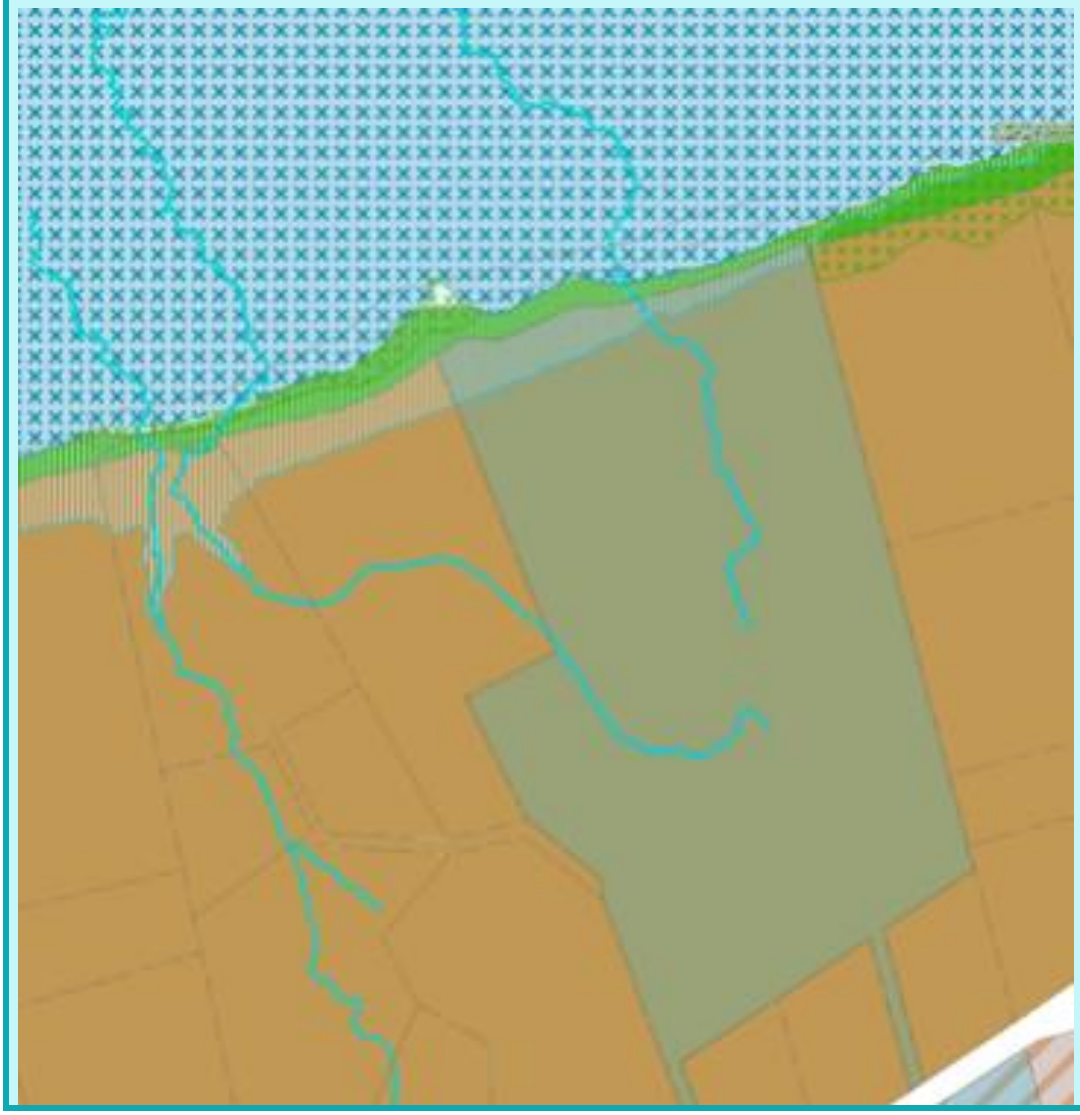
A

Appendix A – Long List Site Summaries

Option A

Option A is located at 257 Clarks Beach Road Pukekohe (Lot 8 DP 437281), is 16.58ha in size, and is subject to the following key constraints:

- A Methodist Church is in close proximity to the site, but the impact of the proposal will be inconsequential;
- At 16.58ha in size, "Option A" will provide for treatment, but will require additional land for the buffer;
- In terms of odour amenity, a 200m buffer distance between the plant and the boundary is unlikely to be achieved;
- The site is close to neighbouring lifestyle properties; therefore, the proposal will likely create outlook impacts for these properties;
- The site is subject to a Coastal SEA, includes some indigenous vegetation, and wetland towards the coastline. No major streams are present;
- Minor floodplains run through the centre of the site; and
- Coastal inundation affects the northern end of the site.



Option B

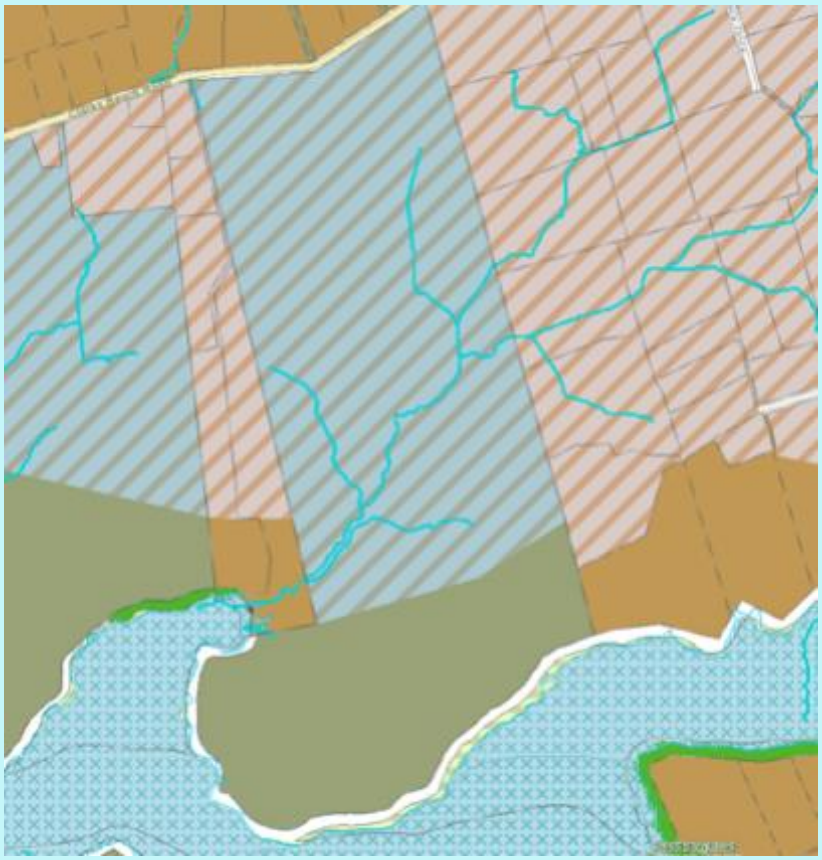
Option B is located at Clarks Beach Road (Lot 3 DP 337204), is 73ha in size, and is subject to the following key constraints:

- A small portion of the site is subject to a Terrestrial SEA and a Coastal SEA. In addition, the site contains multiple streams and potential wetlands; and
- Minor flood plains run through the gully system on the site and towards the northern end.

Option C

Option C is located at 246 Clarks Beach Road (PT ALLOT E28 Parish WAIAU DISTRICT), is 87ha in size, and is subject to the following key constraints:

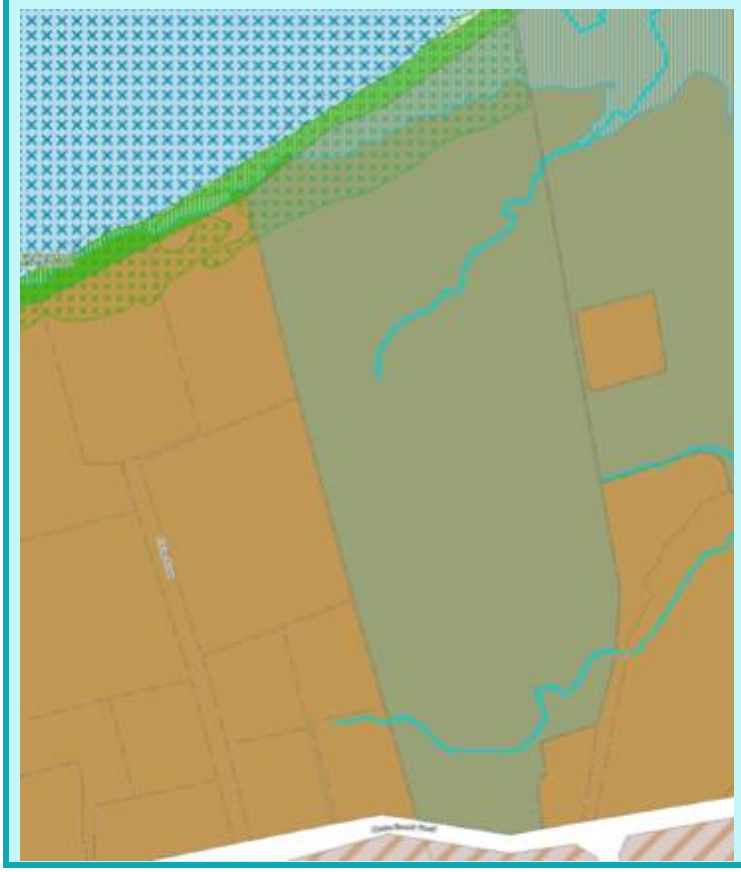
- “Option C” is adjacent to Karaka Point Vineyard to the east, however no direct impact to social/recreational facilities. The property was recently sold**,** and it is unclear what the intended use will be. This will need to be considered further;
- A 200m buffer distance between the plant and site boundary could be achieved. 1-3 rural dwellings (on either side) likely to be located within 300m of the plant;
- Assuming that site can be sufficiently screened by planting etc. and there is a sufficient buffer distance from surrounding properties (200m); and
- Given proximity of site to Karaka Point Vineyard and other sensitive receivers likely to have potential visual amenity effects to the east



Option D

Option D is located at 311 Clarks Beach Road (Lot 2 DP 156413), is 20.2ha in size, and is subject to the following key constraints:

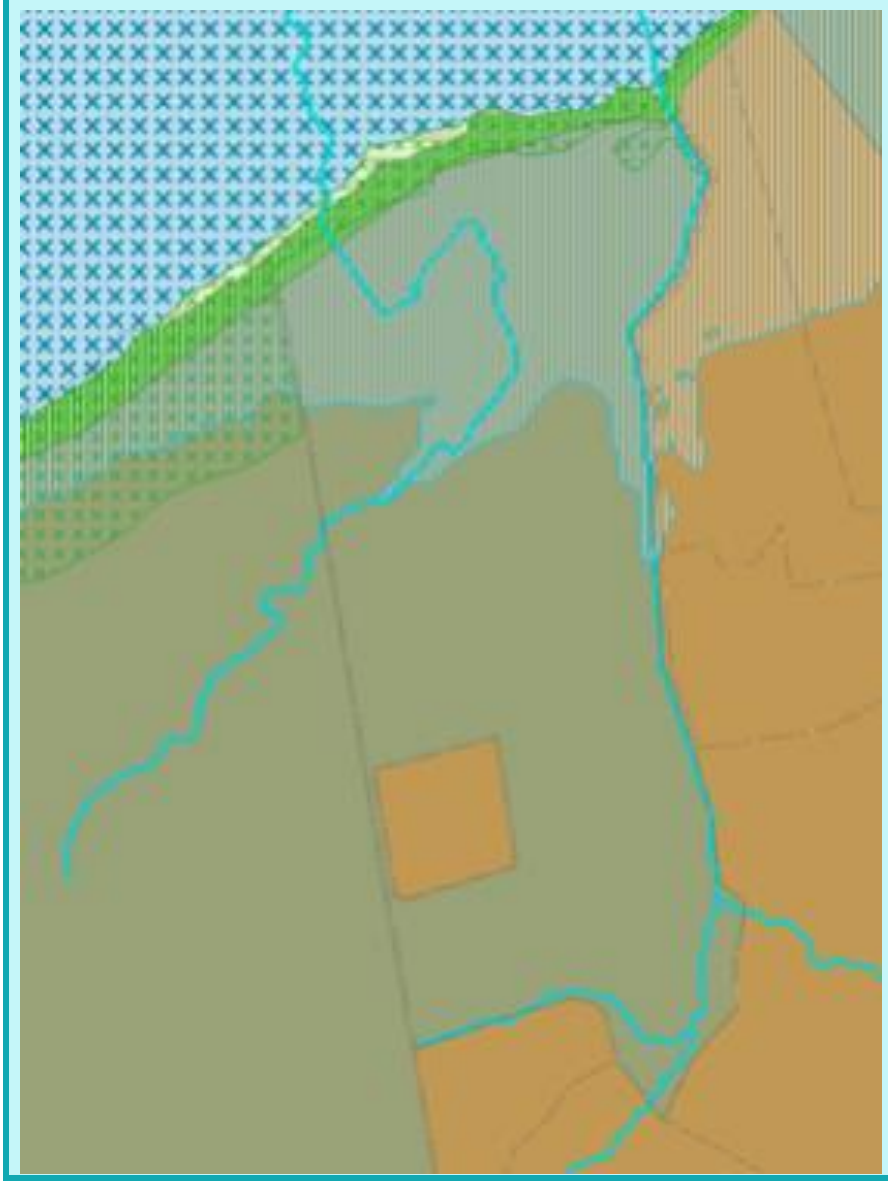
- At 20.2ha, the site is likely likely to provide for treatment but will require additional land for buffer;
- In terms of odour amenity, a 200m buffer distance between the plant and boundary is unlikley to achieved. Up to 6 rural dwellings would be located within 300m of the plant;
- The site is close to several neighbouring rural/lifestyle properties;
- The site includes terrestrial SEA, wetland, oioi rushland, possible intermittent streams, and modified water courses;
- A minor floodplain runs through the centre of the site;
- Coastal inundaton affects the northern end of the site; and
- Additional complexity as “Option D” is far from the Boyd Road conveyance point



Option E

Option E is located at 327C Clarks Beach Road (Lot 2 DP 489202), is 12.5ha is size, and is subject to the following key constraints:

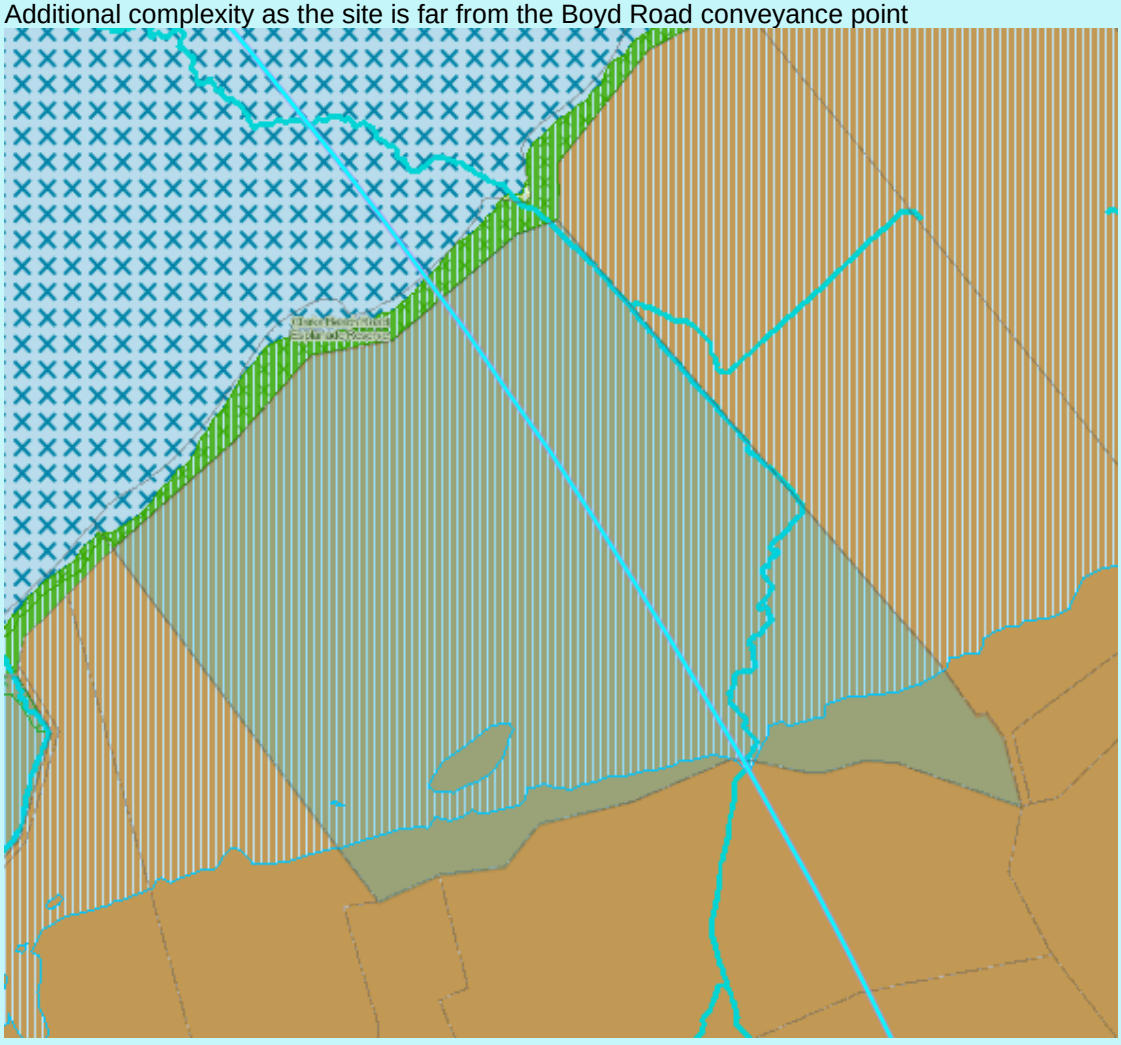
- At 12.5ha, “Option E” is likely to provide for treatment but will require additional land for buffer;
- In terms of odour amenity, a 200m buffer distance between the plant and boundary is unlikely to be achieved. Up to 3 rural dwellings would be located within 300m of the plant;
- The site has poor access;
- Site close to some neighbouring rural/lifestyle properties, with potential outlook impacts. One property parcel adjoining the site;
- The site includes possible wetlands, a modified watercourse, terrestrial SEA, and is adjacent to Coastal SEA;
- Floodplains constrain a large part of the northern area of the site;
- Coastal inundaton affects the northern end of the site; and
- Additional complexity as this site is far from the Boyd Road conveyance point



Option F

Option F is located at 109 Dell Road (Lot 1 DP 357749), is 12.4ha is size, and is subject to the following key constraints:

- At 12.4ha, “Option F” is likely to provide for treatment but will require additional land for buffer;
- In terms of odour amenity, a 200m buffer distance between the plant and boundary is unlikely to achieved in all directions and 1- 2 rural dwellings would be located within 300m of the plant;
- The site has poor access;
- Site close to neighbouring rural/lifestyle properties;
- Streams, Wetlands, Coastal SEA, salt marsh, possible banded rail, adjacent to Terrestrial SEA, Opportunity to renaturalise streams;
- Floodplains constrain a large part of the site;
- Coastal inundation affects a large part of the site; and
- Additional complexity as the site is far from the Boyd Road conveyance point



Option G

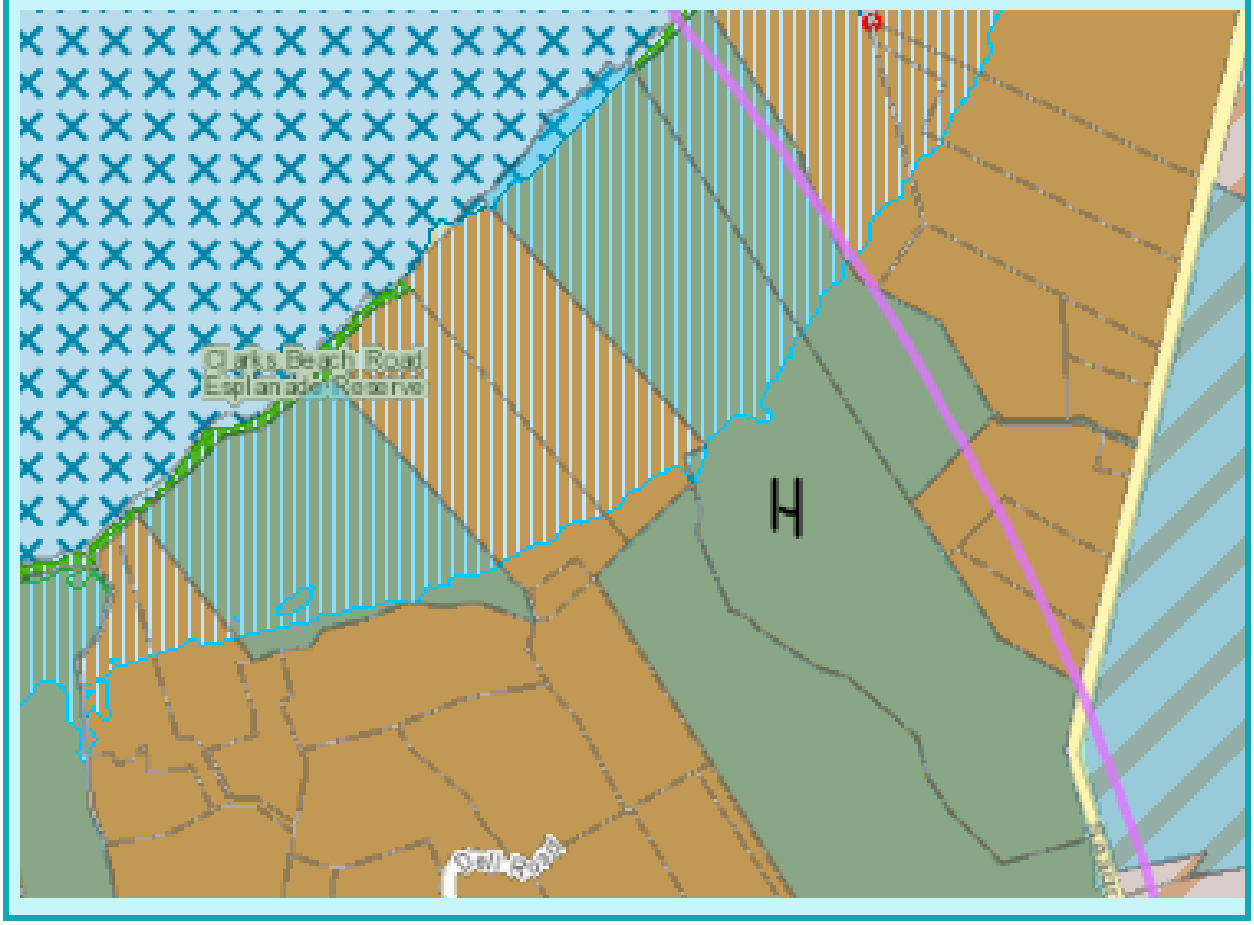
Option G is located at Seagrove Road (Lot 1 DP 33357), is 18.2ha in size, and is subject to the following key constraints:

- "Option G" is likely to provide for treatment but will require additional land for buffer. Opportunity to amalgamate Option G and Option H. Both sites in same ownership;
- In terms of odour amenity, a 200m buffer distance between the plant and boundary is unlikely to achieved in all directions. The residential developments to the south increase the sensitivity of site to odour. A 300m separation distance would not be achieved between the plant and dwellings;
- The site is close to the Waiau Pa settlement and neighbouring lifestyle/rural properties;
- Minor floodplains run through the centre of the site; and
- Additional complexity as site is far from the Boyd Road conveyance point

Option H

Option H is located at 63A Seagrove Road (Lot 2 DP 16463), is 31.8ha in size, and is subject to the following key constraints:

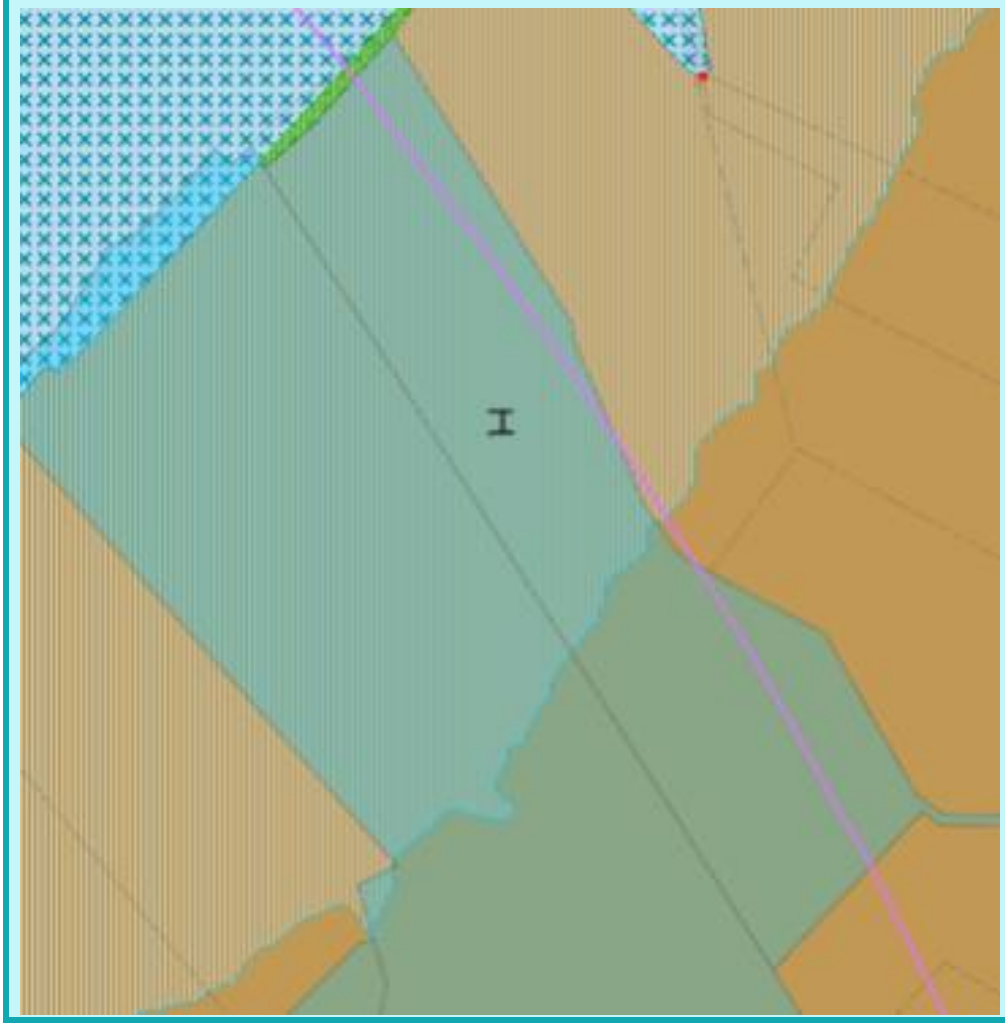
- “Option H” is likely to provide for treatment but will require additional land for buffer. Opportunity to amalgamate with Option G or Option I, negotiations with one or two landowners likely to be simpler than several;
- In terms of odour amenity, a 200m buffer distance between the plant and boundary is unlikely to be achieved. Potentially a 300m separation distance between the plant and residents could be achieved;
- The site includes a permanent stream, is adjacent to coastal SEA, possible dune habitat, few scattered wetlands
- Floodplains constrain a large part of the site;
- Coastal inundation affects a large part of the site; and
- Additional complexity as site is far from the Boyd Road conveyance point



Option I

Option I is located at 99D Seagrove Road (Lot 5 DP 105892), is 10.89ha, and is subject to the following key constraints:

- “Option I” is likely to provide for treatment but will require additional land for buffer. Opportunity to amalgamate with Option H negotiations two landowners likely to be simpler than several;
- In terms of odour amenity, a 200m buffer distance between the plant and boundary would not be achieved. Likely that at least one dwelling would within 300m of the plant;
- Site too small , poor access and on edge of the 4km buffer;
- Site close to neighbouring rural/lifestyle properties;
- The site includes a permanent stream, possible dune habitat, several scattered wetlanda and is adjacent to Coastal SEA;
- Floodplains constrain a large part of of the site;
- Coastal inundaton affects a large part of the site; and
- Additional complexity as site is far from the Boyd Road conveyance point



Option J

Option J is located at 74 Seagrove Road (Lot 3 DP 209401), is 104.9ha in size, and is subject to the following key constraints:

- Majority of the site lies outside of the 4km buffer;
- The site includes three permanent water courses, possible intermittent streams, a possible wetland, not a lot of vegetation;
- Minor floodplain runs through the centre of the site; and
- Additional complexity as site is far from the Boyd Road conveyance point

Option K

Option K is located at Clarks Beach Road (Lot 1 DP 504521), is 10.5ha in size, and is subject to the following key constraints:

- At 10.5ha, Option K is likely to provide for treatment but will require additional land for buffer. Opportunity to amalgamate Option K and Option L - both sites in same ownership. Property negotiation with a single landowner;
- In terms of odour amenity, a 200m buffer distance between the plant and site boundary unlikely to be achieved and a separation distance of 300 m from the plant to nearby residents is unlikely to be achieved;
- Close to Waiau Pa settlement;
- Site close to neighbouring rural/lifestyle properties**;**
- Minor floodplain runs through the centre of the site; and
- Additional complexity as site is far from the Boyd Road conveyance point

Option L

Option L is located at 428 Clarks Beach Road (Lot 1 DP 489139), is 34.97ha in size, and is subject to the following key constraints:

- Close proximity to Historic Heritage Overlay Place - 1551, Waiau Pa War Memorial Monument;
- “At 34.97ha in size, Option L” likely to provide for treatment but will require additional land for buffer. Opportunity to amalgamate Option K and Option L - both sites in same ownership. Property negotiation with a single landowner;
- Fire station, shops kindergarten and school located adjacent to the eastern boundary of site. Assumed no direct impact;
- In terms of odour amenity, a 200m buffer distance between the plant and site boundary can achieve in a limited area but not enough for the plant footprint. A separation distance of 300 m from the plant to nearby residents would also be unlikely to be achieved. The residential development to NE increase the sensitivity of the site;
- Close to Waiau Pa settlement;
- Site adjoining Waiau pa school. Residential catchment to the north east of the site;
- The site contains a several streams, possible wetlands, ponds and not a lot of Terrestrial vegetation;
- Floodplain runs through the centre of the site; and
- Additional complexity as site is far from the Boyd Road conveyance point

Option M

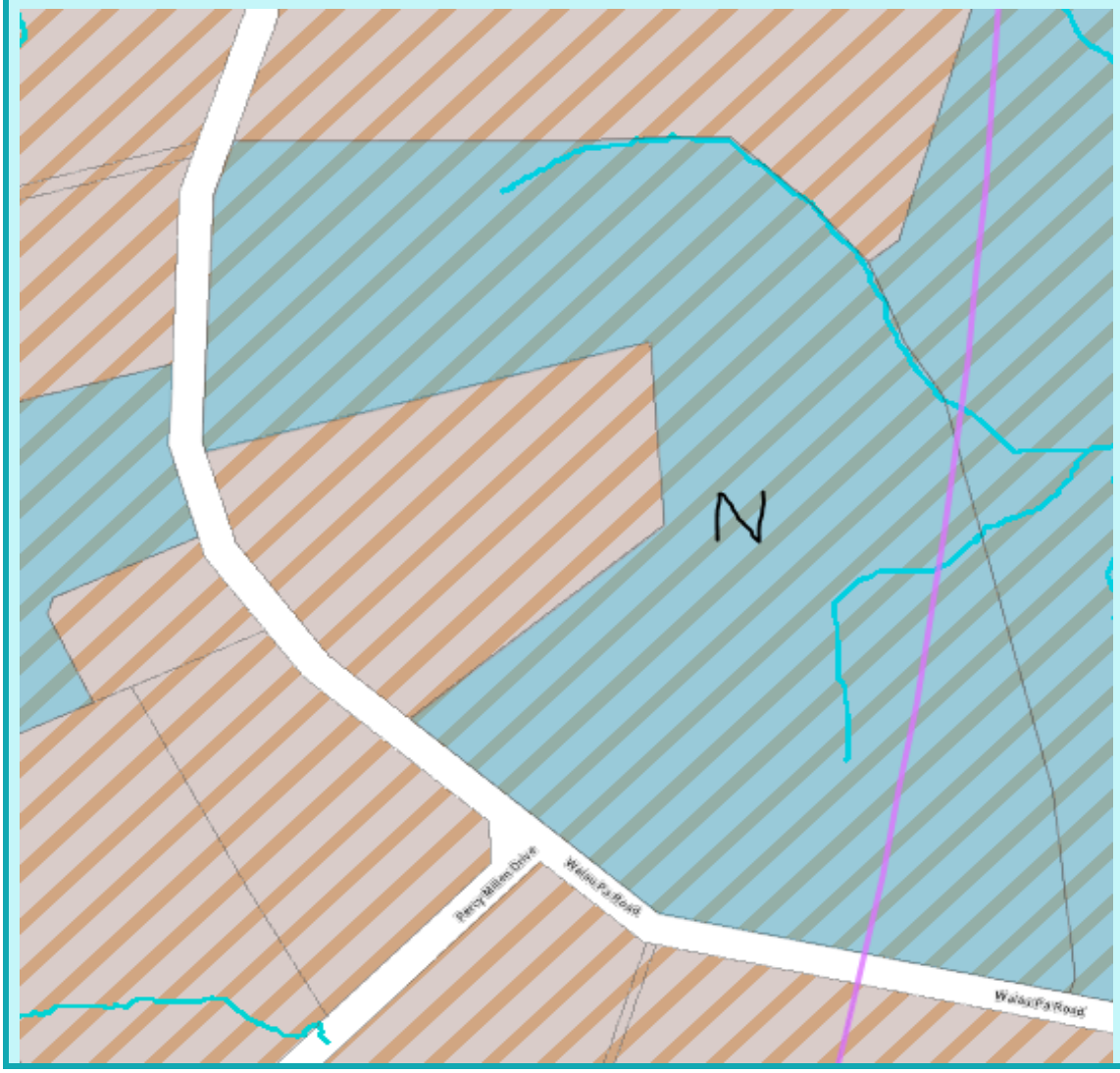
Option M is located at 524 Waiau Pa Road (Lot 1 DP 93648 & Lot 2 DP 77463), is approximately 46ha in size, and is subject to the following key constraints:

- Floodplain runs through the centre of the site; and
- Additional complexity as site is far from the Boyd Road conveyance point

Option N

Option N is located at 422 Waiau Pa Road (Lot 3 DP 153227), is 16.1ha in size, and subject to the following key constraints:

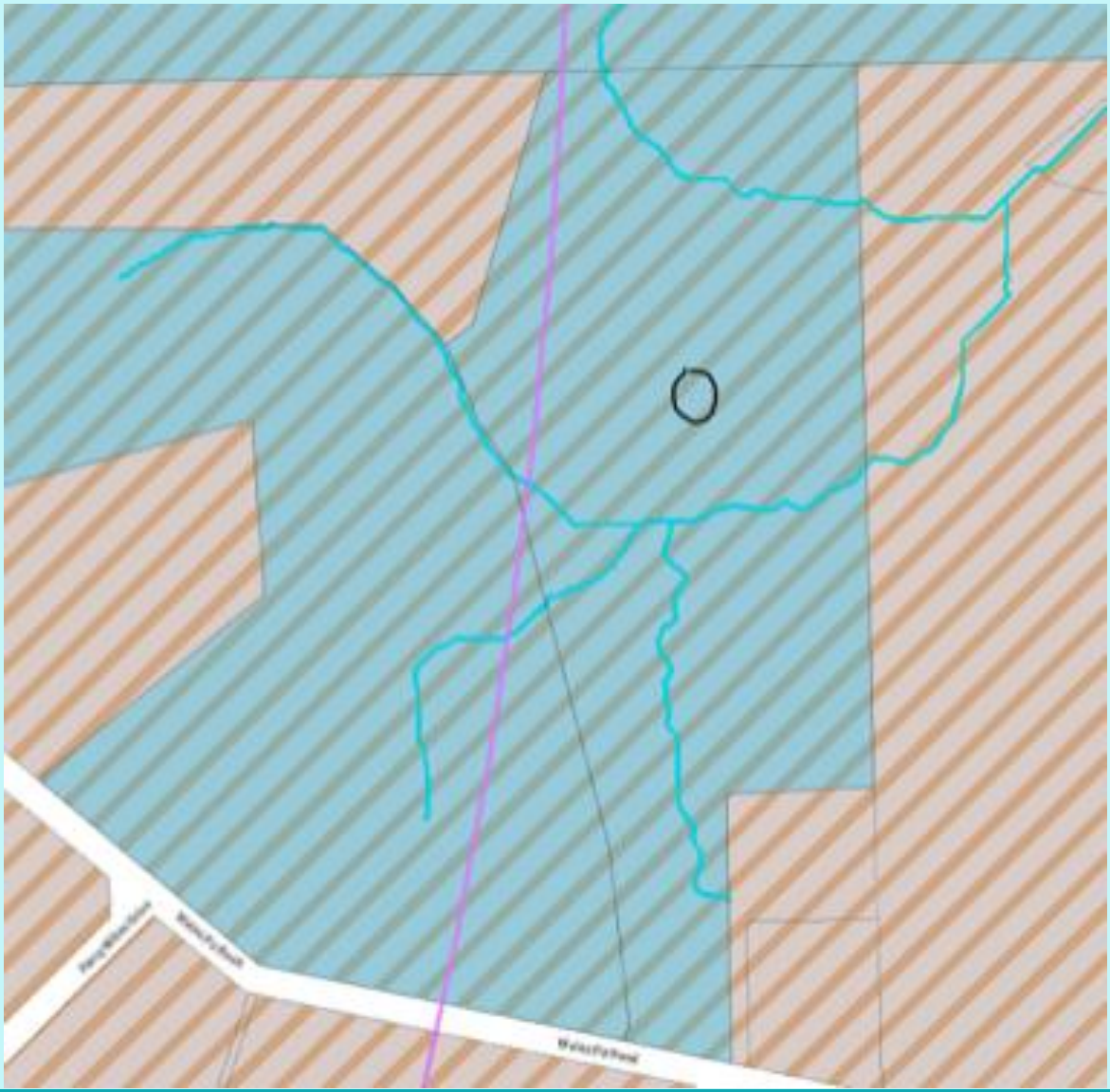
- At 16.1ha in size, Option N likely to provide for treatment but will require additional land for buffer. Adjacent properties look to be lifestyle/rural properties. Potential negotiations with several landowners;
- In terms of odour amenity, a 200m buffer distance between the plant and site boundary would not be achieved. It is unlikely a separation distance of 300 m from the plant to nearby residents could be achieved;
- Site close to neighbouring rural/lifestyle properties;
- Minor floodplains run through the northern and southern end of the site; and
- Additional complexity as site is far from the Boyd Road conveyance point



Option O

Option O is located at 404 Waiau Pa Road (Lot 3 DP 506483), is 12.8ha in size, and is subject to the following key constraints:

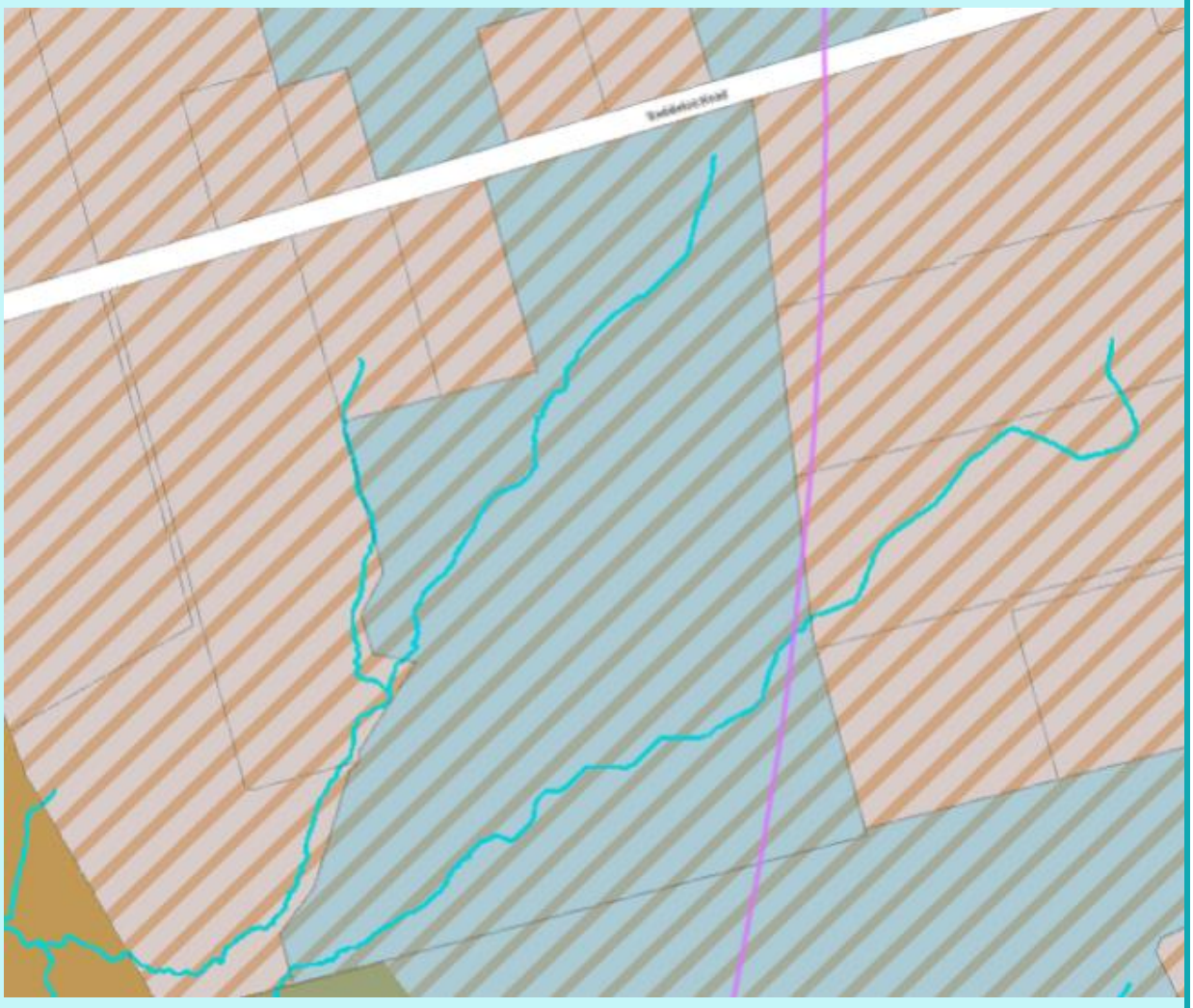
- At 12.8ha in size, Option O is likely to provide for treatment but will require additional land for buffer. Adjacent properties look to be lifestyle/rural properties. Could amalgamate with Option N but likely to require more parcels. Potential negotiations with several landowners;
- In terms of odour amenity, a 200m buffer distance between the plant and site boundary would not be achieved. A separation distance of 300 m from the plant to nearby residents could only be achieved by locating the plant in the NE corner of the site. Overall a marginal site from an odour perspective;
- The site include possible wetlands and streams;
- A floodplain runs through the centre of the site; and
- Additional complexity as site is far from the Boyd Road conveyance point.



