Monitoring Strategy – Te Whānau-ā-Apanui

MACA seawater space

Foundations for aquacultures first ‘digital twin’

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If Te Whānau-ā-Apanui are to develop a long-term sustainable aquaculture sector, several key foundation pieces will need to be put in place to achieve this. Perhaps one of the most important pieces amongst those, alongside a deep understanding of the influence a Te Ao Māori world view has to offer, is a systems view of the moana coupled to a strong contemporary science foundation, based on hard data collected for this specific purpose.

It follows we must dedicate effort and resources to develop a knowledge platform of research-based evidence so we can add to our already deep understanding of the moana, through the contract we have with Tangaroa. Currently, our (everyone's) contemporary science knowledge across the moana is, at best, patchy. Even with an initial high-level assessment, it is surprising to find how little information there is in the 'tribal waters' of Te Whānau-ā-Apanui. Moreover, even where information has been captured, stored, and analysed, it is disjointed, disaggregated, and generally siloed within the respective organisations who have completed the work.

Given the nature of the current circumstance, it seems logical to approach the strategy with three initiatives within the 184,000ha of Te Whānau-ā-Apanui customary title seawater space out to the 12 nautical mile limit (rohe moana). The first is to collate and connect all current information from anyone who has already conducted research within the rohe moana (including satellite data). The second is to set up a monitoring / measuring programme within the rohe moana to capture the information necessary to give insights into the types of aquaculture options Te Whānau-ā-Apanui might like to consider. The third is an analytical and insights strategy to extract the value this information provides to make evidence-based investment decisions – on behalf of the people of Te Whānau-ā-Apanui and the regional and national communities we will also support.

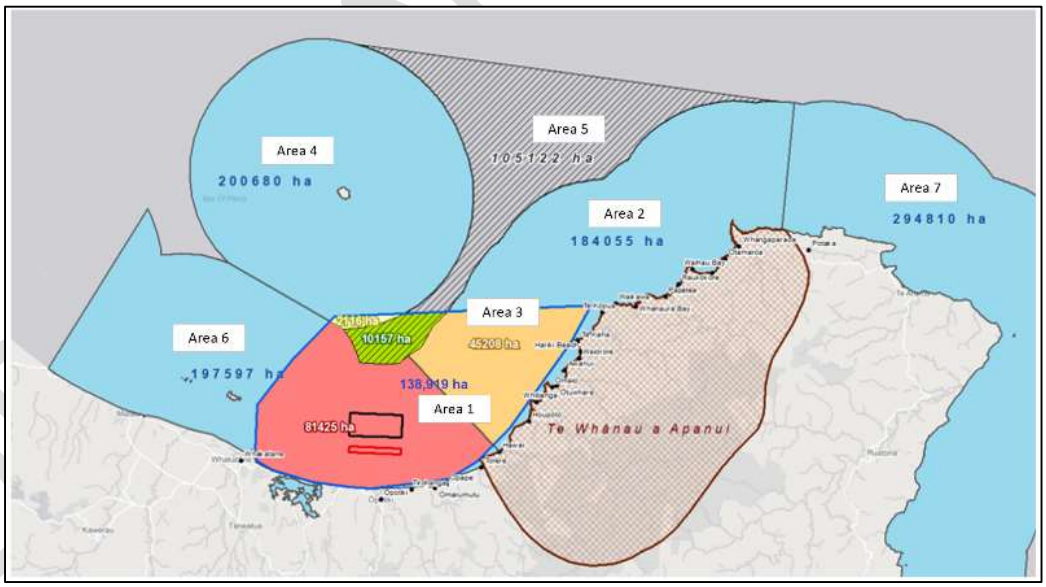

Figure 1 – Tribal seawater space and Cawthron Research Institute Research Area

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Te Whānau-ā-Apanui MACA seawater space – Proposed monitoring / measuring regime (including sites)

Introduction

For Te Whānau-ā-Apanui to be able to make informed investment decisions of what aquaculture activity might like to be considered where, more environmental circumstance information is required to inform those decisions. As it stands, this requires data and information to be collected over time by recording and monitoring, reporting, and analysing the environmental circumstances in the areas we are considering aquaculture activities.

