



Far North District Council
Memorial Avenue
Kaikohe

5 July 2021

Attention: Ben Bowden

Dear Ben,

Hihi WWTP treated wastewater disposal to land

Far North District Council (FNDC) prepared the Hihi Wastewater Treatment Plant Land Disposal Options Assessment report in June 2021. The report provided results of an assessment to identify potential sites for land discharge of treated wastewater from the Hihi Wastewater Treatment Plant (Hihi WWTP) and shortlisted suitable sites for a future detailed assessment. However, the report did not include cost estimates for wastewater pumping, storing and irrigation on the potential sites.

The purpose of this letter is to provide a high level cost estimates to support suitability of potential sites¹ provided to Beca by FNDC.

Scope of Works

The scope of works includes a high level engineering design which is required to develop a high level capital cost estimate for two preferred sites for treated wastewater discharge to the land. The following scope is covered in this letter:

- High-level design of the pump station and conveyance to the two land discharge sites, provided by FNDC
- High-level consideration of potential storage
- High-level consideration of discharge system (assumed surface spray irrigation)
- Class 5 (-30% to +50% accuracy) cost estimates

1.1 Pump Station design and Conveyance to Preferred sites

A high level pump station design was undertaken, and the pipeline routes were identified to deliver treated wastewater to two potential sites. The pump station and pipeline design assumed the following:

- The pump station will be located at Hihi WWTP site for the ease of tie-in works, assumed to be at a sea level +/- 1m.
- Adopted pumping design flow 5 L/s. This will provide the following approximate pumping time per day:

¹ Option 1 for Land Disposal in Hihi GIS Mapping, by FNDC, June 2020 and Option 2 for Land Disposal in Hihi GIS Mapping, by FNDC, June 2020

- 3 hr based on average flow of 52 m³/d (projection² for year 2055)
- 5 hrs based on 90%tile flow of 89 m³/d
- 24 hrs based on maximum flow of 446 m³/d
- Treated wastewater storage will be provided at the land discharge site.
- Treated wastewater quality will be sufficient for the pumping purpose to avoid biofilm forming in the pipeline.
- Discharge of pipeline assumed to be a potential storage location within proposed irrigation site boundaries on a relatively flat area (contour line 60 m).



Therefore, the following head loss is calculated through the system assuming minor pipe losses based upon proposed pipe route:

- Disposal site option 1 – 72.03 m
- Disposal site option 2 – 75.33 m
- Pipework to be constant diameter throughout the proposed route.
- Estimated size of PE pipeline (PN9) is DN100 at a target velocity of 0.5-1.0 m/s.
- Pipeline will be buried along the road in a road corridor and entering each site via council owned land.
- Assumed no clashes with existing utility services (e.g. electricity, telecommunications) and road structures.

² Hihi Land Disposal Calculations, excel spreadsheet, provided by FNDC

Indicative pipeline routes to potential Site Option 1 and Site Option 2 are presented in Figure 1 and Figure 2 respectively below.