Option P

Option P is located at 47 Saddleton Road (Lot 3 DP 337113), is 15.5ha in size, and is subject to the following key constraints:

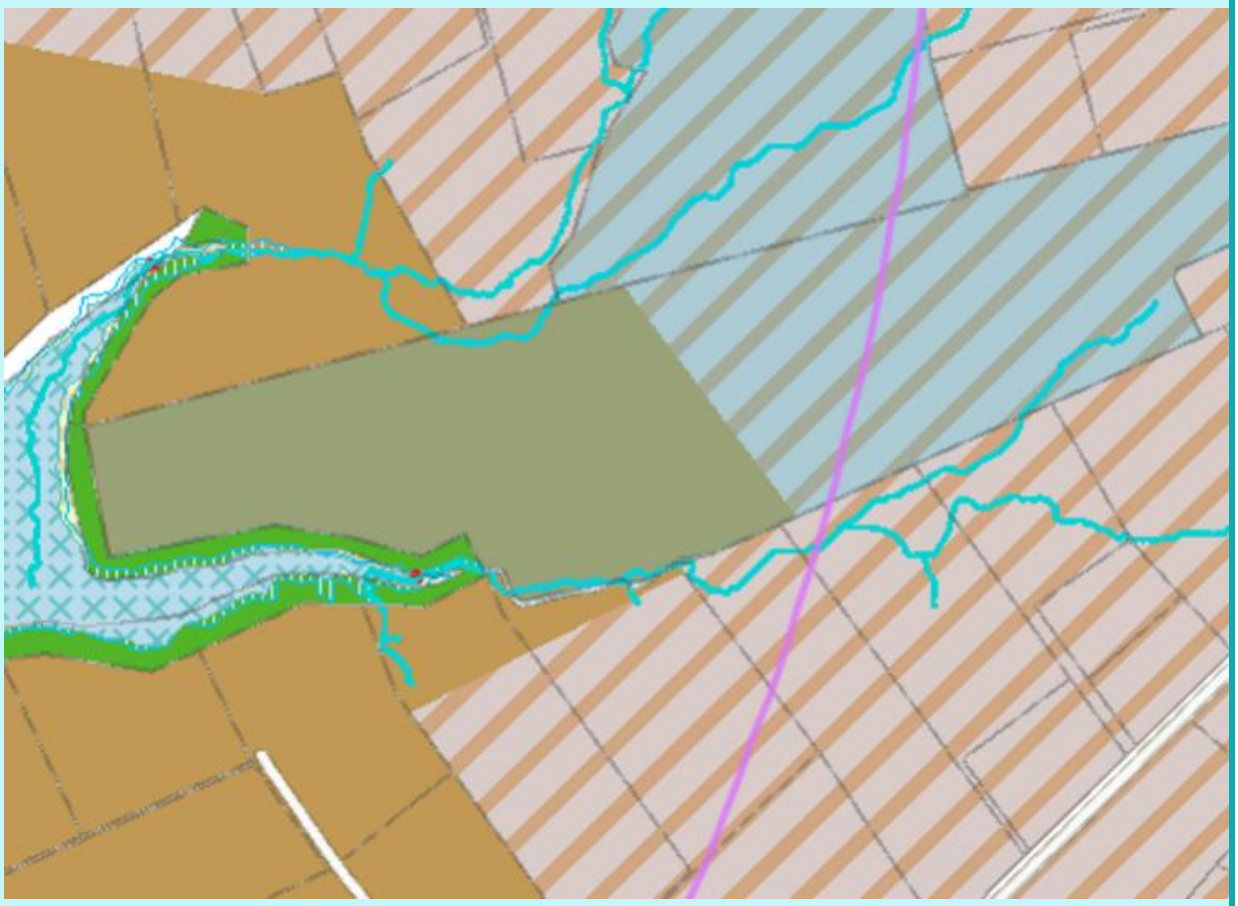
- At 15.5ha in size, “Option P” likely to provide for treatment but will require additional land for buffer. Opportunity to amalgamate with Option Q negotiations with two landowners likely to be simpler than several;
- In terms of odour amenity, a 200m buffer distance between the plant and site boundary would not be achieved. A separation distance of 300 m from the plant to nearby residents is also unlikely to be achieved;
- Site close to neighbouring rural/lifestyle properties;
- The site includes ponds, possible wetlands and stream;
- Minor floodplains run through the northern and southern end of the site; and
- Additional complexity as site is far from the Boyd Road conveyance point.



Option Q

Option Q is located at 491 Waiau Pa Road (LOT 2 DP 468838), is 25.4ha in size and is subect to the following key constraints:

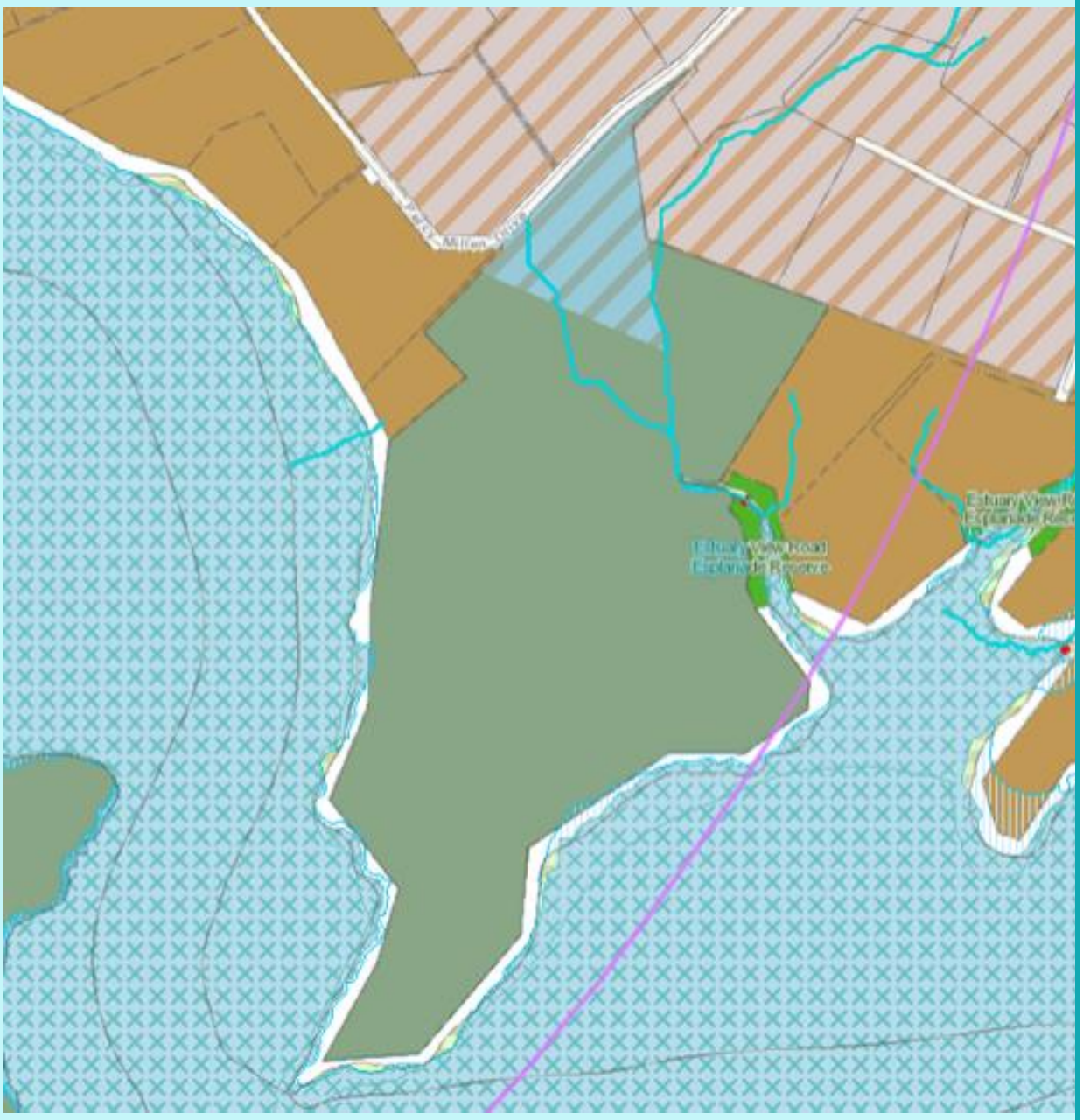
- At 25.4ha in size, Option Q is likely to provide for treatment but will require additional land for buffer. Opportunity to amalgamate with Option Q negotiations with two landowners likely to be simpler than several;
- In terms of odour amenity, a 200m buffer distance between the plant and site boundary would not be achieved. A separation distance of 300 m from the plant to neraby neraby residents is also unlikely to be achieved;
- The site includes a main watercourse, regenerating terrestrial vegetation, and is adjacent to Coastal SEA;
- Minor floodplains run through the northern and southern end of the site; and
- Additional complexity as site is far from the Boyd Road conveyance point.



Option R

Option R is located at 83 Percy Millen Drive (Lot 1 DP 361846), is 49.6ha in size, and is subject to the following key constraints:

- The site includes Marine Mammal Sanctuary, Coastal SEA, Wadding Birds, one Main Stream at least, possible wetland.
- Minor floodplains through the northern end of the site.
- Additional complexity as we are far from the Boyd Road conveyance point
- Potentially will require two crossings under Taihiki River
- Furthest option from the outfall.



Option S

Option S is located at 338 Glenbrook Beach Road (Pt Lot 2 DP 21299, Lot 1 DP 21299), is 93.3ha in size and is subject to the following key constraints:

- The site is adjacent to Marine SEA
- Minor floodplains toward the southern end of the site.
- Minor coastal inundation towards the northern end of the site.
- Further from the outfall than Option A and B
- Overall pipeline lengths are reduced
- May be issues catering for flows initially before more flows come online
- An additional crossing of Taihiki R for the outfall pipeline
- 

Option T

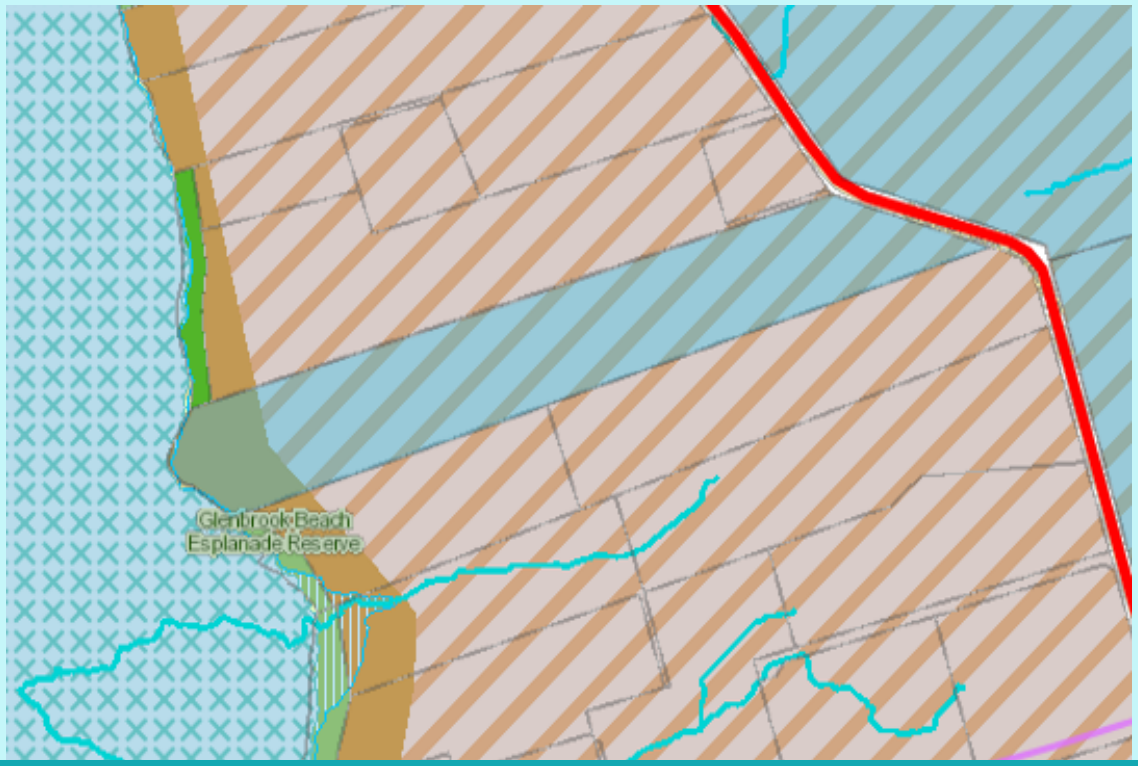
Option T is located at 372 Glenbrook Beach Road (Lot 1 DP 367461), is 56ha in size, and is subject to the following key constraints:

- The site includes salt Marsh, lots of possible intermittent streams, possible wetland, ponds
- Floodplain runs through the centre of the site.
- Minor coastal inundation towards the northern end of the site.
- Further from the outfall than Option A and B
- Overall pipeline lengths are reduced
- May be issues catering for flows initially before more flows come online
- An additional crossing of Taihiki River for the outfall pipeline

Option U

Option U is located at 381-389 Glenbrook Beach Road (Lot 12 DP 62517), is 10.2ha in size, and is subject to the following key constraints:

- Smaller site, likely to provide for treatment but will require additional land for buffer. Adjacent properties look to be lifestyle/rural properties. Potential negotiations with several landowners
- A 200m buffer distance between the plant and site boundary would not be achieved. A separation distance of 300 m from the plant to neraby residents would also not be achieved
- Narrow site
- Site close to neighbouring rural/lifestyle properties. Unlikely to have separation distance. Potential outlook impacts
- Floodplain runs through the centre of the site.



Option V

Option V is located at 62A Dunsmuir Road (PT ALLOT 7 Parish KAHAWAI DISTRICT, PT ALLOT 7 Parish KAHAWAI DISTRICT), is 41.6ha in size, and is subject to the following key constraints:

- Site looks to include Salt Marsh, few possible intermittent streams, one possible wetland area (could be just pasture)
- Minor floodplains through the site.
- Minor coastal inundation towards the southern end of the site.

Option W

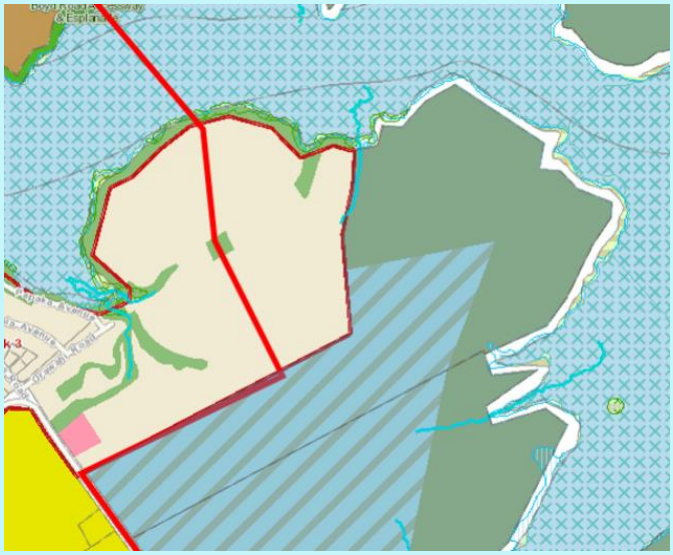
Option W is located at 149 McLarin Road,(Lot 3 DP 19268), is 33.8ha in size, and is subject to the following key constraints:

- A 200m buffer distance between the plant and site boundary may not be achieved. However, it is possible the plant could be located more than 300m from nearby residents.
- Located adjacent to Future Urban Zone
- Site not directly adjacent to rural/lifestyle properties. However adjacent to FUZ on southern boundary. Potential outlook impacts
- The site is adjacent to Coastal SEA, ponds and small potential wetland, possible intermittent**.**
- Minor floodplains through the site.
- Minor coastal inundation towards the southern end of the site.

Option X

Option X is located at 149 McLarin Road,(Lot 2 DP 21692), is 32.4ha in size, and is subject to the following key constraints:

- A 200m buffer distance between the plant and site boundary could be achieved. Also possible to locate the plant more than 300 m from nearby residents. Located adjacent to SHA - live zone residential
- Site adjoining future residential area , however, likely to have separation buffer of 200m
- Adjacent to Terrestrial SEA, Coastal SEA, small potential wetland, streams present
- Minor floodplains through the site.



Option Y

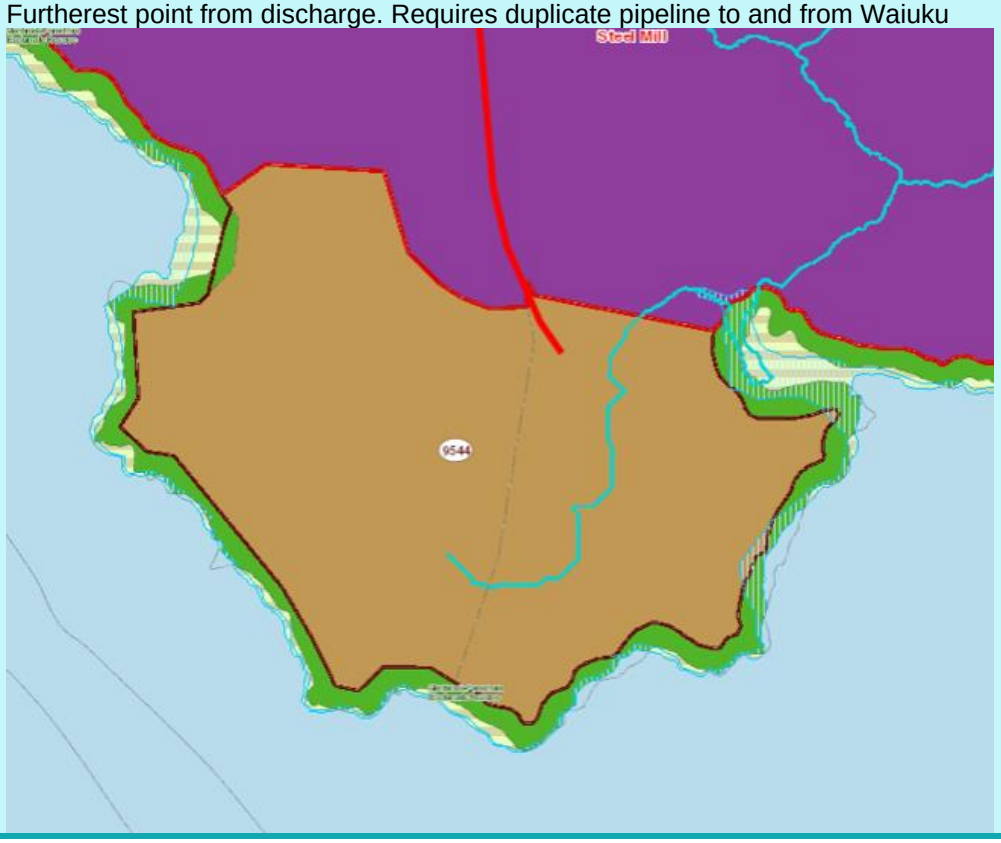
Option Y is located at Torkar Road (Lot 8 DP 77055), is 2.9ha in size, and is subject to the following key constraints:

- May require additional land from Golf course - given recreational facility, may pose some challenges from a property negotiation perspective
- May result in greater impact to the Clarks Beach Golf Club
- A 200m buffer distance between the plant and site boundary could not be achieved. A residential area would be located within 300m of the plant
- Adjacent Coastal SEA, potential wetland, possible intermittent
- Minor floodplains through the site.

Option Z

Option Z is located at Williams Road (Lot 1 DP 73307 & Lot 1 DP 154681), is 17.4ha in size, and is subject to the following key constraints:

- Adjacent Coastal SEA, potential wetland, possible intermittent
- Minor floodplains through the site.
- Minor coastal inundation around the site.
- Furtherest point from discharge. Requires duplicate pipeline to and from Waiuku



B

Appendix B – Long List Assessment

SOUTHWEST WWTP - LONG LIST

Long list assessment for a new wastewater treatment plant to provide for planned growth at Kingseat, Clarks Beach, Glenbrook Beach and Waiuku.

Assessment Criteria		OPTION A Ranking	OPTION A	OPTION B Ranking	OPTION B Rationale
1. Cultural Values	1a. Cultural Values				
2. Heritage	2a Heritage	1	No known historic hertiage sites	1	No known historic hertiage sites
3. Social and community	3a. Land requirement	2	Smaller site, likely to provide for treatment but will require additional land for buffer. Adjacent properties look to be lifestyle/rural properties. Potential negotiations with several landowners	1	Larger site - ability to provide for treatment plant and buffer. Property negotiations with single landowner
	3b. Social impact	1	Methodist chruch located on the southern boundary of site. Assuming no impact	1	No direct impact to social, recreational facilities
	3c. Odour amenity	3	A 200m buffer distance between the plant and boundary is unlikley to be achieved. Multiple rural dwellings would be located within 300m of the plant	1	A 200m buffer distance between the plant and site boundary could be achieved. Possible to locate plant 300 m from neraby residents
	3d. Operational effects	2	future development will likely be along foreshore	1	sufficient distance, good access
4. Natural environment	4a. Landscape / visual	2	Site close to some neighbouring rural/lifestyle properties. Potential outlook impacts	1	Assuming that site can be screened by planting etc. and there is a sufficient buffer distance from sites (200m), potential visual amenity effects are likely to be mitigated
	4b. Ecology	2	Coastal SEA, Some indigenous vegetation, wetland towards coast line. No major Streams	2	Small SEA, Coastal SEA, Multiple Streams, Potential wetlands
	4c. Flooding risk	2	Minor floodplain runs through the centre of the site.	2	Minor flood plains run through the gully system on the site and towards the northern end.
	4d. Coastal inundation	2	Coastal inundaton affects the northern end of the site.	1	No anticipated coastal inundation.
5. Constructability	5a. Wastewater conveyance	2	Additional complexity as we are far from the Boyd Road nexus	1	Reduces the length of pipe to the outfall Close to the logical nexus of pipes at Boyd Road
	5b. Construction risk	1	Gradients and extensive earthworks possible depending on location of WWTP. Gradient from 25 - 10. However, higher RL should be stiffer clays. Erosion features and potential slope stability issues towards the south. Central location within the site at higher RLs, cutting is preferable as reduced settlement issues can use and can use raft slab rather than piles potentially.	1	Gradients and possible exensive earthworks but also flatter areas. Impact will depend on the location of WWTP within site. Two valleys - likely incur high costs. Associated temp and permanent works. However, higher RL should be stiffer clays. Erosion features and potential slope stability issues towards the south. Central location within the site at higher RLs, cutting is preferable as reduced settlement issues can use raft slab rather than piles potentially. Option A is Better than B due to the prominent waterway to be mucked out.
6. Operability	6a. Operation and maintenance - WWTP	3	Small site, limited buffer. Any problems with odour and noise will impact community and impacts. Longer pipes will affect influent properties (septicity, lower RBCOD, etc.).	1	good location, site access. Will need to consider ecological features and potential implications of this on maintenance
	6b. Operation and maintenance - conveyance	1	Miminises pipe length. Minimises length of pipe with lowest startup flows.	1	Miminises pipe length. Minimises length of pipe with lowest startup flows.
7. Carbon	7a. Greenhouse gas emissions	1	low pipe length.May be an extra high point for the pipe, will need to consider further	1	Miminises pipe length.

Assessment Criteria		OPTION C Ranking	OPTION C Rationale	OPTION D Ranking	OPTION D Rationale
1. Cultural Values	1a. Cultural Values				
2. Heritage	2a Heritage	1	No known historic hertiage sites	1	No known historic hertiage sites
3. Social and community	3a. Land requirement	1	Larger site - ability to provide for treatment plant and buffer. Property negotiations with single landowner	2	Smaller site, likely to provide for treatment but will require additional land for buffer. Opportunity to amalgamate Option D and Option E, negotiations with two landowners likely to be simpler than several
	3b. Social impact	2	Site adjacent to Karaka Point Vineyard to the east, however no direct impact to social/recreational facilities. Recently sold, unclear what the intended use will be. Will need to consider further	1	No direct impact to social, recreational facilities
	3c. Odour amenity	2	A 200m buffer distance between the plant and site boundary could be achieved. 1-3 rural dwellings (on either side) likely to be located within 300 of the plant.	3	A 200m buffer distance between the plant and boundary is unlikley to achieved. Up to 6 rural dwellings would be located with 300m of the plant. More viable if connected with site E
	3d. Operational effects	1	sufficient distance, good access	1	sufficient distance, good access
4. Natural environment	4a. Landscape / visual	2	Assuming that site can be screened by planting etc. and there is a sufficient buffer distance from sites (200m). Given proximity of site to Karaka Point Vineyard and other sensitive receivers likely to have potential visual amenity effects to the east	2	Site close to some neighbouring rural/lifestyle properties. Potential outlook impacts
	4b. Ecology	2	Planted Streams, potential wetland, Drains into SEA Coastal	3	Terrestrial SEA, Wetland, oioi rushland, Possible intermittent streams, modified water courses
	4c. Flooding risk	2	Minor flood plains run through the gully system on the site and towards the northern end.	2	Minor floodplain runs through the centre of the site.
	4d. Coastal inundation	1	No anticipated coastal inundation.	2	Coastal inundaton affects the northern end of the site.
5. Constructability	5a. Wastewater conveyance	1	Reduces the length of pipe to the outfall Close to the logical nexus of pipes at Boyd Road	2	Additional complexity as we are far from the Boyd Road nexus
	5b. Construction risk	2	Potential effects assocaited with dust, noise and vibration effects. Coastal erosion concerns, allow set back from coast. Should be relatively stiff ground. Avoid waterways and erosion features.	2	Potential effects assocaited with dust, noise and vibration effects. Coastal erosion concerns, allow set back from coast. Should be relatively stiff ground. Avoid waterways and erosion features.
6. Operability	6a. Operation and maintenance - WWTP	1	Similar to site A - likely require a bridge over planted gully	3	Small site, limited buffer. Any problems with odour and noise will impact community and impacts. Longer pipes will affect influent properties (septicity, lower RBCOD, etc.).
	6b. Operation and maintenance - conveyance	1	Miminises pipe length. Minimises length of pipe with lowest startup flows.	2	More pipework to operate. Potential extra pump station or big syphon
7. Carbon	7a. Greenhouse gas emissions	1	lower pipe length.	2	additional pipe length

Assessment Criteria		OPTION E Ranking	OPTION E Rationale	OPTION F Ranking	OPTION F Rationale
1. Cultural Values	1a. Cultural Values				
2. Heritage	2a Heritage	1	No known historic hertiage sites	1	No known historic hertiage sites
3. Social and community	3a. Land requirement	2	Smaller site, likely to provide for treatment but will require additional land for buffer. Opportunity to amalgamate Option D and Option E, negotiations with two landowners likely to be simpler than several	2	Smaller site, likely to provide for treatment but will require additional land for buffer. Adjacent properties look to be lifestyle/rural properties. Potential negotiations with several landowners
	3b. Social impact	1	No direct impact to social, recreational facilities	1	No direct impact to social, recreational facilities
	3c. Odour amenity	3	A 200m buffer distance between the plant and boundary is unlikley to achieved. Up to 3 rural dwellings would be located within 300m of the plant. More viable if connected with site D	3	A 200m buffer distance between the plant and boundary is unlikley to achieved in all directions. 1- 2 rural dwellings would be located within 300m of the plant. Would require building the plant in NE corner of site to achieve necessary buffer distance
	3d. Operational effects	3	poor access	3	poor access
4. Natural environment	4a. Landscape / visual	2	Site close to some neighbouring rural/lifestyle properties. Potential outlook impacts. One property parcel adjoining the site.	2	Site close to neighbouring rural/lifestyle properties.
	4b. Ecology	3	Possible wetlands, Terrestrial SEA and adjacent to Coastal SEA, Modified Watercourse,	2	Straighten Streams, Wetlands, Coastal SEA, salt marsh, possible banded rail, adjacent to Terrestrial SEA, Opportunity to renaturalise streams.
	4c. Flooding risk	3	Floodplains constrain a large part of the northern area of the site.	3	Floodplains constrain a large part of of the site.
	4d. Coastal inundation	2	Coastal inundaton affects the northern end of the site.	3	Coastal inundaton affects a large part of the site.
5. Constructability	5a. Wastewater conveyance	2	Additional complexity as we are far from the Boyd Road nexus	3	Additional complexity as we are far from the Boyd Road nexus Significant increase in the length and complexity of the pipelines and pumping stations
	5b. Construction risk	2	Potential effects assocaited with dust, noise and vibration effects. Coastal erosion concerns, allow set back from coast. Should be relatively stiff ground. Avoid waterways and erosion features.	2	Potential effects assocaited with dust, noise and vibration effects. Coastal erosion concerns, allow set back from coast. Should be relatively stiff ground. Avoid waterways and erosion features.
6. Operability	6a. Operation and maintenance - WWTP	3	Small site, limited buffer. Any problems with odour and noise will impact community and impacts. Longer pipes will affect influent properties (septicity, lower RBCOD, etc.).	3	Small site, limited buffer. Any problems with odour and noise will impact community and impacts. Longer pipes will affect influent properties (septicity, lower RBCOD, etc.).
	6b. Operation and maintenance - conveyance	2	More pipework to operate. Potential extra pump station or big syphon	3	More pipework to operate. Potential extra pump station or big syphon
7. Carbon	7a. Greenhouse gas emissions	2	additional pipe length	3	High embedded carbon associated with pipe.

Assessment Criteria		OPTION G Ranking	OPTION G Rationale	OPTION H Ranking	OPTION H Rationale
1. Cultural Values	1a. Cultural Values				
2. Heritage	2a Heritage	1	No known historic hertiage sites	1	No known historic hertiage sites
3. Social and community	3a. Land requirement	2	Smaller site, likely to provide for treatment but will require additional land for buffer. Opportunity to amalgamate Option G and Option H. Both sites in same ownership. Property negotiation with single landowner	2	Smaller site, likely to provide for treatment but will require additional land for buffer. Opportunity to amalgamate with Option G or Option I, negotiations with one or two landowners liekly to be simpler than several
	3b. Social impact	1	No direct impact to social, recreational facilities	1	No direct impact to social, recreational facilities
	3c. Odour amenity	3	A 200m buffer distance between the plant and boundary is unlikley to achieved in all directions. The residential developments to the south increases the sensitivity of site to odour. A 300m seperation distance would not be achieved	2	A 200m buffer distance between the plant and boundary is unlikley to be achieved. Potentially a 300m separation distance between the plant and residents could be achieved
	3d. Operational effects	3	close to Waiau Pa settlement	1	road access
4. Natural environment	4a. Landscape / visual	2	Site close to Waiau settlement and neighbouring rural/lifestyle properties.	1	Site is not directly adjacent any rural/lifestyle properties, likely to have some level of separation + assumed to have a planted buffer
	4b. Ecology	1	Some intermittent stream and Permanant Streams, Not Coastal boundary, No SEA, Few possible wetlands.	2	Permenant Stream, Adjacent to Coastal SEA, Possible Dune Habitat, Few scattered Wetlands
	4c. Flooding risk	2	Minor floodplain runs through the centre of the site.	3	Floodplains constrain a large part of of the site.
	4d. Coastal inundation	1	No anticipated coastal inundation.	3	Coastal inundaton affects a large part of the site.
5. Constructability	5a. Wastewater conveyance	3	Additional complexity as we are far from the Boyd Road nexus Significant increase in the length and complexity of the pipelines and pumping stations	3	Additional complexity as we are far from the Boyd Road nexus Significant increase in the length and complexity of the pipelines and pumping stations
	5b. Construction risk	2	Potential effects assocaited with dust, noise and vibration effects. Steep site with likely high cut and fill. Should be relatively stiff ground. Avoid waterways and erosion features but this may be difficult.	2	Potential effects assocaited with dust, noise and vibration effects. Coastal erosion concerns, allow set back from coast. Should be relatively stiff ground. Avoid waterways and erosion features.
6. Operability	6a. Operation and maintenance - WWTP	3	Small site, limited buffer. Any problems with odour and noise will impact community and impacts. Longer pipes will affect influent properties (septicity, lower RBCOD, etc.).	3	Small site, limited buffer. Any problems with odour and noise will impact community and impacts. Longer pipes will affect influent properties (septicity, lower RBCOD, etc.).
	6b. Operation and maintenance - conveyance	3	More pipework to operate. Potential extra pump station or big syphon	3	More pipework to operate. Potential extra pump station or big syphon
7. Carbon	7a. Greenhouse gas emissions	3	High embedded carbon associated with pipe.	3	High embedded carbon associated with pipe.

Assessment Criteria		OPTION I Ranking	OPTION I Rationale	OPTION J Ranking	OPTION J Rationale
1. Cultural Values	1a. Cultural Values				
2. Heritage	2a Heritage	1	No known historic hertiage sites	1	No known historic hertiage sites
3. Social and community	3a. Land requirement	2	Smaller site, likely to provide for treatment but will require additional land for buffer. Opportunity to amalgamate with Option H negotiations two landowners liekly to be simpler than several	1	Larger site - ability to provide for treatment plant and buffer. Property negotiations with single landowner
	3b. Social impact	1	No direct impact to social, recreational facilities	1	Wairau Pa Presbyterian Chruch located on the southern boundary of site. Assuming no impact.
	3c. Odour amenity	3	A 200m buffer distance between the plant and boundary would not be achieved. Likely that at least one dwelling would within 300m of the plant	1	A 200m buffer distance between the plant and site boundary could be achieved. Possible to locate the plant more than 300 m from nearby residents
	3d. Operational effects	3	Site too small , poor access & on edge of radius	3	outside of the radius
4. Natural environment	4a. Landscape / visual	2	Site close to neighbouring rural/lifestyle properties.	1	Assuming that site can be screened by planting etc. and there is a sufficient buffer distance from sites (200m), potential visual amenity effects are likely to be mitigated
	4b. Ecology	2	Permenant Stream, Adjacent to Coastal SEA, Possible Dune Habitat, Few scattered Wetlands	2	Three Permenant Water Course, not a lot of Terrestrial Vegetation, Not Coastal, possibly lots of intermittent streams. Possible wetland
	4c. Flooding risk	3	Floodplains constrain a large part of of the site.	2	Minor floodplain runs through the centre of the site.
	4d. Coastal inundation	3	Coastal inundaton affects a large part of the site.	1	No anticipated coastal inundation.
5. Constructability	5a. Wastewater conveyance	3	Additional complexity as we are far from the Boyd Road nexus Significant increase in the length and complexity of the pipelines and pumping stations	3	Additional complexity as we are far from the Boyd Road nexus Significant increase in the length and complexity of the pipelines and pumping stations
	5b. Construction risk	2	Potential effects assocaited with dust, noise and vibration effects. Coastal erosion concerns, allow set back from coast. Should be relatively stiff ground. Avoid waterways and erosion features.	1	Geotech risks have not yet been reviewed. Potential effects assocaited with dust, noise and vibration effects. Will need to consider watercourse on site
6. Operability	6a. Operation and maintenance - WWTP	3	Small site, limited buffer. Any problems with odour and noise will impact community and impacts.	2	Longer pipes will affect influent properties (septicity, lower RBCOD, etc.).
	6b. Operation and maintenance - conveyance	3	More pipework to operate. Potential extra pump station or big syphon	3	More pipework to operate. Potential extra pump station or big syphon
7. Carbon	7a. Greenhouse gas emissions	3	High embedded carbon associated with pipe.	3	High embedded carbon associated with pipe. Potenitally needs extra PS.

