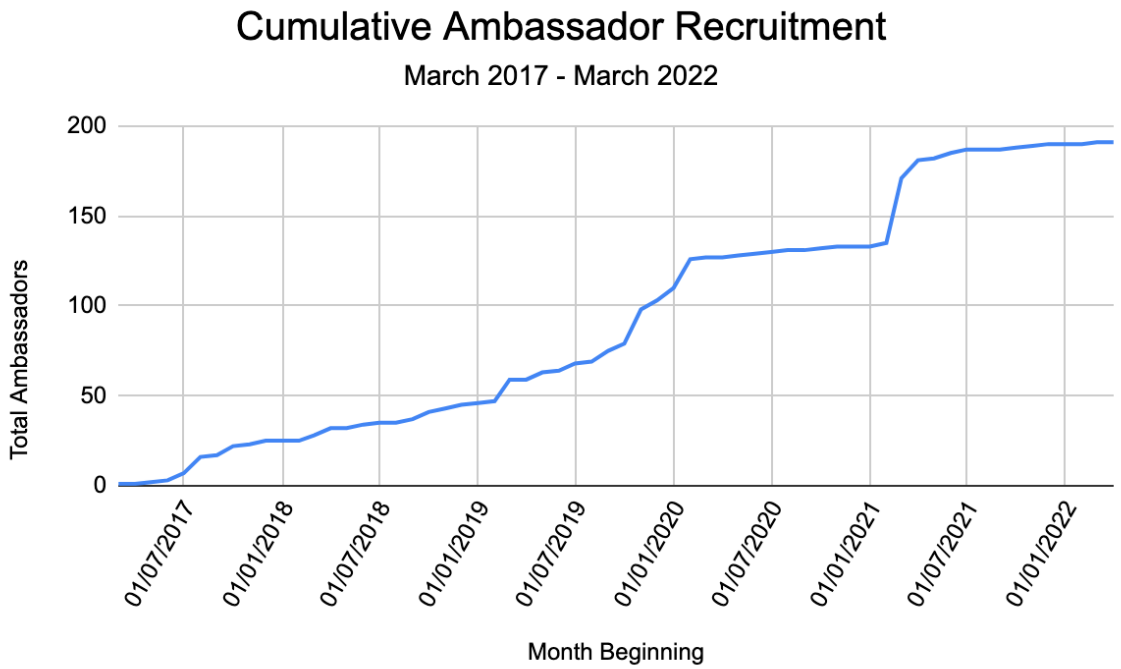

Figure 3.2: Cumulative number of Ambassadors recruited from March 2017 to March 2022

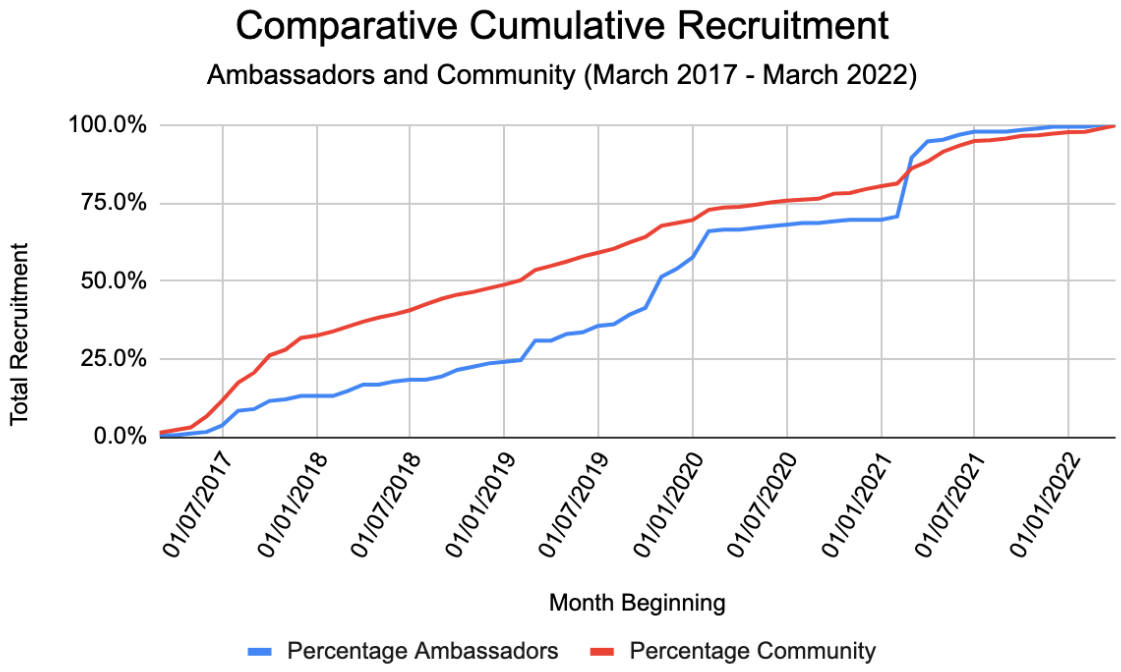

Figure 3.3: Comparative percentage cumulative recruitment of Ambassadors and Community recruited between March 2017 and March 2022

Ambassador recruitment data included the 60 month period from 6 March 2017 to 12 March 2022. Monthly Ambassador recruitment varied between zero and 36 Ambassadors per month. No Ambassadors were recruited in 15 of the calendar months (20.8%) during the period and 36 Ambassadors were recruited in the single month of March 2021.

The pattern of cumulative Ambassador recruitment during the period shows a number of differences with the pattern of Community engagement. Whereas both show a similar pattern of recruitment early in the Project phase of Kauri Rescue's development, later in this phase the rate of Ambassador recruitment accelerated whereas the rate of Community engagement remained relatively constant. The rate of both recruitments plateaued during the Transition phase before the rate of Ambassador recruitment markedly accelerated at the beginning of the Charity phase to be much higher than Community engagement. Both types of recruitment then slowed markedly during the second half of 2021 and into 2022 during which time they were similar to the recruitment rates recorded during the Transition phase.

Contact Channel

The data field "Contact Channel" was 100% complete for the 192 data records in the Ambassador data file. There were six different responses for this variable and the number of occurrences of each of these was counted and tabulated.

Table 3.1: Frequency of different Ambassador recruitment Contact Channels.

Contact Channel		
Channel	**Frequency**	**Percent**
TOTAL	192	100.0%
Team Member	20	10.4%
Website	24	12.5%
Event	98	51.0%
Social Media	44	22.9%
Print aticle (Fringe)	1	0.5%
Email	5	2.6%

These contacts can be combined into higher level groups to show that 61.4% of contacts were from personal face to face engagements (Team Member and Event) and 38.5% of contacts were from digital and print engagements (Website, Social Media and Print Article).

Contact Purpose

The data field "Contact Purpose" was 100% complete for the 192 data records in the Ambassador data file. There were six different contact purposes recorded and the frequency of each of these was counted and tabulated. Many of the data records included multiple contact purposes and in total the 192 data records recorded 236 individual contact purposes.

Table 3.2: Frequency of different Ambassador recruitment Contact Purposes.

Contact Purpose		
Purpose	**Frequency**	**Percent**
TOTAL	236	100.0%
Volunteer Offer	179	75.8%
Site Inspection	14	5.9%
General interest	2	0.8%
Newsletter subscription	28	11.9%
Request for engagement	12	5.1%
Media	1	0.4%

Unsurprisingly, given this data file recorded engagement information with people recruited to be Kauri Rescue Ambassadors, the offering of volunteer assistance to Kauri Rescue dominated the purpose that these Ambassadors had engaged. The only other contact purpose that exceeded a frequency of 10% was "Newsletter subscription", however across the 28 occurrences of this contact purpose it never occurred on its own but rather it always occurred in association with another contact purpose.

Recruitment Type

Of the total of 192 Ambassador data records, 191 records (99.5%) recorded a "Recruitment Type". There were only two different responses for this variable and the frequency of occurrence of each was counted and tabulated.

Table 3.3: Frequency of different Ambassador Recruitment Types.

Recruitment Type		
Recruitment	**Frequency**	**Percent**
TOTAL	196	100.0%
Ambassador	179	91.3%
Participant	13	7.3%
None	4	2.0%

A total of four data records did not include a "Recruitment Type" and a further five data records recorded both Ambassador and Participant as the Recruitment Type. Unsurprisingly, the Recruitment Type was dominated by Ambassador recruitment.

Location

To analyse the "Location" of Ambassador recruitment the Ambassador data record address details were concatenated and then reduced to a "suburb" location level. Of the total of 192 Ambassador data records, 113 records (58.9%) included sufficient physical address information to allow a suburb to be determined.

Suburbs were then combined to reduce duplication. For example records of Te Atatu and Te Atatu Sth were combined to be Te Atatu. Locations within the Auckland region were kept separate for suburb, while locations outside Auckland were combined into regional locations, such as Whangarei. One international record occurred from Australia.

Table 3.4: Locations from where Ambassadors were recruited.

Location		
Location	**Frequency**	**Percent**
TOTAL	113	100.0%
Titirangi	28	24.8%
Kaukapakapa	8	7.1%
Laingholm	6	5.3%
Ranui	3	2.7%
Panmure	3	2.7%
Hobsonville	3	2.7%

A total of 51 locations were recorded from where Ambassadors were recruited. Only locations from where more than two Ambassadors were recruited have been tabulated. Overall, Ambassador recruitment was concentrated in a small area and was highly fragmented beyond this as 48 of the 51 locations (94.1%) produced three or fewer Ambassadors each and 28 of these locations (54.9%) produced a single Ambassador.

Locations from where more than five Ambassadors were recruited included Titirangi (28 Ambassadors), Kaukapakapa (8 Ambassadors) and Laingholm (6 Ambassadors). Therefore, the two (1.8%) neighbouring suburb locations of Titirangi and Laingholm produced 30.1% of the recruited Ambassadors. The eight Kaukapakapa Ambassadors were recruited at a single event.

Volunteer Offer

Of the total of 192 Ambassador data records, 188 records (97.9%) included specific offers of volunteer assistance for Kauri Rescue. Many of these records included multiple offers of volunteer assistance and in total the 188 data records recorded 215 individual offers of volunteer assistance. The full range of individual offers of volunteer assistance were grouped into six different types of volunteer assistance and the frequency of each type of offer was

counted and tabulated. The types of volunteer offers included Fieldwork, Promotion, Co-ordination, Funding, General and Indigenous Knowledge

Table 3.5: Frequency of Ambassador volunteer types.

Volunteer type		
Volunteer offer	**Frequency**	**Percent**
TOTAL	215	100.0%
Fieldwork	170	79.1%
Promotion	32	14.9%
Co-ordination	4	1.9%
Funding	2	0.9%
General	5	2.3%
Indigenous Knowledge	2	0.9%

Within each type of volunteer offer the different volunteer offers were tabulated and their frequency and percentage composition were calculated.

Table 3.6: Offers of Ambassador volunteer assistance for project Fieldwork.

Volunteer offer		
Fieldwork	**Frequency**	**Percent**
TOTAL	170	79.1%
Treatment team	162	75.3%
cleaning equipment	1	0.5%
data entry / input	5	2.3%
fieldwork	1	0.5%
Conservation Volunteers leader	1	0.5%

Table 3.7: Offers of Ambassador volunteer assistance for project Promotion.

Volunteer offer		
Promotion	**Frequency**	**Percent**
TOTAL	32	14.9%
doorknocking	12	5.6%
stalls	5	2.3%
Spread the word	1	0.5%
markets	5	2.3%
Schools	1	0.5%
Design support	1	0.5%
Deliver flyers / leaflets	3	1.4%
Creative	1	0.5%
educating others	1	0.5%
Public education	1	0.5%
photo journalist	1	0.5%

Table 3.8: Offers of Ambassador volunteer assistance for project Co-ordination.