Figure 1 Pipeline route to potential Site Option 1

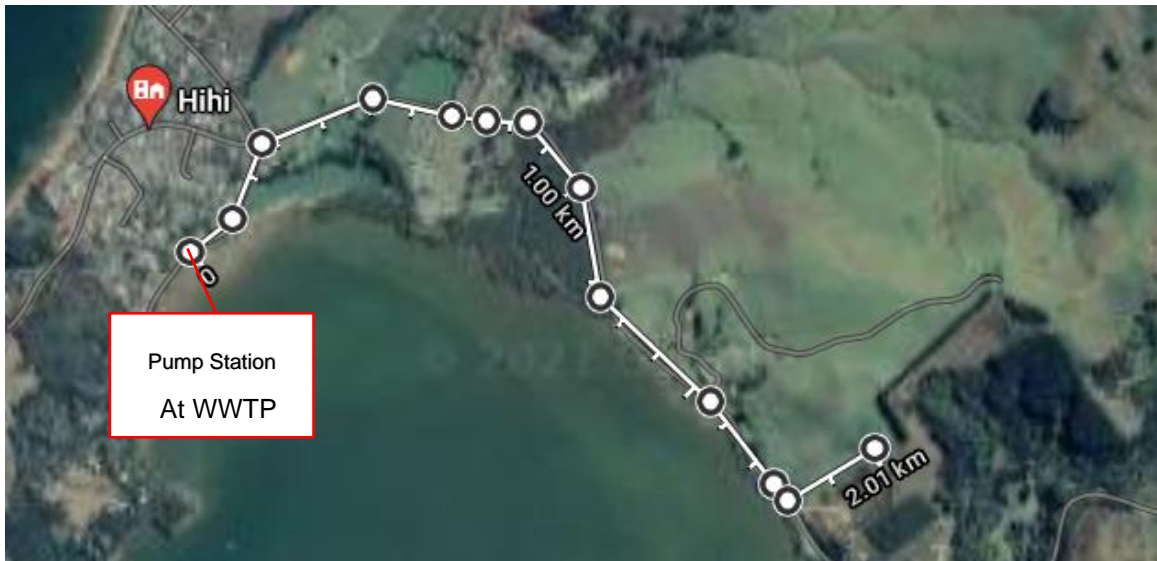


Figure 2 Pipeline route to potential Site Option 2

1.1.1 Site options

The potential sites were assessed³ by FNDC and provided to Beca:

- Option 1 for Land disposal Hihi GIS Mapping June, 2021
- Option 2 for Land disposal Hihi GIS Mapping June, 2021

The land disposal areas which could be suitable for irrigation, determined by FNDC for potential Site Option 1 and Site Option 2 are presented in Figure 3 and Figure 4 respectively below.

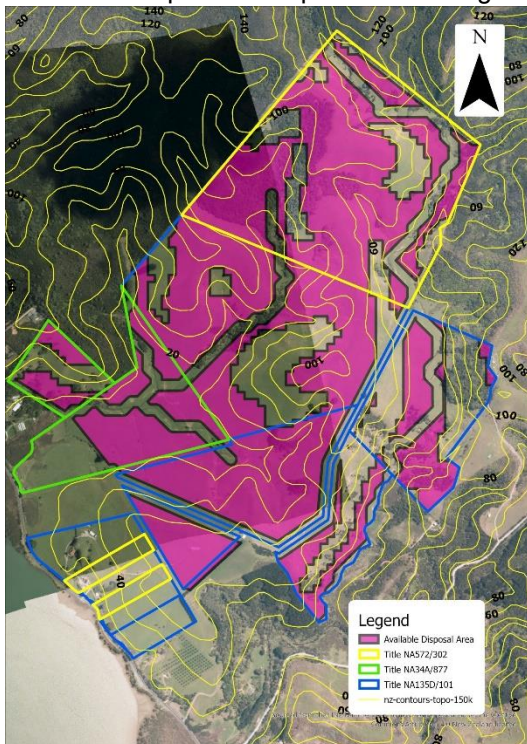


Figure 3 Potential disposal to land Site Option 1

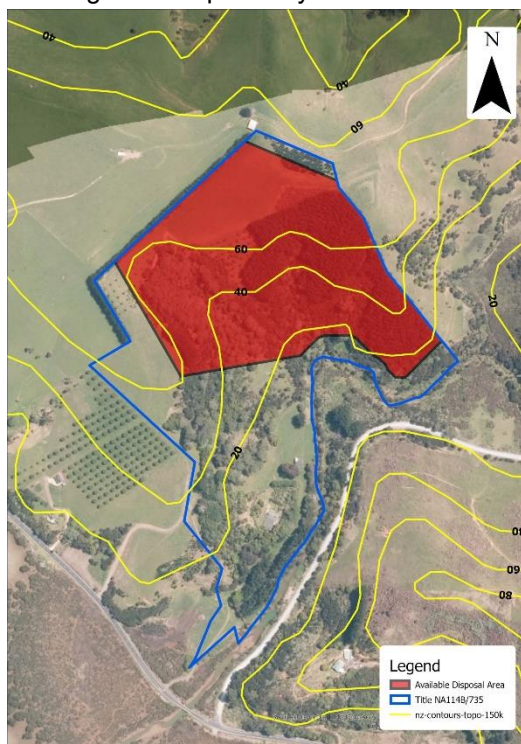


Figure 4 Potential disposal to land Site Option 2

It is understood that:

- Option 1 - Underlying Property Size: 193.6 Ha across 8 parcels of land and 3 titles. 43.5 ha across 3 titles are marked as land available for irrigation.
- Option 2 - Underlying Property Size: 17.5 Ha across a single parcel. 12.2 ha is marked as land available for irrigation.

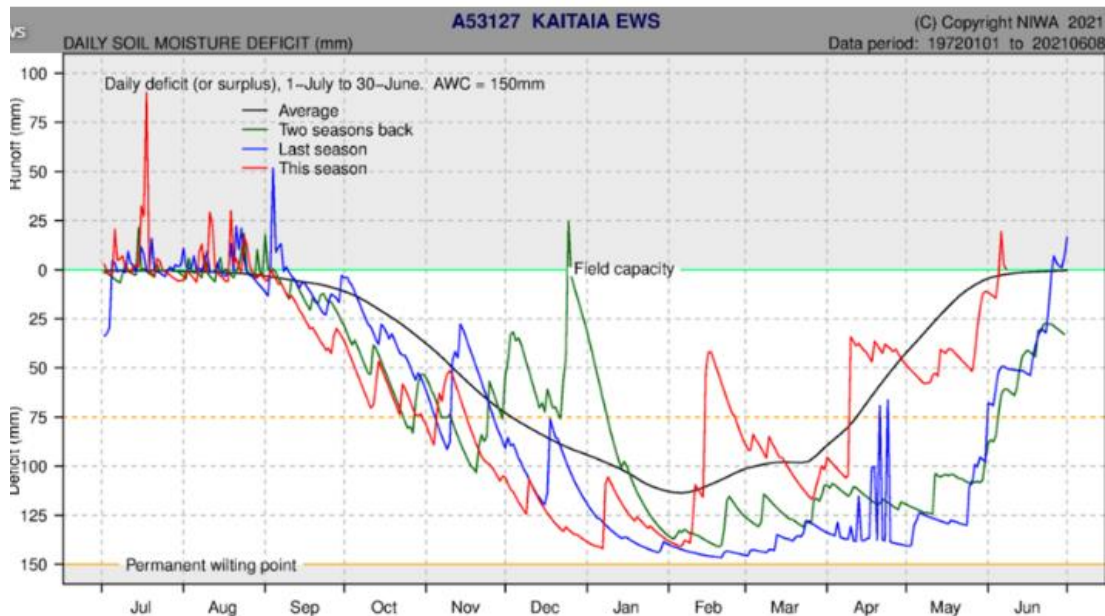
³ Hihi Wastewater Treatment Plant Land Disposal Options Assessment Draft report prepared by Far North District Council (FNDC) in June 2021

1.2 Irrigation and Storage

A high level assessment of required treated wastewater storage and irrigation area was undertaken to provide indicative sizing information for the cost estimates. The storage and irrigation system assumed the following:

- The storage for treated wastewater will be at the discharge point from the pipeline from the pump station and is assumed to be an open pond with a clay liner and standard slopes of 1:3.

The pond size is based on 2 month storage of average daily flow in 2055. This assumption is based on typical soil moisture deficit in Kaitaia (see Figure below, obtained from Northland Regional Council website, NIWA data). During the months of July and August there are typically extended periods of no soil moisture deficit (i.e. soil is saturated) and therefore low volumes of treated wastewater are expected to be disposed of to land during this period. At other times of the year, the storage pond is required to buffer out peak treated wastewater flows.