Assessment Criteria		OPTION K Ranking	OPTION K Rationale	OPTION L Ranking	OPTION L Rationale
1. Cultural Values	1a. Cultural Values				
2. Heritage	2a Heritage	1	No known historic hertiage sites	2	Close proximity to Historic Heritage Overlay Place - 1551, Waiau Pa War
3. Social and community	3a. Land requirement	2	Smaller site, likely to provide for treatment but will require additional land for buffer. Opportunity to amalgamate Option K and Option L - both sites in same ownership. Property negotiation with a single landowner	2	Smaller site, likely to provide for treatment but will require additional land for buffer. Opportunity to amalgamate Option K and Option L - both sites in same ownership. Property negotiation with a single landowner
	3b. Social impact	1	No direct impact to social, recreational facilities	2	Fire station , shops kindergarten and school located adjacent to the eastern boundary of site. Assumed no direct impact
	3c. Odour amenity	3	A 200m buffer distance between the plant and site boundary unlikely to be achieved. A separation distance of 300 m from the plant to nearby residents is unlikley to be achieved	3	A 200m buffer distance between the plant and site boundary can achieve in a limited area but not enough for the plant footprint. A separation distance of 300 m from the plant to neraby neraby residents would also be unlikley to be achieved. The residential development
	3d. Operational effects	3	close to Waiau Pa settlement	3	close to Waiau Pa settlement
4. Natural environment	4a. Landscape / visual	2	Site close to neighbouring rural/lifestyle properties.	2	Site adjoining Waiau pa school. Residential catchment to the north east of the site
	4b. Ecology	1	Only a few flow paths (maybe intermittent streams)	2	Few streams and possible wetlands, not a lot of Terrestrial vegetation, ponds present
	4c. Flooding risk	2	Minor floodplain runs through the centre of the site.	2	Floodplain runs through the centre of the site.
	4d. Coastal inundation	1	No anticipated coastal inundation.	1	No anticipated coastal inundation.
5. Constructability	5a. Wastewater conveyance	3	Additional complexity as we are far from the Boyd Road nexus Significant increase in the length and complexity of the pipelines and pumping stations	3	Additional complexity as we are far from the Boyd Road nexus Significant increase in the length and complexity of the pipelines and pumping stations
	5b. Construction risk	1	Geotech risks have not yet been reviewed. Potential effects assocaited with dust, noise and vibration effects. Will need to consider watercourse on site	1	Geotech risks have not yet been reviewed. Potential effects assocaited with dust, noise and vibration effects.
6. Operability	6a. Operation and maintenance - WWTP	3	Small site, limited buffer. Any problems with odour and noise will impact community and impacts. Longer pipes will affect influent properties (septicity, lower RBCOD, etc.).	2	Longer pipes will affect influent properties (septicity, lower RBCOD, etc.).
	6b. Operation and maintenance - conveyance	3	More pipework to operate. Potential extra pump station or big syphon	3	More pipework to operate. Potential extra pump station or big syphon
7. Carbon	7a. Greenhouse gas emissions	3	High embedded carbon associated with pipe. (~3.5km from boyd rd, with two pipes needing to run to this location (CB and Waiuku pipe, or one much bigger pipe and and associated PS) this is ~equivalent to going 70% of the way to Waiuku.	3	High embedded carbon associated with pipe. (~3.5km from boyd rd, with two pipes needing to run to this location (CB and Waiuku pipe, or one much bigger pipe and and associated PS) this is ~equivalent to going 70% of the way to Waiuku.

Assessment Criteria		OPTION M Ranking	OPTION M Rationale	OPTION N Ranking	OPTION N Rationale
1. Cultural Values	1a. Cultural Values				
2. Heritage	2a Heritage	1	No known historic hertiage sites	1	No known historic hertiage sites
3. Social and community	3a. Land requirement	1	Larger site - ability to provide for treatment plant and buffer. Property negotiations with single landowner	2	Smaller site, likely to provide for treatment but will require additional land for buffer. Adjacent properties look to be lifestyle/rural properties. Potential negotiations with several landowners
	3b. Social impact	1	No direct impact to social, recreational facilities	1	No direct impact to social, recreational facilities
	3c. Odour amenity	1	A 200m buffer distance between the plant and site boundary could be achieved. Possible to locate the plant more than 300m from nearby residents	3	A 200m buffer distance between the plant and site boundary would not be achieved. It is unlikely a separation distance of 300 m from the plant to nearby residents could be achieved
	3d. Operational effects	1	sufficient distance, good access	1	sufficient distance, good access
4. Natural environment	4a. Landscape / visual	1	Assuming that site can be screened by planting etc. and there is a sufficient buffer distance from sites (200m), potential visual amenity effects are likely to be mitigated.	2	Site close to neighbouring rural/lifestyle properties.
	4b. Ecology	2	Two Permenant Streams, Possible Intermittent stream, no terrestrial vegetation of concern	1	Possible intermittent stream
	4c. Flooding risk	2	Floodplain runs through the centre of the site.	2	Minor floodplains run through the northern and southern end of the site.
	4d. Coastal inundation	1	No anticipated coastal inundation.	1	No anticipated coastal inundation.
5. Constructability	5a. Wastewater conveyance	3	Additional complexity as we are far from the Boyd Road nexus Significant increase in the length and complexity of the pipelines and pumping stations	3	Additional complexity as we are far from the Boyd Road nexus Significant increase in the length and complexity of the pipelines and pumping stations
	5b. Construction risk	1	Geotech risks have not yet been reviewed. Potential effects assocaited with dust, noise and vibration effects.	1	Geotech risks have not yet been reviewed. Potential effects assocaited with dust, noise and vibration effects.
6. Operability	6a. Operation and maintenance - WWTP	2	Longer pipes will affect influent properties (septicity, lower RBCOD, etc.).	3	Small site, limited buffer. Any problems with odour and noise will impact community and impacts. Longer pipes will affect influent properties (septicity, lower RBCOD, etc.).
	6b. Operation and maintenance - conveyance	3	More pipework to operate. Potential extra pump station or big syphon	3	More pipework to operate. Potential extra pump station or big syphon
7. Carbon	7a. Greenhouse gas emissions	3	High embedded carbon associated with pipe.	3	High embedded carbon associated with pipe.

Assessment Criteria		OPTION O Ranking	OPTION O Rationale	OPTION P Ranking	OPTION P Rationale
1. Cultural Values	1a. Cultural Values				
2. Heritage	2a Heritage	1	No known historic hertiage sites	1	No known historic hertiage sites
3. Social and community	3a. Land requirement	2	Smaller site, likely to provide for treatment but will require additional land for buffer. Adjacent properties look to be lifestyle/rural properties. Could amalgamate with Option N but likely to require more parcels. Potential negotiations with several landowners	2	Smaller site, likely to provide for treatment but will require additional land for buffer. Opportunity to amalgamate with Option Q negotiations with two landowners likely to be simpler than several
	3b. Social impact	1	No direct impact to social, recreational facilities	1	No direct impact to social, recreational facilities. Site close to Osborne Estate - assuming no impact
	3c. Odour amenity	2	A 200m buffer distance between the plant and site boundary would not be achieved. A separation distance of 300 m from the plant to nearby residents could only be achieved by locating the plant in the NE corner of the site. Overall a marginal site from an odour	3	A 200m buffer distance between the plant and site boundary would not be achieved. A separation distance of 300 m from the plant to neraby neraby residents is also unlikley to be achieved
	3d. Operational effects	1	sufficient distance, good access	1	sufficient distance, good access
4. Natural environment	4a. Landscape / visual	1	Site is not directly adjacent any rural/lifestyle properties, likely to have some level of separation + assumed to have a planted buffer	2	Site close to neighbouring rural/lifestyle properties.
	4b. Ecology	2	Possible wetlands, Streams	2	Ponds, Possible wetlands, streams
	4c. Flooding risk	2	Floodplain runs through the centre of the site.	2	Minor floodplains run through the northern and southern end of the site.
	4d. Coastal inundation	1	No anticipated coastal inundation.	1	No anticipated coastal inundation.
5. Constructability	5a. Wastewater conveyance	3	Additional complexity as we are far from the Boyd Road nexus Significant increase in the length and complexity of the pipelines and pumping stations	3	Additional complexity as we are far from the Boyd Road nexus Significant increase in the length and complexity of the pipelines and pumping stations
	5b. Construction risk	1	Geotech risks have not yet been reviewed. Potential effects assocaited with dust, noise and vibration effects.	1	Geotech risks have not yet been reviewed. Potential effects assocaited with dust, noise and vibration effects.
6. Operability	6a. Operation and maintenance - WWTP	3	Small site, limited buffer. Any problems with odour and noise will impact community and impacts. Longer pipes will affect influent properties (septicity, lower RBCOD, etc.).	3	Small site, limited buffer. Any problems with odour and noise will impact community and impacts. Longer pipes will affect influent properties (septicity, lower RBCOD, etc.).
	6b. Operation and maintenance - conveyance	3	More pipework to operate. Potential extra pump station or big syphon	2	? What would operation of pipe from Clarks Beach be like?
7. Carbon	7a. Greenhouse gas emissions	3	High embedded carbon associated with pipe.	3	High embedded carbon associated with pipe.

Assessment Criteria		OPTION Q Ranking	OPTION Q Rationale	OPTION R Ranking	OPTION R Rationale
1. Cultural Values	1a. Cultural Values				
2. Heritage	2a Heritage	1	No known historic hertiage sites	1	No known historic hertiage sites
3. Social and community	3a. Land requirement	2	Smaller site, likely to provide for treatment but will require additional land for buffer. Opportunity to amalgamate with Option Q negotiations with two landowners likely to be simpler than several	1	Larger site - ability to provide for treatment plant and buffer. Property negotiations with single landowner
	3b. Social impact	1	No direct impact to social, recreational facilities	1	No direct impact to social, recreational facilities
	3c. Odour amenity	3	A 200m buffer distance between the plant and site boundary would not be achieved. A separation distance of 300 m from the plant to neraby neraby residents is also unlikley to be achieved	1	A 200m buffer distance between the plant and the site boundary could be achieved. Alos possible to locate the plant more than 300 m from nearby residents
	3d. Operational effects	1	sufficient distance, good access	1	sufficient distance, good access
4. Natural environment	4a. Landscape / visual	1	Site is not directly adjacent any rural/lifestyle properties, likely to have some level of separation + assumed to have a planted buffer	1	Site directly adjacent to rural/lifestyle properties on the eastern and western end, however likely to have sufficient buffer (200m)
	4b. Ecology	2	Main watercourse, adjacent to Coastal SEA, no Terrestrial SEA, Regenerating terrestrial vegetation	2	Marine Mammal Santuary, Coastal SEA, Wadding Birds, One Main Stream at least, possible wetland.
	4c. Flooding risk	2	Minor floodplains run through the northern and southern end of the site.	2	Minor floodplains through the northern end of the site.
	4d. Coastal inundation	1	No anticipated coastal inundation.	1	Very minor coastal inundation.
5. Constructability	5a. Wastewater conveyance	3	Additional complexity as we are far from the Boyd Road nexus Significant increase in the length and complexity of the pipelines and pumping stations	2	Additional complexity as we are far from the Boyd Road nexus Significant increase in the length and complexity of the pipelines and pumping stations Potentially will require two crossings under Taihiki R Furtherest option from the outfall
	5b. Construction risk	1	Geotech risks have not yet been reviewed. Potential effects assocaited with dust, noise and vibration effects.	2	Topography relatively flat. Geotech risks are yet to be considered. Potential access issues. Additional pipeline likely to become redundant
6. Operability	6a. Operation and maintenance - WWTP	3	Small site, limited buffer. Any problems with odour and noise will impact community and impacts. Longer pipes will affect influent properties (septicity, lower RBCOD, etc.).	1	Site generally looks okay. Long pipes will affect influent properties but HRT is possibility shorter? Need to understand CB pipe better.
	6b. Operation and maintenance - conveyance	2	? What would operation of pipe from Clarks Beach be like?	2	? What would operation of pipe from Clarks Beach be like? Dependent on pipeline from Glenbrook on whether amber or red.
7. Carbon	7a. Greenhouse gas emissions	3	High embedded carbon associated with pipe.	3	High embedded carbon associated with pipe.

Assessment Criteria		OPTION S Ranking	OPTION S Rationale	OPTION T Ranking	OPTION T Rationale
1. Cultural Values	1a. Cultural Values				
2. Heritage	2a Heritage	1	No known historic hertiage sites	1	No known historic hertiage sites
3. Social and community	3a. Land requirement	1	Larger site - ability to provide for treatment plant and buffer. Property negotiations with single landowner	1	Larger site - ability to provide for treatment plant and buffer. Property negotiations with single landowner
	3b. Social impact	1	No direct impact to social, recreational facilities	1	No direct impact to social, recreational facilities. Some businesses on southern boundary, assuming no direct impact.
	3c. Odour amenity	1	A 200m buffer distance between the plant and site boundary could be maintained. Possible to locate the plant 300 m from nearby residents	1	A 200m buffer distance between the plant and site boundary could be maintained. Possible to locate the plant 300 m from nearby residents
	3d. Operational effects	1	sufficient distance, good access	1	sufficient distance, good access
4. Natural environment	4a. Landscape / visual	1	Site directly adjacent to rural/lifestyle properties on the southern boundary however likely to have sufficient buffer (200m)	1	Site directly adjacent to rural/lifestyle properties on the southern boundary however likely to have sufficient buffer (200m)
	4b. Ecology	2	Adjacent to Marine SEA, Cant identify any Watercourses, Salt Marsh Present, Ponds	2	Salt Marsh, Lots of possible intermittent streams, possible wetland, ponds
	4c. Flooding risk	2	Minor floodplains toward the southern end of the site.	2	Floodplain runs through the centre of the site.
	4d. Coastal inundation	2	Minor coastal inundation towards the northern end of the site.	2	Minor coastal inundation towards the northern end of the site.
5. Constructability	5a. Wastewater conveyance	2	Further from the outfall than Option A and B Overall pipeline lengths are reduced May be issues catering for flows initially before more flows come online An additional crossing of Taihiki R for the outfall pipeline	2	Further from the outfall than Option A and B Overall pipeline lengths are reduced May be issues catering for flows initially before more flows come online An additional crossing of Taihiki R for the outfall pipeline
	5b. Construction risk	3	Low lying site, shallow driven (10-12m) piles required. Already very low can't drop the level. Construction of pipeline between Glenbrook and Waiuku needs to commmence as soon as possible to provide for growth in the short term. Additioanl assets may be required that would then become redundant.	3	Scarp and stream features of concern indicating poor ground. Likely to have soft alluvium and will likely require ground improvement (surcharging). Low lying area. Construction of pipeline between Glenbrook and Waiuku needs to commmence as soon as possible to provide for growth in the short term. Additioanl assets may be required that would then become redundant.
6. Operability	6a. Operation and maintenance - WWTP	1	good size, flatish.	1	good size, flatish.
	6b. Operation and maintenance - conveyance	3	Siphon from Kingseat and Clarks to Glenbrook will have very low start up flows to carry solids through.	3	Siphon from Kingseat and Clarks to Glenbrook will have very low start up flows to carry solids through.
7. Carbon	7a. Greenhouse gas emissions	2	Long pipes. From Kingseat / Clarks	2	Long pipes. From Kingseat / Clarks

Assessment Criteria		OPTION U Ranking	OPTION U Rationale	OPTION V Ranking	OPTION V Rationale
1. Cultural Values	1a. Cultural Values				
2. Heritage	2a Heritage	1	No known historic hertiage sites	1	No known historic hertiage sites
3. Social and community	3a. Land requirement	2	Smaller site, likely to provide for treatment but will require additional land for buffer. Adjacent properties look to be lifestyle/rural properties. Potential negotiations with several landowners	1	Larger site - ability to provide for treatment plant and buffer. Property negotiations with single landowner
	3b. Social impact	1	No direct impact to social, recreational facilities	1	No direct impact to social, recreational facilities
	3c. Odour amenity	3	A 200m buffer distance between the plant and site boundary would not be achieved. A separation distance of 300 m from the plant to neraby residents would also not be achieved	1	A 200m buffer distance between the plant and site boundary could be achieved. Possible to locate the plant more than 300 m from nearby residents
	3d. Operational effects	3	Narrow site	1	sufficient distance, good access
4. Natural environment	4a. Landscape / visual	2	Site close to neighbouring rural/lifestyle properties. Unlikely to have separation distance. Potential outlook impacts	1	Site not directly adjacent to rural/lifestyle properties and likely to have sufficient buffer (200m)
	4b. Ecology	1	no major features, appart from coastal adjacent, Shell barrier beach, coastal threatened species.	2	Salt Marsh, few possible Intermittent stream, one possible wetland area (could be just pasture)
	4c. Flooding risk	2	Floodplain runs through the centre of the site.	2	Minor floodplains through the site.
	4d. Coastal inundation	1	Very minor coastal inundation.	2	Minor coastal inundation towards the southern end of the site.
5. Constructability	5a. Wastewater conveyance	1	Further from the outfall than Option A and B Overall pipeline lengths are reduced May be issues catering for flows initially before more flows come online An additional crossing of Taihiki R for the outfall pipeline	1	Further from the outfall than Option A and B Overall pipeline lengths are reduced May be issues catering for flows initially before more flows come online An additional crossing of Taihiki R for the outfall pipeline
	5b. Construction risk	3	Construction of pipeline between Glenbrook and Waiuku needs to commmence as soon as possible to provide for growth in the short term. Additioanl assets may be required that would then become redundant.	3	Construction of pipeline between Glenbrook and Waiuku needs to commmence as soon as possible to provide for growth in the short term. Additioanl assets may be required that would then become redundant.
6. Operability	6a. Operation and maintenance - WWTP	3	Very narrow. Limited buffer	1	good size, flatish.
	6b. Operation and maintenance - conveyance	3	Siphon from Kingseat and Clarks to Glenbrook will have very low start up flows to carry solids through.	3	Siphon from Kingseat and Clarks to Glenbrook will have very low start up flows to carry solids through.
7. Carbon	7a. Greenhouse gas emissions	2	Long pipes. From Kingseat / Clarks	2	Long pipes. From Kingseat / Clarks

Assessment Criteria		OPTION W Ranking	OPTION W Rationale	OPTION X Ranking	OPTION X Rationale
1. Cultural Values	1a. Cultural Values				
2. Heritage	2a Heritage	1	No known historic hertiage sites	1	No known historic hertiage sites
3. Social and community	3a. Land requirement	1	Larger site - ability to provide for treatment plant and buffer. Property negotiations with single landowner. Opportunity to amalgamate with Option X - under same ownership	1	Larger site - ability to provide for treatment plant and buffer. Property negotiations with single landowner. Opportunity to amalgamate with Option W - under same ownership
	3b. Social impact	1	No direct impact to social, recreational facilities	1	No direct impact to social, recreational facilities
	3c. Odour amenity	2	A 200m buffer distance between the plant and site boundary may not be achieved. However, it is possible the plant could be located more than 300m from nearby residents. Located adjacent to FUZ	2	A 200m buffer distance between the plant and site boundary could be achieved. Also possible to locate the plant more than 300 m from nearby residents. Located adjacent to SHA - live zone residential
	3d. Operational effects	1	sufficient distance, good access	1	sufficient distance, good access
4. Natural environment	4a. Landscape / visual	2	Site not directly adjacent to rural/lifestyle properties. However adjacent to FUZ on southern boundary. Potential outlook impacts	2	site adjoining future residential area , however, likely to have separation buffer of 200m
	4b. Ecology	2	Adjacent Coastal SEA, ponds and small potential wetland, possible intermitent	2	Adjacent to Terrestrial SEA, Coastal SEA, small potential wetland, streams present
	4c. Flooding risk	2	Minor floodplains through the site.	2	Minor floodplains through the site.
	4d. Coastal inundation	2	Minor coastal inundation towards the southern end of the site.	1	Very minor coastal inundation.
5. Constructability	5a. Wastewater conveyance	1	Further from the outfall than Option A and B Overall pipeline lengths are reduced May be issues catering for flows initially before more flows come online An additional crossing of Taihiki R for the outfall pipeline	1	Further from the outfall than Option A and B Overall pipeline lengths are reduced May be issues catering for flows initially before more flows come online An additional crossing of Taihiki R for the outfall pipeline
	5b. Construction risk	3	Scarp and stream features of concern indicating poor ground. Likely to have soft alluvium and will likely require ground improvement (surcharging). Low lying area. Similar to other sites. Dependent on location of pump station in Glenbrook.	2	Slightly higher ground, WWTP better to be located further inland away from the coast. Cut to create a plateu. Limited good sites within the area as slip features to be avoided. Won't require as much imported material. Similar to other sites. Dependent on location of pump station in Glenbrook.
6. Operability	6a. Operation and maintenance - WWTP	1	good size, flatish.	1	good size, flatish.
	6b. Operation and maintenance - conveyance	3	Siphon from Kingseat and Clarks to Glenbrook will have very low start up flows to carry solids through.	3	Siphon from Kingseat and Clarks to Glenbrook will have very low start up flows to carry solids through.
7. Carbon	7a. Greenhouse gas emissions	2	Additional pipe length.	2	Additional pipe length.

Assessment Criteria		OPTION Y - Clarks Beach WWTP Ranking	OPTION Y - Clarks Beach WWTP Rationale	OPTION Z - Waiuku WWTP Ranking	OPTION Z - Waiuku WWTP Rationale
1. Cultural Values	1a. Cultural Values				
2. Heritage	2a Heritage	1	No known historic hertiage sites	1	No known historic hertiage sites
3. Social and community	3a. Land requirement	2	May require additional land from Golf course - given recreational facility, may pose some challenges from a property negotiation perspective	1	Site likely to have the ability to provide for treatment plant and buffer. If additional area is required, adjacent lots look to be larger.
	3b. Social impact	2	May result in greater impact to the Clarks Beach Golf Club	1	No direct impact to social, recreational facilities
	3c. Odour amenity	3	A l 200m buffer distance between the plant and site boundary could not be achieved. A residentail area would be located within 300m of the plant	1	An internal 200m buffer distance between the plant and site boundary could potentailly be achieved - although this is likley to be marginal. Possible to locate the plant more than 300 m from nearby residents
	3d. Operational effects	1	sufficient distance, good access	1	sufficient distance, good access
4. Natural environment	4a. Landscape / visual	1	Site not directly adjacent to rural/lifestyle properties and likely to have sufficient buffer (200m)	1	Site not directly adjacent to rural/lifestyle properties and likely to have sufficient buffer (200m)
	4b. Ecology	2	Adjaccent Coastal SEA, potential wetland, possible intermitent	2	Adjaccent Coastal SEA, potential wetland, possible intermitent
	4c. Flooding risk	2	Minor floodplains through the site.	2	Minor floodplains through the site.
	4d. Coastal inundation	1	Very minor coastal inundation.	2	Minor coastal inundation around the site.
5. Constructability	5a. Wastewater conveyance	1	Shortest pipe length overall. But long pipeline from Waiuku	3	Furtherest point from discharge. Requires duplicate pipeline to and from Waiuku
	5b. Construction risk	3	Maintaining compliance during construction would be very difficult. Space is very small increasing H&S risks and potentially increasing programme, Would need to deal with effects of cliff and potential erosion issues. Remote laydown area would be required.	2	Would need to build on existing operating assets. Access is difficult dur to step access road.
6. Operability	6a. Operation and maintenance - WWTP	3	Operation during new build very difficult. Small site affects operability if assets too close together. Public in close vicinity to assets adding to risk.	2	Operation of existing WWTP during construction will be difficult. Access is very poor (may be able to be improved during upgrade but its still a steep hill.
	6b. Operation and maintenance - conveyance	1	shortest pipe length.	3	Pipeline from Clarks to Waiuku will have very low start up flows making it difficult to carry solids to the WWTP due to syphon and very long uphill pumped section. May need extra pump stations with storage, or treated effluent carry water which would then need to pass through WWTP and be returned.
7. Carbon	7a. Greenhouse gas emissions	1	lowest pipe lengths	3	Very high embedded carbon associated with pipe.

C

Appendix C – Mana Whenua and Community Engagement

Southwest Wastewater Servicing

Kingseat, Clarks Beach, Glenbrook Beach and Waiuku

Watercare
An Auckland Council Organisation

Tonight's Event

- First of ongoing conversations with the community as we develop this solution
- Format for this event
- Opportunities for questions at the end
- Get in touch with us at southwest@water.co.nz

Please note that this presentation will be recorded and posted online, for those who could not attend

Introductions

Priyan Perera – Head of Strategy and Planning

Richie Waiwai – Poutiaki, Tikanga Māori

Tanvir Bhamji – Manager Production Consent Planning

Haydee Allan – Senior Wastewater Treatment Planner

Anshita Jerath – Resource Consent Planner

Brent Evans – Manager Local Board / Stakeholder Engagement

Leroy Beckett – Stakeholder Liaison

Jonathan Piggot – Wastewater Production Manager South

Garrett Hall – Technical Director (BECA)

How do we currently provide wastewater services to:
Waiuku, Glenbrook Beach, Clarks Beach and Kingseat?

Clarks Beach WWTP
Services the Clark Beach and Glenbrook Beach Communities

Kingseat WWTP
Services a small portion of the Kingseat Community

Waiuku WWTP
Services the Waiuku Community

Watercare
An Auckland Council Organisation

Working to Improve Outcomes

Watercare embarked on developing a programme to improve environmental outcomes, support community growth and enhancing service levels in Waiuku, Glenbrook Beach, Clarks Beach and Kingseat.

The programme we have developed will:

- Reduce the existing four discharge points down to one
- Provide a very high level of treatment
- Service growth in the long term
- Provide the opportunity to implement beneficial reuse in the future
- Provide sustainable solutions to our customers and these communities

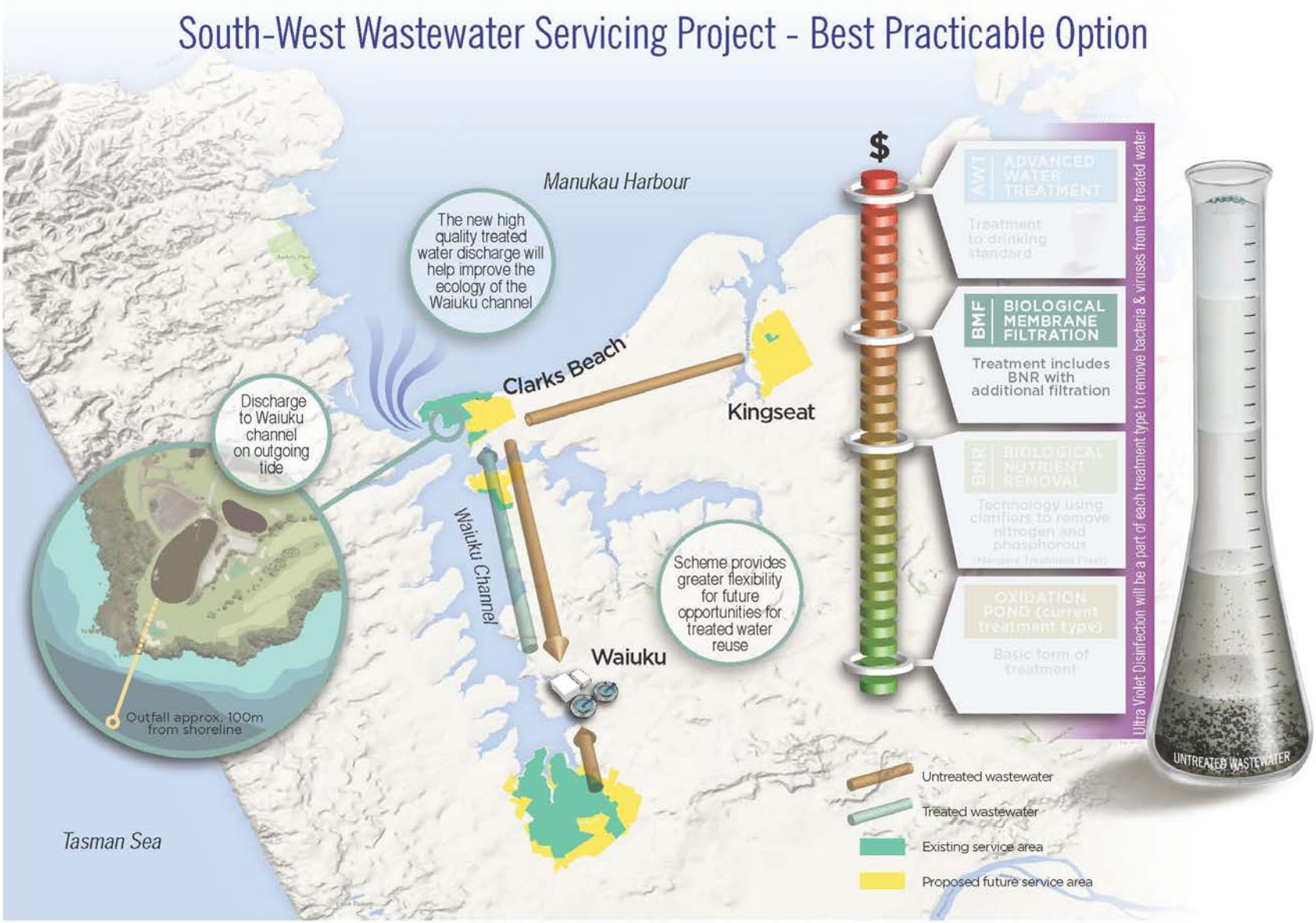
Southwest Discharge Consent Background

- Environment Court Consent order – June 2018 (Consent obtained to construct a new outfall structure and discharge treated wastewater into the Waiuku Estuary).
- Consent to be Operational by June 2026

Discharge Consent Conditions

- Community Liaison Group
  - Review performance of the WWTP
  - Review results of monitoring and receiving environment monitoring report
  - Review Operations and Management Plan
- Monitoring and Technology Review conditions
  - Assess options for wastewater reduction and/or reuse
- Operations and Management Plans developed

South-West Wastewater Servicing Project - Best Practicable Option



Watercare
An Auckland Council Organisation

What has changed?

Our focus on carbon footprint and climate change impacts of our infrastructure programme.

- Central Government focus on Climate change and reducing Carbon footprint
- Auckland Council's climate plan focuses on halving greenhouse gas emissions by 2030
- While Watercare considered climate change impacts such as sea level rise, the assessment of carbon emissions associated with this programme was not considered in the options assessment
- Watercare initiative:
  - Reduce carbon emissions from our operations by 50% by 2030
  - Reduce carbon emissions from construction by 40% by 2025
  - Achieve net zero emissions by 2050
- Deliver in a different manner as Kingseat developers not signing up to implement pipeline from Kingseat area

Why are we considering a change to the Southwestern Wastewater Servicing Scheme

To clarify we are not:

- deviating from the positive environmental outcomes
- Seeking to change our resource consent requirement

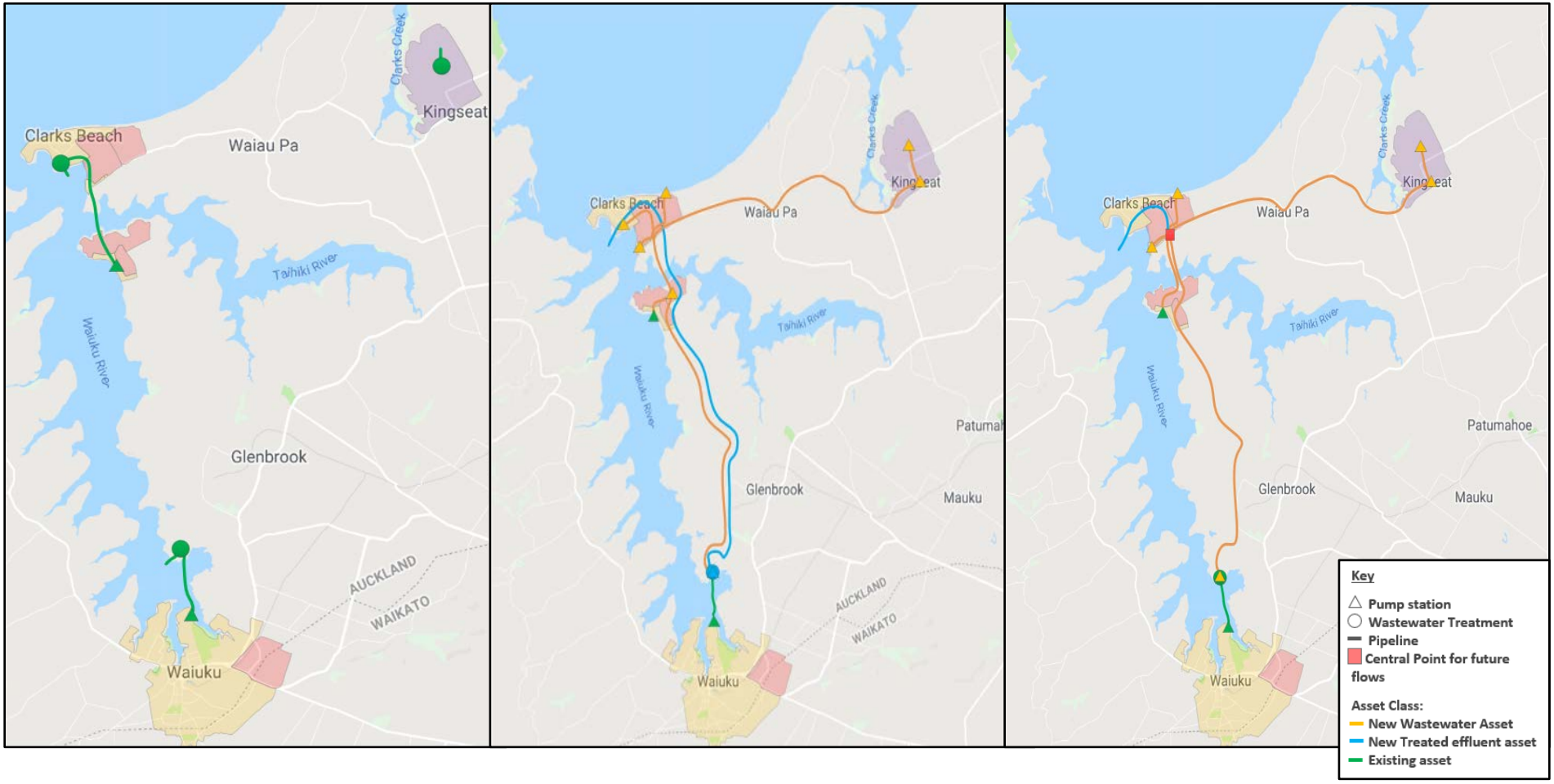
But to improve the carbon and cost efficiencies of this wastewater scheme we are considering:

- Removing the need for a return pipeline from Waiuku to Clarks Beach (10km length) which will reduce the construction carbon by about 23% or 6,600 tCO2e
- Ensure we are prudently and effectively managing our financial position and spending our capital funding wisely
- Improve the operability by removing the raw wastewater pipe between Clarks Beach and Waiuku.
- Reduces the ongoing operating costs and our carbon footprint for future generations

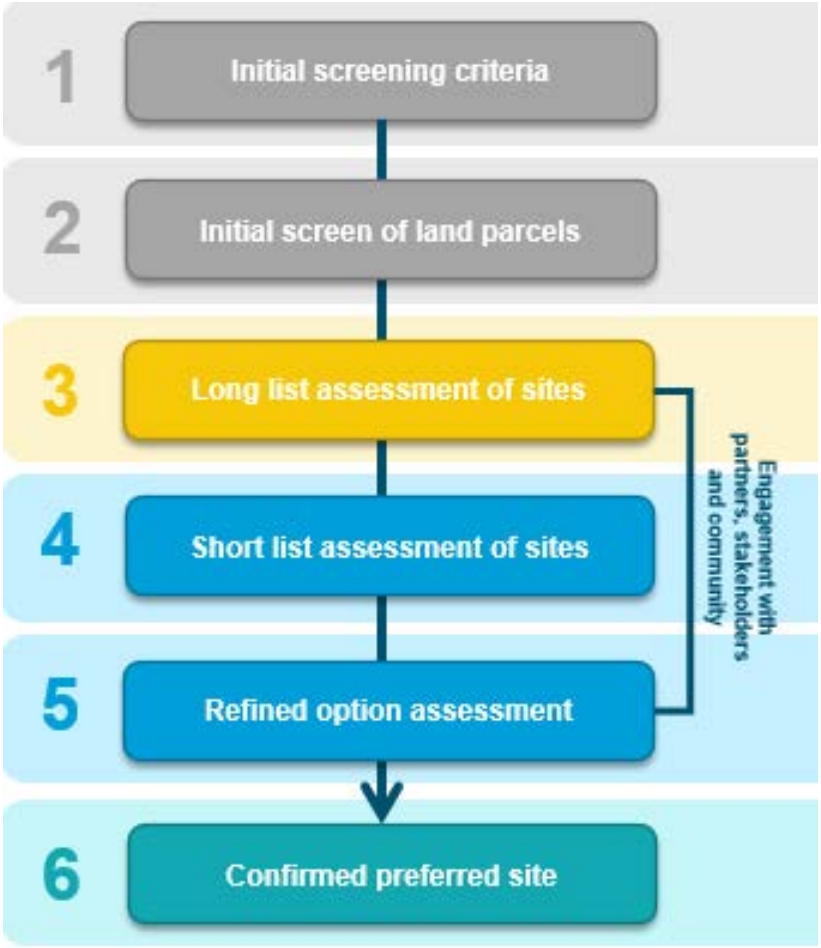
Existing Scheme

Proposed South-West Discharge Scheme (2018)

Optimised Scheme For Consideration/Feedback



Methodology



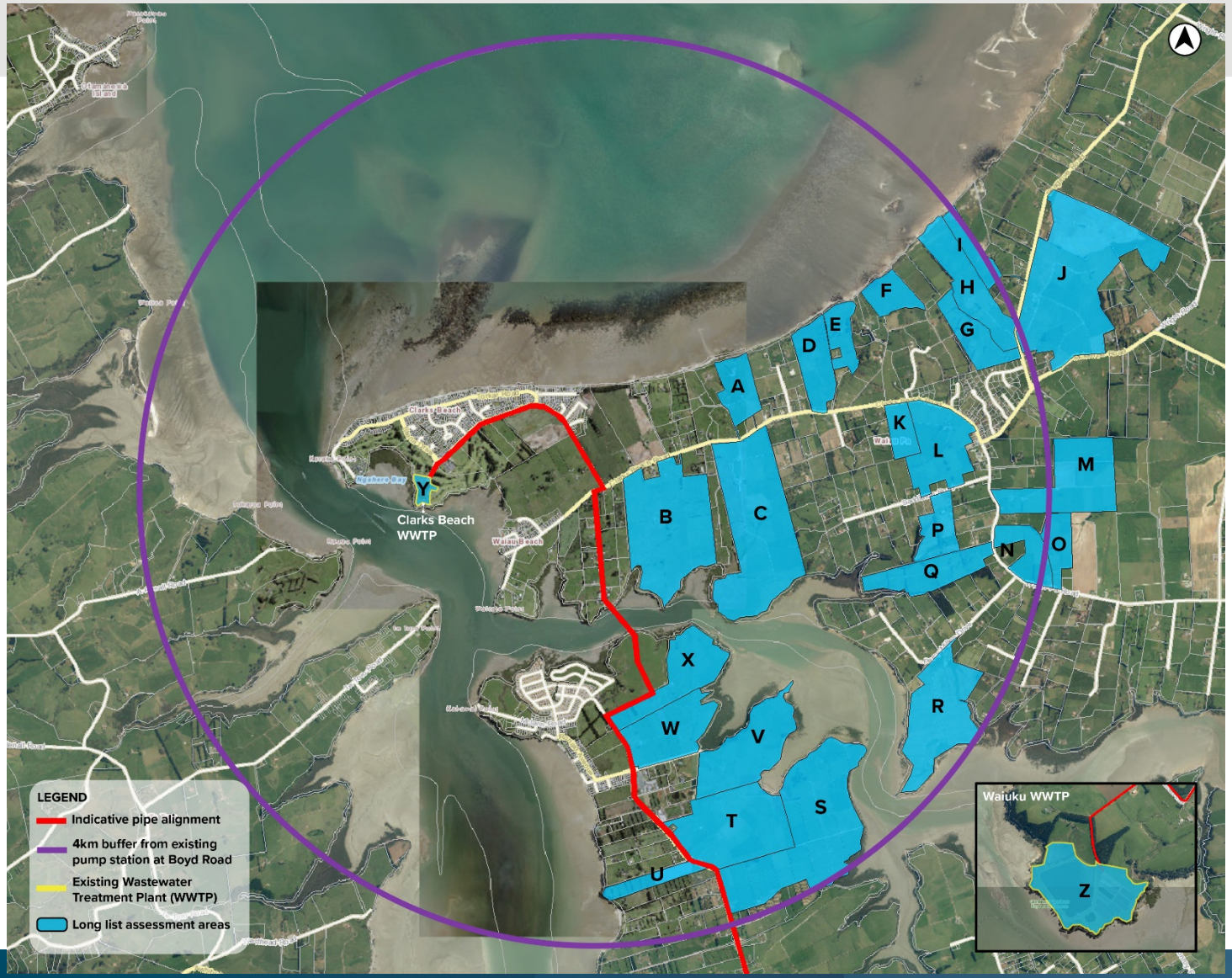
Site requirements

- We are seeking developing a site that will be future proofed in a variety of potential growth scenarios
- Additional area allowance for an Advanced Water Treatment Plant process.
- This area is approximately 4 ha.
- Inclusion of a 200m buffer around the 4ha site.
- The land requirement for the WWTP + buffer is approximately **30 ha.**