Volunteer offer		
Co-ordination	**Frequency**	**Percent**
TOTAL	4	1.9%
dropping stuff here & there	1	0.5%
Running groups	1	0.5%
wrangling athletes	1	0.5%
experience in public sector	1	0.5%

Table 3.9: Offers of Ambassador volunteer assistance for project Funding.

Volunteer offer		
Funding	**Frequency**	**Percent**
TOTAL	2	0.9%
donated artwork	1	0.5%
Fundraising	1	0.5%

Table 3.10: Offers of Ambassador volunteer assistance for General project work.

Volunteer offer		
General	**Frequency**	**Percent**
TOTAL	5	2.3%
Anything	5	2.3%

Table 3.11: Offers of Ambassador volunteer assistance for Indigenous Knowledge.

Volunteer offer		
Indigenous Knowledge	**Frequency**	**Percent**
TOTAL	2	0.9%
matauranga	1	0.5%
rongoa	1	0.5%

Of the 188 data records that included offers of volunteer assistance, 23 (12.2%) included specific locations. The most common of these was “Kaukapakapa”, a village and locality in the southern reaches of the Kaipara Harbour. All these data records had the same date of initial contact of 17 November 2019, and their entries for the “Purpose Notes” data field show this subgroup of Ambassadors were recruited during a Kauri Rescue promotional event held at the Kaukapakapa market towards the end of the Project phase.

Table 3.12: Locations of offers of Ambassador volunteer assistance.

Volunteer offer	
Locations	**Frequency**
TOTAL	23
Kaukapakapa	15
Northland	3
Karekare	1
Piha	1
North Coromandel	1
North Shore	1
Kumeu	1

Engagement

Of the total of 192 Ambassador data records, 191 records (99.5%) recorded a specific response action that initially followed the Ambassador's engagement with Kauri Rescue. Many of these data records included multiple response actions and in total the 191 data records recorded 360 individual initial response actions. Additionally, the data file also recorded further followup Ambassador engagement actions taken by Kauri Rescue following the initial response action.

Table 3.13: Kauri Rescue Initial Response Actions following Ambassador recruitment.

Initial Response Action		
TOTAL	360	100.0%
Added to newsletter database	165	45.8%
Passed to	191	53.1%
Inspection booked	4	1.1%

Of the 191 data records that recorded a specific initial response action, 165 (86.4%) included the Ambassador being added to the Kauri Rescue newsletter database and all of them (100%) included the details of the Ambassador being "Passed on" to at least one, and sometimes several individual Kauri Rescue team members. There is no information about what the receiving Kauri Rescue team member did with the Ambassador information. Additionally there was a small number of kauri site inspections booked. However, the Ambassador data file does not record if these inspections were completed or what they found.

Following the initial response action, 63 data records (32.8%) record a follow up response action. These records varied from short records, such as "Sent welcome email" to very extensive records of correspondence with the Ambassador. These 63 follow up responses included 50 different data records and although there were no standard responses that could be analysed

for frequency, 18 of them (28.6%) did record that the Ambassador was "Invited" to attend a Kauri Rescue event, such as a training day. The data file does not record how many of these invitations translated into attendance by the Ambassador at a Kauri Rescue event.

For 190 of the 191 data records (99.5%) that recorded an initial response action and for 30 of the 63 follow up response actions (47.6%) the date of response was also recorded. Therefore, the date of the Ambassador's initial contact is followed by the date of the initial Kauri Rescue response action and the date of the followup response action to create a timeline of engagement between the Ambassador and Kauri Rescue. These sequences of dates have been tabulated and summarised to analyse the Kauri Rescue response to the engagement of an Ambassador.

Table 3.14: Kauri Rescue Response Time for Actions following Ambassador recruitment.

	Response Time		
Statistic	**Date of Contact**	**Response Date**	**Date of Action**
Frequency	192	190	30
Percent		99%	16%
Average Response (Days)		1.6	0.8
75% Quartile (Days)		3.0	0.0
90th Percentile (Days)		6.0	0.1
Maximum (Days)		69	15

The average initial response action followed the Ambassador's date of contact by 1.6 days with 75% of responses being completed in 3.0 days, and 90% of responses being completed in 6.0 days. The maximum response time was 69 days, which could be an actual occurrence, or it could be due to a date being incorrectly entered into the data file.

The average followup response action followed the initial response action by 0.8 days with 75% and 90% of responses essentially being completed on the same day as the initial response. The maximum followup response time was 15 days.

3.4 Discussion

It is unclear how a person became qualified to be entered onto the Ambassador spreadsheet. A total of 219 Community engagements selected a recruitment type of "Ambassador", either solely or in conjunction with a second recruitment type, however the Ambassador dataset only contained a total of 192 engagements.

Furthermore, the Ambassador dataset only recorded 179 engagements having selected the recruitment type “Ambassador” and because the Ambassador dataset was almost completely formed from data records copied from the Community dataset this suggests that 40 Community engagements who selected “Ambassador” as a recruitment type (18.3%) were not transferred from the Community dataset to the Ambassador dataset. A number of data records on the Community spreadsheet with the “Recruitment Type” data field that contained the response “Ambassador” did not appear as data records on the Ambassador spreadsheet. Furthermore, it also suggests that 13 data records in the Ambassador dataset (6.8%) came from the Community dataset where the Community engagement did not record a recruitment type of “Ambassador”.

The formation of the Ambassador dataset by copying and pasting records from the Community dataset could potentially be problematic given that 260 cells in the Community dataset contain the note “Responder updated this value”. This is a potential source of error as if an original data record was transferred from the Community Contact spreadsheet to the Ambassadors spreadsheet before the submitter amended their response then the information on the two spreadsheets for the same person would be different as Google Forms can only submit responses to one spreadsheet.

To offset this risk, the recruitment of Ambassadors clearly preferentially came from face to face engagements rather than digital engagements. Whereas face to face Community engagements exceeded digital engagements by 20%, face to face Ambassador recruitments exceeded digital engagements by 60%, an increase of 33.3%.

A comparison of the “Contact Purpose” variable between the Community dataset and the Ambassador dataset reveals a striking difference. The highest frequency contact purpose in the Community dataset was “Site inspection” selected by 36.6% of engagements. In comparison only 5.9% of Ambassador recruitments sought a site inspection. In contrast, 75.8% of Ambassadors recorded their contact purpose as ”Volunteer offer” compared with only 19.5% of Community engagements. This can be interpreted as Community engagements being dominated by people who had come to Kauri Rescue to GET help for kauri dieback affected trees they were connected to whereas Ambassador recruitments were dominated by people who came to Kauri Rescue to GIVE help to kauri dieback affected trees in their location.

Therefore, although the Ambassador dataset was built from data records copied from the Community dataset it is likely that these two datasets have self selected as two distinctly different and contrasting subpopulations of people who engaged with Kauri Rescue. Furthermore, because those Community engagement data records that were copied to the Ambassador dataset remained in the Community dataset then this fundamental difference may

have been even more evident had these records been removed from the Community dataset when they were added to the Ambassador dataset. Remaining in the Community dataset they have the effect of diluting the characteristics of that dataset, an effect that does not occur in the Ambassador dataset.

This wish to give assistance to kauri dieback affected trees is very prominent in the "Volunteer offer" variable in the Ambassador dataset. Almost 80% of Ambassadors wanted to be involved with "Fieldwork" and 75% of Ambassadors specifically wanted to be part of a "Treatment Team". Whereas four out of five Ambassadors wanted to engage in fieldwork, only one in seven (14.9%) offered to help promote Kauri Rescue in a range of ways.

The relative rates of Community and Ambassador recruitment suggest that as Kauri Rescue increased the size of its cumulative Community, the demands of co-ordinating and managing the activities of the Community also increased. For the first two years of the Project phase from establishment to the end of 2018 the ratio of the number of Ambassadors to the size of the Community remained steady at around 1:10. At the beginning of 2019 the size of the Community was 451 engagements and during 2019 this grew 42.4% to become 642 engagements at the end of 2019. In the same period the number of Ambassadors recruited expanded from 46 to 110 Ambassadors and the Ambassador ratio fell from 1:9.8 to 1:5.8.

Kauri Rescue's Community engagement was clearly concentrated in and around Titirangi as 50% of Community engagements (323 engagements) came from this suburb and the adjacent suburb of Laingholm. These same suburbs were also the source of 30.1% of Ambassador recruitments (34 recruitments) indicating that in this key focal area the Ambassador to Community ratio remained high at 1:9.5. Accordingly, in all other locations the number of Ambassadors recruited was 158 with 603 Community engagements for an Ambassador to Community ratio of 1:3.8.

Kauri Rescue's response to the engagement of both Community and Ambassadors was generally timely with some outliers that could be recording errors. However, the depth of Kauri Rescue's engagement with people who did engage with it is difficult to objectively assess. Whereas outreach communication was facilitated by people being added to the Kauri Rescue newsletter database the "Passing on" of contact information to other members of the Kauri Rescue management group risks having these engagements being lost. Individual entries in the "Action Taken" data field suggest that a number of these people may have eventually entered the Participant dataset but there is no data field in either the Community dataset or the Ambassador dataset where this could be specifically recorded to provide a bridge between the Community and Ambassador data sets and the Participant data sets.

4.0 Participants

4.1 Introduction

The Participants data file recorded Kauri Rescue's engagement and ongoing relationship with people who were recruited into the Participant subpopulation because they suspected they had kauri dieback affected trees on their land. This data file was subdivided into three segments including:

- Participants confirmed to have kauri dieback present on their property and whose trees were being treated with phosphite and then regularly assessed for tree health
- Participants suspected to have kauri dieback present on their property where investigations to determine the presence of kauri dieback were being undertaken
- Participants who suspected they had kauri dieback present on their property but for whom the presence of the pathogen had not been confirmed by a soil sample found to be positive for the pathogen.

4.2 Data

Data File

The spreadsheet containing the data about the Kauri Rescue Participants was titled "Copy of Participant_Master_spreadsheet_for Marie_17may22". It contained three sheets titled:

- "Participant log - KD CONFIRMED"
- "Participant log - OPEN"
- "Participant log - NOT KD"

Data Records

Participant log - KD CONFIRMED

The worksheet titled "Participant log - KD CONFIRMED" contained 89 data fields as spreadsheet columns and 130 data records as spreadsheet rows. Each data record recorded the details of one street address where the presence of kauri dieback had been confirmed and the data fields for each record included:

- Unlabeled - Contains the region in which the address is located
- Address - The complete address of the site recorded as one text string
- Participant Name - The full name of the participant for the address recorded as one text string
- KR Reference - A unique alphanumeric reference for each address prefixed with KR
- Telephone Number - A contact telephone number for the participant
- Email - An email address for the participant
- Contacted KR via - Record of participant's Kauri Rescue engagement channel but also including notes about the site, kauri dieback symptoms and sampling or contact details
- Five groups of three columns headed "General Action Point" with columns headed
    - Date - date of recorded management action
    - Action - management action eg. "Passed to AC"
    - Comment - other information such as follow up information or participant response but also may include Covid-19 vaccination status of the participant
        - In general these groups of columns form an historical record of Kauri Rescue management actions relating to the address
- Initial inspection diagnosis - Record of signs of kauri dieback from site visit, visual assessment of trees or adjacent property
- Soil sample result - Result of kauri dieback soil sample taken from the address
- One group of five columns headed "Initial kit delivery" with columns headed
    - Date scheduled - Scheduled date for delivery of phosphite treatment kit to the site address
    - Kit reference - Unique reference code for treatment kit delivered to address
    - Date delivered - Actual date of delivery of treatment kit to site address
    - Time spent with participant - Duration of treatment kit delivery engagement
    - Questions/conversation comments - Summary points of treatment kit delivery engagement but may include participant Covid-19 health information
- One group of five columns headed "Follow up meeting" with columns headed
    - Date scheduled - Scheduled date of follow up meeting after treatment kit delivery
    - Date conducted - Date of treatment kit follow up meeting