- It is assumed that dry mounted pump will be installed on the bank of the pond to transfer treated wastewater from the storage pond to the irrigation system. The pump is assumed to be in-housed in a standard shed together with controls for the pump itself and irrigation system.
- Due to the relatively steep slopes on both sites and assumed future site management requirements we assumed that a cut and carry operation is not feasible, therefore we have assumed that the cover will be native trees, pines or similar. Fixed Spray irrigation/k-lines is assumed to be installed.
- The land requirement for irrigation was determined by applying a simple modelling tool using daily flows, rain data, hydraulic application rate of 3 mm/day and effluent storage of 3,600 m³.
- A 50% factor was applied to total land area required to be purchased to account for buffer zones around drains/streams and the boundary.

1.2.1 Storage

An estimated storage pond volume required to accommodate 2 months treated wastewater storage is 3,600 m³ based on the average flow future (2055) of 52 m³/d. The approximate internal dimensions of the pond are 30m x 40m with an effective water level of 3m (total depth 3.5 m). Indicative locations for the storage pond are presented in the figures below:

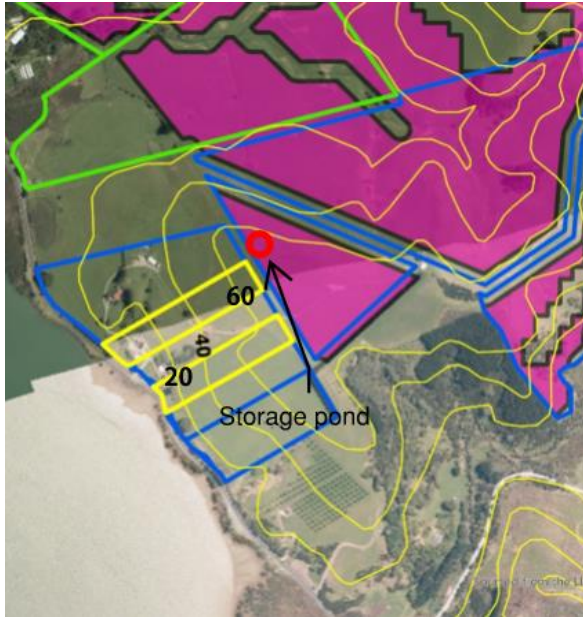


Figure 5 Storage pond location for land disposal Site Option 1

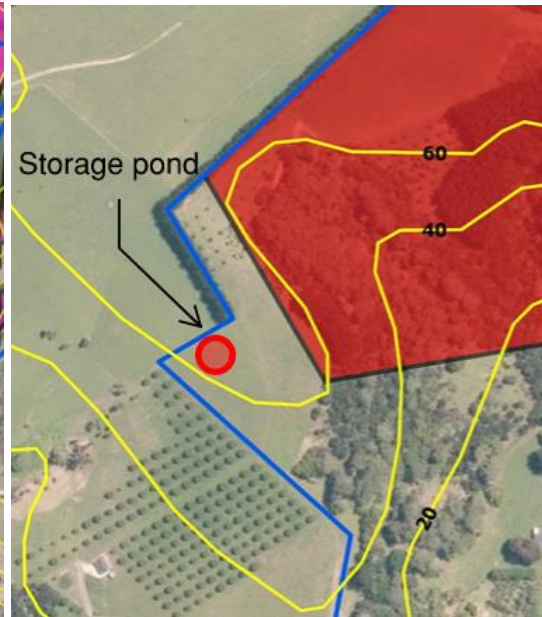


Figure 6 Storage pond location for land disposal Site Option 2

1.2.2 Irrigation system

High level modelling was applied to determine land irrigation area and therefore the size of irrigation system. The model used flow data provided by FNDC for the period January 2017 – December 2020. Rain data provided by FNDC for this period had some gaps, especially in winter months in 2017. Rain data was adjusted by filling in gaps with rain data provided by NIWA (Kaitaia AWS).

The estimated irrigation area required for effluent disposal is summarised in Table 1 below.