Initial screening

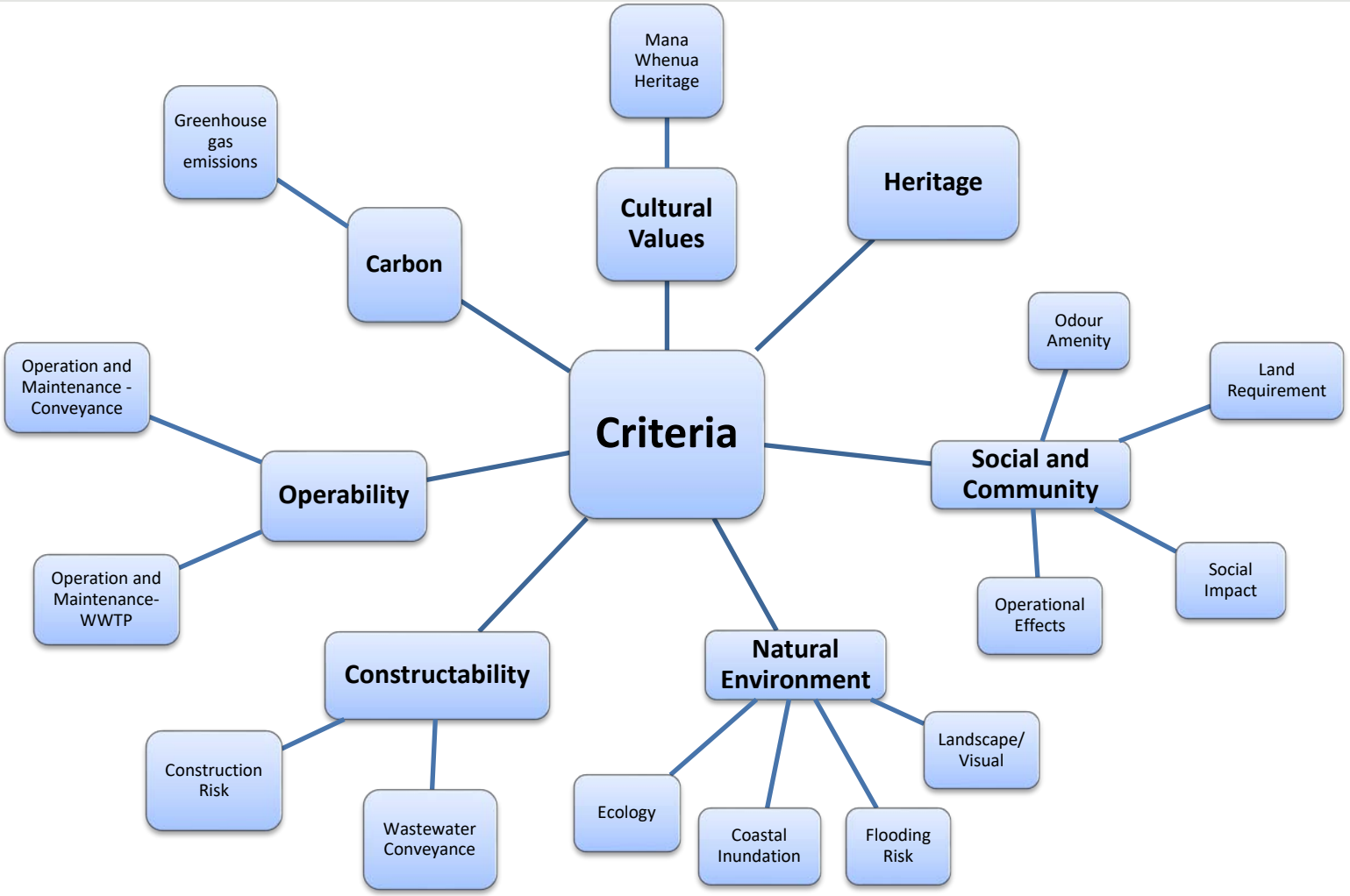
- Exclude urban and future urban zoned land
- Exclude sites less than 10ha
- Within 4km of Boyd Rd collection point
- Exclude sites west of Waiuku Channel

Long List Options

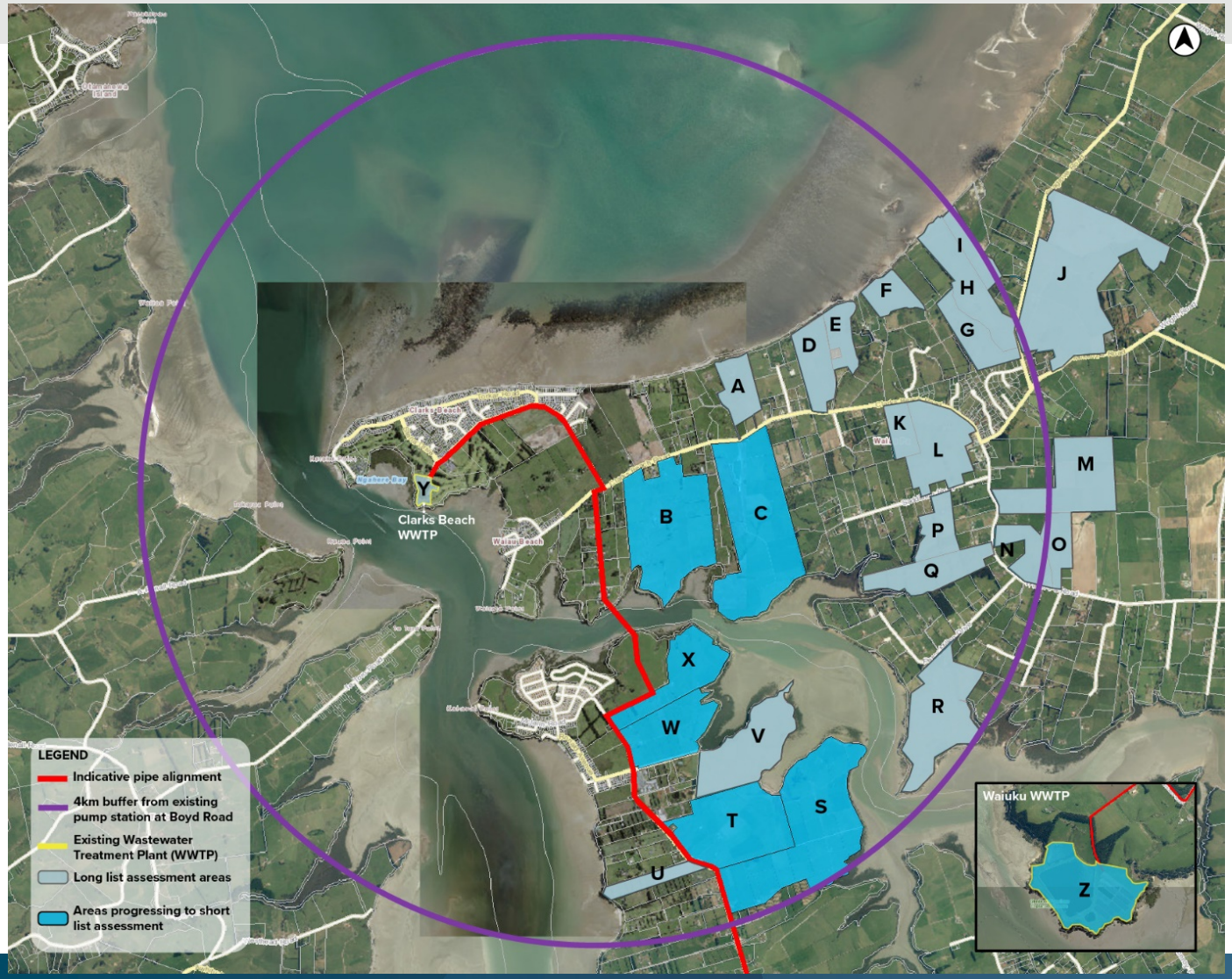


Watercare
An Auckland Council Organisation

Long-list Criteria



Short-listed sites based on technical criteria



Note: Short-listed sites are indicative and not finalised.

Watercare
An Auckland Council Organisation

Next Steps

- Feedback from the Community on the options by next week (COB Wednesday 6th October)
- Over the course of October, Watercare will carry out site specific studies and undertake a detailed analysis. The short-listed sites will be shared with the community thereafter.
- Second Community Information session to be held in November (date TBC – hopefully in person)
- We will continue to discuss with Mana Whenua
- Continue discussions with CLG and Community
- Continue concept design and site investigations.
- Construction to commence in the next 2 years
- Scheme operational by June 2026

Feedback avenues and mechanisms

We will be collecting feedback on the information presented today via the following communication channels:

- The feedback you provided tonight
- Email us at: southwest@water.co.nz
- This presentation will be on our website under the South West project page, please share it with people who would be interested.

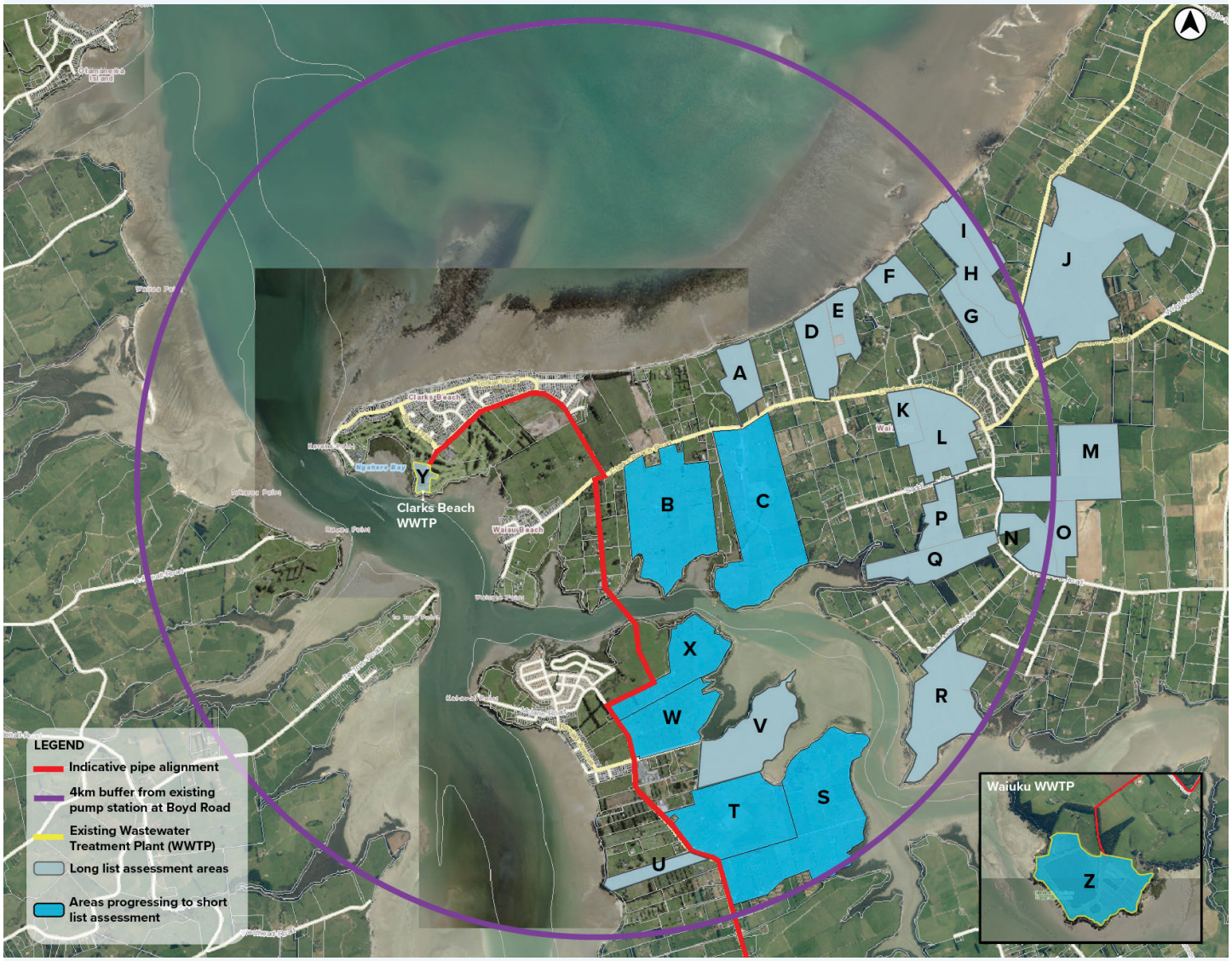
October 2021
Newsletter 6

An update on the

South-West wastewater servicing project

Overview

The South-West wastewater servicing project will provide wastewater services to the communities of Waiuku, Glenbrook Beach, Clarks Beach and Kingseat. It is one of the key projects for Watercare over the next five years.



Following consideration of feedback on the long-list assessment programme, Watercare is now commencing further more detailed assessments on the seven short-listed sites (B, C, S, T, W, X, and Z) and is in the process of contacting landowners. This will include a number of investigations to assess potential wastewater treatment plant layouts on each site and how site-specific issues such as odour management/road access/ ecology etc. can be managed. This information will then be used to assess the short-listed sited in November.

Watercare

September 2021

South-West Wastewater Servicing Project

Questions from the Community open day session

Existing Clarks Beach Wastewater Treatment Plant

Q1: Are we at risk of losing the golf course? What happens to the Stella Drive Wastewater Treatment Plant in the golf course – ponds stay or relocated?

Response

The golf course site does not meet the minimum land area criteria for a new wastewater treatment plant (WWTP). Based on the technical criteria, the Clarks Beach WWTP does not provide for the future expansion of the facility. However, we may require the existing Clarks Beach WWTP site as a tidal storage pond.

Kingseat

Q2: I've been told that Kingseat pipeline has been dropped from the scheme and will only be included if privately funded by landowners/developers. Is this true?

Response

The Kingseat community has been included in the Southwest Discharge Consent.

The servicing scheme includes the construction of a new wastewater treatment plant and conveyance pipelines from the communities of Waiuku, Clarks Beach and Kingseat. The wastewater pipe from Kingseat to the new wastewater treatment plant is to be funded by the landowners/developers in Kingseat. This wastewater connection is a local network connection and therefore will need to be fully funded by the Kingseat landowners/developers. Watercare has been working with a number of the landowners/developers. There is currently no agreement(s) in place for the funding of this pipe, which is key to ensuring that service can be provided in Kingseat.

Q3: Is the potable water supply included in the Kingseat project?

Response

Capacity to provide water supply to Kingseat was provided in the watermain that Watercare constructed to service Patumahoe, Clarks Beach and Glenbrook Beach. A new watermain will need to be constructed from Patumahoe to Kingseat as well as a water reservoir. This will need to be developer funded, a similar arrangement to the likes of the Clevedon developments.

Reuse

Q4: Beneficial reuse questions, what are the most likely activities that reused water would be used for? And, would these fit within the current Auckland unitary plan rules?

Response

A number of beneficial reuse options may become available for this area. They include, industrial reuse, aquifer re-injection to recharge the aquifer water levels and direct potable reuse.

Watercare

Carbon

Q5: You mention carbon neutrality in the presentation, how much is based on off-sets and what will be the increased cost to consumers?

Response
Watercare has a longer-term goal to produce net zero carbon emissions by 2050. When looking at ways to achieve our carbon goals we consider a hierarchy of methods to reduce emissions. First, we look to remove emissions by changing the way we operate and build infrastructure, then we consider switching energy sources, then carbon removals, such as planting, within our land holdings. Purchasing offsets would only be considered in the long term once we have looked at each of these options.

The additional cost of offsets has not been calculated as its not in the current plan and we believe we can use many existing project budgets to achieve emission reductions. We also believe that the cost of inaction from climate change impacts will be far higher than investments we make today to reduce emissions.

Q6: What is the carbon cost of a second CB-Waiuku pipeline vs the carbon cost of a new plant?

Response
This information will be prepared and will be presented as part of the short-listed options.

Q7: Doesn't the addition of this "carbon lens" make all of the previous analysis void?

You went through Fatal Flaw assessment, then Traffic Light assessment, then weighted-score assessment. That gave you three preferred options. You are applying the carbon lens to those options, when one of the previously discounted options may now be better. Go back to the initial long list and apply the carbon lens to ALL options.

De-carbonise Glenbrook steel mill (carbon-free steel production is now a thing), and steel pipe becomes cheap and low-carbon. Keep the CB-Waiuku-CB plan?

Response
The Southwest discharge consent had a primary focus on the discharge. The carbon emissions assessment will be undertaken in more detail in the short listed phase.

Q8: You mentioned a pipeline will need to be dropped to reduce carbon footprint. Which pipeline will be dropped?

Response
If the wastewater treatment plant is located within the Clarks Beach area, the treated effluent pipeline between Waiuku and Clarks Beach would no longer be required. The next stage of work will determine the most suitable site for a new wastewater treatment plant and accordingly confirm the number of pipes.

Q9: Have you got a benefit cost associated with ecosystem services within the Hūnua and Waitākere – i.e. for carbon offsetting?

Response
We have not completed a cost benefit analysis of offsetting, whether in the Hūnua's or the Waitākere's. Our current focus is on reducing greenhouse gas emission generation, we may consider the benefits of carbon offsets for residual emissions at a later date.

PWA

Q10: Are you doing compulsory acquisition under the PWA for the site?

Response
A site has not been selected. Watercare is undertaking an options analysis to determine a potential WWTP site. More detailed field assessments for the short-listed sites will be undertaken in October (COVID level dependent).

It is always our intention to enter a mutually acceptable arrangement with the property owner and when we do, Watercare will acquire the land under the Public Works Act as that is how the land is to be held. If we cannot reach agreement, then we have at our disposal, the compulsory acquisition rights under the Public Works Act that we have occasionally had to rely upon to secure the land needed for such a Public Work.

New wastewater treatment plant

Q11: Will the new wastewater treatment plant be enclosed?

Response
The key odour generating parts of the plant such as the inlet works will be enclosed. Air will be extracted from the head space of the enclosures and treated through an odour removal process.

Q12: How long have you had site B in your list and when was that time for site B. as in weeks or months?

Response
Watercare was notified that site B had been placed up for sale. Watercare approached the owners to enquire about the site. Watercare has not purchased any site. Watercare is undertaking an options analysis to determine a potential WWTP site, and site B is one of the options.

Q13: Is that pipeline going down Boyd Road?

Response
The location of the pipeline will depend on which the wastewater treatment plant site is selected. It will aim to follow public roads where practical.

Q14: Does excluding sites west of the Waiuku channel limit development in the peninsula? Seems there would be several sites on the peninsula that could accommodate the new plant?

Response
Watercare needs to provide for development in line with Auckland Councils Plans. There is no plan for residential development on the peninsula west of Clarks Beach. Installing the wastewater treatment plant on the western side of the channel would require a long marine crossing which has additional risks. Pipelines servicing new developments would also need to cross the river in the future, which has construction and operational risks associated with it.

Surplus land

Q15: When the property is purchased, what would likely be done with the excess land? e.g. Site B is 70ha and you only require 30, what happens to the remainder?

Q16: Will the surplus land around the WWTP (i.e., wetlands etc) be open to public as an asset to the community?

Response
The next level of work involves site specific study, which will determine a potential fit for a wastewater treatment plant on the site. This information will be prepared and will be presented as part of the short listed options

Manukau Harbour

Q17: How will this affect the water quality at Clarks Beach for fishing, shellfish, swimming etc. especially after heavy rain?

Response

The WWTP discharge consent was granted in 2018 for a 35-year period and proposes a new modern WWTP that will provide state of the art wastewater treatment and a new discharge location off Clarks Beach golf course. The WWTP will incorporate a very high level of disinfection.

This project is about assessing alternative sites for the WWTP site itself. The new WWTP site will generate stormwater which will need to be managed through a site-specific Stormwater Management Plan that will meet the requirements of the Auckland Unitary Plan.

Q18: Will the outfeed reach the Manukau Heads in a tidal cycle when released on an outgoing tide?

Response

The consented discharge consent requirements stipulate the new discharge is required to not commence until one hour after any high tide and must cease no later than five hours after any high tide. This discharge timing was modelled through a hydrodynamic model developed specifically for the discharge consent project with the aim to flush as much treated wastewater towards the Manukau Heads in a discharge cycle as possible.

Q19: Most sites have a touch point with the harbour or similar. What have you considered in terms of protecting the harbour due to critical environmental events? e.g., earthquake ?

Response

Wastewater treatment plants have higher performance requirements in earthquakes than typical buildings due to the role they play. Any additional protections would need to be considered on a site-by-site basis.

Timeframes/costs

Q20: When do you roughly expect completion of the new treatment facility?

Q21: When does Watercare expect to have this proposal fully operational and budget estimates as at today?

Q22: Who is paying for this, who will own the plant and how will it be affected by the possible 3 Waters if that goes through?

Response

The construction works will need to commence in the next 2 years and the WWTP will have to be operational by June 2026. Funding is largely derived from infrastructure growth charges with some contribution from the volume-based tariff charges paid by all customers. The scheme will be owned, operated and maintained by Watercare.

Watercare requires feedback from the Community by Wednesday 6th October.

During the month of October, we will carry out site specific studies and undertake detailed analysis. The short-listed sites will be shared with the community.

Second community information session to be held in mid-November. Any feedback comments can be emailed to: **southwest@water.co.nz**

Other

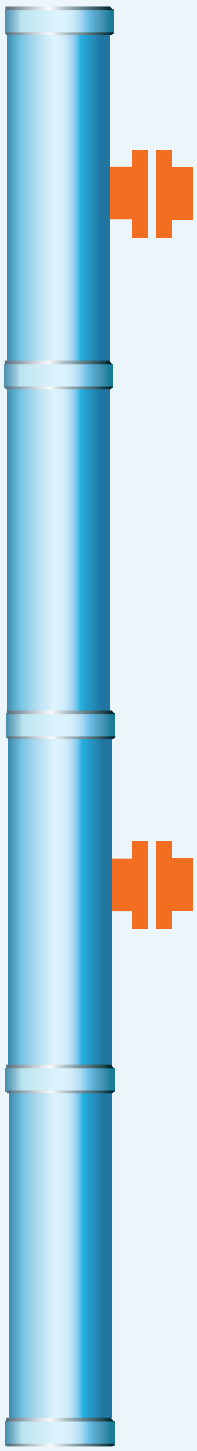
Q23: The consent mentions a submerged pipeline from Clarks Beach to Waiuku. Can that be changed to an elevated pipe to coincide with a walk/cycle bridge from Boyd Road to Kahawai Point? That would benefit both communities and tick many more boxes?

Response

The discharge consent only authorises the discharge pipes from the 12th Green at the Clarks Beach Golf Course. All other pipelines form part of this scheme study. This option will be considered and presented as part of the short listed options.

South-West Wastewater Treatment Plant

Open evening



Watercare would like your feedback on the prospective locations for the South-West Wastewater Treatment Plant

When:

Call in between
5.00pm and 6.30pm

Tuesday, 14 December 2021

Where:

Clark's Beach Yacht Club,
end of Torkar Road,
Clarks Beach

www.watercare.co.nz

Watercare

D

Appendix D – Additional Long List Assessment

SOUTHWEST WWTP - LONG LIST

Long list assessment for a new wastewater treatment plant to provide for planned growth at Kingseat, Clarks Beach, Glenbrook Beach and Waiuku.

Assessment Criteria		OPTION A1		OPTION A2		OPTION A3	
		Ran king	Rationale	Ran king	Rationale	Ran king	Rationale
1. Cultural Values	1a. Cultural Values						
2. Heritage	2a Heritage	🟩 1	No known historic hertiage sites.	🟩 1	No known historic hertiage sites	🟩 1	No known historic hertiage sites
3. Social and community	3a. Land requirement	🟨 2	Smaller site (21ha), likely to provide for treatment but will require additional land for buffer. Adjacent properties look to be lifestyle/rural properties. Potential negotiations with several landowners	🟨 2	Smaller site (16ha), likely to provide for treatment but will require additional land for buffer. Adjacent properties look to be lifestyle/rural properties. Potential negotiations with several landowners	🟩 1	Larger site (60ha) likely to have the ability to provide for treatment plant and buffer. Property negotiations with single property owner.
	3b. Social impact	🟨 2	The site abuts 'A Renall Road Esplanade Reserve'.	🟨 2	The site abuts 'A Renall Road Esplanade Reserve', and the 'Black Rocks Garden', a wedding venue.	🟩 1	No direct impact to social, recreational facilities
	3c. Odour amenity	🟥 3	A 200m buffer distance between the plant and boundary is unlikley to be achieved. 2-3 rural dwellings would be located with 300m of the plant. The purchase of No. 111 would reduce sensitivity.	🟨 2	A 200m buffer distance between the plant and boundary is unlikley to be achieved. Poissble to achieve a 300m separation distance between the plant and nearby houses but only in a small area of teh site. The purchase of No. 213 and the ajoinng coastal property would reduce sensitivity.	🟩 1	Can potentially achieved a 200m buffer distance to site boundary and a 300m separation distance to nearby houses
	3d. Operational effects	🟥 3	Potential adverse odour effects.	🟨 2	Potential for adverse odour effects.	🟩 1	sufficient distance, good access
4. Natural environment	4a. Landscape / visual	🟨 2	Site close to neighbouring rural/lifestyle properties.	🟨 2	Site close to neighbouring rural/lifestyle properties. Additional outlook impacts from the esplanade reserve.	🟨 2	Site close to neighbouring rural/lifestyle properties.
	4b. Ecology	🟨 2	Permenant stream and possible intermittent stream passes thorugh the middle of the site	🟨 2	Permenant Stream and Possible natural wetland occuring within the centre of the site	🟨 2	SEA (terrestrial) applies to a portion of a site, one confirmed stream, possible intermittent streams
	4c. Flooding risk	🟨 2	Floodplains constrain a large portion of the sites' northern area as well as through the gully located in the southern half of the site.	🟨 2	Minor floodplains through the site.	🟨 2	Minor floodplains through the site.
	4d. Coastal inundation	🟨 2	Minor coastal inundation around the site	🟨 2	Minor coastal inundation towards the northern end of the site.	🟩 1	Very minor coastal inundation towards the southeastern end of the site.
5. Constructability	5a. Wastewater conveyance	🟥 3	Options to the west of Waiuku River are: Further from the populations the WWTP services (longer pipes and more pump stations) Potentially additional and longer (more complex) marine crossings under the Waiuku River increased construction risk and cost Supporting services i.e. water, power and road access are lacking (would require large investment) Site is the furtherest from future growth areas that are expected on the east side of teh Waiuku River	🟥 3	Options to the west of Waiuku River are: Further from the populations the WWTP services (longer pipes and more pump stations) Potentially additional and longer (more complex) marine crossings under the Waiuku River increased construction risk and cost Supporting services i.e. water, power and road access are lacking (would require large investment) Site is the furtherest from future growth areas that are expected on the east side of teh Waiuku River	🟥 3	Options to the west of Waiuku River are: Further from the populations the WWTP services (longer pipes and more pump stations) Potentially additional and longer (more complex) marine crossings under the Waiuku River increased construction risk and cost Supporting services i.e. water, power and road access are lacking (would require large investment) Site is the furtherest from future growth areas that are expected on the east side of teh Waiuku River
	5b. Construction risk	🟥 3	A long drill shot under the river presents a high construction risk. Significant earthworks required. Muck-out low lying area, stream diversion, cut-fill. Pad foundation. Constrained by contours at boundaries, which will limit earthworks platform. Therefore, retaining walls may be required. Further to travel for trucks in comparison to options A-Z, approx 18km from Waiuku township to WWTP site-increased transport costs. Installing pipe through Waiuku will require more extensive stakeholder engagement, traffic management, consideration of existing services than installing pipe in farmland areas. WWTP site appears to have minimal stakeholders to consider.	🟥 3	Significant earthworks required. Muck-out low lying area, stream diversion, cut-fill. Except for surficial organics, there will be good sands to work with. Pad foundation. Further to travel for trucks in comparison to options A-Z, approx 18km from Waiuku township to WWTP site-increased transport costs. Installing pipe through Waiuku will require more extensive stakeholder engagement, traffic management, consideration of existing services than installing pipe in farmland areas. WWTP site appears to have minimal stakeholders to consider.	🟥 3	Significant earthworks required. Muck-out low lying area, stream diversion, cut-fill. Except for surficial organics, there will be good sands to work with. Pad foundation. Further to travel for trucks in comparison to options A-Z, approx 18km from Waiuku township to WWTP site-increased transport costs. Installing pipe through Waiuku will require more extensive stakeholder engagement, traffic management, consideration of existing services than installing pipe in farmland areas. WWTP site appears to have minimal stakeholders to consider.
6. Operability	6a. Operation and maintenance - WWTP	🟥 3	Long -distanace from existing Watercare assets. Additional time and expense incurred operating a WWTP in this location.	🟥 3	Long -distanace from existing Watercare assets. Additional time and expense incurred operating a WWTP in this location.	🟥 3	Long -distanace from existing Watercare assets. Additional time and expense incurred operating a WWTP in this location.
	6b. Operation and maintenance - conveyance	🟥 3	Access difficult and response times will be longer making it difficult to achieve service targets (much further from Bombay service hub). Marine crossings are generally low maintainenace however should a break occur it is difficult to detect where and when they have occured. Likely need to redrill (months to repair). Environmental impacts. More pipework to operate. River crossing will be a syphon and therefore may need extra input from operations to ensure flushing.	🟥 3	Access difficult and response times will be longer making it difficult to achieve service targets (much further from Bombay service hub). Marine crossings are generally low maintainenace however should a break occur it is difficult to detect where and when they have occured. Likely need to redrill (months to repair). Environmental impacts. More pipework to operate. River crossing will be a syphon and therefore may need extra input from operations to ensure flushing.	🟥 3	Access difficult and response times will be longer making it difficult to achieve service targets (much further from Bombay service hub). Marine crossings are generally low maintainenace however should a break occur it is difficult to detect where and when they have occured. Likely need to redrill (months to repair). Environmental impacts. River crossing will be a syphon and therefore may need extra input from operations to ensure flushing.
7. Carbon	7a. Greenhouse gas emissions	🟥 3	This score reflects the roughly the distance from the meeting point of the pipes at Boyd road. This site has longer pipe lengths. Options on Awhitu have higher WWTP construction carbon due to the longer transport distances. Pipe lengths provided in the	🟨 2	Longer pipe lengths. Drill shots typically have much lower embodied carbon than pipe trenched in road and slightly lower carbon than pipe in the road berm. Options on Awhitu have higher WWTP construction carbon due to the longer transport distances.	🟥 3	Higher embedded carbon associated with pipe. Options on Awhitu have higher WWTP construction carbon due to the longer transport distances.

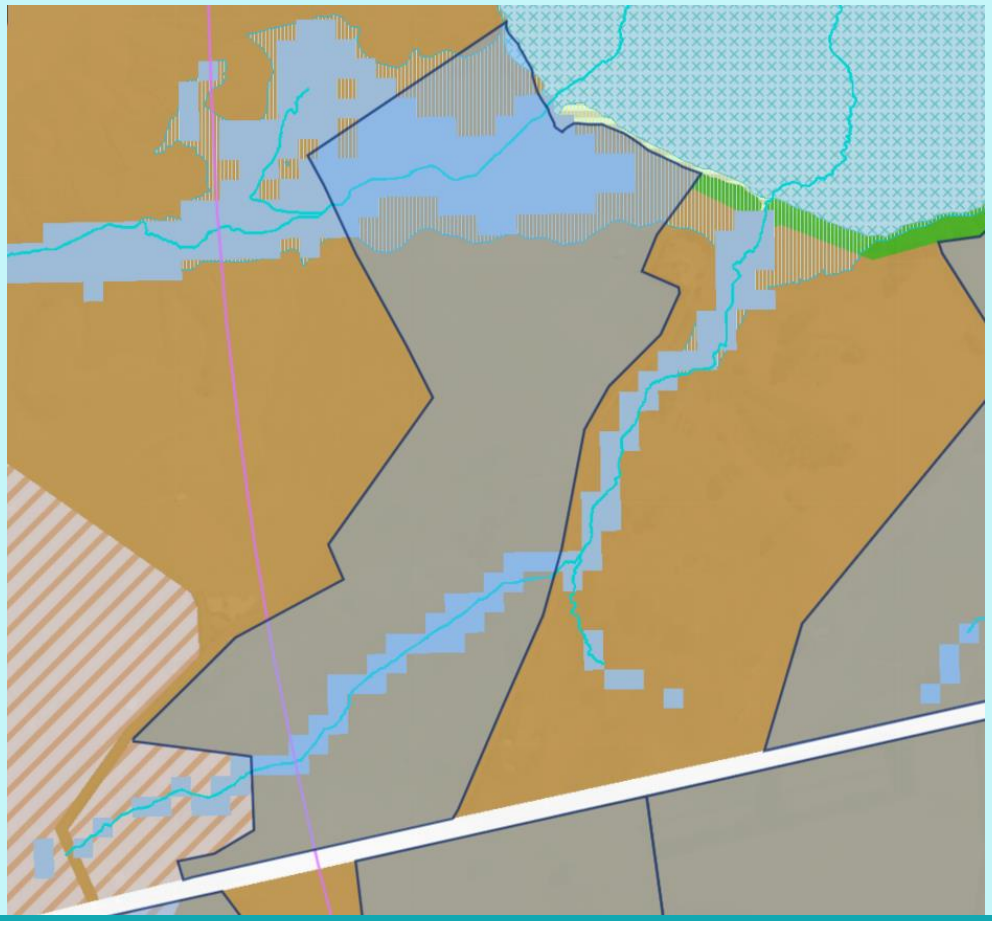
Assessment Criteria		OPTION A4		OPTION A5		OPTION A6	
		Ran king	Rationale	Ran king	Rationale	Ran king	Rationale
1. Cultural Values	1a. Cultural Values						
2. Heritage	2a Heritage	🟩 1	No known historic hertiage sites	🟩 1	No known historic hertiage sites	🟩 1	No known historic hertiage sites
3. Social and community	3a. Land requirement	🟩 1	Larger site (70ha) likely to have the ability to provide for treatment plant and buffer. Property negotiations with single property owner. (NOTE: The entire site which captures A4 and A5 is 70ha)	🟩 1	Larger site (70ha) likely to have the ability to provide for treatment plant and buffer. Property negotiations with single property owner. (NOTE: The entire site which captures A4 and A5 is 70ha)	🟨 2	Smaller site (26ha), likely to provide for treatment but will require additional land for buffer. Opportunity to amalgamate option A4 and A6 as negotiations with two landowners liekly to be simpler than several
	3b. Social impact	🟩 1	The site abuts 'A Renall Road Esplanade Reserve', and the 'Black Rocks Garden', a wedding venue. However, the indicative location of the WWTP is a sufficient distance from these facilities, therefore, effects are anticipated to be minor.	🟩 1	No direct impact to social, recreational facilities	🟨 2	The 'A Renall Road Esplanade Reserve' wraps around most of the site's perimiter.
	3c. Odour amenity	🟨 2	Can potentially achieved a 200m buffer distance to site boundary OR a 300m separation distance to nearby houses - not both	🟩 1	Can potentially achieved a 200m buffer distance to site boundary and a 300m separation distance to nearby houses. Coastal settlement zone is located to the southeast which could increase sensivity over time. The settlement zone is located in the prevaling wind direction	🟩 1	Can potentially achieved a 200m buffer distance to site boundary and a 300m separation distance to nearby houses. More than 430m to from coastal settlement zone
	3d. Operational effects	🟨 2	Potential for adverse odour effects.	🟩 1	Limited sensitive sites,	🟩 1	Limited sensitive sites
4. Natural environment	4a. Landscape / visual	🟨 2	Site close to neighbouring rural/lifestyle properties.	🟩 1	Assuming that site can be screened by planting etc. and there is a sufficient buffer distance from sites (200m), potential visual amenity effects are likely to be mitigated	🟨 2	Outlook impacts possible from the esplanade reserve. Only one property with potential outlook impacts (Option A4)
	4b. Ecology	🟨 2	SEA (terrestrial) applies to a small portion of the site (south). Several Possible Natural Wetlands within the site, however all occuring within the edges.	🟨 2	SEA (terrestrial) applies to a portion of the site Several Possible Natural Wetlands within the site, however all occuring within the site, however all occur on the edge.	🟨 2	SEA (terrestrial) applies to a portion of the site, Several Large Natural wetland throughout the site.
	4c. Flooding risk	🟨 2	Minor floodplains through the site.	🟨 2	Minor floodplains through the site.	🟨 2	Minor floodplains through the site.
	4d. Coastal inundation	🟨 2	Minor coastal inundation around the site (northeast & southern portion of site)	🟨 2	Minor coastal inundation around the site.	🟨 2	Minor coastal inundation around the site, particularly towards the northern end.
5. Constructability	5a. Wastewater conveyance	🟥 3	Options to the west of Waiuku River are: Further from the populations the WWTP services (longer pipes and more pump stations) Potentially additional and longer (more complex) marine crossings under the Waiuku River increased construction risk and cost Supporting services i.e. water, power and road access are lacking (would require large investment) Site is the furtherest from future growth areas that are expected on the east side of teh Waiuku River	🟥 3	Options to the west of Waiuku River are: Further from the populations the WWTP services (longer pipes and more pump stations) Potentially additional and longer (more complex) marine crossings under the Waiuku River increased construction risk and cost Supporting services i.e. water, power and road access are lacking (would require large investment) Site is the furtherest from future growth areas that are expected on the east side of teh Waiuku River	🟥 3	Options to the west of Waiuku River are: Further from the populations the WWTP services (longer pipes and more pump stations) Potentially additional and longer (more complex) marine crossings under the Waiuku River increased construction risk and cost Supporting services i.e. water, power and road access are lacking (would require large investment) Site is the furtherest from future growth areas that are expected on the east side of teh Waiuku River
	5b. Construction risk	🟨 2	Minor earthworks. Good ground. Pad foundation. Further to travel for trucks in comparison to options A-Z, approx 18km from Waiuku township to WWTP site-increased transport costs. Installing pipe through Waiuku will require more extensive stakeholder engagement, traffic management, consideration of existing services than installing pipe in farmland areas. WWTP site appears to have minimal stakeholders to consider.	🟥 4	Coastal area subject to erosion and instabilities. Otherwise good ground if facilities are set-back from the edge slopes. Pad foundation. Further to travel for trucks in comparison to options A-Z, approx 18km from Waiuku township to WWTP site-increased transport costs. Installing pipe through Waiuku will require more extensive stakeholder engagement, traffic management, consideration of existing services than installing pipe in farmland areas. WWTP site appears to have minimal stakeholders to consider.	🟥 3	Low lying area, with relatively higher groundwater. Some muck-out and stream diversion, with minor cut-fill to build platform. Potentially need piles for foundation. Further to travel for trucks in comparison to options A-Z, approx 18km from Waiuku township to WWTP site-increased transport costs. Installing pipe through Waiuku will require more extensive stakeholder engagement, traffic management, consideration of existing services than installing pipe in farmland areas. WWTP site appears to have minimal stakeholders to consider.
6. Operability	6a. Operation and maintenance - WWTP	🟥 3	Long -distanace from existing Watercare assets. Additional time and expense incurred operating a WWTP in this location.	🟥 3	Long -distanace from existing Watercare assets. Additional time and expense incurred operating a WWTP in this location.	🟥 3	Long -distanace from existing Watercare assets. Additional time and expense incurred operating a WWTP in this location.
	6b. Operation and maintenance - conveyance	🟥 3	Access difficult and response times will be longer making it difficult to achieve service targets (much further from Bombay service hub). Marine crossings are generally low maintainenace however should a break occur it is difficult to detect where and when they have occured. Likely need to redrill (months to repair). Environmental impacts. More pipework to operate. River crossing will be a syphon and therefore may need extra input from operations to ensure flushing.	🟥 3	Access difficult and response times will be longer making it difficult to achieve service targets (much further from Bombay service hub). Marine crossings are generally low maintainenace however should a break occur it is difficult to detect where and when they have occured. Likely need to redrill (months to repair). Environmental impacts. More pipework to operate. River crossing will be a syphon and therefore may need extra input from operations to ensure flushing.	🟥 3	Access difficult and response times will be longer making it difficult to achieve service targets (much further from Bombay service hub). Marine crossings are generally low maintainenace however should a break occur it is difficult to detect where and when they have occured. Likely need to redrill (months to repair). Environmental impacts. River crossing will be a syphon and therefore may need extra input from operations to ensure flushing.
7. Carbon	7a. Greenhouse gas emissions	🟨 2	Longer pipe lengths. Drill shots typically have much lower embodied carbon than pipe trenched in road and slightly lower carbon than pipe in the road berm. Options on Awhitu have higher WWTP construction carbon due to the longer transport distances.	🟥 3	Higher embedded carbon associated with pipe. Options on Awhitu have higher WWTP construction carbon due to the longer transport distances.	🟩 1	Relatatively short pipe length. Drill shots typically have much lower embodied carbon than pipe trenched in road and slightly lower carbon than pipe in the road berm. Options on Awhitu have higher WWTP construction carbon due to the longer transport distances.