This strategy seeks to outline a systems and network approach to how this is to be achieved. Alongside the data already available, it is proposed to set up a network of research buoys with state-of-the-art monitoring and recording equipment in order this data can be collected and collated as required. And, the salient environmental elements analysed to support investment decisions in the seawater space captured at this time when we do. The strategy is underpinned by a simple rationale driven by a single purpose. The rationale is based on the realisation our Iwi and others have very little knowledge of the conventional science we require of our environmental system we seek to invest in, with some support from experts in the field, a phased monitoring regime that reflects the importance of the economic potential the seawater space has and the environmental circumstance it is.

Proposed sitesd

Ideally the following general terms will apply (see Figure 1. Te Whānau-ā-Apanui MACA seawater space – Proposed monitoring sites),

1. 4x monitoring devices on 6x longitudinal axis set 1km to 2km from the inshore environment out to the 12 nautical mile limit (24 in total).
2. 13x monitoring devices on the 12 nautical mile limit – set as described in the map below (13 in total).

A suite of monitoring regimes across the devices reflecting the collection of information required to make evidence-based investment decisions in aquaculture farming activities (for example, but not limited to, shellfish, seaweed, and finfish) – see Table 1. Current monitoring of seawater in Te Whānau-ā-Apanui tribal waters.

These will be set out in a phased rollout. And, subject to discussions with experts, measuring the environment as required, for the aquaculture activities being considered within these boundaries. It should be noted the monitoring at each point will in many cases not be the same. We propose a systems approach, recognising the variety of elements we are required to monitor, alongside the various sites we need to analyse. Each site will have some of the required elements, others will have others. But when consolidated, a full picture of the ebbs and flows of the seawater space will be captured, analysed, and visualised for insights into investment decisions, when they are made.

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Figure 1. Te Whānau-ā-Apanui MACA seawater space – Proposed monitoring sites