Table 1 Irrigation area requirements for treated effluent disposal in 2025 and 2055

	Flow m ³ /d	2 month storage m ³	Rounded m ³	Hydraulic loading rate mm/d	Irrigation area (no buffer) ha	Land required (with buffer) ha	Nitrogen loading kgN/ha/year ⁴
2025	45	2790	2800	3	4.7	7.05	92
2055	57	3534	3600	3	5.3	7.95	102

A minimum area of 5.3 ha is required to dispose treated wastewater to the land in the future. The area size accounts for the down time when irrigation will not be possible due to weather conditions. It is assumed that minimal irrigation will occur in July and August, where treated wastewater will be stored in the pond. No irrigation will occur if the rainfall will be greater than 3 mm/d. To catch up with the irrigation for the down

⁴ Based on an assumed continuation of existing treated wastewater quality being discharged from the WWTP.

time period without exceeding hydraulic application rate of 3 mm, more land is required in comparison to the catch up irrigation method where increasing hydraulic rate could be applied.

The minimum land area of 5.3 ha is required for irrigation itself, however a buffer of 50% should be applied to account for the buffer areas to a property boundary. As indicated in the table above approximately 7.95 ha of land will be required including buffer area. The buffer area could also include the area required for pond storage (0.12 ha). Further technical work on soil suitability, pond storage location, irrigation system layout and application rates is recommended before purchasing the land.

We understand that 43.5 ha of land is available for irrigation as Option 1 and 12.2 ha as Option 2. Given that 8 ha of land is required for treated wastewater disposal in the future there is sufficient land available in either option.

1.3 Capital cost estimate

Estimate Construction Costs (-30% to + 50% accuracy)

Options Costs (\$NZD) are summarised in table below. See Appendix A for more detail breakdowns of the costs.

Table 2 Estimated Construction Cost (-30% to + 50%) for Disposal Site Option 1 and Option 2

Cost Item	Site Option 1	Site Option 2
Pump station and pressure pipeline	562,600	686,800
Effluent Storage Pond	307,400	307,400
Irrigation system	920,400	920,400
Electrical and controls	80,000	80,000
Planning	150,000	150,000
Professional fees, Council internal costs and contingency	829,600	875,400
Total	2,850,000	3,020,000
Range	2.2 Mil to 4.3 Mil	2.3 Mil to 4.5 Mil

The above costs are based on current costs as of June 2021, exclude GST and do not include for escalation or risks associated with COVID delays and/or disruptions.

1.3.1 Limitations

This concept cost estimate is based on limited information and is therefore high level only (feasibility - +/- 30 to 50%). It is intended to be used only for high level option assessment/selection and cannot be relied on or used for detailed pricing or budgeting purposes. Detailed construction methodology and geotechnical information is required prior to providing a detailed estimate of construction costs. There is a risk that the geotechnical conditions encountered could make this unfeasible, however this can only be determined through additional geotechnical investigations.

1.3.2 Assumptions

The following assumptions have been made for cost estimating purposes (see also the detail costs for more information)

- Only a rudimentary access allowed for along the pipe route for pipe installation.

- Assume solid block fixed sprinkler irrigation is needed.
- Planting of irrigation area based on 3 small plants per m2.
- All works done during normal work hours.
- The project will be procured on a competitive basis.
- The contractor will be given free access to the Works site.

1.3.3 Exclusions

No allowance has been included in the estimates for the following costs:

- Any upgrades at the WWTP itself (we have assumed the current treated wastewater quality will continue in the future)
- Fencing reconfiguration along the pipeline route.
- Effects of climate change on future irrigation system performance.
- Maintenance access tracks.
- Land purchase.
- Relocation of any existing services / utilities.
- Contaminated material removal or treatment.
- GST
- Escalation
- Costs to date
- Operating cost
- Insurance costs
- Legal and finance fees
- Risk items
- Covid-19 related costs

1.3.4 Contingency Allowance

The cost estimate includes a 10% estimating allowance for design development and 15% contingency for construction/unforeseen costs. This allowance should be reassessed on completion of further site investigations and design development.