Assessment Criteria		OPTION A7		OPTION A8		OPTION A9	
		Ran king	Rationale	Ran king	Rationale	Ran king	Rationale
1. Cultural Values	1a. Cultural Values						
2. Heritage	2a Heritage	🟩 1	No known historic hertiage sites	🟩 1	No known historic hertiage sites	🟩 1	No known historic hertiage sites
3. Social and community	3a. Land requirement	🟨 2	Smaller site (20ha), likely to provide for treatment but will require additional land for buffer. Adjacent properties look to be lifestyle/rural properties. Potential negotiations with several landowners	🟨 2	Smaller site ,likely to provide for treatment but will require additional land for buffer. Adjacent properties look to be lifestyle/rural properties. Potential negotiations with several landowners.	🟩 1	Larger site (60ha) likely to have the ability to provide for treatment plant and buffer. If additional area is required, adjacent lots look to be larger.
	3b. Social impact	🟩 1	No direct impact to social, recreational facilities	🟩 1	No direct impact to social, recreational facilities	🟨 2	Both the Hilary Trail and the Pukewhau Creek Esplanade Reserve wrap around the perimeter of the site.
	3c. Odour amenity	🟨 2	Can potentially achieved a 200m buffer distance to site boundary. Difficult to achieve a 300m separation distance to nearby houses and the coastal settlement zone area. Sterrlemt zoned area in prevailing downwind direction.	🟨 2	Can potentially achieved a 200m buffer distance to site boundary. Difficult to achieve a 300m separation distance to nearby houses and the coastal settlement zone area. Sterrlemt zoned area in prevailing downwind direction.	🟩 1	Can potentially achieved a 200m buffer distance to site boundary and a 300m separation distance to nearby houses.
	3d. Operational effects	🟨 2	Potential for adverse odour effects.	🟨 2	Potential for adverse odour effects.	🟩 1	Limited sensitive sites.
4. Natural environment	4a. Landscape / visual	🟨 2	Site close to neighbouring rural/lifestyle properties.	🟨 2	Site close to neighbouring rural/lifestyle properties.	🟩 1	Assuming that site can be screened by planting etc. and there is a sufficient buffer distance from sites (200m), potential visual amenity effects are likely to be mitigated.However, there are potential overlooking effects from the esplanade reserve.
	4b. Ecology	🟨 2	Possible natural wetland and several possible intermittent streams	🟨 2	Several Wetlands and possible intermittent streams throughout the site	🟨 2	Possible Wetlands and intermittent throughout the site.
	4c. Flooding risk	🟩 1	Very minor floodplains through the site.	🟩 1	Very minor floodplains through the site.	🟨 2	Minor floodplains through the site.
	4d. Coastal inundation	🟩 1	Very Minor coastal inundation toward the northern end of the site.	🟩 1	Very minor coastal inundation toward the southern end of the site.	🟨 2	Minor coastal inundation around the site.
5. Constructability	5a. Wastewater conveyance	🟥 3	Options to the west of Waiuku River are: Further from the populations the WWTP services (longer pipes and more pump stations) Potentially additional and longer (more complex) marine crossings under the Waiuku River increased construction risk and cost Supporting services i.e. water, power and road access are lacking (would require large investment) Site is the furtherest from future growth areas that are expected on the east side of teh Waiuku River	🟥 3	Options to the west of Waiuku River are: Further from the populations the WWTP services (longer pipes and more pump stations) Potentially additional and longer (more complex) marine crossings under the Waiuku River increased construction risk and cost Supporting services i.e. water, power and road access are lacking (would require large investment) Site is the furtherest from future growth areas that are expected on the east side of teh Waiuku River	🟥 3	Options to the west of Waiuku River are Further from the populations the WWTP services (longer pipes and more pump stations) Further distance from Clarks Beach so the treated effluent pipe becomes much longer than the other options Potentially additional and longer (more complex) marine crossings under the Waiuku River increased construction risk and cost Supporting services i.e. water, power and road access are lacking (would require large investment) Site is the furtherest from future growth areas that are expected on the east side of the Waiuku River
	5b. Construction risk	🟨 2	Gently sloping ground. Likely to be stable with only minor earthworks required. Pad foundation. Further to travel for trucks in comparison to options A-Z, approx 18km from Waiuku township to WWTP site-increased transport costs. Installing pipe through Waiuku will require more extensive stakeholder engagement, traffic management, consideration of existing services than installing pipe in farmland areas. WWTP site appears to have minimal stakeholders to consider.	🟥 3	Some muck-out and stream diversion, with moderate cut-fill to build platform. Potential erosion and instability at coastal edge. Pile may be required. Further to travel for trucks in comparison to options A-Z, approx 18km from Waiuku township to WWTP site-increased transport costs. Installing pipe through Waiuku will require more extensive stakeholder engagement, traffic management, consideration of existing services than installing pipe in farmland areas. WWTP site appears to have minimal stakeholders to consider.	🟥 3	Potential erosion and instability at coastal edge. Consider moving proposed structures to the west on the ridgeline. Otherwise good ground if facilities are set-back from the edge slopes. Proposed access is from the north, which crosses two streams / overland flows. Alternatively to avoid water crossing, there is an existing driveway access on the southwest. Existing batter looks steep, potentially unstable but could realign to reprofile to stable batter slope. Pad foundation if on ridgeline, piles near coastal edge. Further to travel for trucks in comparison to options A-Z, approx 18km from Waiuku township to WWTP site-increased transport costs. Installing pipe through Waiuku will require more extensive stakeholder engagement, traffic management, consideration of existing services than installing pipe in farmland areas. WWTP site appears to have minimal stakeholders to consider.
6. Operability	6a. Operation and maintenance - WWTP	🟥 3	Long -distanace from existing Watercare assets. Additional time and expense incurred operating a WWTP in this location.	🟥 3	Long -distanace from existing Watercare assets. Additional time and expense incurred operating a WWTP in this location.	🟥 3	Long -distanace from existing Watercare assets. Additional time and expense incurred operating a WWTP in this location.
	6b. Operation and maintenance - conveyance	🟥 3	Access difficult and response times will be longer making it difficult to achieve service targets (much further from Bombay service hub). Marine crossings are generally low maintainenace however should a break occur it is difficult to detect where and when they have occured. Likely need to redrill (months to repair). Environmental impacts. More pipework to operate. River crossing will be a syphon and therefore may need extra input from operations to ensure flushing.	🟥 3	Access difficult and response times will be longer making it difficult to achieve service targets (much further from Bombay service hub). Marine crossings are generally low maintainenace however should a break occur it is difficult to detect where and when they have occured. Likely need to redrill (months to repair). Environmental impacts. River crossing will be a syphon and therefore may need extra input from operations to ensure flushing.	🟥 3	Access difficult and response times will be longer making it difficult to achieve service targets (much further from Bombay service hub). Marine crossings are generally low maintainenace however should a break occur it is difficult to detect where and when they have occured. Likely need to redrill (months to repair). Environmental impacts. River crossing will be a syphon and therefore may need extra input from operations to ensure flushing.
7. Carbon	7a. Greenhouse gas emissions	🟨 2	Longer pipe lengths. Drill shots typically have lower embodied carbon than trenched pipe. Options on Awhitu have higher WWTP construction carbon due to the longer transport distances.	🟥 3	High embedded carbon associated with pipe. Options on Awhitu have higher WWTP construction carbon due to the longer transport distances.	🟥 3	High embedded carbon associated with pipe. Options on Awhitu have higher WWTP construction carbon due to the longer transport distances.

Additional Long-list sites

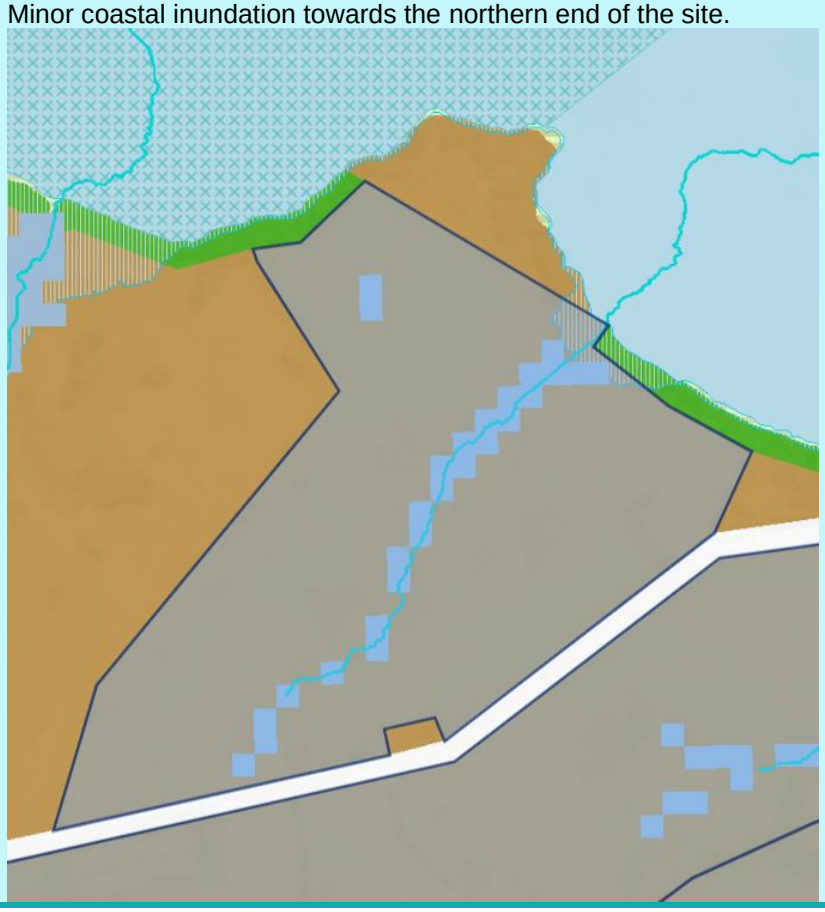
Option A1

Option A1 is located at Renall Road (Lot 3 DP 189795), is 21.1ha in size, and is subject to the following key constraints:

- Smaller site likely to provide for treatment but will require additional land for buffer. Adjacent properties look to be lifestyle/rural properties. Potential negotiations with several landowners;
- In terms of odour amenity, a 200m buffer distance between the plant and boundary is unlikely to be achieved. 2-3 rural dwellings would be located with 300m of the plant. The purchase of No. 111 would reduce sensitivity;
- The site abuts 'A Renall Road Esplanade Reserve'.
- Site close to neighbouring rural/lifestyle properties.
- Permanent stream and possible intermittent stream passes through the middle of the site
- Floodplains constrain a large portion of the sites' northern area as well as through the gully located in the southern half of the site.
- Minor coastal inundation around the site
- 

Option A2

Option A2 is located at 169 A Renall Road (Pt Lot 2 DP 127388), is 16.7ha in size, and is subject to the following key constraints:

- Smaller site likely to provide for treatment but will require additional land for buffer. Adjacent properties look to be lifestyle/rural properties. Potential negotiations with several landowners;
- In terms of odour amenity, A 200m buffer distance between the plant and boundary is unlikely to be achieved. Possible to achieve a 300m separation distance between the plant and nearby houses but only in a small area of the site. The purchase of No. 213 and the adjoining coastal property would reduce sensitivity;
- The site abuts 'A Renall Road Esplanade Reserve', and the 'Black Rocks Garden', a wedding venue.
- Site close to neighbouring rural/lifestyle properties. Additional outlook impacts from the esplanade reserve.
- permanent Stream and Possible natural wetland occurring within the centre of the site
- Minor floodplains through the site.
- Minor coastal inundation towards the northern end of the site.
- 

Option A3

Option A3 is located at 22 A Renall Road (Lot 2 DP 308986), 60ha in size, and is subject to the following key constraints:

- Site close to neighbouring rural/lifestyle properties.
- SEA (terrestrial) applies to a portion of a site, one confirmed stream, possible intermittent streams
- Minor floodplains through the site.

Option A4

Option A4 is located at 172 A Renall Road (Lot 1 DP 114260), is 31.3ha in size, and is subject to the following key constraints:

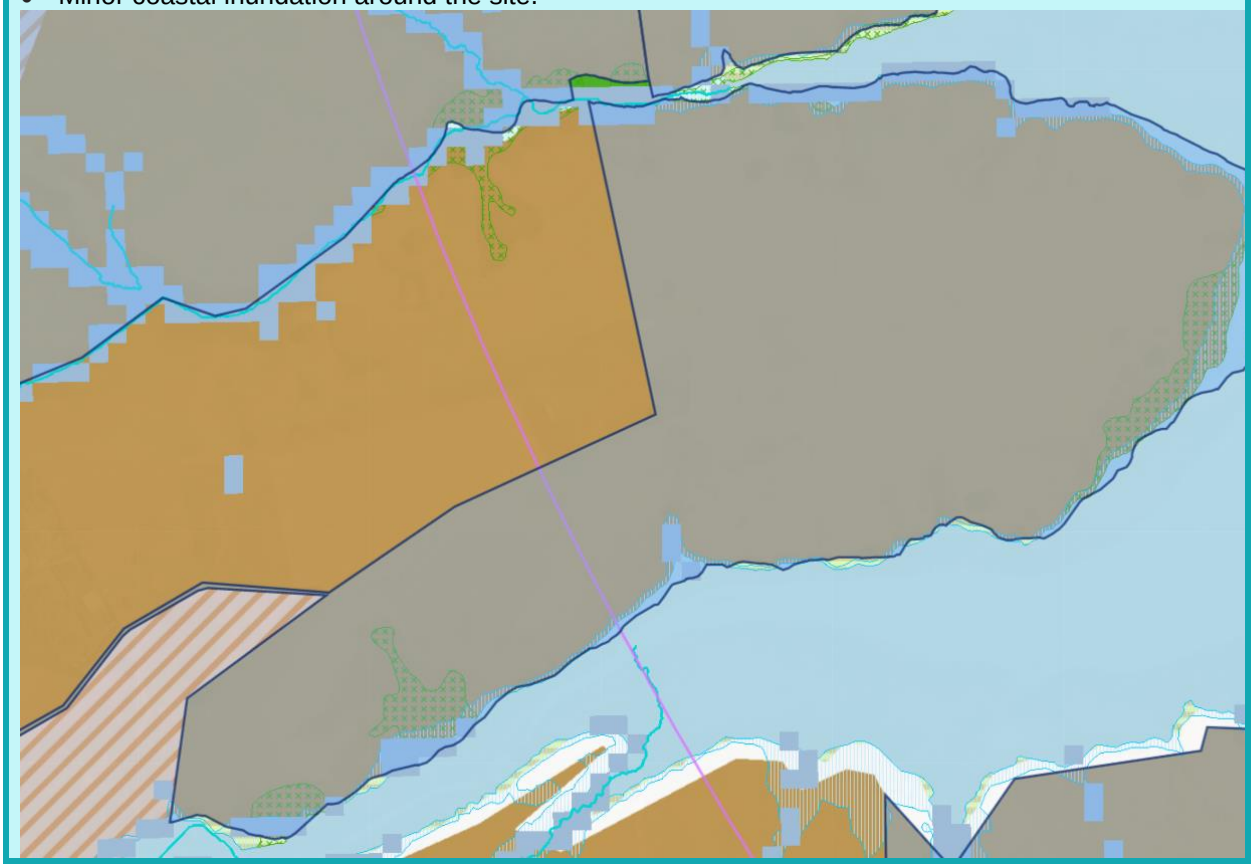
- Site close to neighbouring rural/lifestyle properties.
- In terms of odour amenity, can potentially achieve a 200m buffer distance to site boundary OR a 300m separation distance to nearby houses - not both;
- SEA (terrestrial) applies to a small portion of the site (south). Several Possible Natural Wetlands within the site, however all occurring within the edges.
- Minor floodplains through the site.
- Minor coastal inundation around the site (northeast & southern portion of site).

-

Option A5

Option A5 is located at 172 A Renall Road (Lot 2 DP 53121), is 39.5ha in size, and is subject to the following key constraints:

- SEA (terrestrial) applies to a portion of the site Several Possible Natural Wetlands within the site, however all occurring **within** the site, however all occur on the edge.
- Minor floodplains through the site.
- Minor coastal inundation around the site.



Option A6

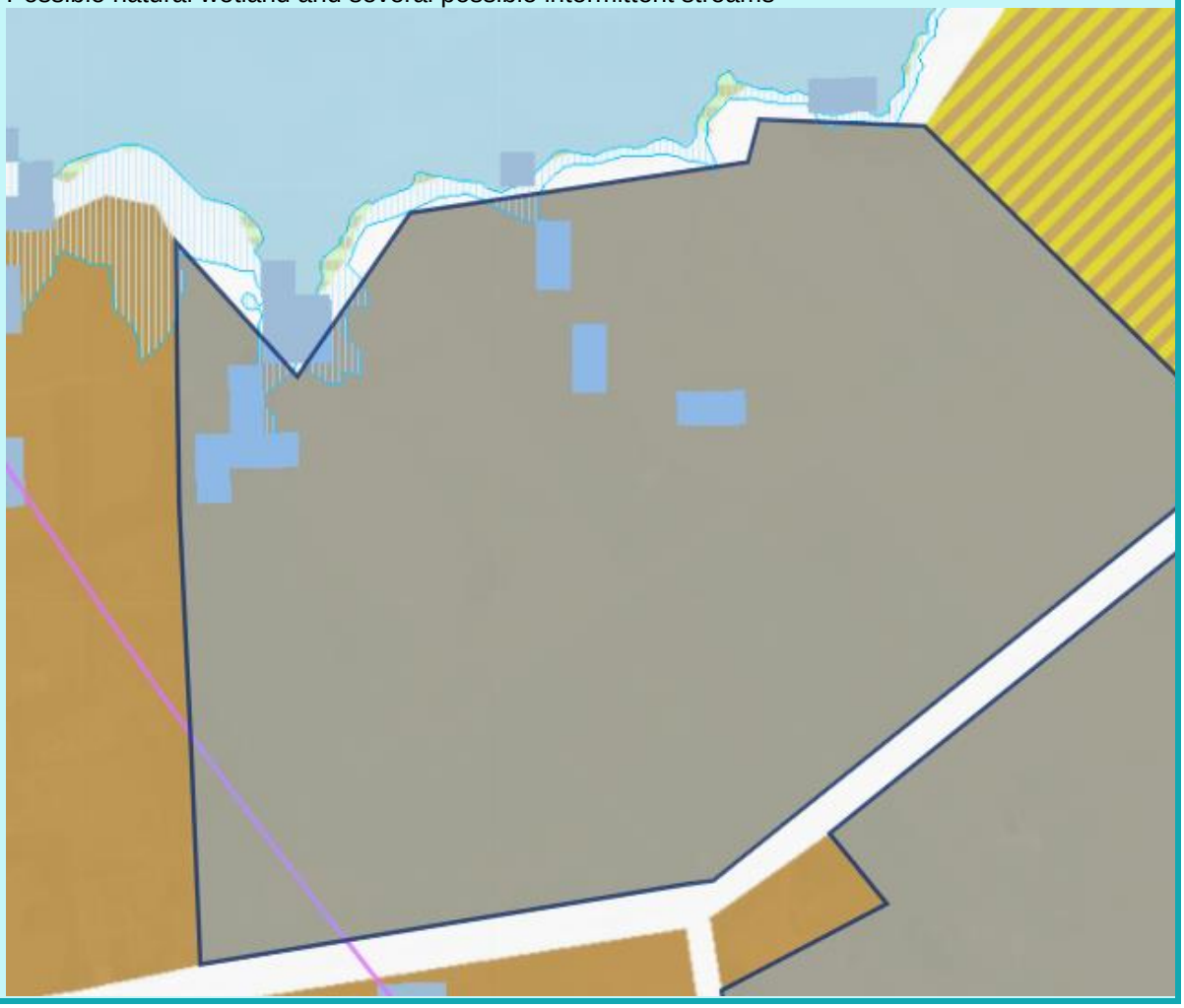
Option A6 is located at 174B A Renall Road (Lot 2 DP 114260), is 26.7ha in size, and is subject to the following key constraints:

- Smaller site likely to provide for treatment but will require additional land for buffer. Opportunity to amalgamate option A4 and A6 as negotiations with two landowners likely to be simpler than several
- The 'A Renall Road Esplanade Reserve' wraps around most of the site's perimeter.
- Outlook impacts possible from the esplanade reserve. Only one property with potential outlook impacts (Option A4)
- SEA (terrestrial) applies to a portion of the site, several large natural wetland throughout the site.

- Minor floodplains through the site.
- Minor coastal inundation around the site, particularly towards the northern end.

Option A7

Option A7 is located at Te Toro Road (Allotment 264 Parish of Waipipi), is 20ha in size, and is subject to the following key constraints:

- Smaller site likely to provide for treatment but will require additional land for buffer. Adjacent properties look to be lifestyle/rural properties. Potential negotiations with several landowners.
- In terms of odour amenity, we could achieve a 200m buffer distance to site boundary. Difficult to achieve a 300m separation distance to nearby houses and the coastal settlement zone area. Settlement zoned area in prevailing downwind direction;
- Site close to neighbouring rural/lifestyle properties; and
- Possible natural wetland and several possible intermittent streams
- 

Option A8

Option A8 is located at Te Toro Road (Allotment 259 Parish of Waipipi), is 17.8ha in size, and is subject to the following key constraints:

- Smaller site, likely to provide for treatment but will require additional land for buffer. Adjacent properties look to be lifestyle/rural properties. Potential negotiations with several landowners;
- In terms of odour amenity, could potentially achieve a 200m buffer distance to site boundary. Difficult to achieve a 300m separation distance to nearby houses and the coastal settlement zone area. Settlement zoned area in prevailing downwind direction;
- Site close to neighbouring rural/lifestyle properties.
- Several Wetlands and possible intermittent streams throughout the site

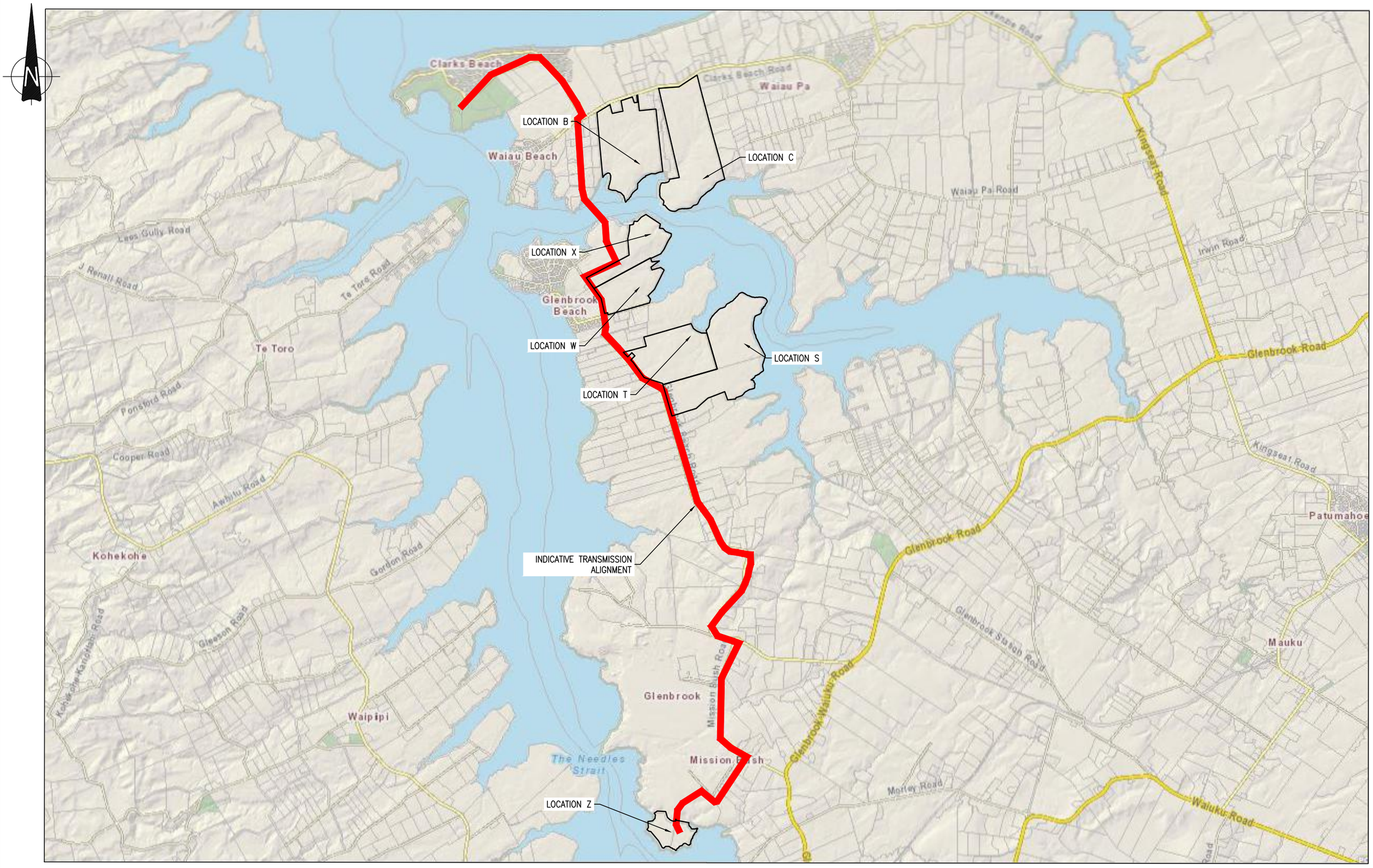
Option A9

Option A9 is located at 66 Te Toro Road (Lot 1-2 DP 14895), is 60ha in size, and is subject to the following key constraints:

- Both the Hilary Trail and the Pukewhau Creek Esplanade Reserve wrap around the perimeter of the site.
- Possible Wetlands and intermittent throughout the site.
- Minor floodplains through the site.
- Minor coastal inundation around the site.

E

Appendix E – Indicative Layouts for Short List Sites



1 — OVERVIEW LOCALITY PLAN
N.T.S.

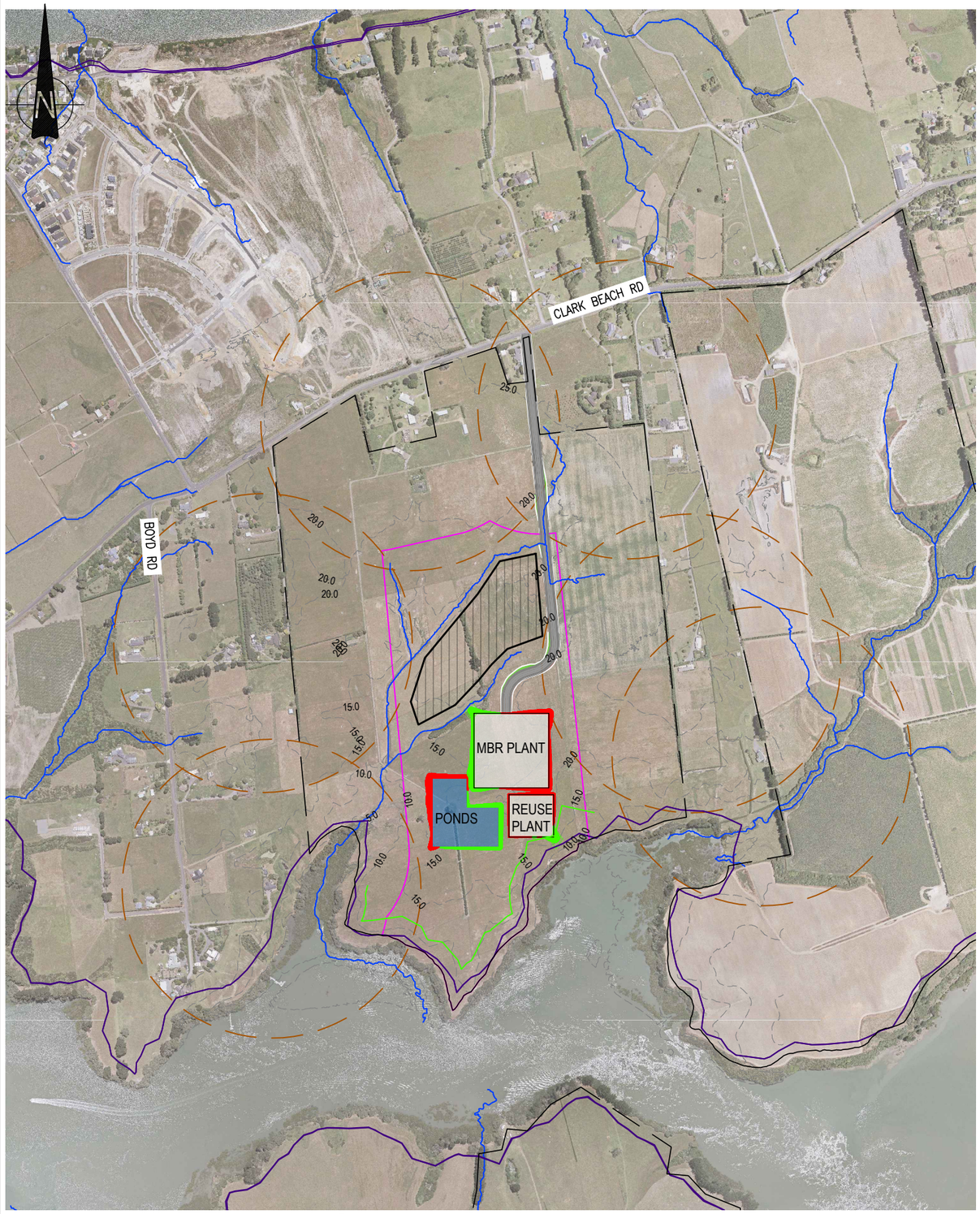
ISSUE	DATE	AMENDMENT	BY	APPD.
B	24.04.23	FINAL ISSUE	GP	
A	01.12.21	DRAFT FOR INFORMATION	GP	

		DATE
DESIGNED		10-21
DES. APPROVED		
DRAWN		
DWG. APPROVED		
WSL DESIGN MGMT.		
WSL PROJ. LEAD		

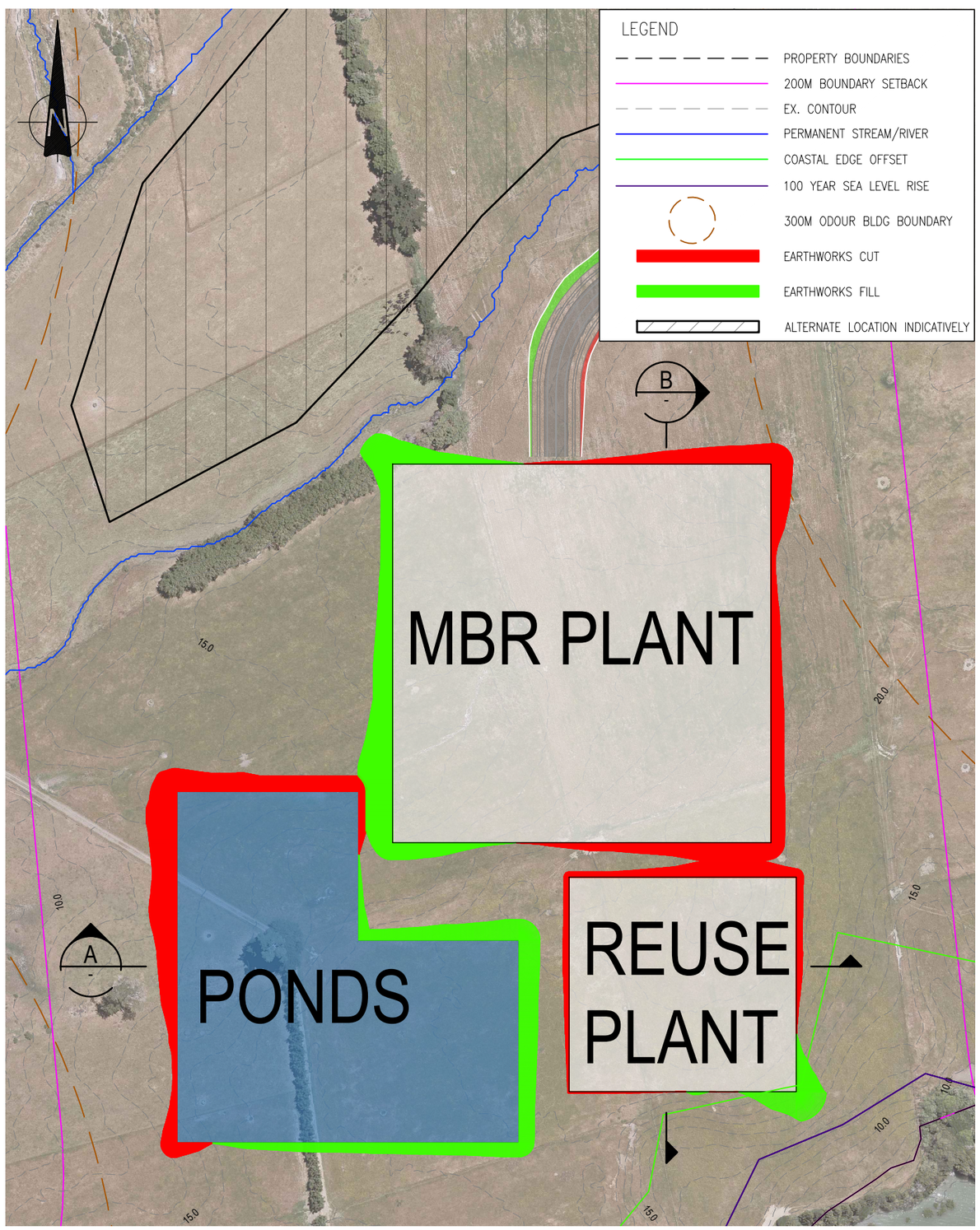
Watercare

SOUTHWEST WWTP SHORTLIST LOCATIONS ASSESSMENT
OVERVIEW LOCALITY PLAN

CAD FILE 3257703-CA-0001	DATE dd-mm-yy
ORIGINAL SCALE A3 AS SHOWN	CONTRACT No. –
REF No. –	
DWG No. CA-0001	ISSUE B



1 OVERVIEW PLAN
1:10000 A3



2 DETAIL PLAN
1:2000 A3

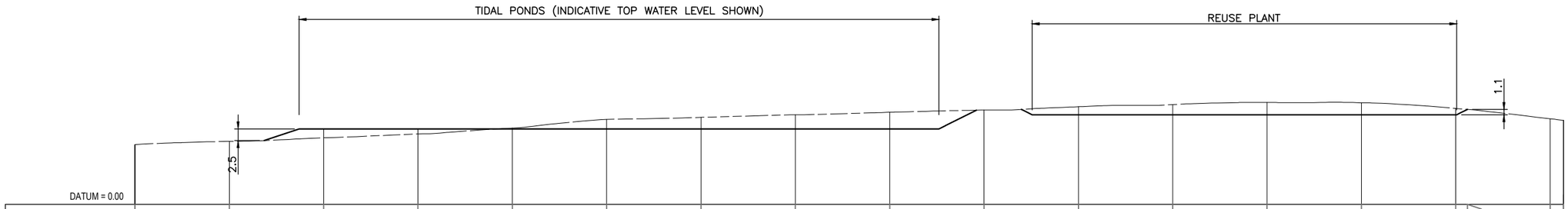
ISSUE	DATE	AMENDMENT	BY	APPD.
C	24.04.23	FINAL ISSUE	GP	
B	13.03.23	AERIAL UPDATED	GP	
A	01.12.21	DRAFT FOR INFORMATION	GP	

		BY	DATE
DESIGNED			10-21
DES. APPROVED			
DRAWN			
DWG. APPROVED			
WSL DESIGN MGMT.			
WSL PROJ. LEAD			

Watercare

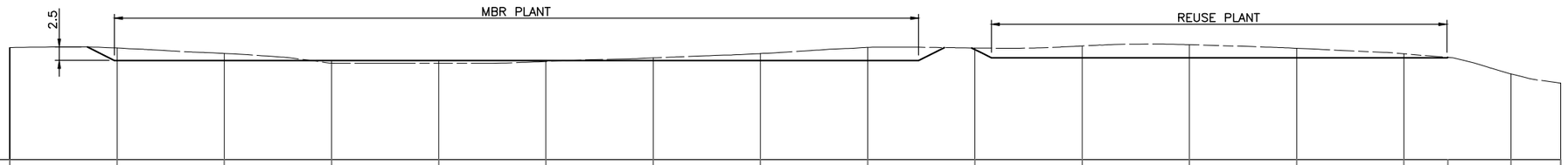
SOUTHWEST WWTP SHORTLIST LOCATIONS ASSESSMENT
LOCATION B
GENERAL ARRANGEMENT

CAD FILE 3257703-CA-0101	DATE dd-mm-yy
ORIGINAL SCALE A3 AS SHOWN	CONTRACT No. –
REF No. –	
DWG No. CA-0101	ISSUE C



CUT/FILL			1.89	1.06	-0.19	-2.02	-2.45	-3.00	-3.54		-1.71	-2.16	-2.63	-2.54	-1.36	0.00	0.00						
DESIGN LEVELS			16.00	16.00	16.00	16.000	16.00	16.00	16.00		19.000	19.00	19.00	19.00	19.00	19.98	20.14						
EXISTING LEVELS	12.661	13.36	14.11	14.94	16.19	18.020	18.45	19.00	19.54	20.00	20.713	21.16	21.63	21.54	20.36	19.98	20.14				18.165	17.821	
CHAINAGE	0.00	20.00	40.00	60.00	80.00	100.00	120.00	140.00	160.00	180.00	200.00	220.00	240.00	260.00	280.00	178.39	282.49				300.00	302.85	

A — SECTION A
1:1000 A3



CUT/FILL		-2.33	-1.31	0.50	0.51	0.19	-0.49	-1.29	-2.43	-0.28	-2.20	-2.44	-1.77	-0.74	0.00								
DESIGN LEVELS		18.50	18.50	18.50	18.50	18.500	18.50	18.50	18.50	20.54	19.000	19.00	19.00	19.00	20.90								
EXISTING LEVELS	20.909	20.83	19.81	18.00	17.99	18.309	18.99	19.79	20.93	20.82	21.204	21.44	20.77	19.74	20.90	15.98	14.243						
CHAINAGE	0.00	20.00	40.00	60.00	80.00	100.00	120.00	140.00	160.00	180.00	200.00	220.00	240.00	260.00	174.31	280.00	289.23						