    - Time spent with participant - Duration of treatment kit follow up meeting
    - Questions/conversation comments - Kauri Rescue notes about participant's progress with tree treatment
    - Recruitment of participant as: - Record of recruitment of participant as an Ambassador or address as a research site
- Date initial treatment completed - Date(s) treatment of trees, or blocks of trees completed
- Date initial data uploaded - Date initial tree treatment data entered to Kauri Rescue treatment records
- One group of five columns headed "Initial kit collection" with columns headed
    - Date scheduled - Date arranged with participant to collect the treatment kit
    - Date collected - Actual date treatment kit collected
    - Questions/conversation comments - Kauri Rescue comments about progress and outcomes of the initial tree treatments attempted or completed by participants
    - Learnings to be forwarded to KR team - Kauri Rescue observations about managing participants and participant's thoughts on methods and equipment
    - Date learning forwarded to KR team - Recorded date but also additional comments
- Photos - A record of whether photographs of the address have been taken
- Bleed assessment method used - Uniquely "Old (every 20cm)"
- Four groups of ten columns headed
    - "6-month tree health reassessment"
    - "12-month (1 year) tree health reassessment"
    - "24-month (2 years) tree health reassessment"
    - "36-month tree (3 years) health reassessment"

  with columns headed
        - Date assessment due - Expected date of the relevant health assessment based on the date the initial treatment was completed
        - Date reminder sent - Date(s) reminders for the relevant health assessment sent to participant that may pre or post date assessment due date
        - Date kit is scheduled to be delivered - Date the treatment kit is scheduled to be delivered to the participant, likely as arranged
        - Date kit is delivered - Date the treatment kit actually delivered to the participant
        - Date assessment completed - Date(s) relevant health assessment of trees completed
        - Date data uploaded - Date relevant health assessment data entered to Kauri Rescue treatment records

        - Date kit is collected - Date treatment kit collected from participant
        - Questions/conversation comments - General comments recorded about participants and relevant health assessment
        - Learnings to be forwarded to KR team - Kauri Rescue observations about participants and participant's thoughts on health assessments
        - Date learning forwarded to KR team - Recorded date
- One group of six columns headed "Other years" with columns headed
    - Date assessment completed - Date other health assessment of trees completed but also includes notes about Kauri Rescue participant engagement
    - Date data uploaded - Date other health assessment data entered to Kauri Rescue treatment records but also includes comments about participants and trees at the site address
    - Date assessment completed - Date other health assessment of trees completed but also includes notes about Kauri Rescue participant engagement, tree treatment and site address
    - Date data uploaded - Date other health assessment data entered to Kauri Rescue treatment records
    - Date assessment completed - Column available to record date any further health assessment of trees completed but also includes notes about site address
    - Date data uploaded - Empty column available to record date that further assessment data is entered to Kauri Rescue treatment records

Additionally this worksheet had a range of colour overlays across all rows of spreadsheet cells and the attached colour key allowed the decoding of the meaning of these colours. These colour overlays indicated:

- Purple - Completed treatment and returned kit
- Magenta - Returned kit but needs a bit of help to complete treatment
- Red - Kit out
- Green - Ok to receive kit asap
- Yellow - Some concern - wait to receive kit until confirmed by (Kauri Rescue team member)
- Light orange - Trees dead / too far declined decided not to treat
- Cyan - Returned kit without completing treatment and doesn't want to continue
- Blue - Didn't request kit, doesn't want to treat / no response from them
- Dark orange - Returned kit but wants it back when got more time to complete treatment
- Dark red - Engaged with but not decided whether they want to treat with phosphite yet or not

Participant log - OPEN

The worksheet titled “Participant log - OPEN” contained 23 data fields as spreadsheet columns and 31 data records as spreadsheet rows. Each data record recorded the details of one street address where the presence of kauri dieback was suspected and investigations were being undertaken to confirm or not confirm its presence. The data fields for each record included:

- Region - The region in which the address is located
- Address - The complete address of the site recorded as one text string
- Name - The full name of the participant for the address recorded as one text string
- Telephone Number - A contact telephone number for the participant
- Email - An email address for the participant
- Notes - Notes about the site, kauri dieback symptoms and sampling or contact details
- Five groups of three columns headed “General Action Point” with columns headed
    - Date - date of recorded management action
    - Action - management action eg. “Passed to AC”
    - Comment - other information such as follow up and site specific information
        - In general these groups of columns form an historical record of management actions relating to the address
- Initial inspection diagnosis - Empty column but available to record initial diagnosis of kauri dieback from site visit and visual assessment of trees or soil test
- Soil sample result - Result of kauri dieback soil sample taken from the address

Additionally this worksheet had different colour overlays across all rows of spreadsheet cells however there was no colour key with the spreadsheet to be able to decode the meaning of these colours. Colour overlays included:

- Light grey
- Cyan
- Orange
- Cornflower blue
- Light magenta
- Light purple
- Light yellow

Participant log - NOT KD

The worksheet titled “Participant log - NOT KD” contained 29 data fields as spreadsheet columns and 248 data records as spreadsheet rows. Each data record recorded the details of

one street address where the presence of kauri dieback had been suspected but had not be confirmed and the data fields for each record included::

- Region - The region in which the address is located
- Address - The complete address of the site recorded as one text string
- Name - The full name of the participant for the address recorded as one text string
- Telephone Number - A contact telephone number for the participant
- Email - An email address for the participant
- Contacted KR via - Record of participant's Kauri Rescue engagement channel
- Five groups of three columns headed "General Action Point" with columns headed
    - Date - date of recorded management action
    - Action - management action eg. "sent document 2"
    - Comment - other information such as reply or follow up information
        - In general these groups of columns form an historical record of Kauri Rescue's management actions relating to the address
- Initial inspection diagnosis - Record of signs of kauri dieback from site visit and visual assessment of trees
- Soil sample result - Result of kauri dieback soil sample taken from the address
- One group of five columns headed "Follow up meeting" with columns headed
    - Date scheduled - Empty column but available to record scheduled date of follow up meeting
    - Date conducted - Date of follow up meeting
    - Time spent with participant - Duration of follow up meeting
    - Questions/conversation comments - Summary points of meeting discussion
    - Recruitment of participant as: - Further Kauri Rescue engagement with the participant for the address
- Unlabeled - An untitled column containing summary points of a follow up meeting discussion created by misplaced copy and paste

Additionally this worksheet had colour overlays across selected blocks of spreadsheet cells however there was no colour key with the spreadsheet to be able to decode the meaning of these colours. Colour overlays included:

- Columns A-E: Data fields "Region" to "Email"
    - Light red berry
    - Cyan
    - Light cyan
    - Light grey
    - Light green
    - White
    - Yellow

- Column F: Data field “Contacted KR via”
    - Light grey
- Columns G-AC: Data fields “General Action Point” to “Unlabeled”
    - Light orange

Data Density

Participant log - KD CONFIRMED

The “Address” data field was 100% complete and four other variables were only missing one data point. Some variables contained no data points but as this worksheet was principally focused on recording engagement with Participants over time then it is possible that some events for which variables had been created had not occurred before the cutoff data for data to enter this forensic analysis. Of a total of 11,570 potential data points the dataset contained 3,793 data points making it 32.8% complete.

Participant log - OPEN

Six variables were 100% complete and one other was missing two data points. Two variables contained no data points but as this worksheet was tracking active kauri dieback investigations then it is unsurprising that the “Initial inspection diagnosis” variable was empty. Of a total of 713 potential data points the dataset contained 335 data points to be 47.0% complete.

Participant log - NOT KD

The “Name” data field was 100% complete and two other variables were missing eight data points. As this worksheet was focused on recording the outcome of kauri dieback site investigations that did not confirm the presence of the pathogen, it is surprising that the “Initial inspection diagnosis” variable only contained 72 data points, making it 29.0% complete and the “Soil sample result” variable only contained 145 data points, making it 58.5% complete. Only 166 data records had a data point in one or both of these data fields making the kauri dieback determination results data 66.9% complete. Of a total of 7,192 potential data points the dataset contained 2,666 data points making it 37.1% complete.

4.3 Analysis

The complete Participant spreadsheet contained a total of 91 individual variables across all three worksheets and 22 of these were common to all three worksheets. Of the remaining 69 variables, 61 of them were unique to the worksheet titled “Participant log - KD CONFIRMED”. Six variables were common to the worksheets titled “Participant log - KD CONFIRMED” and

"Participant log - NOT KD" and one variable was unique to each of the worksheets titled "Participant log - OPEN" and "Participant log - NOT KD".

A total of six variables have not been analysed as they do not contain subpopulation level data including three that contain individual participant personal information, one that is a reference number, and two that contain site specific general notes. A further 18 variables have been analysed as variables pooled across all three worksheets as they contain data that describes the whole Participant subpopulation including two that have been analysed as Location data and 16 that have been analysed as Engagement data. A total of 67 variables solely from the worksheet titled "Participant log - KD CONFIRMED", that together form 11 types of variables, have been analysed as kauri Treatment and Assessment data, including two variables that relate to kauri dieback diagnosis. The Diagnosis variables have also been analysed as an additional two variables of pooled data across all the subpopulation segments.

Location

Location data at the regional level could be determined for 98.3% of the pooled participant subpopulation that totalled 409 data records. These were sorted and counted for frequency. Of the 402 participant data records that could be allocated to a regional level, 95.8% of them were recorded as Auckland with 4.2% recorded in the remaining principal kauri lands regions of Waikato, Northland and Bay of Plenty.

Table 4.1: Regional distribution of the Kauri Rescue Participant subpopulation.

Location					
Region	**KD Confirmed**	**Open**	**Not KD**	**Total**	**Percent**
Auckland	127	23	235	385	95.8%
Waikato	0	4	5	9	2.2%
Northland	3	2	1	6	1.5%
Bay of Plenty	0	2	0	2	0.5%
TOTAL	130	31	241	402	100.0%
Percent	100.0%	100.0%	97.2%	98.3%	

Within the Auckland region, there were a total of 38 locations at suburb level drawn from 383 pooled participant data records. These were sorted and counted for frequency of occurrence and suburbs where more than 1% of participants occurred were tabulated. The most frequent suburb location was Titirangi (59.6%) and the seven most frequent locations were all suburb locations closely associated with the Waitakere Ranges. These combined to include 76.8% of the Auckland segment (294 participants) of the pooled participant subpopulation. Beyond the dominant Waitakere Ranges suburbs a further 31 locations (81.6%) included a pooled 89 participants (23.2%) for an average of less than three participants per location.

Table 4.2: Distribution of the Auckland segment of the Kauri Rescue Participant subpopulation for principal suburbs.

Location		
Suburb	**Frequency**	**Percent**
Titirangi	229	59.8%
Laingholm	16	4.2%
Karekare	15	3.9%
Oratia	11	2.9%
Huia	8	2.1%
Piha	8	2.1%
Parau	7	1.8%
Warkworth	6	1.6%
Henderson	6	1.6%
Waimauku	5	1.3%
Wellsford	5	1.3%
Awhitu	4	1.0%
Waitakere	4	1.0%
Te Henga	4	1.0%
Silverdale	4	1.0%

Engagement

The 409 Participant data records were analysed to portray Kauri Rescue's engagement with its Participant subpopulation from the perspectives of how participants came to Kauri Rescue and the relationship that Kauri Rescue developed with them. Participant recruitment has been analysed using summarised data recorded in the Contact Channel data fields for each participant.

Table 4.3: Recruitment Contact Channels for the Kauri Rescue Participant subpopulation.

Contact Channel			
Total Participants	378		
%age Total Participants	48.7%		
Contact Channel	**Contacts**	**Percent**	**Cumulative**
Event	32	17.4%	17.4%
Website	66	35.9%	53.3%
Team Member	49	26.6%	79.9%
Social Media	4	2.2%	82.1%
Council	32	17.4%	99.5%
Email	1	0.5%	100.0%
TOTAL	184	100.0%	

Participant contact information was only recorded in the "Participant log - KD CONFIRMED" and "Participant log - NOT KD" worksheets. However, because the Contact Channel data fields in these worksheets generally contained explanatory text entries they were summarised to reduce these text entries to the same contact channel categories as used for the Community and Ambassador analyses. Some text entries contained no information about the contact channel through which the participant engaged with Kauri Rescue.