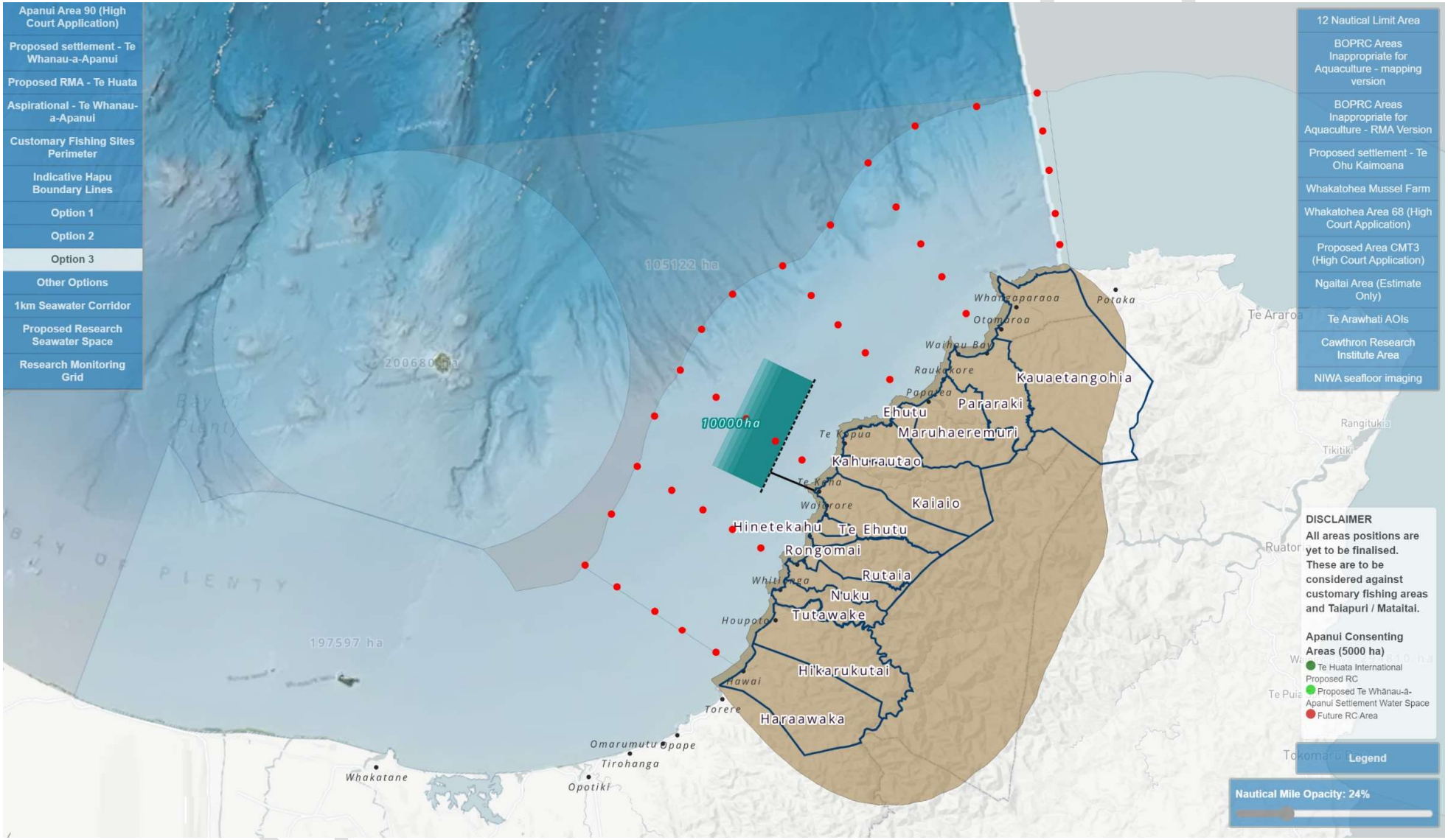

Table 1. Current monitoring of seawater in Te Whānau-ā-Apanui tribal waters

Variable	Kereu River	Sea Water	THCT Sea Water Monitoring Buoy
Total Nitrogen (g/m^3)	BOPRC	THCT	
Nitrate Nitrite Nitrogen (g/m^3)	BOPRC	THCT	
Total Ammoniacal Nitrogen (g/m^3)	BOPRC	THCT	
Total Phosphorus (g/m^3)	BOPRC		
Dissolved Reactive Phosphorus (g/m^3)	BOPRC		
Dissolved Oxygen Sat (%)	BOPRC		
Dissolved Oxygen (g/m^3)	BOPRC		
Escherichia coli (cfu/100ml)	BOPRC	THCT	
Salinity (%)		THCT	Yes
Total Suspended Solids (g/m^3)	THCT	THCT	
Turbidity (NTU)	THCT	THCT	Yes
Water Clarity (m)	BOPRC		
Conductivity (uS/cm)	BOPRC		
pH (pH Units)	THCT	THCT	Yes
Water Temperature (degC)	THCT	THCT	Yes
Discharge (g/m^3)			
Flow Rate (m^3/s)	*TBC*		
River Level (m)	*TBC*		
Biotoxin Monitoring		MPI	
Chlorophyll		THCT	Yes
Heavy Metals	THCT	THCT	

Supporting institutions / organisations

1. Ministry for Primary Industries (MPI)
2. National Institute of Water and Atmospheric Research (NIWA)
3. Cawthron Research Institute
4. Adroit - Environmental IoT monitoring
5. R J Hill Laboratories Limited
6. Waikato University
7. Massey University

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Monitoring locations (including satellite reference locations)

Research Sites – Corner points

	Long_WGS84	Lat_WGS84	OBJECTID	X_NZTM	Y_NZTM
Research Site 1	177.6744	-37.7267	1	2012031.84	5814207.53
	177.6757	-37.726	1	2012156.41	5814277.43
	177.6766	-37.7271	1	2012225.68	5814153.98
	177.6752	-37.7278	1	2012101.1	5814084.08
	177.6744	-37.7267	1	2012031.84	5814207.53
Research Site 2	177.6942	-37.7171	2	2013837.25	5815183.47
	177.6958	-37.7169	2	2013978.86	5815202.21
	177.6961	-37.7182	2	2013997.44	5815061.89
	177.6945	-37.7184	2	2013855.83	5815043.14
	177.6942	-37.7171	2	2013837.25	5815183.47
Research Site 3	177.7057	-37.7003	3	2014940.15	5817006.39
	177.7058	-37.699	3	2014955.1	5817148.45
	177.7074	-37.6991	3	2015095.88	5817133.63
	177.7073	-37.7003	3	2015080.92	5816991.57
	177.7057	-37.7003	3	2014940.15	5817006.39
Research Site 4	177.7095	-37.684	4	2015367.26	5818794.64
	177.7101	-37.6828	4	2015431.17	5818922.39
	177.7116	-37.6833	4	2015557.76	5818859.06
	177.711	-37.6845	4	2015493.86	5818731.31
	177.7095	-37.684	4	2015367.26	5818794.64
Research Site 5	177.7255	-37.6698	5	2016862.52	5820303.69
	177.7271	-37.6695	5	2017003.59	5820326.14
	177.7274	-37.6708	5	2017025.84	5820186.35
	177.7259	-37.671	5	2016884.77	5820163.9
	177.7255	-37.6698	5	2016862.52	5820303.69
Research Site 6	177.7579	-37.6671	6	2019734.32	5820457.25
	177.7595	-37.6671	6	2019876.94	5820449.29
	177.7595	-37.6684	6	2019869.06	5820307.96
	177.7579	-37.6684	6	2019726.44	5820315.91
	177.7579	-37.6671	6	2019734.32	5820457.25