B — SECTION B
1:1000 A3

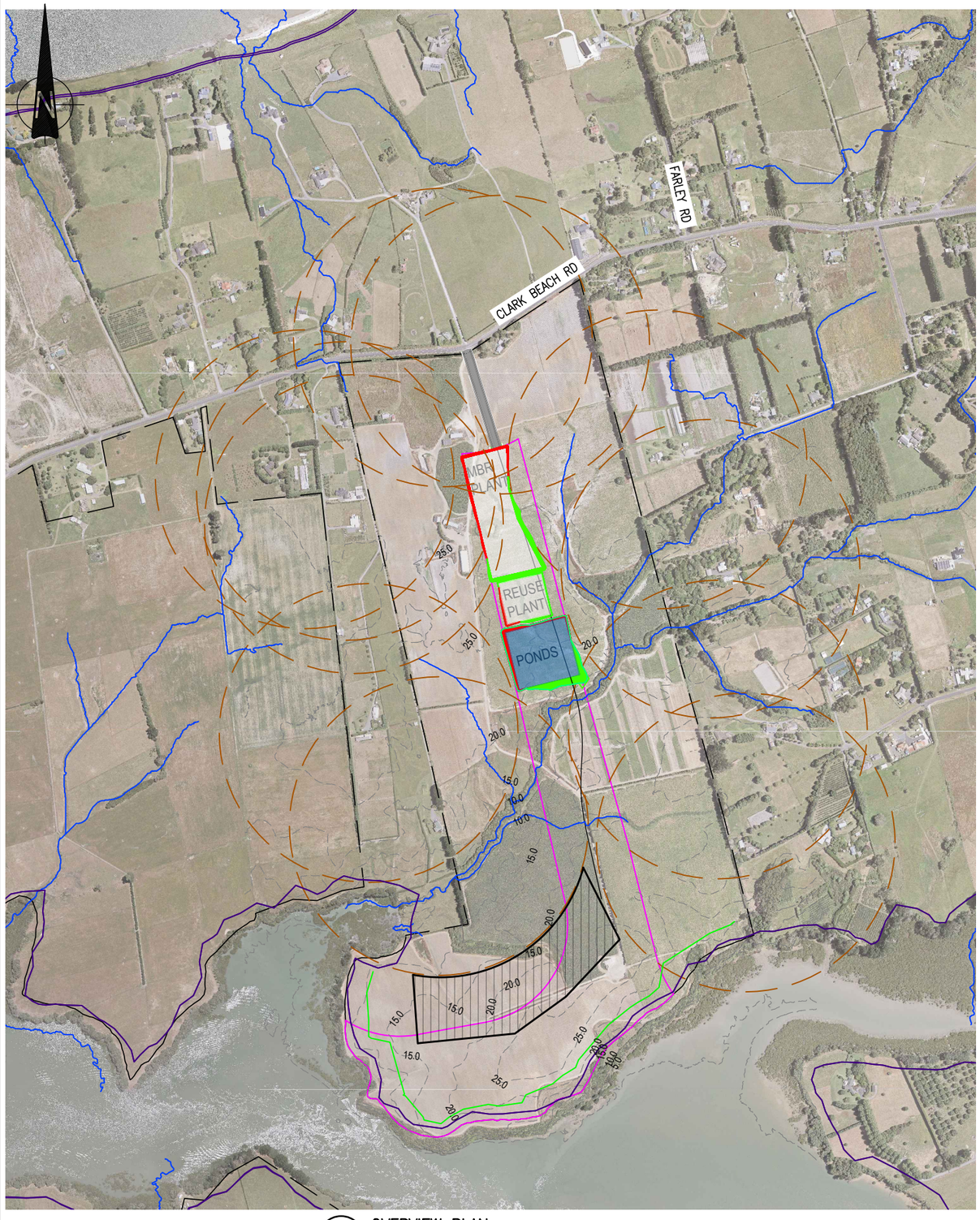
ISSUE	DATE	AMENDMENT	BY	APPD.
B	24.04.23	FINAL ISSUE	GP	
A	01.12.21	DRAFT FOR INFORMATION	GP	

DESIGNED		10-21	
DES. APPROVED			
DRAWN			
DWG. APPROVED			
WSL DESIGN MGMT.			
WSL PROJ. LEAD			
	BY	DATE	

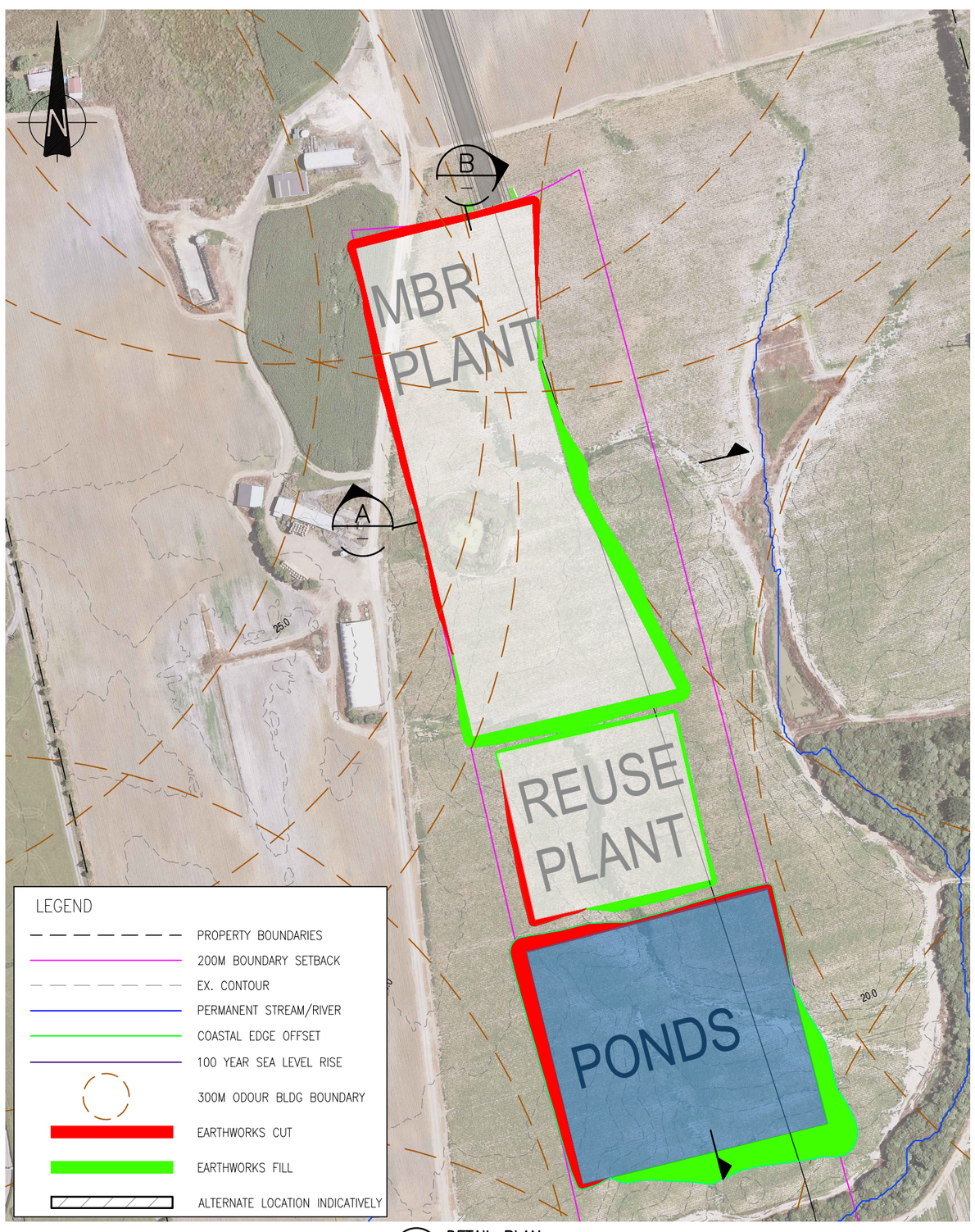
Watercare

SOUTHWEST WWTP SHORTLIST LOCATIONS ASSESSMENT
LOCATION B
CROSS SECTIONS

CAD FILE 3257703-CA-0102	DATE dd-mm-yy
ORIGINAL SCALE A3 AS SHOWN	CONTRACT No. –
REF No. –	
DWG No. CA-0102	ISSUE B



1 — OVERVIEW PLAN
1:10000 A3



2 — DETAIL PLAN
1:2500 A3

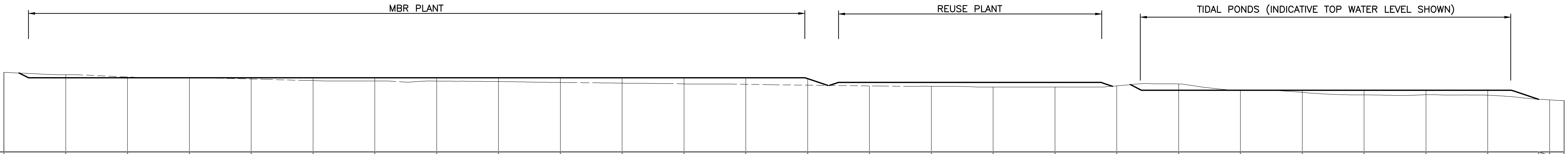
ISSUE	DATE	AMENDMENT	BY	APPD.
C	24.04.23	FINAL ISSUE	GP	
B	13.03.23	300m BLDGS BUFFER ADDED	GP	
A	29.11.21	LAYOUT UPDATED	GP	

DESIGNED			
DES. APPROVED			
DRAWN			
DWG. APPROVED			
WSL DESIGN MGMT.			
WSL PROJ. LEAD			

Watercare

SOUTHWEST WWTP SHORTLIST LOCATIONS ASSESSMENT
LOCATION C
GENERAL ARRANGEMENT

CAD FILE 3257703-CA-0103	DATE dd-mm-yy
ORIGINAL SCALE A3 AS SHOWN	CONTRACT No. –
REF No. –	
DWG No. CA-0103	ISSUE C



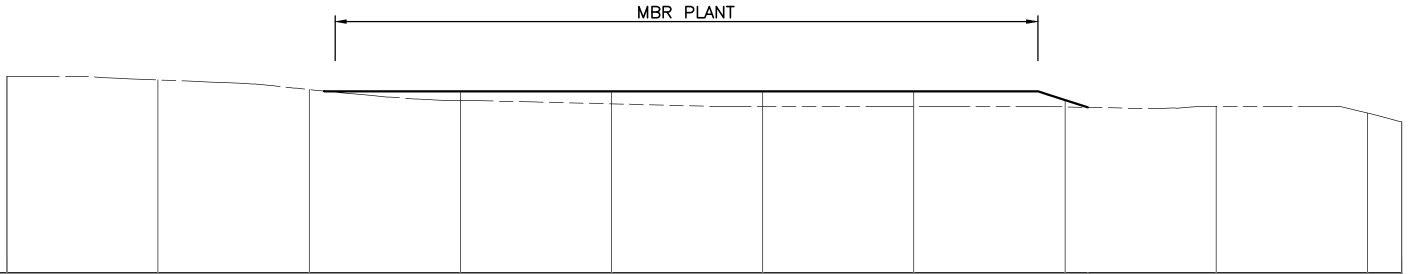
DATUM = 0.00

CUT/FILL		-1.00	-0.27	0.01	0.40	0.91	1.01	1.06	1.20	1.51	1.74	1.97	2.10	2.09
DESIGN LEVELS		24.00	24.00	24.00	24.00	24.000	24.00	24.00	24.00	24.00	24.000	24.00	24.00	23.71
EXISTING LEVELS	25.762	25.00	24.27	23.99	23.60	23.093	22.99	22.94	22.80	22.49	22.258	22.03	21.90	21.62
CHAINAGE	0.00	20.00	40.00	60.00	80.00	100.00	120.00	140.00	160.00	180.00	200.00	220.00	240.00	260.00

CUT/FILL	1.12	1.25	1.50	1.50		-2.02	0.00	0.71	1.52	1.49	1.63	0.00	0.00		
DESIGN LEVELS	22.50	22.500	22.50	22.50		20.00	20.000	20.00	20.00	20.00	20.00	21.54	17.05		
EXISTING LEVELS	21.38	21.248	21.00	21.00	21.38	22.02	19.996	19.29	18.48	18.51	18.37	21.54	17.05	16.851	16.611
CHAINAGE	280.00	300.00	320.00	340.00	360.00	380.00	400.00	420.00	440.00	460.00	480.00	266.50	496.41	500.00	504.68

A SECTION A

– N.T.S. A3



DATUM = 0.00

CUT/FILL				1.22	1.65	2.00	2.00	0.91	0.00			
DESIGN LEVELS				24.00	24.00	24.000	24.00	22.86	21.89			
EXISTING LEVELS	26.000	25.52	24.24	22.78	22.35	21.999	22.00	21.95	21.89	22.00	21.15	19.967
CHAINAGE	0.00	20.00	40.00	60.00	80.00	100.00	120.00	140.00	143.00	160.00	180.00	184.54

B SECTION B

– 1:1000 A3

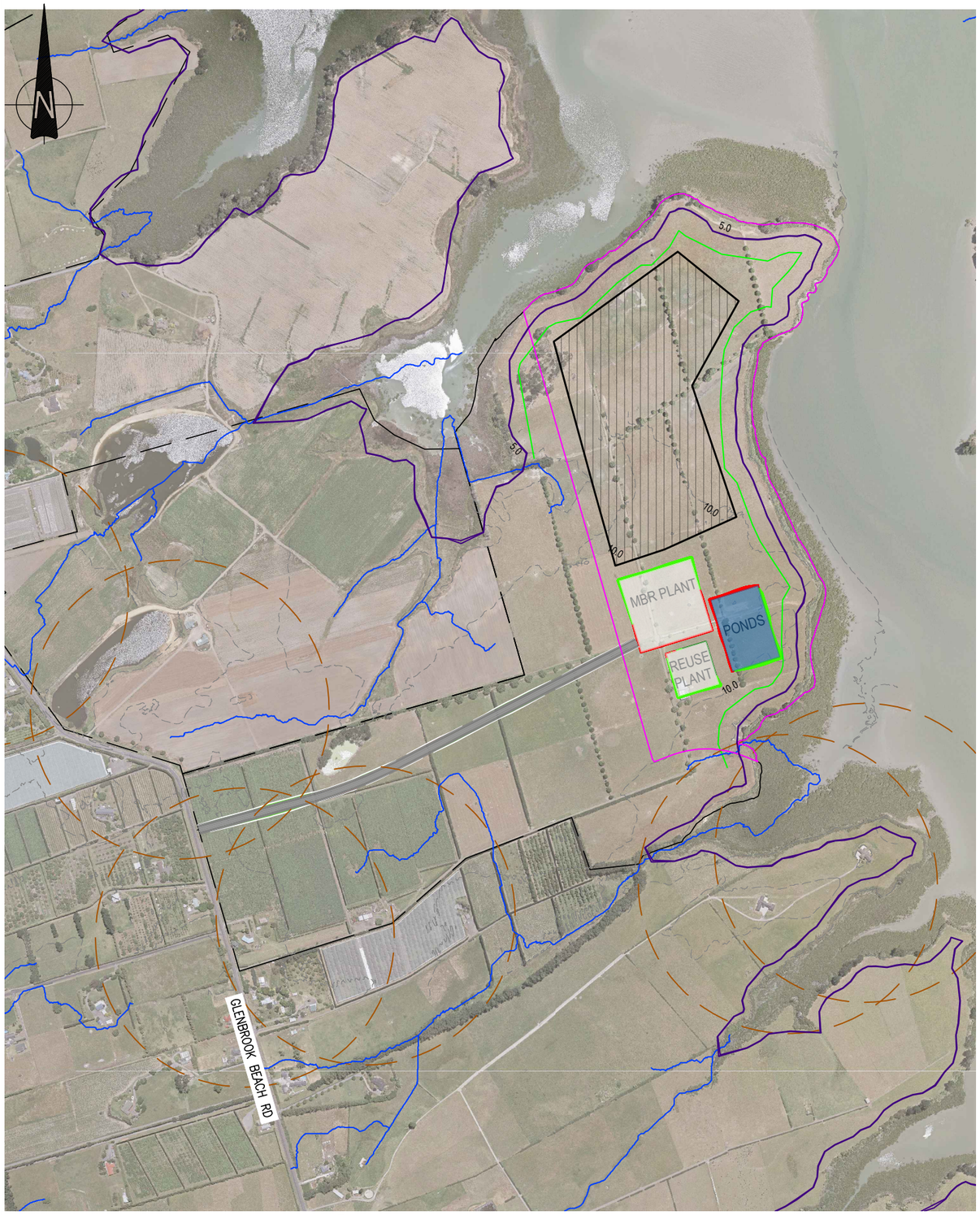
ISSUE	DATE	AMENDMENT	BY	APPD.
B	24.04.23	DRAFT FOR INFORMATION	GP	
A	29.11.21	DRAFT FOR INFORMATION	GP	

	BY	DATE
DESIGNED		10-21
DES. APPROVED		
DRAWN		
DWG. APPROVED		
WSL DESIGN MGMT.		
WSL PROJ. LEAD		

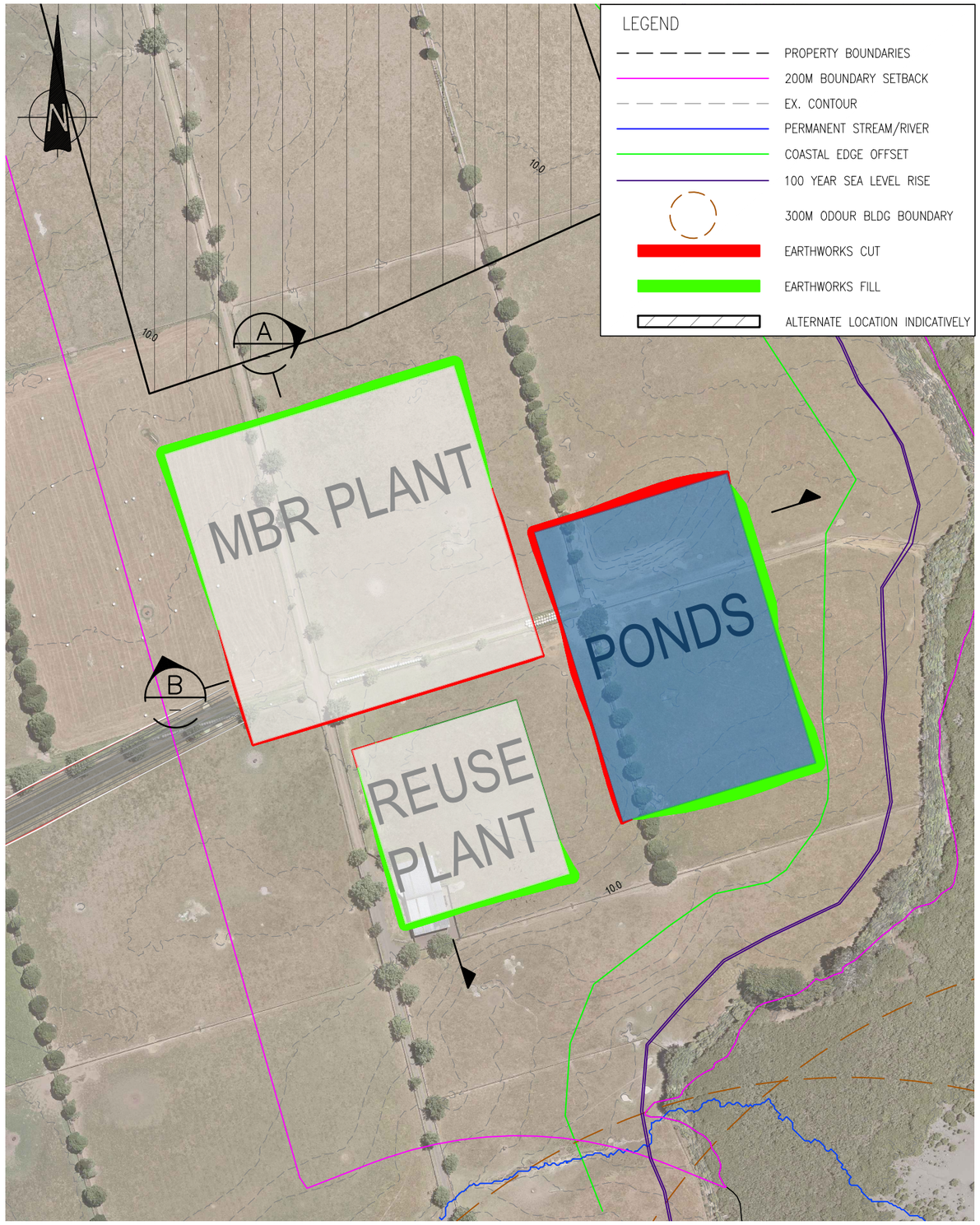
Watercare

SOUTHWEST WWTP SHORTLIST LOCATIONS ASSESSMENT
LOCATION C
CROSS SECTIONS

CAD FILE 3257703-CA-0104 | DATE dd-mm-yy
ORIGINAL SCALE A3 SCALE | CONTRACT No. –
REF No. –
DWG No. CA-0104 | ISSUE B



1 — OVERVIEW PLAN
1:10000 A3



2 — DETAIL PLAN
1:2500 A3

ISSUE	DATE	AMENDMENT	BY	APPD.
C	24.04.23	FINAL ISSUE	GP	
B	13.03.23	AERIAL UPDATED	GP	
A	29.11.21	DRAFT FOR INFORMATION	GP	

DESIGNED			
DES. APPROVED			
DRAWN			
DWG. APPROVED			
WSL DESIGN MGMT.			
WSL PROJ. LEAD			

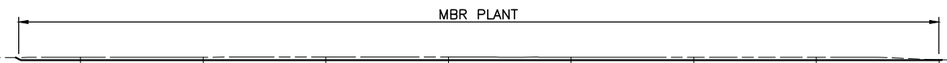
Watercare

SOUTHWEST WWTP SHORTLIST LOCATIONS ASSESSMENT
LOCATION S
GENERAL ARRANGEMENT

CAD FILE 3257703-CA-0105	DATE dd-mm-yy
ORIGINAL SCALE A3 AS SHOWN	CONTRACT No. –
REF No. –	
DWG No. CA-0105	ISSUE C

DATUM = -10.00																				
CUT/FILL		0.96	0.87	0.65	0.24	-0.42	-0.52	-0.50	-0.50		0.00	0.10	0.29	0.59	0.18	0.00	0.00			
DESIGN LEVELS		12.37	12.50	12.50	12.50	12.500	12.50	12.50	12.50		13.000	13.00	13.00	13.00	12.28	13.00	12.09			
EXISTING LEVELS	11.174	11.41	11.63	11.85	12.26	12.919	13.02	13.00	13.00	13.00	13.000	12.90	12.71	12.41	12.10	13.00	12.09	10.658	8.29	8.306
CHAINAGE	0.00	20.00	40.00	60.00	80.00	100.00	120.00	140.00	160.00	180.00	200.00	220.00	240.00	260.00	280.00	171.48	280.57	300.00	320.00	321.54

A — SECTION A
1:1000 A3



DATUM = -10.00																			
CUT/FILL			-0.50	-0.50	-0.51	-0.50	-0.50	-0.50	-0.50	-0.08	-0.87	-1.82	-2.31	-1.01	0.74	0.00	0.00		
DESIGN LEVELS			12.50	12.50	12.50	12.500	12.50	12.50	12.50	12.50	11.500	11.50	11.50	11.50	11.50	12.58	9.99		
EXISTING LEVELS	12.757	12.85	13.00	13.00	13.01	13.004	13.00	13.00	13.00	12.58	12.368	13.32	13.81	12.51	10.76	12.58	9.99	9.990	9.65	9.683
CHAINAGE	0.00	20.00	40.00	60.00	80.00	100.00	120.00	140.00	160.00	180.00	200.00	220.00	240.00	260.00	280.00	180.45	298.48	300.00	320.00	334.69

B — SECTION B
1:1000 A3

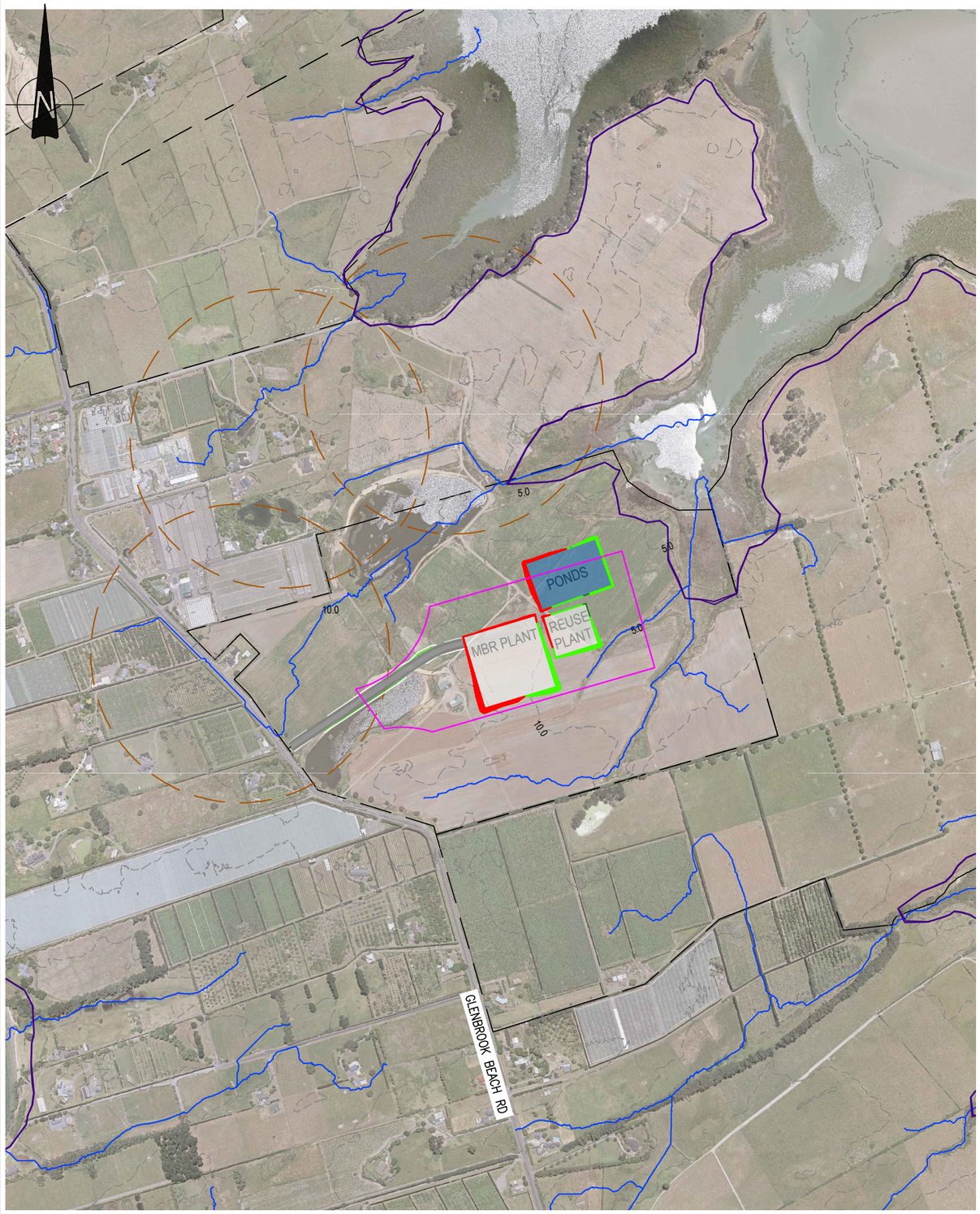
ISSUE	DATE	AMENDMENT	BY	APPD.
B	24.04.23	FINAL ISSUE	GP	
A	29.11.21	DRAFT FOR INFORMATION	GP	

		DATE
DESIGNED		10-21
DES. APPROVED		
DRAWN		
DWG. APPROVED		
WSL DESIGN MGMT.		
WSL PROJ. LEAD		

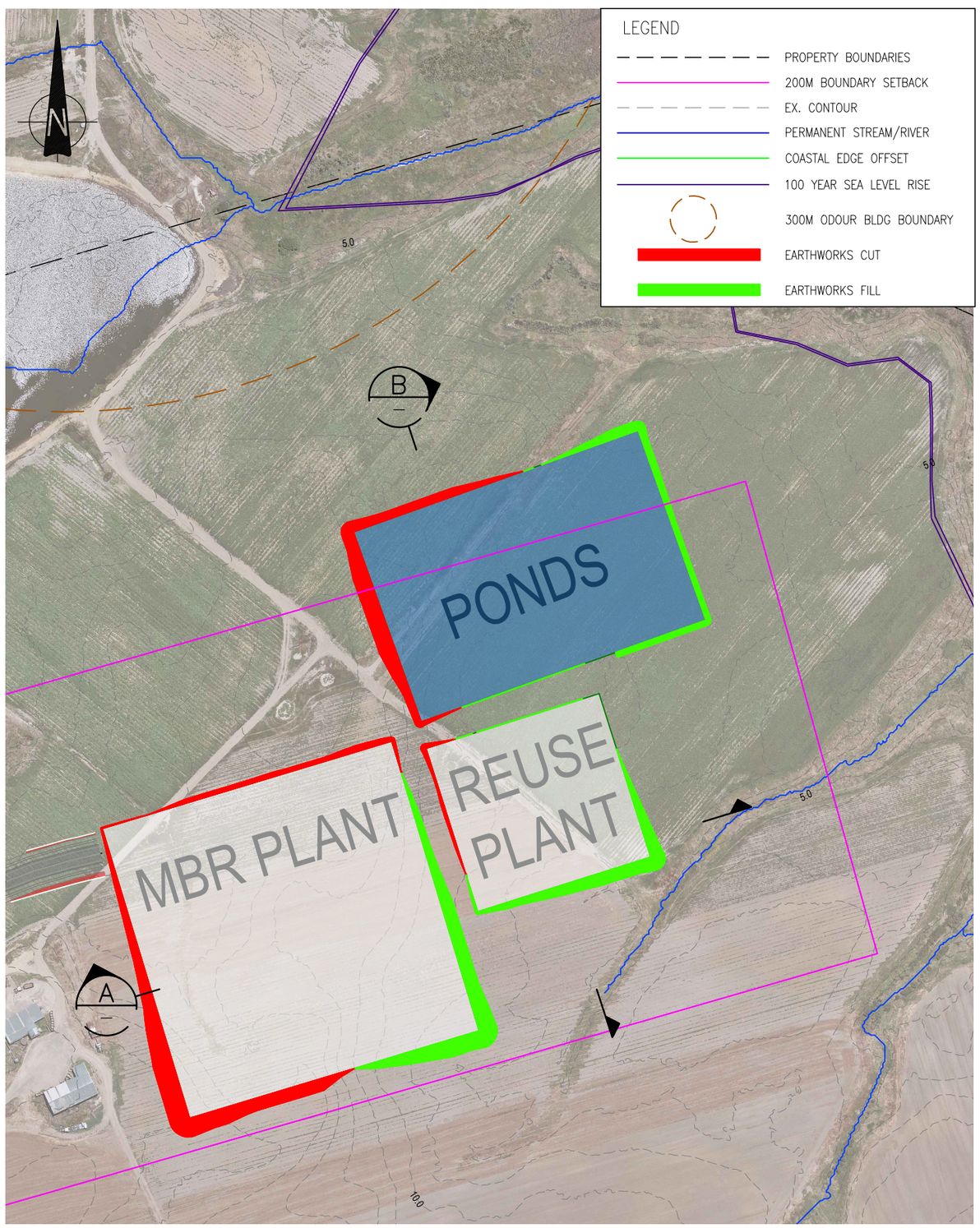
Watercare

SOUTHWEST WWTP SHORTLIST LOCATIONS ASSESSMENT
LOCATION S
CROSS SECTIONS

CAD FILE	DATE
ORIGINAL SCALE A3	CONTRACT No.
REF No.	
DWG No.	ISSUE



1 — OVERVIEW PLAN
1:10000 A3



2 — DETAIL PLAN
1:2500 A3

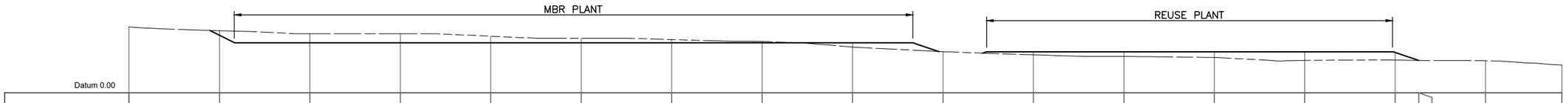
ISSUE	DATE	AMENDMENT	BY	APPD.
C	24.04.23	FINAL ISSUE	GP	
B	13.03.23	AERIAL UPDATED	GP	
A	29.11.21	DRAFT FOR INFORMATION	GP	

DESIGNED			
DES. APPROVED			
DRAWN			
DWG. APPROVED			
WSL DESIGN MGMT.			
WSL PROJ. LEAD		BY	DATE

Watercare

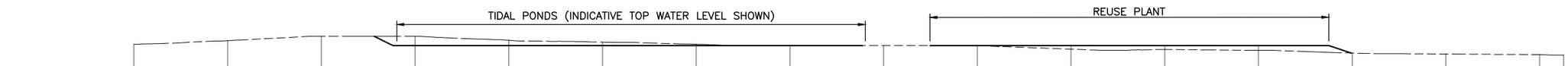
SOUTHWEST WWTP SHORTLIST LOCATIONS ASSESSMENT
LOCATION T
GENERAL ARRANGEMENT

CAD FILE 3257703-CA-0107	DATE dd-mm-yy
ORIGINAL SCALE A3 AS SHOWN	CONTRACT No. –
REF No. –	
DWG No. CA-0107	ISSUE C



CUT/FILL		-0.98	-1.99	-2.00	-1.45	-1.00	-0.71	-0.28	0.93		0.64	1.00	1.23	1.87	1.66	0.00	0.00						
DESIGN LEVELS		12.684	11.000	11.000	11.000	11.000	11.000	11.000	11.000		9.000	9.000	9.000	9.000	8.865	9.08	7.13						
EXISTING LEVELS	14.495	13.663	12.993	12.999	12.452	11.999	11.713	11.277	10.069	9.033	8.357	7.999	7.774	7.126	7.208	9.08	7.13		7.039		6.111		
CHAINAGE	0.00	20.00	40.00	60.00	80.00	100.00	120.00	140.00	160.00	180.00	200.00	220.00	240.00	260.00	280.00	179.14	285.20		300.00		316.85		

A — SECTION A
1:1000 A3



CUT/FILL				-2.00	-1.16	-0.75	-0.30	0.00		0.01	0.74	0.82	1.00	-0.03	0.00								
DESIGN LEVELS				9.000	9.000	9.000	9.000	9.000		9.000	9.000	9.000	9.000	8.97	7.40								
EXISTING LEVELS	9.287	10.083	11.001	11.001	10.156	9.755	9.296	9.000	9.000	8.994	8.257	8.179	8.000	9.00	7.40	7.400		7.205		7.058		7.000	
CHAINAGE	0.00	20.00	40.00	60.00	80.00	100.00	120.00	140.00	160.00	180.00	200.00	220.00	240.00	155.45	259.82	260.00		280.00		300.00		305.14	

B — SECTION B
1:1000 A3

ISSUE	DATE	AMENDMENT	BY	APPD.
B	24.04.23	FINAL ISSUE	GP	
A	29.11.21	DRAFT FOR INFORMATION	GP	

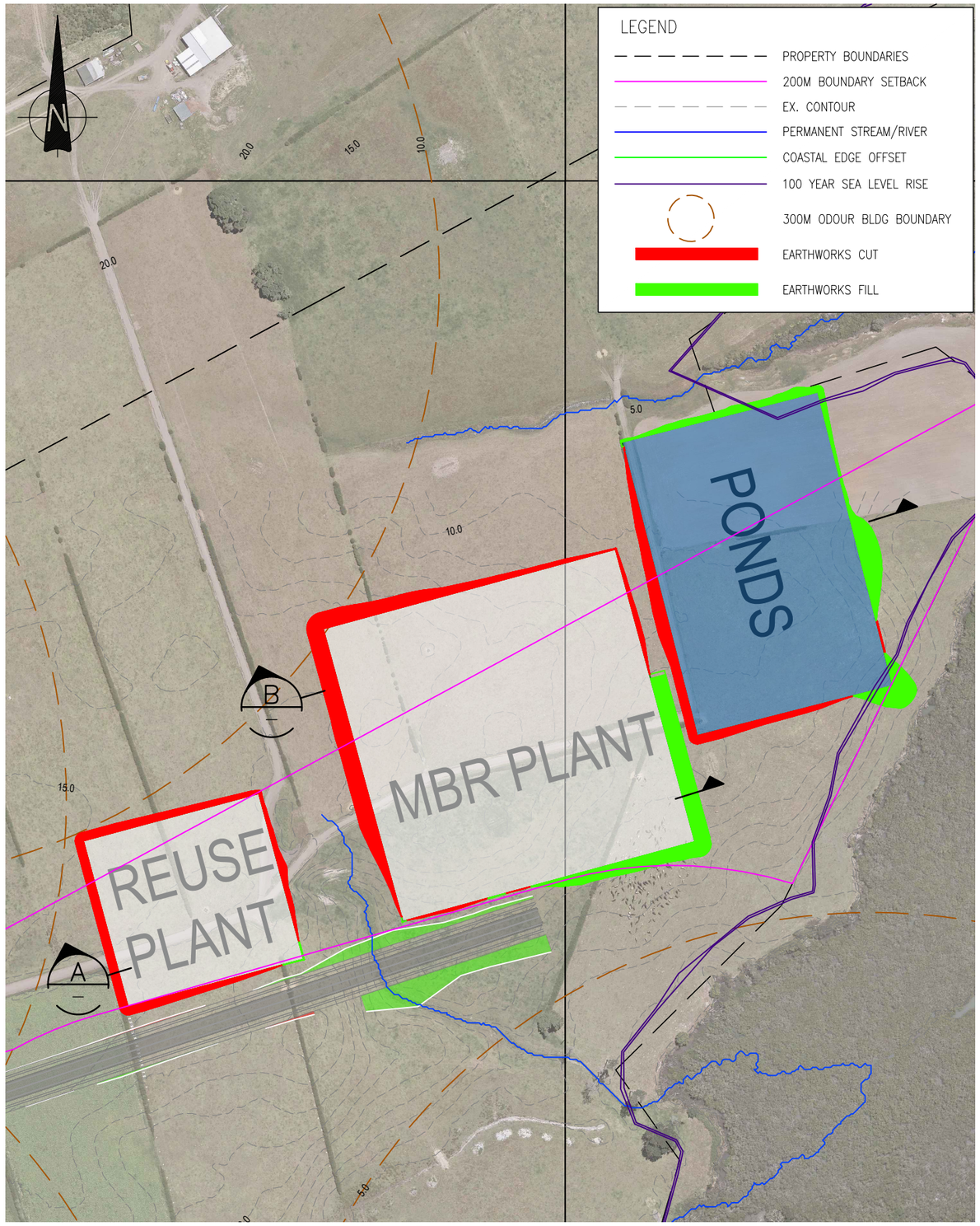
DESIGNED		10-21	
DES. APPROVED			
DRAWN			
DWG. APPROVED			
WSL DESIGN MGMT.			
WSL PROJ. LEAD			
BY		DATE	

Watercare

SOUTHWEST WWTP SHORTLIST LOCATIONS ASSESSMENT
LOCATION T
CROSS SECTIONS

CAD FILE 3257703-CA-0108	DATE dd-mm-yy
ORIGINAL SCALE A3 SCALE	CONTRACT No. –
REF No. –	
DWG No. CA-0108	ISSUE B

1 OVERVIEW PLAN
1:10000 A3



2 DETAIL PLAN
1:2500 A3

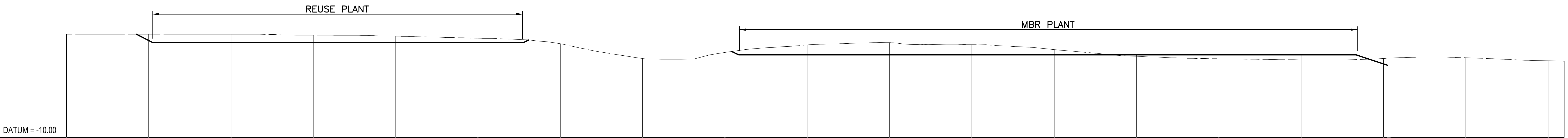
ISSUE	DATE	AMENDMENT	BY	APPD.
C	24.04.23	FINAL ISSUE	GP	
B	13.03.23	AERIAL UPDATED	GP	
A	29.11.21	DRAFT FOR INFORMATION	GP	