Of the 378 participant data records on these two worksheets, contact channel could be determined for 184 participants (48.7%). The most frequent participant contact channel was "Website". At a higher level 44.0% of Participant contacts were through personal face to face engagement channels (Team Member and Event) and 38.6% of Participant contacts were through digital engagement channels (Website, Social Media and Email). A further 17.4% of Participant contacts were referrals from a Council. This compares with 53.1% of Community contacts from personal face to face engagements, 44.6% of Community contacts from digital engagements and 2.2% of Community contacts as referrals from a Council.

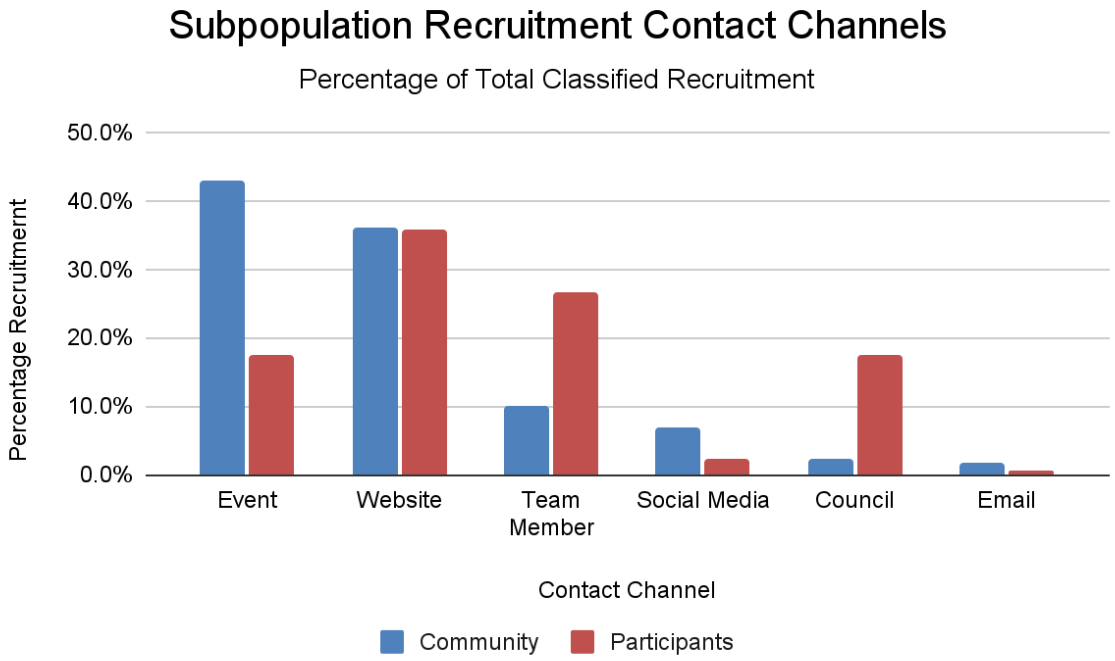

Figure 4.1: Comparative recruitment contact channels for the Community and Participant subpopulations.

The comparison of percentage Community and Participant engagement for each contact channel is also presented graphically. This reveals that while "Events" were a very successful channel for engaging Community, those that did engage through this channel did not frequently become Kauri Rescue Participants. In contrast, Kauri Rescue Community who engaged with Kauri Rescue through the "Team Member" channel transitioned to become Participants at a

much higher frequency than their representation in the Community subpopulation. Council referrals for people to become Participants was substantially more frequent than for people to become Community.

Kauri Rescue's relationship with each participant after they engaged has been characterised by summarising the General Action Point (GAP) data fields in each of the Participant spreadsheet worksheets. On each worksheet, these data fields include 15 variables organised as five groups of three variables with each group having data fields for Date, Action and Comment. By checking all three data fields within each group for the presence of data of any form it is possible to determine the number of General Action Point variable groups used to record information about Kauri Rescue's relationship with the Participant over time.

Table 4.4: Kauri Rescue engagement with Participant subpopulation and segments.

	Relationship Engagement			
Engagement	**KD Confirmed**	**Open**	**Not KD**	**All Participants**
GAP 1	86.2%	100.0%	86.7%	87.5%
GAP 2	77.7%	58.1%	57.3%	63.8%
GAP 3	63.8%	41.9%	56.9%	57.9%
GAP 4	45.4%	25.8%	30.2%	34.7%
GAP 5	28.5%	9.7%	12.1%	17.1%
TOTAL	87.7%	100.0%	89.5%	89.7%

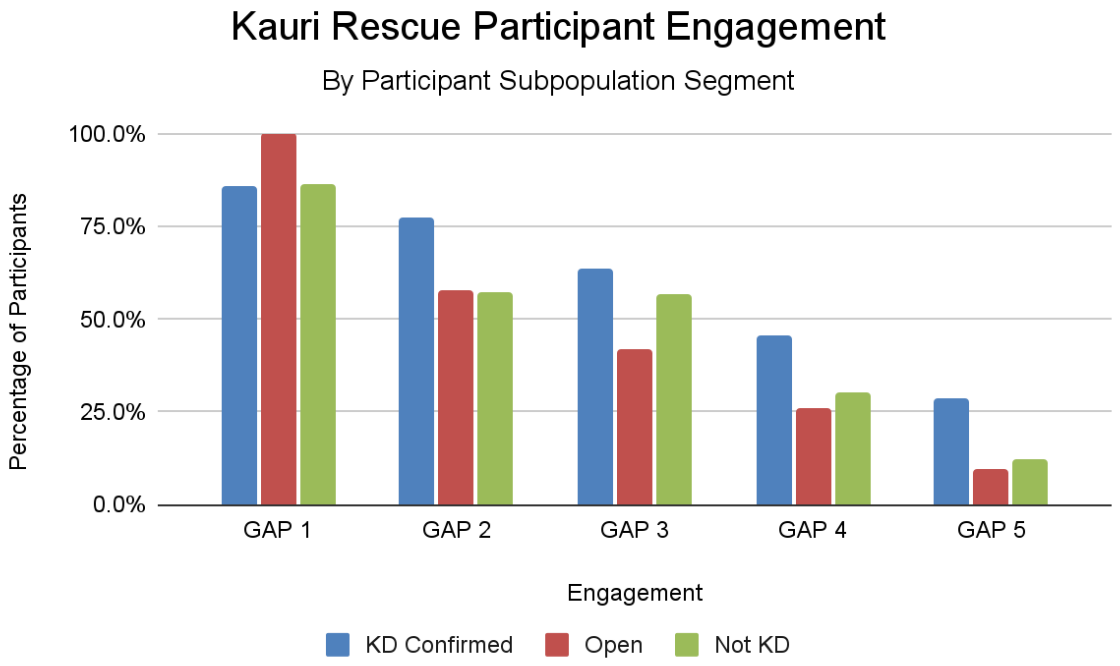

Figure 4.2: Comparative Kauri Rescue Participant subpopulation segment engagement.

Across all Participants, 89.7% of data records recorded at least one General Action Point after the participant engaged with Kauri Rescue. Generally the first relationship engagement was recorded in the first General Action Point group of data fields with subsequent relationship engagements being recorded progressively across the five groups of General Action Point data fields, however occasionally this order did vary.

Fewer participants' data records recorded multiple relationship engagements as the number of participant relationship engagements increased. In general, and unsurprisingly, the frequency of relationship engagements for participants that did not have kauri dieback confirmed was fewer than for participants who did have kauri dieback confirmed. All Participant subpopulation segments recorded high levels of initial relationship engagements with the number of subsequent relationship engagements for:

- "KD Confirmed" participants gradually declining over time but remaining at a level that suggests that more than five General Action Point data field groups will be required
- "Open" participants declining quickly probably because only a small number of relationship engagements were required to determine their kauri dieback status
- "Not KD" participants remaining relatively high (above 50%) before declining quickly to low levels likely due to relationship engagements around the results of kauri dieback testing. A frequently recorded action was " No action as no response from landowner" although many also recorded specific documents being provided to the participant.

Diagnosis

The three worksheets in the Participants spreadsheet datafile each contained two variables whose data fields were used to record kauri dieback diagnosis data for each participant. These were "Initial inspection diagnosis" and "Soil sample result".

Table 4.5: Kauri dieback diagnoses frequency for Participant subpopulation segments.

	Diagnosis			
Type	**KD Confirmed**	**Open**	**Not KD**	**Total**
Soil Test	90	4	145	239
Percent	69.2%	12.9%	58.5%	58.4%
Other	30	0	72	102
Percent	23.1%	0.0%	29.0%	24.9%
Total	99	4	166	269
Percent	76.2%	12.9%	66.9%	65.8%
Participants	130	31	248	409

For some participants the results of only one of these types of diagnoses was recorded while for other participants results for both types of diagnoses were recorded. For the "KD Confirmed" segment of the Participant subpopulation, 90 participants' data records held results in the "Soil sample result" data field (69.2%) and 30 participants' data records held results in the "Initial inspection diagnosis" data field (23.1%). However, as a total of 99 participants (76.2%) held kauri dieback diagnosis data in either of these two variables then 21 participants' data records (16.2%) held diagnosis data in both these data fields. For the "Not KD" segment of the Participant subpopulation those with two recorded diagnoses was 51 participants (20.6%).

For many "KD Confirmed" participants, the "Soil sample result" data field confirmed the presence of kauri dieback by noting the pathogen, or an abbreviation for it, while many "Not KD" participants "Soil sample result" data field listed other *Phytophthora*. Occasionally reference was made to an infected closely adjacent site to substantiate the presence of kauri dieback.

The "Initial inspection diagnosis" variable recorded observational data such as "symptomatic trees" or "ill-thrift kauri:". Council supplied information and kauri dieback on adjacent sites was also recorded. Even "poisoning" was listed as a possible cause of tree decline. On the "Not KD" worksheet "non-symptomatic trees" were recorded and where "possible KD" was recorded, the absence of kauri dieback was often confirmed with "Nil" recorded for "Soil sample result".

Across all subpopulation segments, 65.8% of participant data records included kauri dieback diagnosis data, and understandably only 12.9% of "Open" segment participants data records held diagnosis data as these participants were in the process of having the status of kauri dieback on their properties determined.

Treatment

A total of 59 variables on the "Participant log - KD CONFIRMED" worksheet record the process of Kauri Rescue's engagement with Participants, who were recorded to have kauri dieback present on their properties, to bring about the treatment of infected trees. These variables group into eight types of variables with between one and 40 variables per type. They can be further aggregated to form six broad groups of treatment activities that span the time from initial diagnosis of kauri dieback through management of treatment equipment for the participant, the recording of tree treatment details and the periodic post-treatment health assessment of treated trees. A summary of these variables and their broad groups is:

- Kauri Dieback Confirmed (pooled)
    - Initial inspection diagnosis (1 variable)
    - Soil sample result (1 variable)

- Initial kit delivery (5 variables)
- Follow up meeting (5 variables)
- Initial kit collection (5 variable)
- Kauri Dieback Treatment (pooled)
    - Date initial treatment completed (1 variable)
    - Date initial data uploaded (1 variable)
- Health Assessment (pooled)
    - 6-month tree health reassessment (10 variables)
    - 12-month (1 year) tree health reassessment (10 variables)
    - 24-month (2 years) tree health reassessment (10 variables)
    - 36-month tree (3 years) health reassessment (10 variables)

For each participant on the "KD Confirmed" worksheet, the sequence of these activity groups was analysed by checking for any data recorded in any of the variable data fields within each group. Where data of any kind was recorded in any variable within each activity group that activity group was scored "1". Where no data was recorded in all the variables in each activity group that activity group was scored "0". With the aggregated treatment activity groups summarised in this way the treatment sequence has been illustrated for each participant.