Yours sincerely



Jolanta Liutkute

Senior Process Engineer

on behalf of

Beca Limited

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Garrett Hall , Beca Limited



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Cost Estimate Schedules

CAPITAL COST ESTIMATE		Site Option 1			
Code	Description	Quantity	Units	Rate \$	Subtotal \$
Pump station and pressure line					
1.01	Pre-engineered fiber glass PS at WWTP. Including D/SB pump arrangement. Pump size 7 kW.	1	LS	110,000.00	110,000.00
1.02	PN9 PE pipe DN100	1,560	m	230.00	358,800.00
1.03	Electrical, control cabinet, telemetry	1	LS	50,000.00	50,000.00
Fixed Spray irrigation/K-line					
1.04	Irrigation system for the area of 5.3 ha	5.3	ha	50,000.00	265,000.00
1.05	Planting of irrigation area with natives	5.3	ha	90,000.00	477,000.00
1.06	Storage pond 30mx40mx3.5m construction including earthworks	1,200	m2	185.00	222,000.00
1.07	Site preparation for pond installation	1	LS	15,000.00	15,000.00
1.08	Pond area fencing 35mx45m	160	m	120.00	19,200.00
1.09	Irrigation pump including control shed and concrete slab	1	LS	25,000.00	25,000.00
1.10	Electrical, controls, telemetry, power from the road	1	LS	30,000.00	30,000.00
Planning					
1.11	Baseline groundwater and soil investigations	1	LS	50,000.00	50,000.00
1.12	Consenting, including AEE	1	LS	100,000.00	100,000.00
	Net Construction Cost Estimate				1,572,000.00
	Main Contractor On-site overheads (P&G) and Profit Margin	20%	%	1,572,000.00	314,400.00
	Gross Construction Cost Estimate				2,036,400.00
	Design Development Contingency	10%	%	2,036,400.00	203,640.00
	Construction Contingency	15%	%	2,036,400.00	305,460.00
	Total Construction Budget				2,545,500.00
	Professional Fees	10%	%	2,545,500.00	254,550.00
	Client-owned project costs	2%	%	2,545,500.00	50,910.00
	Rounding	1	LS		-960.00
	Total Expected Concept Capital Cost Estimate				2,850,000.00



CAPITAL COST ESTIMATE		Site Option 2			
Code	Description	Quantity	Units	Rate \$	Subtotal \$
Pump station and pressure line					
1.01	Pre-engineered fiber glass PS at WWTP. Including D/SB pump arrangement. Pump size 7.0 kW.	1	LS	110,000.00	110,000.00
1.02	PN9 PE pipe DN100	2,010	m	230.00	462,300.00
1.03	Electrical, control cabinet telemetry	1	LS	50,000.00	50,000.00
Fixed Spray irrigation/K-line					
1.04	Irrigation system for the area of 5.3 ha	5.3	ha	50,000.00	265,000.00
1.05	Planting of irrigation area with natives	5.3	ha	90,000.00	477,000.00
1.06	Storage pond 30mx40mx3.5m construction including earthworks	1,200	m2	185.00	222,000.00
1.07	Site preparation for pond installation	1	LS	15,000.00	15,000.00
1.08	Pond area fencing 35mx45m	160	m	120.00	19,200.00
1.09	Irrigation pump including control shed and concrete slab	1	LS	25,000.00	25,000.00
1.10	Electrical, controls, telemetry, power from the road	1	LS	30,000.00	30,000.00
Planning					
1.11	Baseline groundwater and soil investigations	1	LS	50,000.00	50,000.00
1.12	Consenting, including AEE	1	LS	100,000.00	100,000.00
Net Construction Cost Estimate					1,675,500.00
Main Contractor On-site overheads (P&G) and Profit Margin		20%	%	1,675,500.00	335,100.00
Gross Construction Cost Estimate					2,160,600.00
Design Development Contingency		10%	%	2,160,600.00	216,060.00
Construction Contingency		15%	%	2,160,600.00	324,090.00
Total Construction Budget					2,700,750.00
Professional Fees		10%	%	2,700,750.00	270,075.00
Client-owned project costs		2%	%	2,700,750.00	54,015.00
Rounding		1	LS		-4,840.00
Total Expected Concept Capital Cost Estimate					3,020,000.00