		DATE
DESIGNED		
DES. APPROVED		
DRAWN		
DWG. APPROVED		
WSL DESIGN MGMT.		
WSL PROJ. LEAD		

Watercare

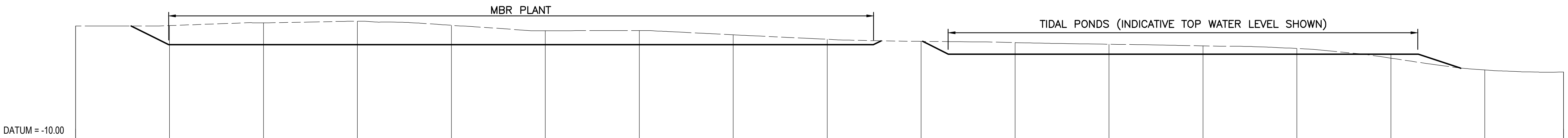
SOUTHWEST WWTP SHORTLIST LOCATIONS ASSESSMENT
LOCATION W
GENERAL ARRANGEMENT

CAD FILE 3257703-CA-0109	DATE dd-mm-yy
ORIGINAL SCALE A3 AS SHOWN	CONTRACT No. –
REF No. –	
DWG No. CA-0109	ISSUE C



CUT/FILL		-1.49	-2.00	-1.81	-1.56	-1.05				-2.41	-2.98	-2.47	-1.30	0.34	0.95	1.20	-1.33	0.00	-1.72		
DESIGN LEVELS		13.51	13.00	13.00	13.00	13.000				10.00	10.000	10.00	10.00	10.00	10.00	10.000	7.80	13.63	7.46		
EXISTING LEVELS	15.000	15.00	15.00	14.81	14.56	14.053	12.71	9.14	10.59	12.41	12.975	12.47	11.30	9.66	9.05	8.803	9.13	13.63	9.18	9.31	8.59	8.471
CHAINAGE	0.00	20.00	40.00	60.00	80.00	100.00	120.00	140.00	160.00	180.00	200.00	220.00	240.00	260.00	280.00	300.00	320.00	112.31	321.01	340.00	360.00	363.92

A
–
SECTION A
1:1000 A3



CUT/FILL		-4.09	-4.68	-5.00	-4.14	-2.99	-3.01	-2.10	-1.16		-2.46	-2.10	-1.75	-1.20	0.86	0.00	0.00		
DESIGN LEVELS		10.00	10.00	10.00	10.00	10.000	10.00	10.00	10.00		8.000	8.00	8.00	8.00	8.00	10.83	5.00		
EXISTING LEVELS	14.000	14.09	14.68	15.00	14.14	12.988	13.01	12.10	11.16	10.72	10.460	10.10	9.75	9.20	7.14	10.83	5.00	4.632	4.172
CHAINAGE	0.00	20.00	40.00	60.00	80.00	100.00	120.00	140.00	160.00	180.00	200.00	220.00	240.00	260.00	280.00	171.50	294.88	300.00	316.75

B
–
SECTION B
1:1000 A3

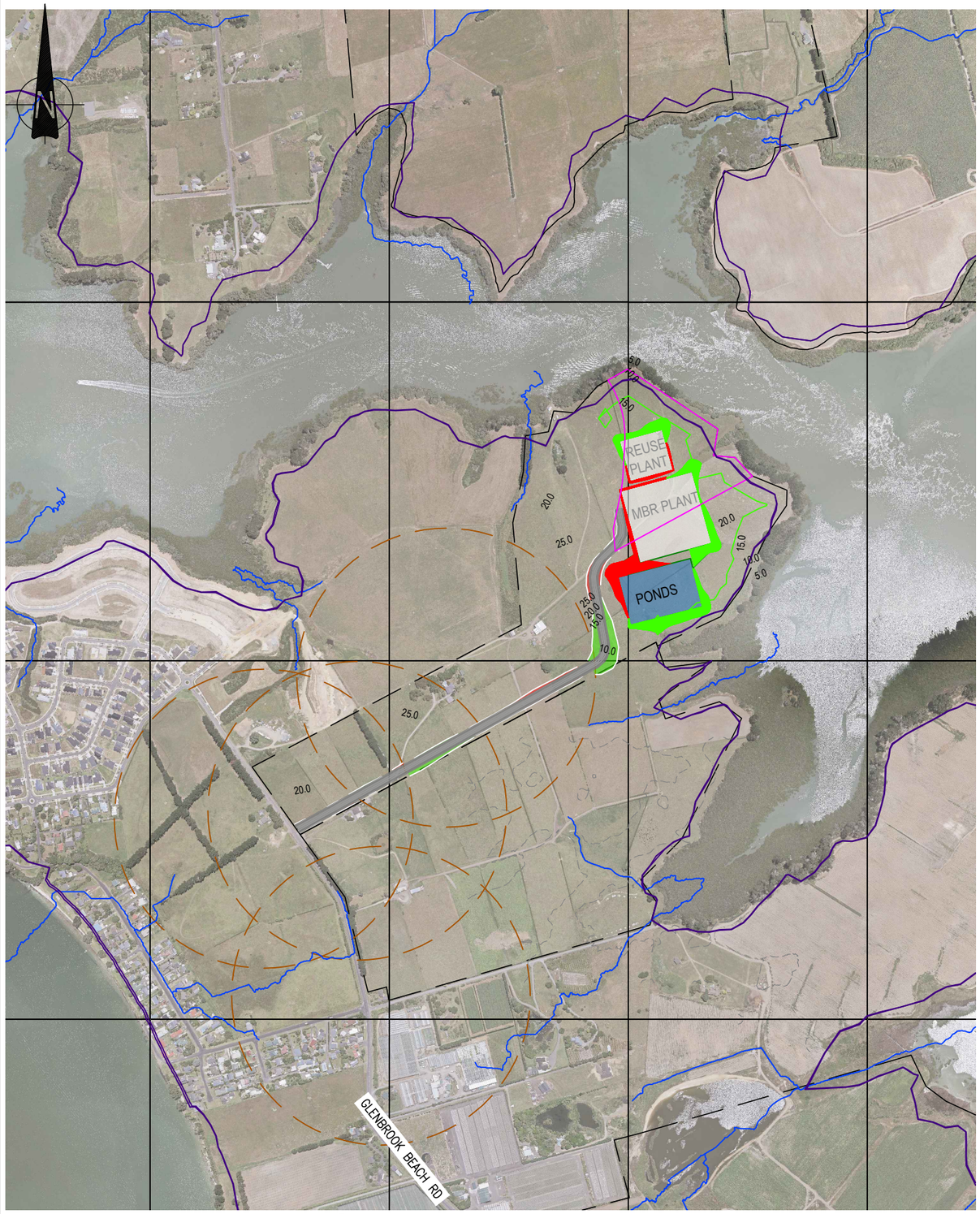
ISSUE	DATE	AMENDMENT	BY	APPD.
B	24.04.23	FINAL ISSUE	GP	
A	29.11.21	DRAFT FOR INFORMATION	GP	

	BY	DATE
DESIGNED		10-21
DES. APPROVED		
DRAWN		
DWG. APPROVED		
WSL DESIGN MGMT.		
WSL PROJ. LEAD		

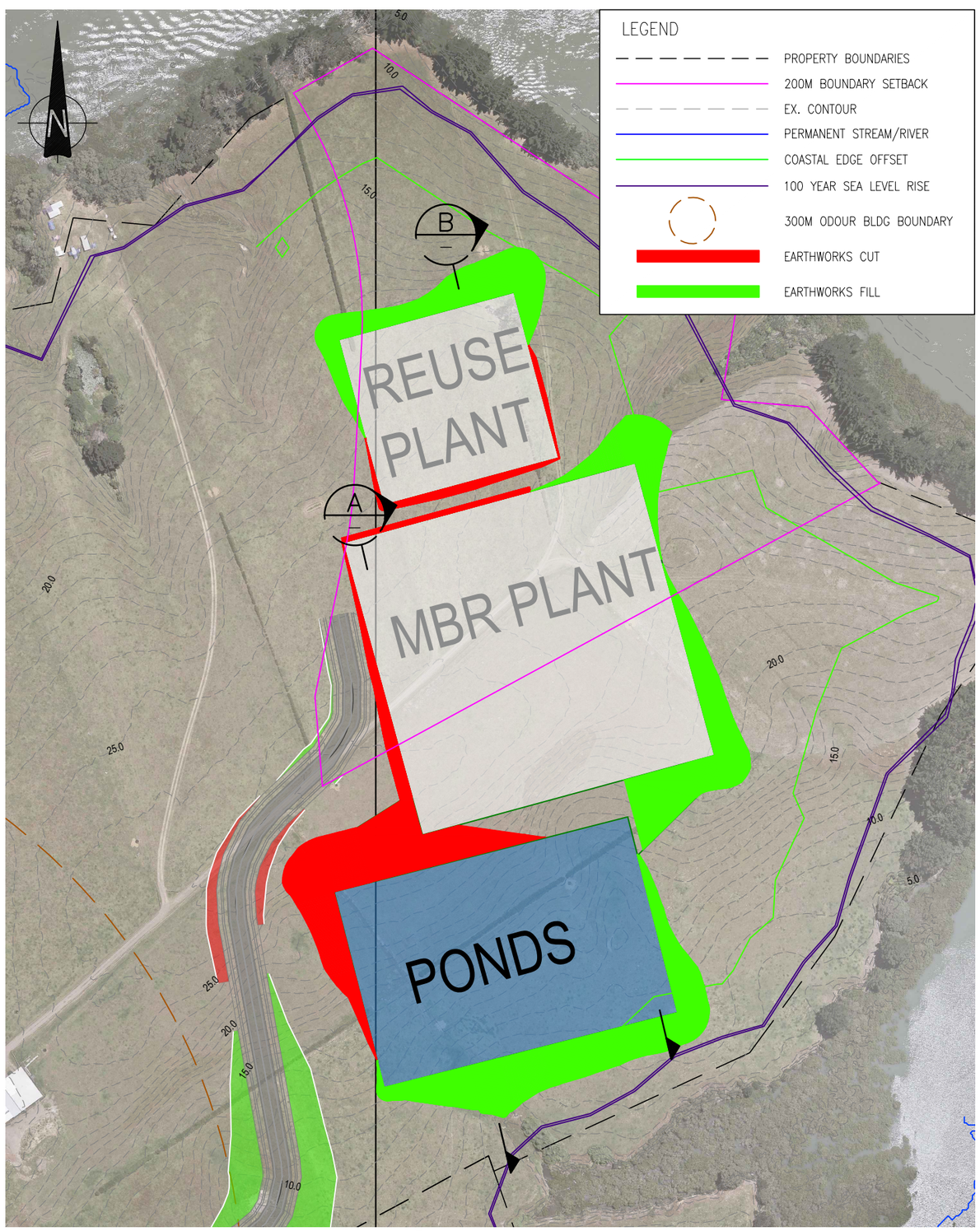
Watercare

SOUTHWEST WWTP SHORTLIST LOCATIONS ASSESSMENT
LOCATION W
CROSS SECTIONS

CAD FILE 3257703-CA-0110
DATE dd-mm-yy
ORIGINAL SCALE A3 AS SHOWN
CONTRACT No. –
REF No. –
DWG No. CA-0110
ISSUE B



1 — OVERVIEW PLAN
1:10000 A3



2 — DETAIL PLAN
1:2500 A3

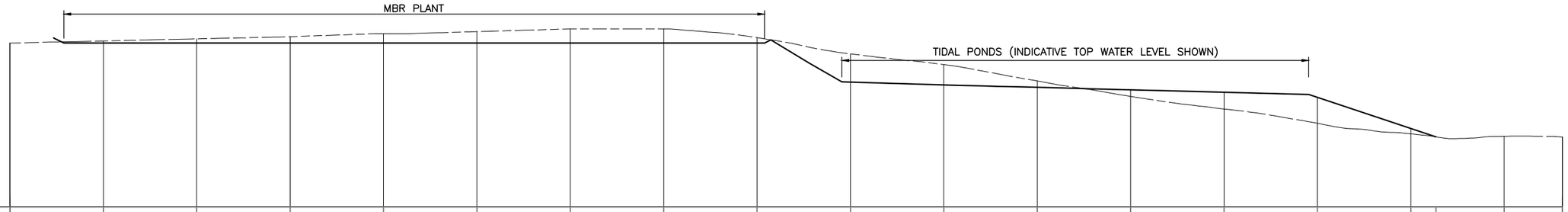
ISSUE	DATE	AMENDMENT	BY	APPD.
C	24.04.23	FINAL ISSUE	GP	
B	13.03.23	AERIAL UPDATED	GP	
A	29.11.21	DRAFT FOR INFORMATION	GP	

		BY	DATE
DESIGNED			
DES. APPROVED			
DRAWN			
DWG. APPROVED			
WSL DESIGN MGMT.			
WSL PROJ. LEAD			

Watercare

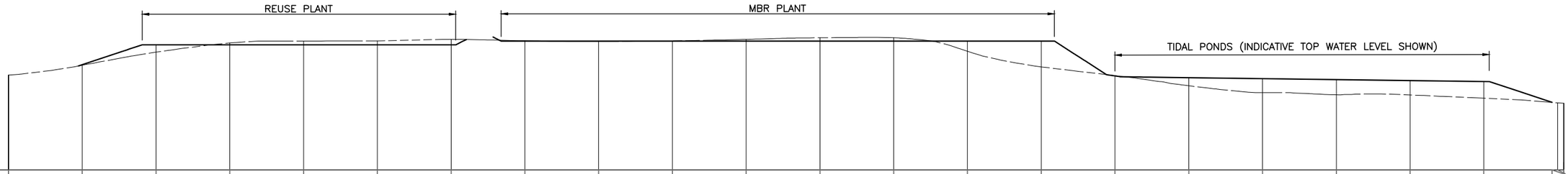
SOUTHWEST WWTP SHORTLIST LOCATIONS ASSESSMENT
LOCATION X
GENERAL ARRANGEMENT

CAD FILE 3257703-CA-0111	DATE dd-mm-yy
ORIGINAL SCALE A3 AS SHOWN	CONTRACT No. –
REF No. –	
DWG No. CA-0111	ISSUE C



DATUM = -10.00																					
CUT/FILL		-0.44	-0.89	-1.36	-2.00	-2.43	-3.00	-3.00	-1.13	-6.04	-4.33	-1.38	1.42	3.59	5.57	1.16	0.00				
DESIGN LEVELS		25.00	25.00	25.00	25.00	25.000	25.00	25.00	25.00	16.64	16.047	15.52	15.00	14.47	13.39	6.729	4.92				
EXISTING LEVELS	24.995	25.44	25.89	26.36	27.00	27.427	28.00	28.00	26.13	22.67	20.379	16.90	13.57	10.88	7.82	5.570	4.92		5.05		4.872
CHAINAGE	0.00	20.00	40.00	60.00	80.00	100.00	120.00	140.00	160.00	180.00	200.00	220.00	240.00	260.00	280.00	300.00	305.41		320.00		332.50

A — SECTION A
1:1000 A3



DATUM = -10.00																					
CUT/FILL		0.14	1.99	-0.47	-1.01	-1.04	-1.46	-0.07	0.10	-0.02	-0.46	-0.89	-0.89	2.77	7.02	-0.05	2.20	3.81	4.12	3.92	4.54	0.00	0.00
DESIGN LEVELS		18.58	24.00	24.00	24.00	24.000	24.00	25.00	25.00	25.00	25.000	25.00	25.00	25.00	25.00	15.536	15.06	14.80	14.54	14.28	14.020	25.42	8.34
EXISTING LEVELS	15.755	18.44	22.01	24.47	25.01	25.045	25.46	25.07	24.90	25.02	25.460	25.89	25.89	22.23	17.98	15.588	12.86	10.99	10.42	10.36	9.479	25.42	8.24
CHAINAGE	0.00	20.00	40.00	60.00	80.00	100.00	120.00	140.00	160.00	180.00	200.00	220.00	240.00	260.00	280.00	300.00	320.00	340.00	360.00	380.00	400.00	124.12	418.49

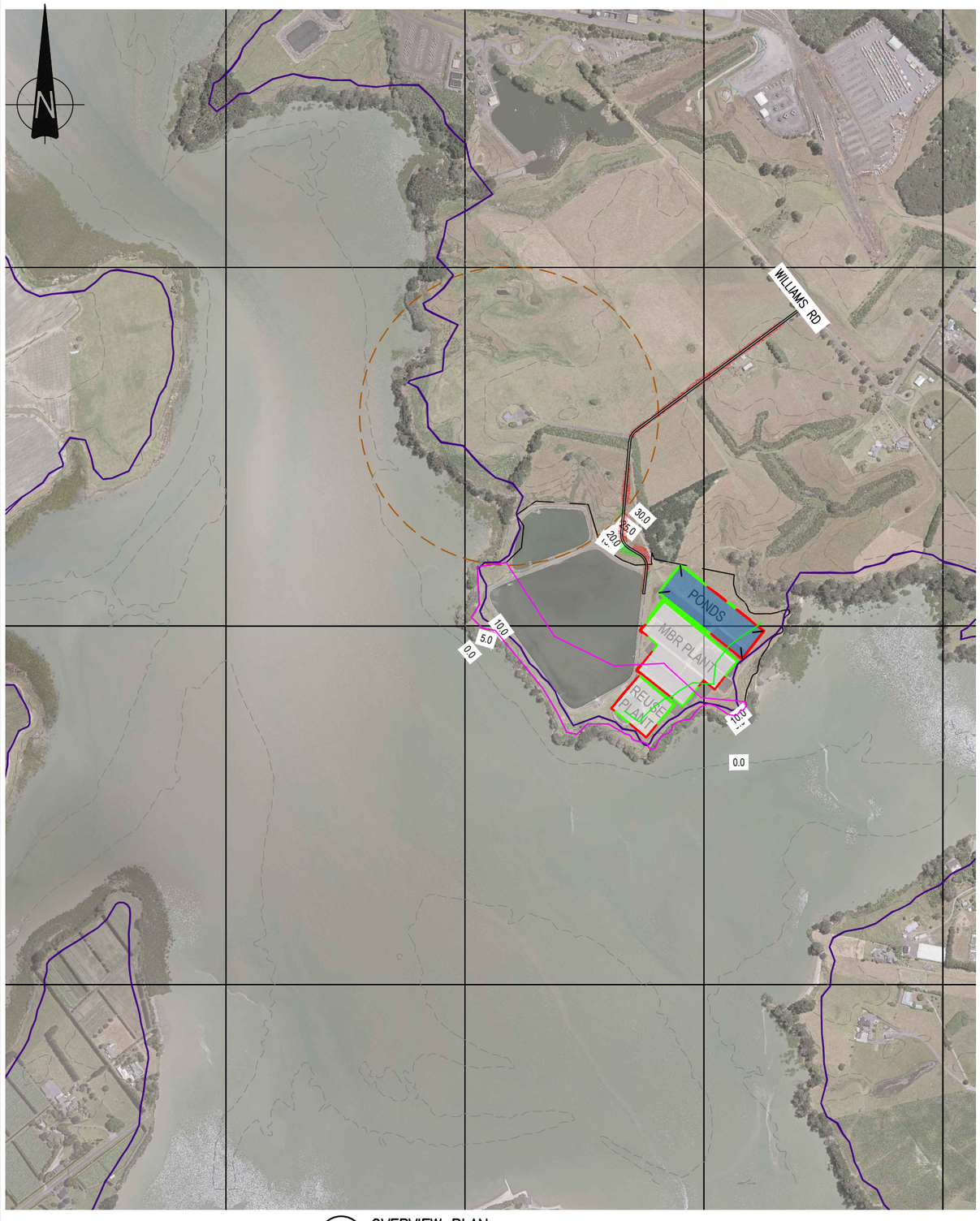
B — SECTION B
N.T.S.

ISSUE	DATE	AMENDMENT	BY	APPD.
B	24.04.23	FINAL ISSUE	GP	
A	29.11.21	DRAFT FOR INFORMATION	GP	

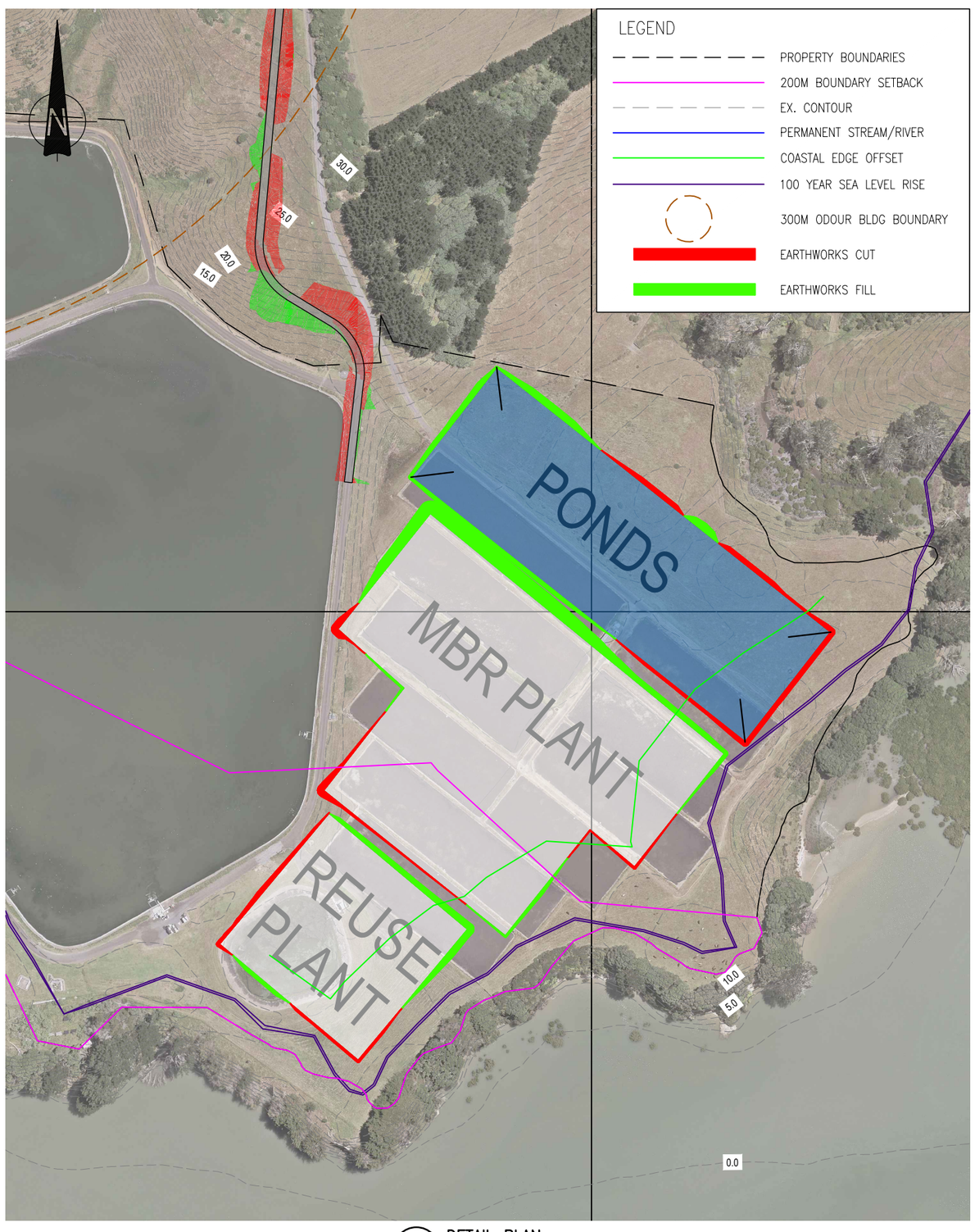
DESIGNED		10-21	
DES. APPROVED			
DRAWN			
DWG. APPROVED			
WSL DESIGN MGMT.			
WSL PROJ. LEAD			
	BY	DATE	

SOUTHWEST WWTP SHORTLIST LOCATIONS ASSESSMENT
LOCATION X
CROSS SECTIONS

CAD FILE 3257703-CA-0112	DATE dd-mm-yy
ORIGINAL SCALE A3 AS SHOWN	CONTRACT No. –
REF No. –	
DWG No. CA-0112	ISSUE B



1 OVERVIEW PLAN
1:10000 A3



2 DETAIL PLAN
1:2500 A3

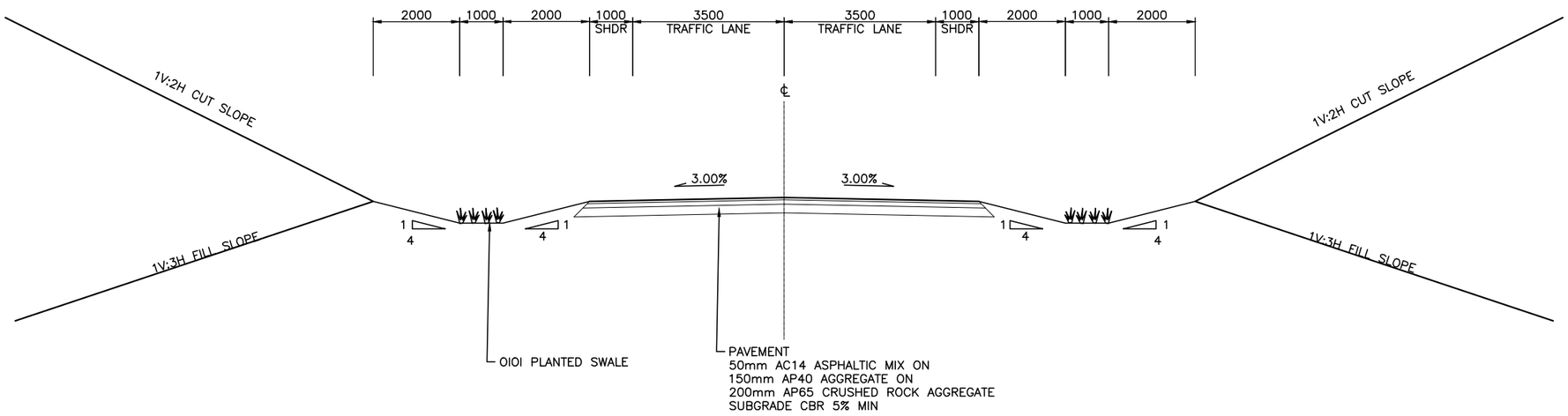
ISSUE	DATE	AMENDMENT	BY	APPD.
C	24.04.23	FINAL ISSUE	GP	
B	13.03.23	AERIAL UPDATED	GP	
A	29.11.21	DRAFT FOR INFORMATION	GP	

		DATE
DESIGNED		
DES. APPROVED		
DRAWN		
DWG. APPROVED		
WSL DESIGN MGMT.		
WSL PROJ. LEAD		

Watercare

SOUTHWEST WWTP SHORTLIST LOCATIONS ASSESSMENT
LOCATION Z
GENERAL ARRANGEMENT

CAD FILE 3257703-CA-0113	DATE dd-mm-yy
ORIGINAL SCALE A3 AS SHOWN	CONTRACT No. –
REF No. –	
DWG No. CA-0113	ISSUE C



1 — ACCESSWAY TYPICAL SECTION

1:250 A3

ISSUE	DATE	AMENDMENT	BY	APPD.
B	24.04.23	FINAL ISSUE	GP	
A	29.11.21	DRAFT FOR INFORMATION	GP	

		DATE
DESIGNED		10-21
DES. APPROVED		
DRAWN		
DWG. APPROVED		
WSL DESIGN MGMT.		
WSL PROJ. LEAD		

Watercare

SOUTH WWTP SHORTLIST LOCATIONS ASSESSMENT
ACCESSWAY TYPICAL CROSS SECTION

CAD FILE 3257703-CA-0200	DATE dd-mm-yy
ORIGINAL SCALE A3 AS SHOWN	CONTRACT No. –
REF No. –	
DWG No. CA-0200	ISSUE B

Appendix F – Technical Assessment Summaries

1 Heritage Summary sheet – technical specialist assessment

Technical discipline:	Heritage
Criteria:	*Sites and places of known value:* *Heritage buildings, places* *Notable trees* *Sites and places of European cultural heritage value*
Date:	2/12/2021
Author:	Matt Campbell (CFG) Anna Wingham/Himani Bhatia-Mitha (Beca)

1.1 Purpose

This summary sheet has been prepared to assist with the assessment of short list options for the Southwest Wastewater Treatment Plant and for the statutory process under the Resource Management Act for the Notices of Requirement.

1.2 Summary of assessment

Option	Potential effects and opportunities	MCA score (1-9)
Option B	**Constraints/values** • There are no sites and places of known value, heritage buildings, notable trees or sites and places of European cultural heritage value on site. **Potential effects** • There will be no adverse effects on heritage values. As this option is a sufficient distance from any sites of heritage value under the AUP, existing heritage will be maintained and protected. • The proposed location of the Plant is in close proximity to the archaeological sites. **Opportunities** • Nil.	7
Option C	**Constraints/values** • There are no sites and places of known value, heritage buildings, notable trees or sites and places of European cultural heritage value on site. **Potential effects**	7

Option	Potential effects and opportunities	MCA score (1-9)
	• There will be no adverse effects on heritage values. As this option is a sufficient distance from any sites of heritage value under the AUP, existing heritage will be maintained and protected. **Opportunities** Nil.	
Option S	**Constraints/values** • There are no sites and places of known value, heritage buildings, notable trees or sites and places of European cultural heritage value on site. **Potential effects** • There will be no adverse effects on heritage values. As this option is a sufficient distance from any sites of heritage value under the AUP, existing heritage will be maintained and protected. **Opportunities** • Nil.	7
Option T	**Constraints/values** • There are no sites and places of known value, heritage buildings, notable trees or sites and places of European cultural heritage value on site. **Potential effects** • There will be no adverse effects on heritage values. As this option is a sufficient distance from any sites of heritage value under the AUP, existing heritage will be maintained and protected. **Opportunities** • Nil.	7
Option W	**Constraints/values** • There are no sites and places of known value, heritage buildings, notable trees or sites and places of European cultural heritage value on site. **Potential effects** • There will be no adverse effects on heritage values. As this option is a sufficient distance from any sites of heritage value under the AUP, existing heritage will be maintained and protected. **Opportunities** • Nil.	7

Option	Potential effects and opportunities	MCA score (1-9)
Option X	**Constraints/values** • There are no sites and places of known value, heritage buildings, notable trees or sites and places of European cultural heritage value on site. **Potential effects** • There will be no adverse effects on heritage values. As this option is a sufficient distance from any sites of heritage value under the AUP, existing heritage will be maintained and protected. **Opportunities** • Nil.	7
Option Z	**Constraints/values** • There are no sites and places of known value, heritage buildings, notable trees or sites and places of European cultural heritage value on site. **Potential effects** • There will be no adverse effects on heritage values. As this a sufficient distance from any sites of heritage value, existing heritage will be maintained and protected. **Opportunities** • Nil.	7

1.3 Recommendation

There are no key differentiators between any of the sites

1.4 Assumptions and limitations

Note: During MCA Workshop # 3, the scores of the following sites were changed:

- Site C: 6 – 7
- Site S: 8 – 7
- Site T: 8 – 7
- Site W: 8 –7

2 Archaeology Summary sheet – technical specialist assessment

Technical discipline:	Archaeology
Criteria:	*Sites and places of archaeological value.*
Date:	29/11/2021
Author:	Matt Campbell (CFG)

2.1 Purpose

This summary sheet has been prepared to assist with the assessment of short list options for the Southwest Wastewater Treatment Plant and for the statutory process under the Resource Management Act for the Notices of Requirement.

2.2 Summary of assessment

Option	Potential effects and opportunities	MCA score (1-9)
Option B	**Potential effects** • The project will avoid the coast, which is the most likely location of archaeological sites (pre-European Māori middens), but there remains the possibility that both Māori and pre-1900 European sites may be discovered away from the coast **Opportunities** • Nil	7
Option C	**Potential effects** • The project will avoid the coast, which is the most likely location of archaeological sites (pre-European Māori middens), but there remains the possibility that both Māori and pre-1900 European sites may be discovered away from the coast **Opportunities** • Nil	7
Option S	**Potential effects** • The project will avoid the coast, which is the most likely location of archaeological sites (pre-European Māori middens), but there remains the possibility that both Māori and pre-1900 European sites may be discovered away from the coast **Opportunities** • Nil	7

Option	Potential effects and opportunities	MCA score (1-9)
Option T	**Potential effects** • The project will avoid the coast, which is the most likely location of archaeological sites (pre-European Māori middens), but there remains the possibility that both Māori and pre-1900 European sites may be discovered away from the coast **Opportunities** • Nil	7
Option W	**Potential effects** • The project will avoid the coast, which is the most likely location of archaeological sites (pre-European Māori middens), but there remains the possibility that both Māori and pre-1900 European sites may be discovered away from the coast **Opportunities** • Nil	7
Option X	**Potential effects** • The project will avoid the coast, which is the most likely location of archaeological sites (pre-European Māori middens), but there remains the possibility that both Māori and pre-1900 European sites may be discovered away from the coast **Opportunities** • Nil	7
Option Z	**Potential effects** • The project will avoid the coast, which is the most likely location of archaeological sites (pre-European Māori middens), but there remains the possibility that both Māori and pre-1900 European sites may be discovered away from the coast **Opportunities** • Nil	7

2.3 Recommendation

There are no key differentiators between the sites.

2.4 Assumptions and limitations

Note: scores were not changed following MCA Workshop #3.

3 Property summary sheet – technical specialist assessment

Technical discipline:	Land requirements
Criteria:	*Area of private land required* *Area of public land required* *Number of properties / specialist status of impacted property* *Consider the current use of the site, landholdings and associated complexity (i.e. acquiring multiple single sites vs larger sites) to make up to the 30 ha requirement*
Date:	25/11/2021
Author:	Peter Nicoll (Watercare) Anna Wingham/Himani Bhatia-Mitha (Beca)

3.1 Purpose

This summary sheet has been prepared to assist with the assessment of short list options for the Southwest Wastewater Treatment Plant and for the statutory process under the Resource Management Act for the Notices of Requirement.

3.2 Summary of assessment

NB – as for all sites, Watercare has the ability to compulsorily acquire the most desirable site under the Public Works Act.

Option	Potential effects and opportunities	MCA score (1-9)
Option B	**Constraints/values** • Developer paid residential block value for land on assumption the zoning will be changed from rural to residential. Impact is that Watercare would be buying residential value land at a much higher rate. • Some resistance to desired buffer area proposed. **Potential effects** • Developer has clear plans to develop up balance of what Watercare does not need, for residential dwellings. • Potential odour, noise, lighting may cause issues with surrounding current and future residential neighbours. • Neighbouring land to north and west zoned residential **Opportunities** • Developer wishes to accommodate Watercare on site	6

Option	Potential effects and opportunities	MCA score (1-9)
	• Developer wishes to transfer a parcel of land to Watercare when it settles with the current owner in Sept 2022 • Developer willing to work in with Watercare to see how best to deal with odour buffer, i.e. storage facilities and other non-occupational use.	
Option C	**Constraints/values** • None identified to date. Most likely will need to acquire rear portion of land with easement to access. **Potential effects** • None immediately envisaged **Opportunities** • Rural zoned land surrounded by other rural zoned land surrounded by lifestyle blocks and rural use, not residential • Rural unit rate $/m2 will be less than Area B	7
Option S	**Constraints/values** • Discussion on whether owner happy to sell yet to be had **Potential effects** • None immediately envisaged **Opportunities** • A potentially willing vendor • Rural zoned land with surrounding rural zoned land	7
Option T	**Constraints/values** • Negligible **Potential effects** • Negligible **Opportunities** • Owner discussed option of selling desired 3 to 4 ha area to Watercare and continuing to market garden the buffer land that Watercare would place a covenant on, this reducing purchase price.	8

Option	Potential effects and opportunities	MCA score (1-9)
	• Owner also asked if the treated wastewater could be used to irrigate the crops. A positive outcome if feasible. • A potentially willing vendor • Rural zoned land with surrounding rural zoned land	
Option W	**Constraints/values** • Resistance to sell strong • May have to purchase entire holding X/W. **Potential effects** • Strong chance of public intervention **Opportunities** • N/A	4
Option X	**Constraints/values** • As above in W	4
Option Z	**Constraints/values** • Land already owned by Watercare and designated as a WWTP site. **Potential effects** • Existing site already used as WWTP site, minimal effects given existing land use. **Opportunities** • Nil	9

3.3 Recommendation

Parcel C, S and T, followed by B if at Clarks Beach. Clearly reuse of existing Watercare land Z is least impactful however if Z was not MCA choice, then it could be sold

3.4 Assumptions and limitations

Nil

Note: following MCA Workshop #3, the following scores were changed:

- Site B: 7 – 6

4 Social impact summary sheet – technical specialist assessment

Technical discipline:	Social Impact
Criteria:	*Impact on community facilities (e.g. schools, shops, cultural facilities) and recreational facilities (e.g. parks and reserves)*
Date:	2/12/2021
Author:	Anna Wingham/Himani Bhatia-Mitha (Beca)

4.1 Purpose

This summary sheet has been prepared to assist with the assessment of short list options for the Southwest Wastewater Treatment Plant and for the statutory process under the Resource Management Act for the Notices of Requirement.

4.2 Summary of assessment

Option	Potential effects and opportunities	MCA score (1-9)
Option B	**Constraints/values** • The 'potential' Tahiki Trail is adjacent to the site, along the coast. The reuse plant will be located within close proximity to the trail. • The overall site is located adjacent to the Clarks Beach Precinct area, however, owing to the positioning of the plant, effects will not be discernible from future development. • There are no community facilities located in proximity to the site. **Potential effects** • Potential adverse impacts on the 'potential' Tahiki Trail, with much of the plant positioned to the southern portion of the site. Potential for the plant to be located more towards the northern end of the site. **Opportunities** • Opportunity to provide for community uses in the buffer zone including the Tahiki Trail.	7
Option C	**Constraints/values** • The 'potential' Taihiki Trail is adjacent to the site, along the coast. The entire plant will be located within close proximity to the trail. • Site adjacent to Karaka Point Vineyard to the east, which also includes a functioning lodge. However, the property was recently sold to NZ Cook Commerce Limited, an investment commercial property firm. The future of this site is therefore uncertain. **Potential effects**	6

Option	Potential effects and opportunities	MCA score (1-9)
	• Potential adverse impacts on Taihiki Trail, with much of the plant positioned to the southern portion of the site. • Due to the positioning of the plant, effects on the Karaka Vineyard could potentially be adverse. **Opportunities** • Nil.	
Option S	**Constraints/values** • There are no community, social or recreational facilities located onsite, or within close proximity to the site. **Potential effects** • Option S will have no direct impact on social, community or recreational facilities. **Opportunities** • Nil.	7
Option T	**Constraints/values** • There are no community, social or recreational facilities located onsite or within close proximity to the site. • There are several businesses located adjacent to the site, however, there is no impact anticipated. **Potential effects** • Option T will have no direct impact on social, community or recreational facilities **Opportunities** • Nil.	7
Option W	**Constraints/values** • There are no community, social or recreational facilities located onsite or within close proximity to the site • The site is located adjacent to sites zoned as Future Urban Zone; however, the proposed location of the plant maintains sufficient distance from any future development. **Potential effects** • There are no community, social or recreational facilities located onsite or within close proximity to the site. • If community or recreational facilities are developed in the FUZ, a sufficient distance has been maintained to minimise any adverse effects.	7

Option	Potential effects and opportunities	MCA score (1-9)
	Opportunities • Nil.	
Option X	**Constraints/values** • There are no community, social or recreational facilities located onsite or within close proximity to the site • The site is located adjacent propertied zoned as Future Urban/Single Housing Zone; however, the proposed location of the plant maintains sufficient distance from any future development. **Potential effects** • There are no community, social or recreational facilities located onsite or within close proximity to the site. • If community or recreational facilities are developed in the FUZ/SHZ a sufficient distance has been maintained to minimise adverse effects. **Opportunities** • Nil.	7
Option Z	**Constraints/values** • There are no community facilities located in proximity to the site. • The Glenbrook Esplanade reserve zoned as Open Space Conservation zone wraps around the coastal permitter. **Potential effects** • Potential adverse impacts on esplanade reserve, with much of the plant positioned to the southern portion of the site. • There are no effects on other community facilities. **Opportunities** • Nil.	7

4.3 Assumptions and limitations

The ‘Taihiki Trail’ is likely to proceed.

Note: the following cores were changed during MCA Workshop #3:

- Site B: 6 – 7
- Site C: 5 – 6
- Site S: 8 – 7

- Site W: 6 – 7
- Site X: 6 – 7
- Site Z: 6 – 7

5 Odour amenity summary sheet – technical specialist assessment

Technical discipline:	Odour amenity
Criteria:	Ability to provide for a minimum 200m odour buffer within the site, and sensitivity of the receiving environment
Date:	20/12/2021
Author:	Mathew Noonan (Beca)

5.1 Purpose

This summary sheet has been prepared to assist with the assessment of short list options for the Southwest Wastewater Treatment Plant and for the statutory process under the Resource Management Act for the Notices of Requirement.