On the illustration of treatment sequence, participants up to and including Participant 69 recorded treatment dates prior to 31/12/19, being the end of the "Project" phase of Kauri Rescue's development. No treatment activities occurred between Participants 70 and 88 inclusive, which overlaps with both Kauri Rescue's "Transition" phase and most of the first year of the Covid-19 pandemic. Although Participant 84 did appear to undertake a tree treatment during this period in fact this treatment was carried out during March 2021 soon after the start date of Kauri Rescue's "Charity" phase.

After the commencement of the "Charity" phase at Participant 89, participant kauri dieback treatment sequences generally became more complete than during the "Transition" phase that predominantly focused on kauri dieback confirmation for participants. However, the "Charity" phase has not yet achieved the same level of treatment consistency as was achieved during the "Project" phase although, for this analysis, the "Charity" phase is approximately half the time period in the "Project" phase and sequence gaps may be completed as more time passes.

Treatment sequences have also been summarised by converting them to binary data to identify the range of different treatment sequences recorded and to allow the frequency of each sequence to be tabulated. Each of the six digits in each sequence refers to one of the treatment activity groups in the order as described, with "1" indicating that data is present for the activity group and "0" indicating no data for the activity group.

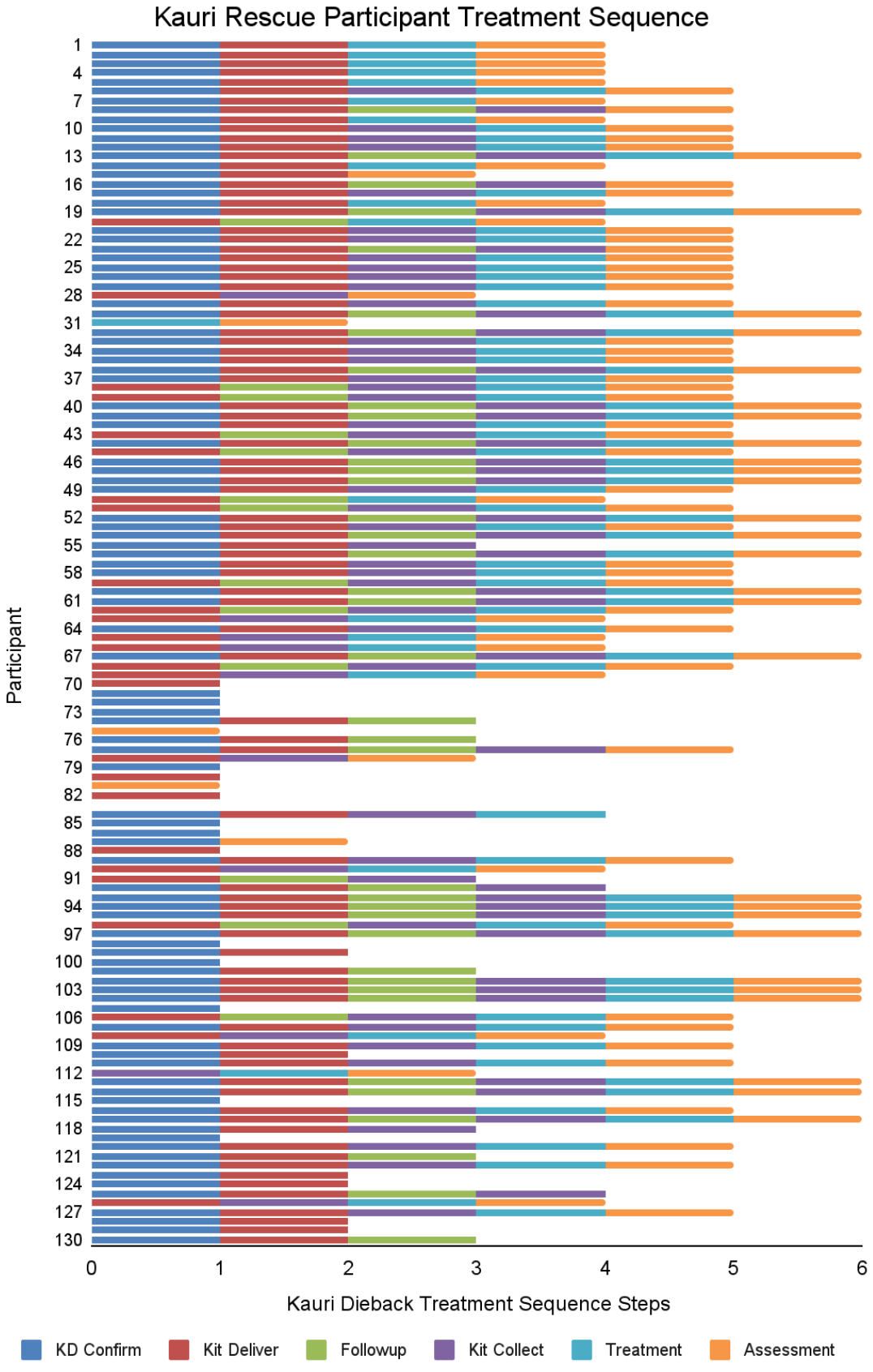

Figure 4.3: Individual Participant kauri dieback treatment sequence completion.

Therefore treatment sequence notation reads as follows:

- 111111 is a complete treatment sequence with data recorded for each sequence step
- 100000 is a treatment sequence where data is only recorded for the first sequence step of “Kauri Dieback Confirmed”
- 110011 is a treatment sequence where data is not recorded for the middle two sequence steps of “Follow up meeting” and “Initial kit collection”

Table 4.6: Frequency of each of the 22 recorded kauri dieback treatment sequences..

Treatment			
Sequence	**Frequency**	**Percent**	**Cumulative**
110011	9	6.9%	6.9%
110111	30	23.1%	30.0%
111101	4	3.1%	33.1%
111111	27	20.8%	53.8%
110001	1	0.8%	54.6%
011011	2	1.5%	56.2%
010101	2	1.5%	57.7%
000011	1	0.8%	58.5%
011111	10	7.7%	66.2%
110100	2	1.5%	67.7%
010111	7	5.4%	73.1%
010000	4	3.1%	76.2%
100000	11	8.5%	84.6%
111000	5	3.8%	88.5%
000001	2	1.5%	90.0%
000000	1	0.8%	90.8%
110110	1	0.8%	91.5%
100001	1	0.8%	92.3%
011100	1	0.8%	93.1%
111100	2	1.5%	94.6%
110000	6	4.6%	99.2%
000111	1	0.8%	100.0%
TOTAL	130	100.0%	

Across the 22 different treatment sequences recorded for all 130 participants on the “Participant log - KD CONFIRMED” worksheet:

- 23.9% omitted the first sequence step, Kauri Dieback Confirmed
- 13.2% omitted the second sequence step, Initial kit delivery

- 60.9% omitted the third sequence step, Follow up meeting
- 33.1% omitted the fourth sequence step, Initial kit collection
- 32.3% omitted the fifth sequence step, Kauri Dieback Treatment
- 25.4% omitted the six sequence step, Health Assessment

The most common treatment sequence (23.1%) was "110111" that was a near complete sequence missing only the "Follow-up Meeting". The second most common treatment sequence (20.8%) was "111111", which was a fully complete sequence. The third and fourth most common treatment sequences were respectively "100000" (8.5%) and "011111" (7.7%) that were treatment sequences that did not progress past kauri dieback being confirmed and a near complete treatment sequence missing only the confirmation of kauri dieback being present.

Health Assessments begin six months post treatment so it is expected that some Participants who began their treatment sequence during the "Charity" phase may not have commenced Health Assessments prior to the cutoff date for data to enter this analysis. However almost a third of sequences (42 sequences), and mostly during the "Transition" phase also did not record a kauri dieback treatment step although 10 of these (23.8%) did record a subsequent Health Assessment. Notably, 23.9% of sequences commenced without kauri dieback being recorded.

Assessment

Post treatment, the health of individual kauri trees treated with phosphite was scheduled to be assessed by Participants using a standard health assessment methodology at intervals of six, 12, 24 and 36 months. It is understood that this used the same methodology as a tree health assessment completed at the time each tree was treated, although the Participant data records do not contain a specific data field for recording that this treatment health assessment was completed. It is anticipated that this specific information is separately held as part of Kauri Rescue's tree treatment information system.

However, the Participant data records do record if the Participant took photographs of the treated trees and the type of "Bleed Assessment" they used. Participant data records also record the date that the initial treatment was completed and the date that initial data was uploaded and presumably this includes a tree health assessment at the time of treatment.

A total of 83 of the 130 Participants (63.8%) on the "KD Confirmed" worksheet are recorded as having taken photos and 99 Participants (76.2%) have a recorded bleed assessment. This is uniquely recorded as "Old (every 20cm)".

Because Participants on the "KD Confirmed" worksheet are recorded as having treatment dates ranging from March 2017 through until May 2022 then, depending on their respective treatment

dates, individual participants can be expected to be at all stages of the Health Assessment schedule, including some who would not yet be expected to have begun post treatment tree health assessments at the cutoff date for data to enter this analysis.

The post-treatment tree health assessment schedule for individual participants has been summarised by checking for data in the "Date assessment completed" variable that records each periodic health assessment. Where these variables contained any data that suggested that the relevant assessment had been completed, either a date or comment, then the assessment was scored "1". Where data, or no data, suggested that the relevant assessment had not been completed, either left blank or a comment, then the assessment was scored "0". A frequently recorded comment was "Not done". Based on the recorded date that each Participant completed tree treatments, the status of the periodic health assessments that were expected to have been completed was summarised and the actual number of completed health assessments was calculated as a percentage of the expected number of health assessments.

Table 4.7: Frequency of percentage completion of tree health assessment schedule..

Health Assessment		
Percent Complete	**Frequency**	**Percent**
0%	47	59.5%
25%	11	13.9%
33%	5	6.3%
50%	9	11.4%
75%	7	8.9%
100%	0	0.0%
TOTAL	79	100.0%

The tree health assessment schedule for a total of 79 of the 130 participants (60.8%) on the "KD Confirmed" worksheet was able to be examined. Some of the 51 other participants either had treatment completion dates that meant that their health assessment schedule had not begun at the cutoff date for data to enter this analysis whereas others had data deficiencies that meant their assessment schedules could not be meaningfully reconstructed.

Notably, no participants for whom their health assessment sequence could be examined have been recorded to have a fully complete post treatment health assessment schedule and almost 60% of participants who completed the treatment of trees have not recorded any subsequent scheduled health assessments. Participants who have recorded some proportion of their expected health assessment schedule may have completed the early assessments and then not completed later assessments, or they may have missed at least one health assessment in the

schedule but then completed subsequent scheduled assessments. A total of 16 participants (20.3%) have completed 50% or more of their expected health assessment schedule.