Research Sites – Centroids

	OBJECTID	ID	X_NZTM	Y_NZTM	Long_WGS84	Lat_WGS84
Research Site	1	38	2012128.76	5814180.76	177.6755	-37.7269
Research Site	2	39	2013917.34	5815122.68	177.6952	-37.7177
Research Site	3	40	2015018.01	5817070.01	177.7065	-37.6997
Research Site	4	41	2015462.51	5818826.85	177.7105	-37.6837
Research Site	5	42	2016944.18	5820245.02	177.7265	-37.6703
Research Site	6	43	2019801.69	5820382.6	177.7587	-37.6677

10,000-hectare Monitoring Grid

OBJECTID	X_NZTM	Y_NZTM	Long_WGS84	Lat_WGS84
9	2014542.98	5826312.09	177.6959	-37.6169
9	2005299.18	5814770.76	177.5979	-37.7247
9	1999923.73	5818922.85	177.5348	-37.6897
9	2009205.13	5830531.41	177.6333	-37.5813
0	2005127.92	5819935.93	177.5931	-37.6783
0	2009394.33	5825392.97	177.6383	-37.6274

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Research Sites - Buoy points

X_NZTM	Y_NZTM	Long_WGS84	Lat_WGS84	OBJECTID	Name
2016049.37	5816315.64	177.7186	-37.706	1	Start
2015548.35	5816319.27	177.7129	-37.7062	2	500m mark
2015366.06	5816504.62	177.7108	-37.7046	3	Star

Research Sites – Rohe Moana Monitoring Sites

Long_WGS84	Lat_WGS84	OBJECTID	X_NZTM	Y_NZTM
177.4937	-37.8974	1	1995186.73	5796039.59
177.452	-37.8662	2	1991680.99	5799677.62
177.4185	-37.8398	3	1988869.79	5802753.41
177.3718	-37.8055	4	1984934.11	5806755.24
177.3325	-37.7754	5	1981626.81	5810260.98
177.5822	-37.7906	6	2003554.2	5807515.92
177.5472	-37.7646	7	2000610.7	5810558.63
177.5107	-37.7374	8	1997534.91	5813733.64
177.4718	-37.7097	9	1994260.69	5816974.79
177.3816	-37.7241	10	1986223.95	5815751.09
177.4294	-37.6764	11	1990688.8	5820844.33
177.466	-37.6241	12	1994194.54	5826499.81
177.5134	-37.5782	13	1998626.32	5831394.61
177.5568	-37.6153	14	2002264.35	5827095.13
177.5935	-37.6451	15	2005340.14	5823622.46
177.6291	-37.6756	16	2008316.7	5820083.65
177.6614	-37.7014	17	2011028.69	5817074.01
177.8045	-37.6295	18	2024059.44	5824416.21
177.5531	-37.5371	19	2002363.57	5835793.32
177.6053	-37.5041	20	2007159.15	5839232.91
177.6825	-37.4823	21	2014104.48	5841316.51
177.7152	-37.5209	22	2016783.39	5836884.73
177.7456	-37.5587	23	2019263.86	5832552.17
177.7768	-37.5952	24	2021810.48	5828351.9
177.7598	-37.4461	25	2021149.02	5844987.61
177.8283	-37.3841	26	2027565.18	5851569.13
177.8565	-37.4389	27	2029748	5845351.41
177.8819	-37.4849	28	2031732.38	5840125.88
177.9032	-37.5257	29	2033386.03	5835495.66
177.9279	-37.5714	30	2035304.26	5830303.2
177.9035	-37.3521	31	2034411.29	5854777.21
177.995	-37.3423	32	2042580.31	5855438.67
178.0835	-37.3391	33	2050451.68	5855372.53
178.0816	-37.3826	34	2050021.74	5850543.87
178.0806	-37.428	35	2049657.93	5845516.78
178.0783	-37.4775	36	2049161.84	5840026.66
178.0766	-37.513	37	2048798.04	5836090.98

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