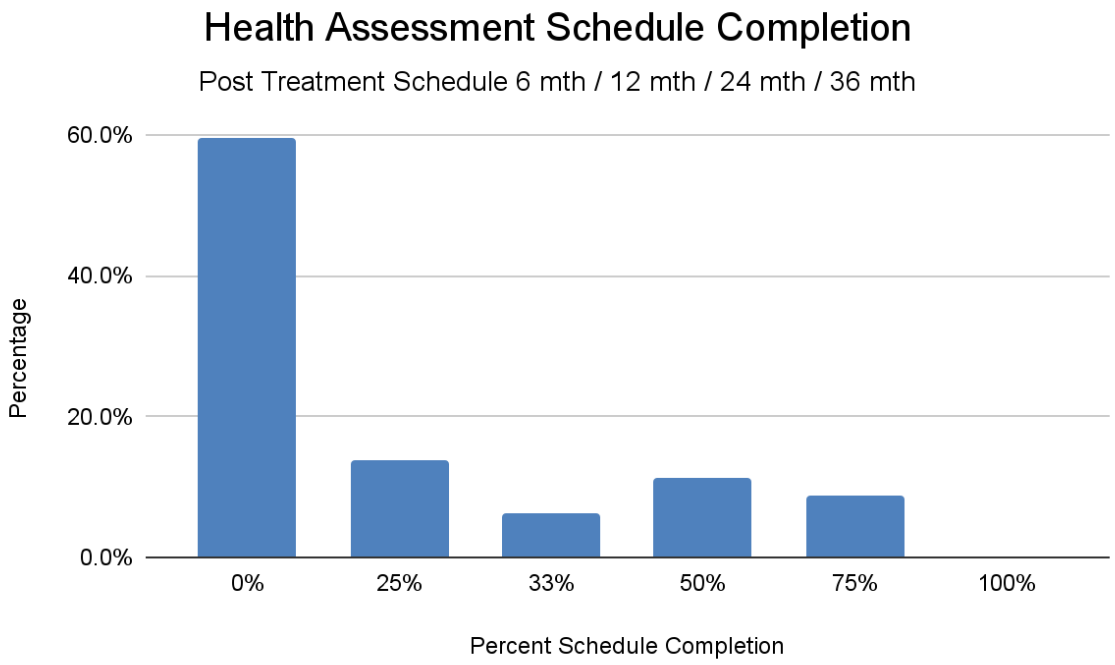

Figure 4.4: Post treatment completion of health assessment sequence.

A total of 19 participants (14.6%) also had data recorded in the "Other Years" data fields of their data records. Many of these recorded that the participant would not continue in the programme for reasons including moving house and ill health. Other data records recorded evidence of health assessments being undertaken four and five years post treatment and some of these were completed by the participant while others were completed by Kauri Rescue contractors.

4.4 Discussion

The Kauri Rescue Participant data file is a large segmented dataset that in total contains 409 data records spread across three worksheets that together include 91 variables. The aggregated data arrays of all three worksheets include 19,475 potential data points and 6,794 recorded data points for a data density of 34.9%

However, this data set is structured differently compared with the Community and Ambassador datasets as fundamental Participant data is recorded differently. Whereas in the Community and Ambassador datasets, peoples' names and addresses are recorded across a range of data fields, in the Participant dataset these two variables are recorded using one data field each. The column order of data fields also differs in the Participant dataset compared with the Community and Ambassador datasets.

Therefore, data records cannot easily be moved between the Community and Ambassador datasets and the Participant dataset meaning that details have to be re-keyed for data records that move from either the Community or Ambassador dataset to the Participant data set and this represents a potential source of error. Similarly the column order of variables across the three Participant datafile worksheets is also not consistent with the result that the transfer of data records between these worksheets could also be problematic if not handled with care.

Essentially the Participant dataset is set up and could work as a funnel where people who suspect they have kauri dieback on their property can be entered into the "Open" dataset while investigations are undertaken to confirm or discount the presence of kauri dieback. Once this process has been completed then the Participant could be moved to either the "KD Confirmed" dataset or the "Not KD" dataset depending on the outcome of the investigation. However, without any variables being present to record linkages between these three worksheets it is not certain this is how the datafile is managed. The presence of soil test results on the "Open" worksheet that determine the status of kauri dieback on some properties suggest this worksheet may have a different purpose.

There is a fundamental tension between the Community and Ambassador spreadsheets and the Participant spreadsheet as the former need to be built around person-centric data whereas the later needs to be built around location-centric data as the process of treating and assessing the health of trees is a multiyear activity during which the Participants at each location could move house. Therefore, a tighter integration between the Community and Participant datasets could relieve this tension especially when the Participant living at the location may not be able to give permission for the treatment programme to occur if the property is rented to them.

In addition to the column variables on each Participant datafile worksheet, further information about Participants on these worksheets is coded in the colour overlays that have been applied to cell ranges. Whereas two of the worksheets did not provide colour keys to be able to interpret the meaning of the colour overlays the one worksheet that did provide a colour key showed that this additional information could have been captured using alphanumeric characters in additional column variables. These colour overlays, especially when they are dark colours, can be disruptive when manipulating data on the worksheet, which would not occur if they were converted to column variables.

The Participant data file clearly demonstrates that Kauri Rescue's focus of kauri dieback intervention is in the Auckland suburb of Titirangi and extending into neighbouring suburbs throughout the Waitakere Ranges that have widespread and significant kauri dieback infection

sites. Beyond this, Kauri Rescue has also established a Participant presence throughout the natural range of kauri, although beyond Auckland this is a scattered and fragmented presence.

The data also demonstrates that Participant engagement and relationship management is most highly effective when it is based on a personal face to face relationship with a Kauri Rescue team member. Therefore, this engagement channel represents a possible avenue for Kauri Rescue to quickly spread its activities beyond the Waitakere Ranges, if it chose to do so, as the scattered and fragmented nature of Participant distribution beyond Auckland represents a nascent regional Participant base that could be leveraged through a Kauri Rescue champion in those areas.

Council referral of participants to Kauri Rescue is also a significant recruitment channel as Kauri Rescue offers a kauri dieback treatment option on private land that councils probably cannot either provide or justify. However, this also represents a risk that Kauri Rescue could be perceived by participants that come to Kauri Rescue through this channel as a local authority run programme for kauri dieback management on private land. Kauri Rescue communication needs to emphasise and continually reinforce its community roots to ensure it is perceived correctly by participants who, by joining the Kauri Rescue programme, need to understand they must commit to significant and long-term self-help kauri dieback activities with guidance, direction and support from Kauri Rescue and to not expect to have this work done for them.

Kauri Rescue clearly commits to significant and ongoing relationship engagements with Participants and no doubt some Participants need more help than others. This is a potentially time consuming and expensive commitment by Kauri Rescue, especially the provision of technical equipment and know-how to support Participants to undertake tree treatments and subsequent health assessments.

The confirmation of kauri dieback being present on a Participant’s property is a key pivot point in the relationship between Kauri Rescue and individual Participants as this determines the course of action and the nature of the relationship moving forward from that point. Therefore, it is notable that only approximately three quarters of “KD Confirmed” participants' data records held kauri dieback diagnosis data meaning almost one in four of these participants were part of the phosphite treatment group without a positive diagnosis of kauri dieback being recorded in their data record.

Equally notable was that only approximately two thirds of “Not KD” participants' data records held kauri dieback diagnosis data. This means almost one in three of these participants were excluded from the phosphite treatment group without having confirmation that kauri dieback was absent from their property recorded in their data record.

Beyond the treatment of trees the ongoing health assessment of the treated trees suffers significant limitations. The very high frequency of Participants who do not undertake any health assessments and the very low frequency of Participants who undertake more than one or two health assessments suggests that Participants may view the phosphite treatment of infected trees either as a last gasp “do or die” option, or alternatively as a “sure thing” for infected kauri.

Whatever the reason, it suggests that most Participants may not see much value in health assessments, although some obviously do and are willing to commit significant time to repeatedly complete these. Understanding Participants attitudes to health assessments and the barriers to completing them, including potential assessment methodology complexity challenges, through targeted research would provide insight into how this low level of engagement with health assessments could be improved.

Kauri Rescue’s ability to deliver kauri dieback phosphite treatment through its subpopulation of Participants was substantially hampered by the different phases that the overall programme has had to traverse. Whereas the Project phase of Kauri Rescue provided a secure resource base on which to establish and build Kauri Rescue, the Transition phase did not have this security and treatment delivery effectively stopped. This markedly reduced treatment activity was also likely driven by the impacts of the initial phases of the Covid-19 pandemic including significant restrictions on people’s movement, gatherings of people and requirements for social distancing. The Charity phase has provided better resource security and treatment activity has again ramped up. However, there are apparent challenges with treatment sequence completion that will need to be carefully managed in addition to improving Participants' engagement with the health assessment schedule post treatment.

5.0 Network Analysis

5.1 Introduction

The three spreadsheets that were the input datasets for each of the individual Kauri Rescue subpopulation analyses collectively captured each person's journey of engagement with Kauri Rescue, albeit each dataset only captured a focused segment of each engagement's overall journey. By stitching together all five worksheets from the three spreadsheets and aligning data records based on variables common to all worksheets, the full engagement journey of each person who was recruited into the total Kauri Rescue population could be recreated.

Once these individual engagement journeys had been recreated the relationship of different subpopulations with each other and the movement of people into and between them could be portrayed. This report includes a static network diagram for all Kauri Rescue engagements across the full 65 month period of this analysis. A dynamic Kumu network analysis has also been undertaken to capture the temporal, spatial and relational dimensions of the engagements recorded in the total Kauri Rescue population dataset and preliminary network maps are included here. The complete dynamic Kumu network analysis will be presented separately.

5.2 Data

Population Reconstruction

Engagement data records from all five worksheets in the three spreadsheets were copied and pasted into a single worksheet in the order of:

- Community Contact Spreadsheet: Columns C - Y
- Ambassadors spreadsheet: Columns AA - AU
- "Participant log - KD CONFIRMED": Columns AY - EI
- "Participant log - OPEN": Columns EK - FG
- "Participant log - NOT KD": Columns FI - GK

Data from each worksheet was also pasted onto rows within its column range below the last row of the previous worksheet data block. Therefore, the completed single worksheet was approximately 200 columns wide and 1,000 rows long with blocks of data arranged diagonally from top left to bottom right across the worksheet.

With all the separate subpopulation data compiled into one worksheet, each original data record was then shifted vertically within its columns, by cutting and pasting, to align with the original data record for the same engagement in the data block above and to the left. This alignment was made using name, address and date of initial contact data fields that were common to both original data records being aligned. Data records that could not be aligned were marked as being unique.

This alignment could only be undertaken manually as the formatting of the alignment control data fields was not consistent to allow scripts or logic functions to be able to complete the task. Once the alignment of all the original data records in all the data blocks was complete the alignments were tested using logic functions and any discrepancies were manually checked and adjusted if necessary.

Population Data

Once reconstructed, the complete Kauri Rescue engagement population dataset was then simplified by concatenating common data fields and reducing engagement information to binary data. This produced a simplified dataset with:

- Identifier information
    - Reference number
    - Name
- Spatial information
    - Concatenated address
    - Suburb location
- Temporal information
    - Earliest date
    - Engagement phase
- Engagement information
    - Community
    - Ambassadors
    - Participants
        - All KD
        - KD confirmed
        - KD open
        - Not KD

Engagement phase data was determined from the earliest date of engagement as follows:

- Phase 1: "Project - Establishment" - 1/1/17 - 31/5/17
- Phase 2: "Project - Expansion" - 1/6/17 - 31/12/17
- Phase 3: "Project - Operation" - 1/1/18 - 31/12/19
- Phase 4: "Transition" - 1/1/20 - 31/12/20
- Phase 5: "Charity"- 1/1/21 - 31/5/22

5.3 Analysis

Engagement Network

The complete Kauri Rescue population dataset can be diagrammatically summarised as an engagement network to illustrate the origin of engagements, the size of the subpopulations and the flow of engagements into and between the subpopulations. These engagements include duplications of individual people where they occur.

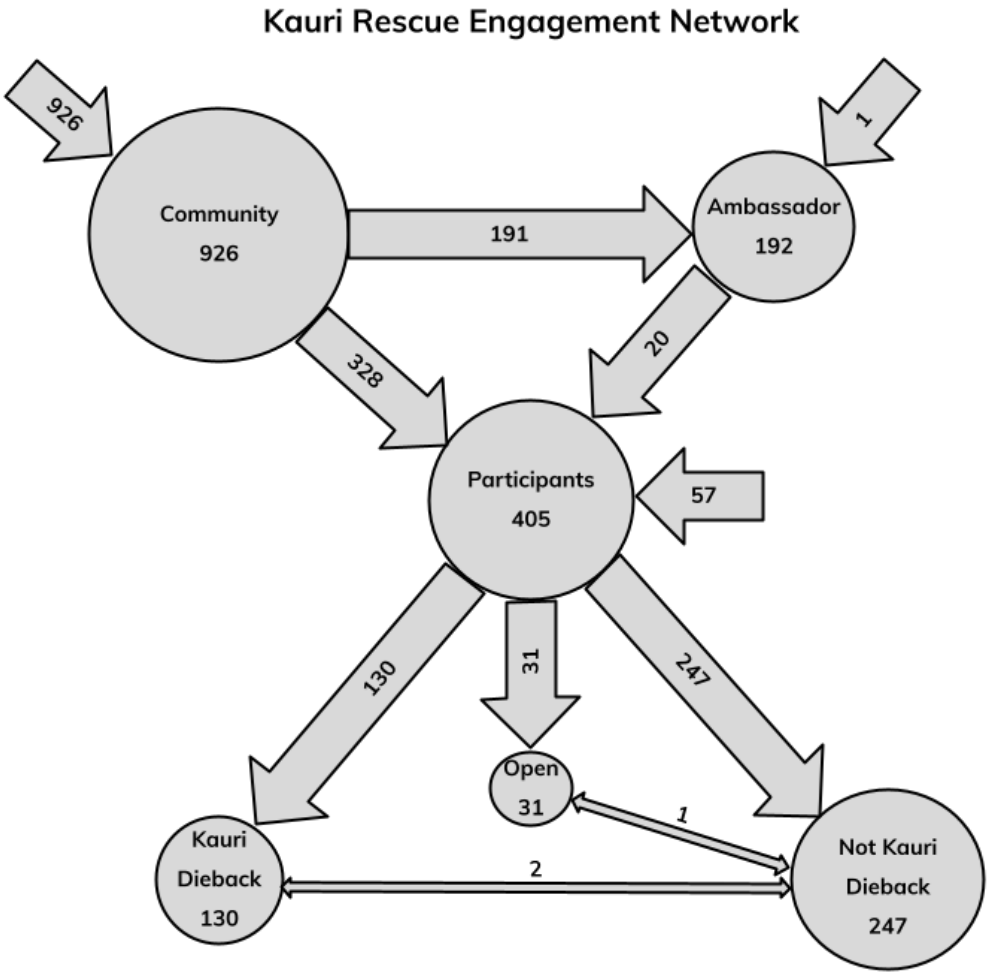

Figure 5.1: Kauri Rescue Engagement Network for the period 1/1/17 - 31/5/22. Not to scale.

Of the total engagement population, 41.4% of engagement remained as Community only, 19.5% of engagements entered the Ambassador subpopulation and 41.2% of engagements entered the Participant subpopulation, from where 16.4% entered the two Kauri Dieback subpopulations segments and 25.1% entered the Not Kauri Dieback subpopulation segment. The Kauri Dieback - Open subpopulation segment and the Not Kauri Dieback subpopulation segment shared one duplicate data record and the Kauri Dieback subpopulation segment and the Not Kauri Dieback subpopulation segment shared two duplicate data records.

Kumu Network

The Kumu network analysis portrays the temporal development of Kauri Rescue through the five time periods described above. For each phase it records each engagement in that phase as a red dot identified by a unique serial number.

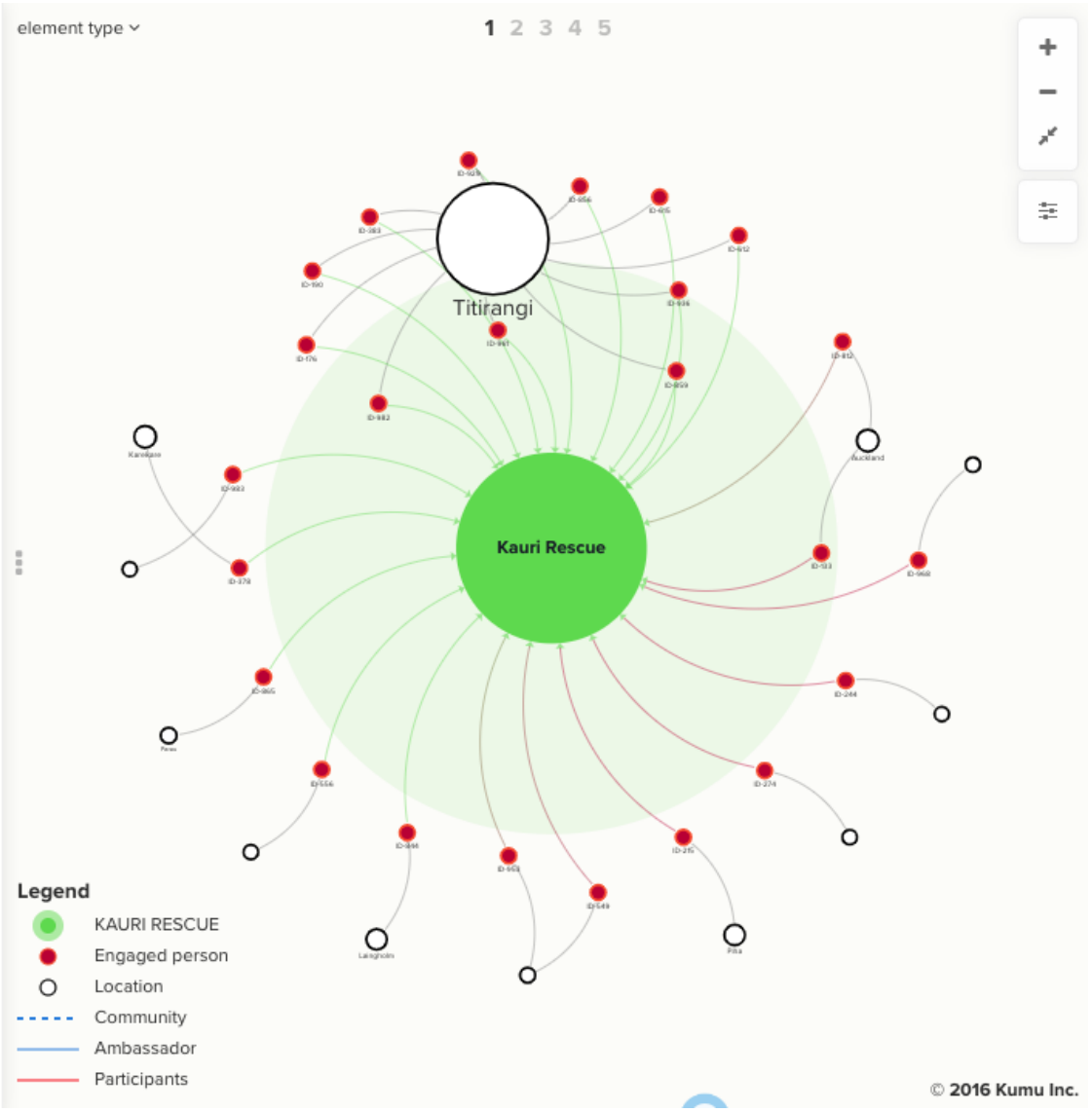

Figure 5.2: Kauri Rescue Kumu network map for the Establishment phase 1/1/17 - 31/5/17.

In each phase, each engagement is then connected both to Kauri Rescue and to a location to portray the spatial distribution of engagements. The colour of the connecting lines between Kauri Rescue and each engagement symbol (red dot) identifies the type of engagement as either Community, Ambassador or Participant.

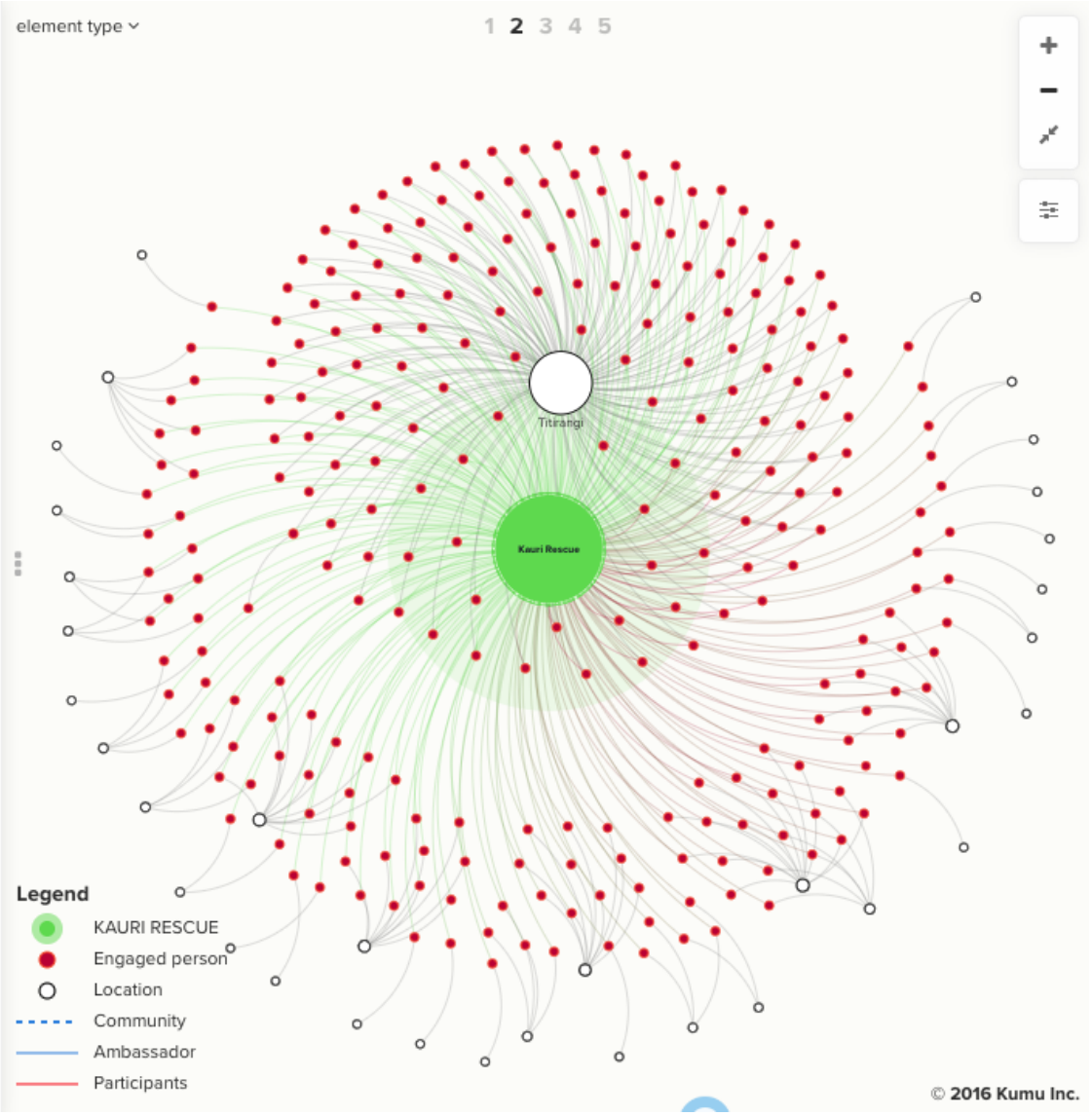

Figure 5.3: Kauri Rescue Kumu network map for the Expansion phase 1/6/17 - 31/12/17.

The dynamic nature of the Kumu network map means that locations can be drawn out of the graph to see their relationship to other locations. During the Establishment phase many locations only recorded one or two engagements each whereas Titirangi recorded almost a dozen. However, by the end of the Expansion phase, Titirangi was already the clearly dominant location that could be conceptualised as a large planet orbiting Kauri Rescue with many other locations with much smaller numbers of engagements each orbiting as a cloud of moons.

5.4 Discussion

There are several key points that come out of this analysis of the complete reconstructed Kauri Rescue engagement population. A review of the name and address data records found a number of duplications. These included data records with the same name at the same address with different earliest dates and data records with the same name at different addresses with different earliest dates. This latter type of duplication is likely a result of a person shifting house to a new address but being recorded as a new engagement. Therefore, the complete population of engagement data records is viewed as individual engagement events and not as data records of individual engaged people.

While the Community spreadsheet records 926 engagements, the full Kauri Rescue population actually includes 984 engagements because one engagement was uniquely entered directly into the Ambassador spreadsheet and 57 engagements were uniquely entered directly into one of the worksheets in the Participant spreadsheet. Therefore, the Community spreadsheet only records 94.1% of the total Kauri Rescue engagement population.

A search of the complete engagement population compiled a list of 901 unique names indicating that at least 83 (8.4%) engagements were duplications. This is likely an underestimate of duplications as different spellings of the same name were treated as being unique. Therefore “Jacqui” and “Jacqueline” with the same surname are likely to be duplicates of the same person as was “Nicki” and “Nicola”. Alternative spellings, such as “Tania” and “Taina” with the same surname are also likely to be duplications of the same person and these variations have most likely been caused by name data being variably entered multiple times into the different individual spreadsheets that have been used to reconstruct the complete Kauri Rescue engagement population. Some duplicate names at the same address appeared four times with earliest dates spread over a period of two years.

6.0 Summary

6.1 Data Management

Kauri Rescue has built a relatively large and complicated engagement management system using information management tools that were likely quick to establish at the beginning of the project but which have never been critically revisited to determine if they are fit for purpose as the volume of data they are expected to handle has grown. Having five different worksheets across three different spreadsheet files means that data may need to be entered multiple times as a person's engagement with Kauri Rescue matures and this has led to duplication and errors.

Whereas the five worksheets could be arranged to form nested funnels to manage people's engagement with Kauri Rescue this has only been partially achieved. When a person engages with Kauri Rescue the entry of their details into the Community spreadsheet would form the basis of their engagement record. If they elected to expand their engagement to become an Ambassador then the establishment of their details on this spreadsheet is sensible, however marking their data record in the Community spreadsheet with this expansion provides a traceable link between the two spreadsheets.

Similarly, if a person then became a Participant their details could also be transferred to and linked with the Participant management funnel as described above. That 57 data records were able to enter the Participant dataset directly, and not through the Community dataset, risks these people being left off important outreach activities, such as newsletter circulations, if these are made using contact details held in the Community dataset.

In reality, having separate worksheets and separate spreadsheet files is not necessary using modern computing technology as the reconstruction of the full Kauri Rescue population on one worksheet demonstrates. If a spreadsheet was the preferred data management system then all the engagement data could be managed on one worksheet using classification variables to record which subpopulations each data record belonged to.

Beyond spreadsheets, databases, and especially relational databases, are extremely powerful information management tools that allow data to be arranged and portrayed from multiple perspectives. Open source software means deploying these types of tools is not expensive and because data can be exported from spreadsheets in CSV (comma separated values) format that can also be used to import data to databases then a transition pathway could be designed to upgrade to this alternative software.

Employing a database information management system would provide more complete management of the lifetime engagement history for each person who engages with Kauri Rescue. It would also remove the tension between person-centric and location-centric data records as people can be recorded, no matter where they live, and locations can be recorded, no matter who lives there. This is difficult to achieve using two dimensional spreadsheets.

It also opens a pathway to a future web enabled information management system using a portal that would allow people to see and even record and manipulate data within their personal account. TrapNZ is an example of a fully web enabled community based environmental management system in the predator management space that also employs an app for use on mobile devices in the field. It has approximately 42,000 registered users across 6,500 projects and holds 15.5 million data points for 750,000 separate GPS locations. iNaturalist is another example.

The structure and content of the engagement data files suggests the principal purpose of deploying these is for the recording of data and not for ease of management of the recorded data. None of the worksheets employ data filters to be able to quickly and accurately sort and select data records based on classification variables and none employ data validations that require certain information to be entered in certain ways, such as from a selected list of predetermined options.

Establishing data protocols for the form of each variable would also prevent descriptive text being entered into data fields where this is better held in a separate comments or notes data field. This would also help with data alignment as for example with address details. Where address details are to be held as segmented character strings in different data fields then it is easier if the same address segment is held in the same data field across different data records.

For example, an address of 25 Short Street, Whangarei could be held as 25 Short Street in one data field and Whangarei in another data field. However, when another address of 37 Long Street, Papatoetoe, Auckland is entered this would be held as 37 Long Street in one data record and Papatoetoe in another data field and Auckland in a third data field. Using sequential data

fields for these two data records means that Whangarei and Papatoetoe are in the same data field when Whangarei is a town location and Papatoetoe is a suburb location within Auckland.

By having data entry conform to data fields for Street Address, Suburb and City, that are in the datasets, means the same data is held in the same data field for all data records. By then applying a filter to these data fields makes it very simple to locate all data records for a given location. At a finer level of detail the house number and Street Address information could also be segmented so it would be straightforward to retrieve all engagement records for people who live in, for example, Round Avenue, should a local event be planned that may be of interest to these specific people.

This type of rigour applied to many different data fields would speed the process of entering data and make for greater consistency of data across all data records. Given the prevalence of date data fields throughout the datasets these need to be formatted using the same layout as 6/9/2020 is understood to be the 6th of September 2020 in New Zealand whereas it is the 9th of June 2020 in an American date format. Similarly 30/11/2021 is the 30th of November 2021 in New Zealand but is an error in an American date format as there is not 30 months in a year.

6.2 Community

In spite of these information system challenges, since its establishment at the beginning of 2017, Kauri Rescue has built a substantial community of engagement of approximately 1,000 data records that probably represents about 900 individual people. Whereas this is centred on Kauri Rescue's focal area of Titirangi in Auckland, and associated Waitakere Ranges locations, it does extend across the whole range of kauri.

While this demonstrates ready uptake of the Kauri Rescue community model of response to kauri dieback it does come with risk. Adequately servicing the needs of people, especially participants, when they are at such low density in locations beyond the focal area becomes difficult and expensive and risks these people not getting the support they need potentially leading to disillusionment.

There could be merit in restricting the engagement of people outside defined areas of operation to just enrolling in the Kauri Rescue community so they can be kept informed of activities. When the area of operation can be expanded to a new location then these people represent highly qualified leads to be able to rapidly establish and expand Kauri Rescue's operations in the new locality by recruiting them as Ambassadors and Participants.

By building capacity in its key localities then allows Kauri Rescue to leverage its skills and expertise into other areas where there is clearly interest from community members. Using this

type of approach puts Kauri Rescue in proactive charge of its growth and development rather than having to reactively service engagements that are difficult to crystallise into growth.

This analysis has also identified the most successful engagement channels for different types of engagements. Whereas events are highly successful for engaging Community and Ambassadors, Participants are most successfully engaged through a Kauri Rescue team member. Although face to face channels are consistently more productive at generating engagements, digital channels can also make a meaningful contribution to engagement especially given they require little additional effort once established.

It was particularly notable that the Community and Ambassador subpopulations self-selected for people seeking help for kauri dieback and people who sought to contribute to kauri dieback management actions. People who sought to contribute to kauri dieback management overwhelmingly wanted to take an active part in these activities.

6.3 Ambassadors

The range of skills that Ambassadors offered meant the strategic identification of key skills could result in specific Ambassadors having a disproportionately large positive effect on Kauri Rescue engagements, given the success of Kauri Rescue's mixed engagement model across both face to face and digital engagements. Similarly the important identification of indigenous knowledge skills represents an opportunity for Kauri Rescue to broaden its kauri dieback response away from being dominated by phosphite treatment to be able to be attractive to a potential audience who more highly value cultural or non-invasive kauri dieback treatment interventions.

The limited capacity of Kauri Rescue to respond to engagements is revealed by the large number of data records that recorded details of an engagement being passed on to other Kauri Rescue team members but it does not record an expanding and responsive network of volunteers being recruited into these community engagement functions. Given the level of community engagement that Kauri Rescue generated, the concomitant development of a skilled and co-ordinated labour force using its Ambassadors resources would expand Kauri Rescue's capacity to handle these referrals without needing to resort to outside organisations, such as Councils. Changes in priorities or funding in those outside organisations could then feedback and negatively impact Kauri Rescue's ability to service engagements, which having a network of skilled Ambassadors could mitigate.

Whereas the recruitment of a higher ratio of Ambassadors to Community engagements may help alleviate Community co-ordination and management pressures, it also risks shifting the same pressure to the Ambassador subpopulation as people who engaged with Kauri Rescue to

help with activities then needed to have activities to be involved in. Because Kauri Rescue's rate of Ambassador recruitment was significantly higher across multiple locations where it only had a fragmented base of Community engagements this also makes the effective co-ordination and management of this scattered human capital resource more challenging.

6.4 Participants

Kauri Dieback Diagnosis

People who engaged with Kauri Rescue seeking help for trees they suspected were infected by kauri dieback made up a substantial proportion of the total Kauri Rescue population as over 400 data records entered the Participant dataset. This indicates that private landowners saw Kauri Rescue as a real opportunity they could use to do something to help protect kauri trees on their properties they suspected were infected and dying from kauri dieback.

However, the analysis of this data identified some significant challenges. Approximately 60% of people in the dataset were classified as not having kauri dieback and the remaining 40% were either under active investigation or had entered the phosphite treatment group. Confirming a kauri dieback infection is technically difficult and relatively expensive but is pivotal to determining further actions. Therefore the discovery that a substantial percentage of both groups had been classified without a confirmed kauri dieback diagnosis being recorded is notable. If in fact these diagnoses were recorded elsewhere in Kauri Rescue's information management system this then further questions the utility of the engagement data.

Health Assessments

Once those who did enter the treatment group and actively treated trees a further challenge became apparent around the completion of the post treatment health assessment schedule. Whereas the treatment of trees is where tree recovery may begin it is not until post treatment health assessments are completed is it possible to determine the relative success of the treatment. Taken on the quantitative data alone, this analysis identifies that of 984 engagements with Kauri Rescue over a period of 65 months, 130 engagements entered the phosphite treatment group but just 16 people completed the majority of the kauri dieback treatment and health assessment programme assuming the trees they treated were actually infected with the causative pathogen for kauri dieback.

6.5 Recommendations

Throughout the 65 month period of analysis, Kauri Rescue faced periods of significant uncertainty about its ability to survive and continue with its programme. That it has survived and is now structured as a Charitable Trust, and with the outcome of this analysis of its

engagement data available, it has the opportunity to target specific pain points to rapidly improve this outcome. Immediate responses include:

- establishing more rigorous data protocols to reduce the amount of data clutter within the engagement information system
- reviewing kauri dieback diagnosis data to identify if gaps in this area are real or apparent as a result of diagnosis data not being correctly recorded
- gaining a better understanding about Participants' barriers to undertaking post treatment health assessments
- Identifying easy opportunities to backfill incomplete Participant treatment sequences to advance these towards an acceptable level of completion
- developing a more targeted Ambassador programme to generate a support network of people who can meaningfully contribute to the directed growth of Kauri Rescue
- undertake the development of a strategic framework that will make and justify active choices about how Kauri Rescue can utilise its available capital resources (of all types) to grow its footprint both in terms of its area of operations and its intensity of operations.

Longer term, decisions need to be made about how to evolve the engagement management system so it is able to support the continued operation and any future growth of Kauri Rescue. A well designed and effectively managed engagement information system could leverage a considerable improvement of Kauri Rescue's performance and outcomes and with the challenges of kauri dieback remaining acute, Kauri Rescue has an important and valuable role to play moving forward as it has demonstrated it can deliver results with the significant progress it has made in its short and turbulent history to date.

7.0 Limitation

This report has been prepared solely for the benefit of the Kauri Rescue and no responsibility is taken in respect of any other organisation or person. It contains confidential and privileged information and Aranovus Limited reserves all its rights with respect to this information. Reliance by other parties on the information or opinions contained in this report shall be at such parties sole risk without our prior review and agreement in writing. No part of this report may be reproduced without the prior permission of Aranovus Limited. Aranovus Limited is not responsible for any changes made to this report after it has left our office.