5.2 Summary of assessment

Option	Potential effects and opportunities	MCA score (1-9)
Option B	**Constraints/values** • It is possible to locate the proposed WWTP at least 300m from existing rural dwellings and with a 200m site odour buffer distance. • The site is large, and good level of separation is provided to existing houses • The property to the north of the site (and on the northern side Clarks Beach Road) is currently being developed residential purposes (zoned Residential - Mixed Housing Suburban). Although the nearest dwelling in the land would be approximately 700m from the WWTP. There are also Future Urban zoned land to the northwest. • It is also understood that the developer of proposed WWTP site wishes to develop the balance of site which Watercare does require for the WWTP for residential purposes. Potentially a smaller odour buffer distance would be requested by the developer which would increase the sensitivity of the site. **Potential effects** • The current residential developments to the north and those proposed by the developer could over time increase the sensitivity of the receiving environment to nuisance odour. **Opportunities** • Not applicable for odour	7
Option C	**Constraints/values**	6

Option	Potential effects and opportunities	MCA score (1-9)
	• It is possible to locate the proposed WWTP at least 300m from existing rural dwellings and with a 200m site odour buffer distance. • The sensitivity of the receiving environment to odour amenity effects is impacted by the number of rural dwelling located close to the site boundary. Approximately five dwellings are approximately 300m away from the proposed site • The WWTP would be visible to a number of these dwellings. Therefore, residents at these properties could be more aware of any odours emitted WWTP. • The Karaka Point Vineyard and Lodge is also located approximately 400m to east of proposed WWTP. The vineyard was a function venue and offers guest accommodation and therefore high level of amenity would be expected at the maintained at the property (noting the property has recently changed ownership). It is noted the main building is located in the predominant downwind wind direction from the WWTP, and therefore could more frequency be exposed to any odour emitted from the site. **Potential effects** • Although a 300m separation distance could be maintained between the WWTP and nearby sensitive receptor, given the number of nearby sensitive receptors there is a higher risk than a nuisance odour could at time be experienced by neighbours, particularly during abnormal operating conditions. **Opportunities** • Not applicable for odour	
Option S	**Constraints/values** • It is possible to locate the proposed WWTP at least 300m from existing rural dwellings and with a 200m site odour buffer distance. • There are no obvious constraints. There are relatively few sensitive receptors in the vicinity of the site. The closest residential property is located approximately 400m to the south of the site. • Limited visibility of the plant from residential properties would be expected to help reduce the sensitivity of receiving environment. • The predominant wind direction from the SW would on average tend to transport odour away from the nearest dwellings **Potential effects** • Overall, the receiving environment has a relatively low sensitivity to odour nuisance effects. **Opportunities**	8

Option	Potential effects and opportunities	MCA score (1-9)
	• Not applicable for odour	
Option T	**Constraints/values** • It is possible to locate the proposed WWTP at least 300m from existing rural dwellings and with a 200m site odour buffer distance. • There are no obvious constraints. There are relatively few sensitive receptors in the immediate vicinity of the site. The closest residential property is located more than 400m to the northwest WWTP. • The site is relatively open and parts of the WWTP would likely be visible to a number of these dwellings. Although the topography site may help screen elements of the MBR plant • The predominant wind direction from the SW would on average tend to transport odour away from the nearest dwellings **Potential effects** • Overall, the receiving environment has a relatively low sensitivity to odour nuisance effects. **Opportunities** • Not applicable for odour	8
Option W	**Constraints/values** • It is possible to locate the proposed WWTP at least 300m from existing rural dwellings and with a 200m site odour buffer distance. • However, the area located approximately 300m to the west of the WWTP are zoned Future Urban and can be expected to be developed over time. • Similarly, areas located approximately 300m to the north of the WWTP are zoned Residential can be expected to be developed over time **Potential effects** • Over time the sensitivity of the receiving environment to nuisance odour would also be expected to increase. The potential for nuance odours to be experienced would similarly be expected to increase **Opportunities** • Not applicable for odour	5
Option X	**Constraints/values** • It is possible to locate the proposed WWTP at least 300m from existing rural dwellings and with a 200m site odour buffer distance.	4

Option	Potential effects and opportunities	MCA score (1-9)
	• However, the area located approximately 200m to the west of the WWTP are zoned Residential and can be expected to be developed over time. **Potential effects** • The proximity of future residential area to the site would substantially increase the sensitivity of the receiving environment **Opportunities** • Not applicable for odour	
Option Z	**Constraints/values** • It is possible to locate the proposed WWTP at least 300m from existing rural dwellings and with a 200m site odour buffer distance. • The WWTP would be located at an existing WWTP site. There the nearby residents could potentially have a higher familiarity and tolerance to plant odours when compared to residents living near a new greenfield site. • The zoning of the surround land use (Heavy Industry Zone and Rural Coastal Zone) would help maintain the relatively low sensitivity of the receiving environment • The WWTP would be located at lower elevation than the nearby dwelling on William Rd which would help channel emitted odour away from these properties during poor dispersion conditions • Limited visibility of the plant from nearby residential properties would be expected to help reduce the sensitivity of receiving environment. **Potential effects** • Overall, the receiving environment has a relatively low sensitivity to odour nuisance effects. **Opportunities** • Not applicable for odour	8

5.3 Recommendation

The areas surrounding Sites S, T and Z are considered to be the least sensitive to odour. The zoning of the surrounding area indicates that sensitivity of the receiving environment is unlikely to increase to any significant extent over the foreseeable future. Consequently, from an odour perspective these sites are considered to be the most favourable.

The area surrounding Site B is proposed to be developed for residential purposes and future development is planned. There is a risk that the sensitivity of the receiving environment to odour would increase over the plant's lifetime.

A relatively high number of rural dwellings surrounds Site C, which increase the site sensitivity to nuisance odour. Although the plant could be constructed more than 300m from the existing dwelling there is a risk that the odour would at time be observed at these receptors.

Sites X and W are the least favourable due to the proposed residential and future urban zoning. The sensitivity of these sites to odour nuisance effect could be expected to increase over time. The proximity of a residential area to Site X is a particular concern.

5.4 Assumptions and limitations

The assessment has been based on the following:

- The indicative locations and layouts of the WWTP
- GIS has been used to identify the location of nearby houses
- The Auckland Unitary Plan zoning
- Sites C, S, T and Z were also visited.

Note: no changes to the scores were made following MCA workshop #3.

6 Operational effects summary sheet – technical specialist assessment

Technical discipline:	Operational Effects
Criteria:	*Operational impacts on people and businesses regarding:* *Truck movements – noise and vibration* *Impacts on businesses/urban areas*
Date:	1/12/2021
Author:	Jonathan Piggott and Iris Tscharntke (Watercare)

6.1 Purpose

This summary sheet has been prepared to assist with the assessment of short list options for the Southwest Wastewater Treatment Plant and for the statutory process under the Resource Management Act for the Notices of Requirement.

6.2 Summary of assessment

Option	Potential effects and opportunities	MCA score (1-9)
Option B	**Constraints/Values** • Set away from public view. Site large enough to mitigate effect to neighbours. Space for extension. **Potential effects** • Driveway right beside small private property an issue. Midge & odour from Tidal Pond potential issue if not covered. Lighting at night (during callouts could be an issue).	7
Option C	• Few more residential properties closer to this site. • Site is narrower and building odour boundaries closer to neighbours. • Plant might have to be located very close to slopes. • Very long drive way.	7
Option S	• Good distance from other residences and coast is good portion of the boundary. • Neighbouring properties are to the west with south westerlies being the prevailing winds. • Space for extension.	8
Option T	• Has more property boundaries than option S. • Building odour boundaries closer to neighbours. • Space for extension.	7

Option	Potential effects and opportunities	MCA score (1-9)
	• Development on site S could impact this site and odour concerns may arise.	
Option W	• Has a more property boundaries than option S. • Building odour boundaries closer to neighbours. • Overall relatively close to main settlement. • Could be seen as area for future developments. • Neighbouring properties are to the west with south westerlies being the prevailing winds.	6
Option X	• Good distance from other residence and coast is good portion of the boundary. • Treatment Plant area seems quite steep. • Neighbouring properties are to the west with south westerlies being the prevailing winds.	6
Option Z	• Good distance from residences and coast is good portion of the boundary. • Existing site. • Very little odour impact on neighbouring properties. • Neighbours are used to a WWTP. • Good access as long as road is modified.	8

6.3 Recommendation

Site Z is the most favourable when considering operational effects.

6.4 Assumptions and limitations

Note: the following cores were changed during MCA Workshop #3:

- Site C: 6 – 7
- Site S: 7 – 8
- Site T: 6 – 7
- Site X: 7 – 6

7 Landscape visual summary sheet – technical specialist assessment

Technical discipline:	Landscape Visual
Criteria:	*Natural landscape and features such as streams, coastal edges and natural vegetation* *Natural character and outstanding natural features/landscapes* *Visual Amenity*
Date:	1/12/2021
Author:	Garrett Hall/Himani Bhatia-Mitha (Beca)

7.1 Purpose

This summary sheet has been prepared to assist with the assessment of short list options for the Southwest Wastewater Treatment Plant and for the statutory process under the Resource Management Act for the Notices of Requirement.

7.2 Summary of assessment

Option	Potential effects and opportunities	MCA score (1-9)
Option B	**Potential effects** • Several properties along the site boundaries. Screening should be able to screen the site. **Opportunities** • Nil.	7
Option C	**Potential effects** • Several properties along the site boundaries. Screening should be able to screen the site. **Opportunities** • Nil.	7
Option S	**Potential effects** • Big site, with two lifestyle properties situated to the south with potential overlooking impacts. Screening is also possible, however unsure whether this would be totally effective given the site is slightly elevated. **Opportunities** • Nil.	6

Option	Potential effects and opportunities	MCA score (1-9)
Option T	**Potential effects** • The southern side of the property is screened by a bamboo shelterbelt. There is one farm cottage to the north owned by the site owner, with several other properties to the north west. Screening would likely be effective. **Opportunities** • Nil.	7
Option W	**Potential effects** • The plant is to be located on an elevated portion of the site, exacerbating adverse visual impacts. Lifestyle properties to the south of the site have a clear view onto the site. **Opportunities** • Nil.	5
Option X	**Potential effects** • Site is clearly seen from the other side of the Tahiki River over a wide area. In addition, the proposed location of the plant is 200m from a live residential zone. **Opportunities** • Nil.	5
Option Z	**Potential effects** • Several lifestyle properties to the southeast of the site (across the river) with potential impacts. However, these are quite far away from the site, and there is already existing screening present onsite. **Opportunities** • Nil.	8

8 Ecology summary sheet – technical specialist assessment

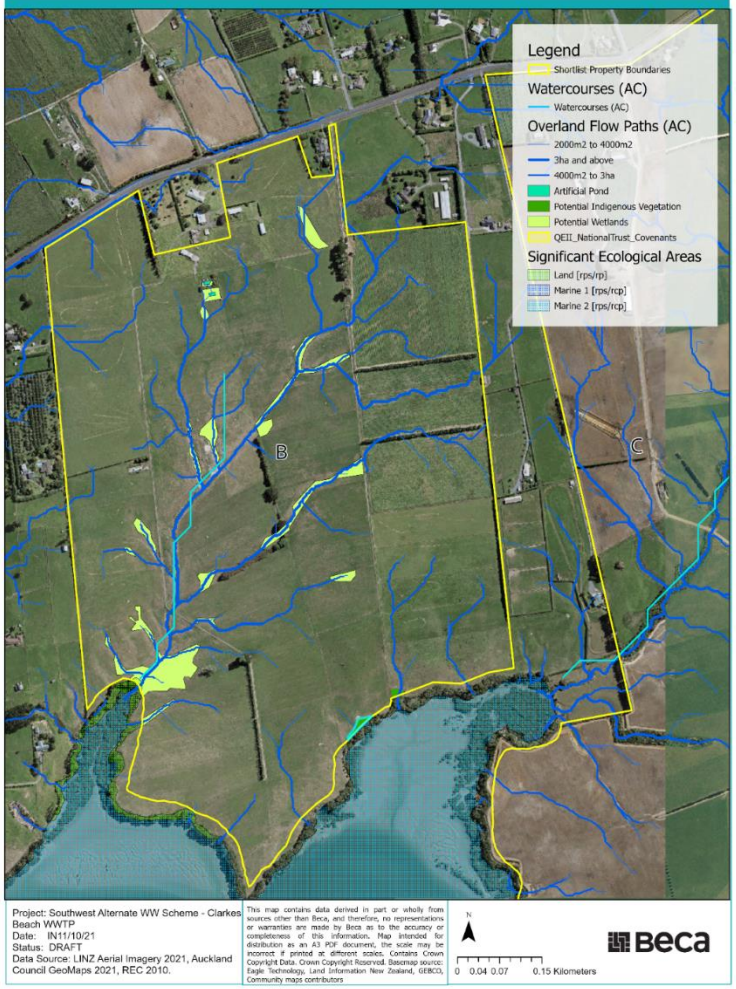
Technical discipline:	Ecology
Criteria:	*Significant indigenous flora* *Significant habitats of indigenous flora* *Indigenous biodiversity* *Stream/waterway/wetland ecology* *Coastal environment*
Date:	02/12/2021
Author:	Connor Whiteley (Beca)

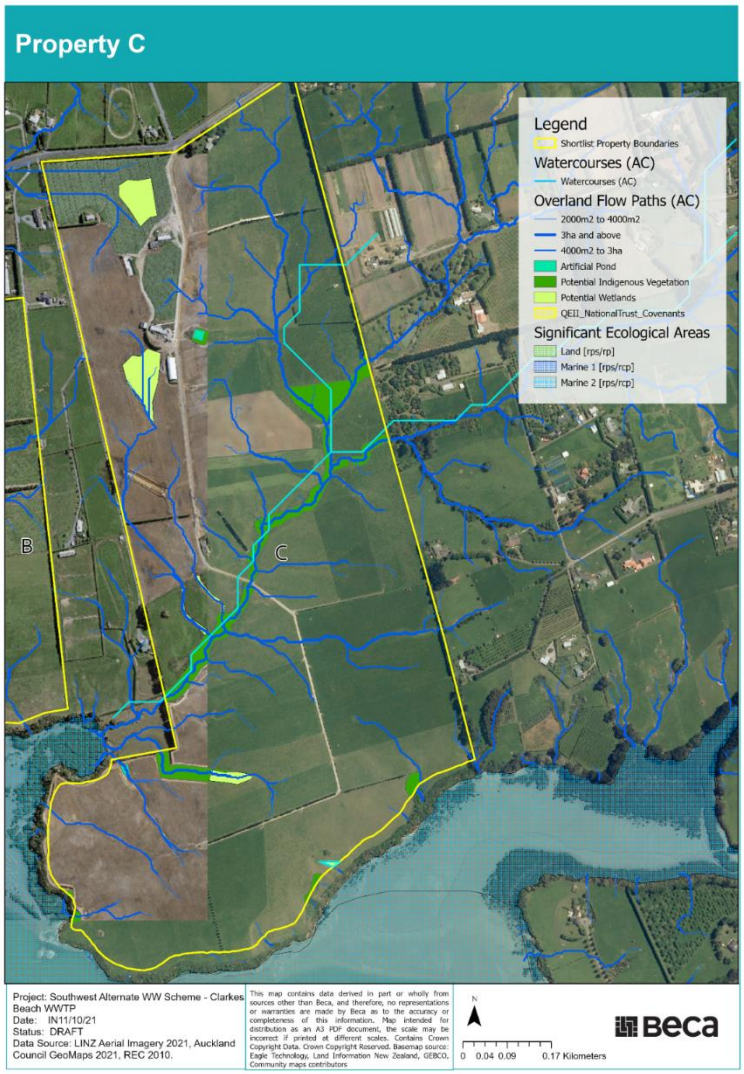
8.1 Purpose

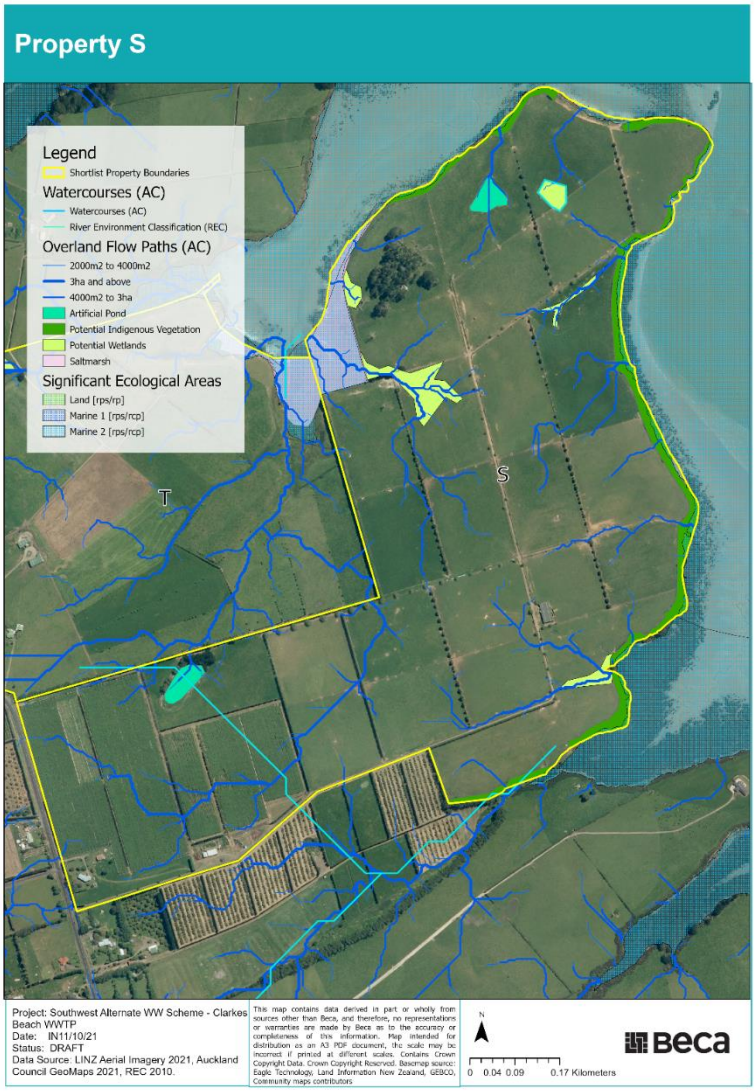
This summary sheet has been prepared to assist with the assessment of short list options for the Southwest Wastewater Treatment Plant and for the statutory process under the Resource Management Act for the Notices of Requirement.

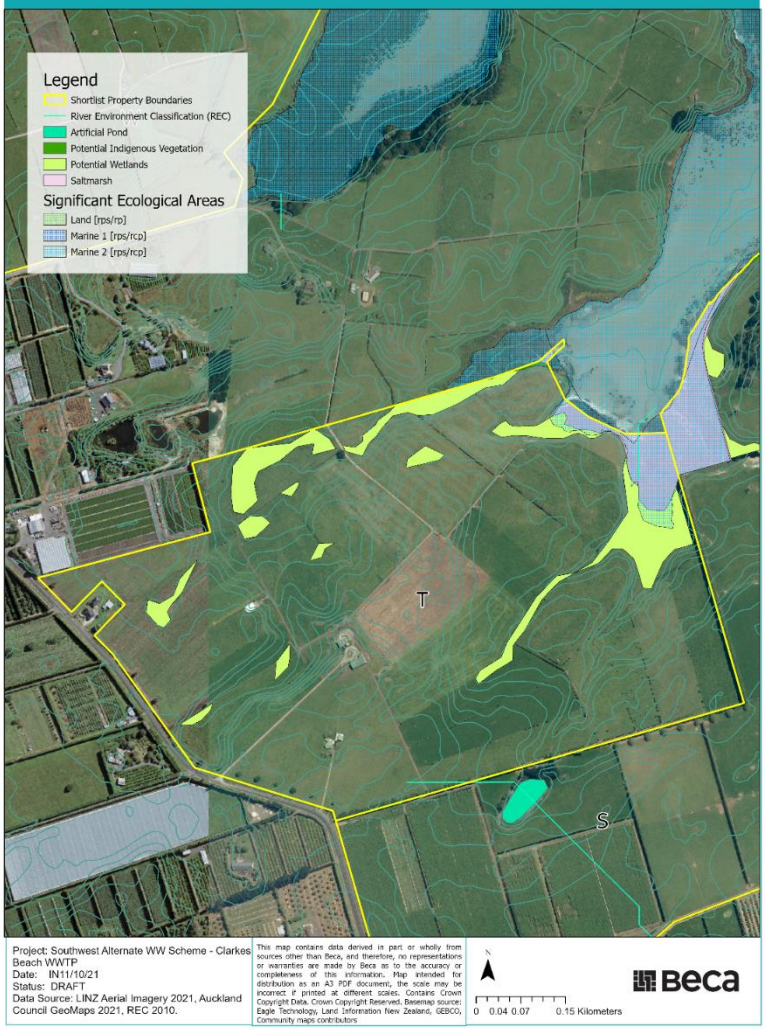
8.2 Summary of assessment

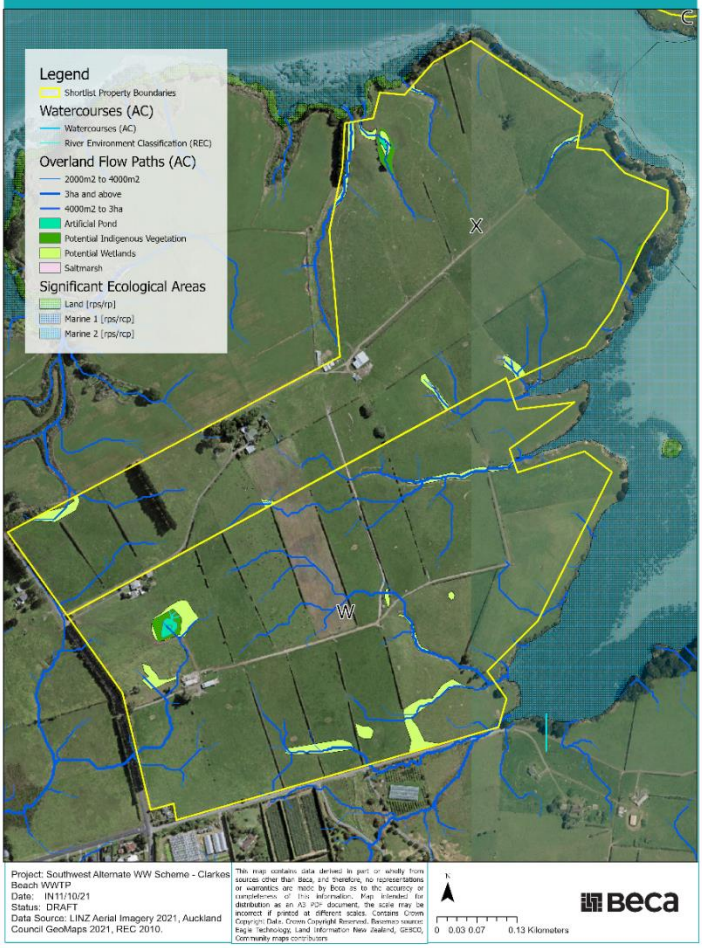
Option	Potential effects and opportunities	MCA score (1-9)
Option B	**Constraints/values** • Several Potential Natural Wetlands within the proposed works footprint. • Several Potential Natural Wetlands within 100m of the proposed Works footprint • Potential streams occurring within the works footprint **Potential effects** • Wetland reclamation • Triggers for consent of dam, diversion, and discharge within 100m of a natural wetland. May result in partial drainage/may not, difficult to determine at this level. • Possible stream culverting to provide for access to the site. **Opportunities** • Potential Natural Wetland that can be restored and used as offset/compensation either for this project or an eco-credit (subject to agreement with regulatory) for other project (cost saving) • Ample stream length that could be restored, potential used as Ecobank stream	6

Option	Potential effects and opportunities	MCA score (1-9)
	Property B  	
Option C	**Constraints/values** • Appears to contain native restored stream, potential linked to past consents (possible covenants) • Several Potential Natural Wetlands within 100m of the proposed Works footprint • Potential streams occurring within the works footprint **Potential effects** • Removal of protected riparian vegetation • Triggers for consent of dam, diversion, and discharge within 100m of a natural wetland. May result in partial drainage/may not, difficult to determine at this level. • Possible stream culverting to provide for access to the site. **Opportunities**	6

Option	Potential effects and opportunities	MCA score (1-9)
	• Potential Natural Wetland that can be restored and used as offset/compensation either for this project or an eco-credit (subject to agreement with regulatory) for other project (cost saving) 	
Option S	**Constraints/values** • Several Potential Natural Wetland within 100m of the proposed Works footprint **Potential effects** • Triggers for consent of dam, diversion, and discharge within 100m of a natural wetland. Not likely to result in any effects **Opportunities** • Potential Natural Wetland that can be restored and used as an eco-credit (subject to agreement with regulatory) for other project (cost saving)	8

Option	Potential effects and opportunities	MCA score (1-9)
	• Stream length that could be restored, potential used as Ecobank stream  	
Option T	**Constraints/values** • Several Potential Natural Wetlands within 100m of the proposed Works footprint **Potential effects** • Triggers for consent of dam, diversion, and discharge within 100m of a natural wetland. Not likely to result in any effects **Opportunities** • Potential Natural Wetland that can be restored and used as an eco-credit (subject to agreement with regulatory) for other project (cost saving)	8

Option	Potential effects and opportunities	MCA score (1-9)
	• Stream length that could be restored, potential used as Ecobank stream **Property T**  	
Option W	**Constraints/values** • Several Potential Natural Wetland within 100m of the proposed Works footprint **Potential effects** • Triggers for consent of dam, diversion, and discharge within 100m of a natural wetland with potential for adverse effects on a wetland. **Opportunities** • Potential Natural Wetland that can be restored and used as an eco-credit (subject to agreement with regulatory) for other project (cost saving)	7

Option	Potential effects and opportunities	MCA score (1-9)
	Property W and Property X  	
Option X	**Constraints/values** • Several Potential Natural Wetland within the proposed works footprint. • Several Potential Natural Wetland within 100m of the proposed Works footprint **Potential effects** • Wetland reclamation • Triggers for consent of dam, diversion, and discharge within 100m of a natural wetland. May result in partial drainage/may not, difficult to determine at this level. **Opportunities** • Potential Natural Wetland that can be restored and used as offset/compensation either for this project or an eco-credit (subject to agreement with regulatory) for other project (cost saving)	3
Option Z	**Constraints/values**	9

Option	Potential effects and opportunities	MCA score (1-9)
	• No Ecological values or constraints within the site. **Potential effects** • No considered ecological impacts **Opportunities** • Opportunity to naturalise the existing pond into an ecological wetland.	

8.3 Recommendation

At this stage based on the information and understanding of the sites, it would be the ecologist recommendation that Site T is likely the preferable site (slightly ahead of Site S) as while there will likely be consent trigger in relation to the NES FW, it is considered that there will be no notable impact, however the site presents opportunities to continue the restoration work currently being undertaken by the current landowner.

It is also the understand of the Ecologist that there is an opportunity to undertake a water reuse system within the agricultural setting that may result in additional indirect benefits to surround freshwater and marine ecological values, i.e. nutrient input reduction, reduction on bore water demands.

8.4 Assumptions and limitations

During the analysis of the constraints, values, potential effects, and opportunities it has been assumed that all Potential Natural Wetlands are considered Natural Wetlands and have therefore been assessed against this conservative estimate. Should it be established through a comprehensive wetland delineation assessment that these areas are not considered to be wetland and/or the NPS FM definition is adjusted to exclude these Potential Natural Wetlands then the MCA score will be required to be adjusted.

Note: the following scores were changed during MCA Workshop #3

- Site B: 2 – 6
- Site C: 3 – 6

9 Flooding risk summary sheet – technical specialist assessment

Technical discipline:	Flooding Risk
Criteria:	*Flooding Risk*
Date:	1/12/2021
Author:	George Pedroso (Beca)

9.1 Purpose

This summary sheet has been prepared to assist with the assessment of short list options for the Southwest Wastewater Treatment Plant and for the statutory process under the Resource Management Act for the Notices of Requirement.

9.2 Summary of assessment

Option	Potential effects and opportunities	MCA score (1-9)
Option B	**Constraints/values** • Accessway over permanent streams and flood prone areas and overland flow path **Potential effects** • Nil. **Opportunities** • Nil.	5
Option C	**Constraints/values** • Flood plain areas within future Plant area (localised low points) **Potential effects** • Nil. **Opportunities** • Nil.	5
Option S	**Constraints/values** • Wider flooding on local and access roads crossing overland flow path. **Potential effects** • Nil.	7

Option	Potential effects and opportunities	MCA score (1-9)
	Opportunities • Nil.	
Option T	**Constraints/values** • Wider flooding on local and access roads crossing overland flow path. **Potential effects** • Nil. **Opportunities** • Nil.	7
Option W	**Constraints/values** • Flood prone areas within future plant area. Access crossing overland flow path **Potential effects** • Nil. **Opportunities** • Nil.	4
Option X	**Constraints/values** • Some minor overland flow paths and streams on the site and localised ponding and flood prone areas nearer the road frontage. Plant area closer to a gully **Potential effects** • Nil. **Opportunities** • Nil.	6
Option Z	**Constraints/values** • Existing site with some flooding prone/ ponding issues shown on GIS. **Potential effects** • Nil. **Opportunities** • Nil.	7

9.3 Recommendation

Options S, T and Z rank the highest with no key differentiators between them. Prior to site visit, Option Z was a 4, but was increased to 7 during the MCA workshop.

9.4 Assumptions and limitations

Nil.

10 Coastal inundation summary sheet – technical specialist assessment

Technical discipline:	Coastal Inundation
Criteria:	*Risk of coastal inundation from future sea level rise*
Date:	1/12/2021
Author:	George Pedroso (Beca)

Purpose

This summary sheet has been prepared to assist with the assessment of short list options for the Southwest Wastewater Treatment Plant and for the statutory process under the Resource Management Act for the Notices of Requirement.

Summary of assessment

Option	Potential effects and opportunities	MCA score (1-9)
Option B	**Constraints/values** • Nil. **Potential effects** • Minor foreshore retreat expected **Opportunities** • Nil.	8
Option C	**Constraints/values** • Nil. **Potential effects** • Minor foreshore retreat expected **Opportunities** • Nil.	8
Option S	**Constraints/values** • Coastal inundation present within wider site. **Potential effects** • Coastal inundation present within wider site boundaries but not impacted plant location.	7

Option	Potential effects and opportunities	MCA score (1-9)
	Opportunities • Nil.	
Option T	**Constraints/values** • Low laying land on water frontage **Potential effects** • Coastal inundation anticipated on water frontage. • Foreshore retreat expected. **Opportunities** • Nil.	7
Option W	**Constraints/values** • Nil. **Potential effects** • Minor foreshore retreat expected **Opportunities** • Nil.	8
Option X	**Constraints/values** • Very minor coastal inundation at the edges of the site **Potential effects** • Very minor coastal inundation, but not impacting the plant location. **Opportunities** • Nil.	7
Option Z	**Constraints/values** • Coastal inundation present within wider site. **Potential effects** • Coastal inundation present within wider site boundaries but not impacted plant location.	7

10.1 Recommendation

Options B, C, and W rank the highest with no key differentiators between them.

10.2 Assumptions and limitations

Nil. Note: no changes to the scores were made following MCA workshop #3.

11 Highly productive land summary sheet – technical specialist assessment

Technical discipline:	Potential Loss of Highly Productive Land
Criteria:	Highly Productive Land
Date:	1/12/21
Author:	Garrett Hall (Beca)

11.1 Purpose

This summary sheet has been prepared to assist with the assessment of short list options for the Southwest Wastewater Treatment Plant and for the statutory process under the Resource Management Act for the Notices of Requirement.

11.2 Summary of assessment

All short-listed sites sit within Land Use Capability (LUC) 2 classified land. This is described as:

"…very good land with slight physical limitations to arable use, readily controlled by management and soil conservation practices. The land is suitable for many cultivated crops, vineyards and berry fields, pasture, tree crops or production forestry. The most common physical limitations may include:

- *Slight susceptibility to erosion under cultivation*
- *Moderate soil depth (45 – 90 cm)*
- *Slight wetness after drainage*
- *Occasional flood overflow*
- *Unfavourable soils structure and difficulty in working*
- *Very weak to weakly saline*
- *Slight climatic limitations"*

Source: Land Use Capability Survey Handbook: A New Zealand Handbook for the Classification of Land, 3rd Edition, Agresearch Limited, Landcare Research New Zealand Limited and Institute of Geological and Nuclear Sciences Limited.

The Proposed National Policy Statement for Highly Productive Land (NPS-HPL) was published for consultation in 2019 and submissions received. As of December 2021, the Ministry for the Environment and Ministry for Primary Industries are reviewing public submissions and final decisions are likely to be made by ministers and Cabinet in the first half of 2022[1].

[1] Proposed National Policy Statement for Highly Productive Land | NZ Government (mpi.govt.nz)

The discussion document on the proposed NPS-HPL states that:

> *"The purpose of the proposed NPS is to improve the way highly productive land is managed under the RMA. It does not provide absolute protection of highly productive land, but rather it requires local authorities to proactively consider the resource in their region or district to ensure it is available for present and future primary production. A focus of the NPS is to protect highly productive land from "inappropriate subdivision, use and development". Councils would have some flexibility in how they apply this through regional policy statements and district plans. The proposal does not impact on existing urban areas and land that councils have identified as future urban zones in district plans."*

Highly Productive Land is defined in the NPS-HPL as Class 1-3 under the LUC, although the NPS-HPL would require councils to identify highly productive land in regional policy statements and district plans using the LUC classification system.

Given all short-listed sites are located on LUC land, the development of a new Wastewater Treatment Plant (WWTP) would involve the loss of LUC 2 land.

For all greenfield sites, being sites B, C, S, T, X and W, the land is either currently being used for arable farming (in the case of C and T), or has the potential to be used for that purpose. The area of the WWTP (up to 4ha) would be lost for the new WWTP infrastructure. This is deemed to be a low-moderate adverse effect, as the land would be lost permanently. Therefore all of these sites have been scored 5

.

For site Z, the existing Waiuku WWTP site, although the underlying LUC classification is 2, arable farming would not be able to occur on this site given its use as a WWTP and that the site is classified as a Hazardous Activities Industries List (HAIL) site under the National Environmental Standard for the Protection of Human Health from Contaminants in Soils. Development of this site would therefore not result in the loss of highly productive land, and this site has been scored 9.

11.3 Recommendation

From a loss of highly productive land perspective only, site X is preferred as it will not result in the loss of land that is currently used for, or could in the future be used for, arable farming purposes.

11.4 Assumptions and limitations

All sites have been assessed using the Land Use Capability classification, New Zealand Land Resource Inventory.

Sites have been assessed for their potential to be used for arable farming, not their current land-use. Note: there were no changes to these scores following MCA workshop #3.

12 Constructability summary sheet – technical specialist assessment

Technical discipline:	Constructability
Criteria:	5a. Wastewater conveyance – Constructability 5b. Construction risk – Constructability 5c. WWTP construction – Constructability
Date:	1/12/2021
Author:	Will Dufour and George Pedroso (Beca), Craig Cock (Fulton Hogan), Graham Nairn, Andre Stuart and Haydee Allan (Watercare), Troy McAlister (T&T)

12.1 Purpose

This summary sheet has been prepared to assist with the assessment of short list options for the Southwest Wastewater Treatment Plant and for the statutory process under the Resource Management Act for the Notices of Requirement.

12.2 Summary of assessment

Option	Potential effects and opportunities	MCA score (1-9)
Option B	**5a. Wastewater conveyance – Constructability** **Constraints/values** • Long pipeline from Waiuku -tricky undulating terrain to convey wastewater (requires a daisy chain of pumping stations) **Opportunities** • Located near areas of population growth in the north – this means the length of pipelines with the greatest variability in base flow over time are minimised. This simplifies design and therefore construction and commissioning by avoiding having additional assets (two pipes or cross connections pumping treated effluent around in circles). These are also the pipelines with the greatest risk of resident times and septicity. • Located closest to the outfall - Shorter pipes • Waiau Beach and Crispe Rd can pump direct to new WWTP (rather than daisy chain via Clarks Beach PS) • One marine crossing • Only one pipe in narrow single access road corridors.	8

Option	Potential effects and opportunities	MCA score (1-9)
	5b. Construction risk **Constraints/values** • None noted. **Opportunities** • Conveyance – One marine crossing reduces drilling risk – One pipe in road reduces traffic management risk. • WWTP – Open farmland, no obvious constraints (Geotech covered in section 5c).	8
	5c. WWTP Construction **Constraints/values** • Longer access road. • Reasonable cut and fill volumes **Opportunities** • Open farmland, no obvious constraints • Large site with alternative sublocations may be able to reduce cut and fill volumes.	8
Option C	**5a. Wastewater conveyance – Constructability** **Constraints/values** • Long pipeline from Waiuku -tricky undulating terrain to convey wastewater (requires a daisy chain of pumping stations) **Opportunities** • Located near areas of population growth in the north – this means the length of pipelines with the greatest variability in base flow over time are minimised. This simplifies design and therefore construction and commissioning by avoiding having additional assets (two pipes or cross connections pumping treated effluent around in circles). These are also the pipelines with the greatest risk of resident times and septicity. • Located 2nd closest to the outfall - Shorter pipes • Waiau Beach and Crispe Rd can pump direct to new WWTP (rather than daisy chain via Clarks Beach PS) • One marine crossing • Only one pipe in narrow single access road corridors. • Optimise the alignment of the Taihiki River crossing to go direct to the new WWTP (rather than up Boyd Rd and Clarks Beach Rd) • Could explore utilising the membrane pumps to convey treated effluent to the outfall removing the need for an extra pump station (depends on where the tidal storage is located).	7

Option	Potential effects and opportunities	MCA score (1-9)
	5b. Construction risk **Constraints/values** • None noted. **Opportunities** • Conveyance – One marine crossing reduces drilling risk – One pipe in road reduces traffic management risk. • WWTP – Open farmland, no obvious constraints (Geotech covered in section 5c).	8
	5c. WWTP Construction **Constraints/values** • Pockets of sandiness **Opportunities** • Use of northern end of site to reduce utility and pipeline lengths. • Open farmland, no obvious constraints • Large site with alternative sublocations may be able to reduce cut and fill volumes. More constrained in northern area.	8
Option S	**5a. Wastewater conveyance – Constructability** **Constraints/values** • Long pipeline from Clarks Beach/Kingseat requires a daisy chain of pumping stations including an intermediate PS located adjacent Taihiki River • Long pipeline to the outfall (including an additional Taihiki River crossing) • The WWTP site is located ~1.5km distance from Glenbrook Beach Road which forms the main spine of the wastewater conveyance pipelines • Two pipes in Glenbrook Beach Road, through Kahawai point development and up Boyd road. Very narrow road corridors in places. • South of the Taihiki River – construction and commissioning of raw wastewater pipelines south of Clarks Beach will require extra assets to address low start up populations (two pipes or cross connections pumping treated effluent around in circles). These are also the pipelines with the greatest risk of resident times and septicity. • Two marine crossings. **Opportunities** • Kahawai Point development could directly connect to new WWTP (LPS and gravity) instead of daisy chain from the Glenbrook Beach PS. • Located at the bottom of the “Waiuku” hill – means that the wastewater from Waiuku can gravitate from the top of the hill	3

Option	Potential effects and opportunities	MCA score (1-9)
	5b. Construction risk **Constraints/values** • Conveyance – Extra drilled marine crossing increases construction risk. – Extra pipe in narrow road corridors • WWTP **Opportunities** • Conveyance • WWTP – Open farmland, no obvious constraints	7
	5c. WWTP Construction **Constraints/values** • 5cm bands of sandiness. • Water table is generally low, but pockets may be present. • Long distance from road for access, pipelines. • Furthest from residential centres for utilities. **Opportunities** • Flat farmland, no obvious constraints.	5
Option T	**5a. Wastewater conveyance – Constructability** **Constraints/values** • Long pipeline from Clarks Beach/Kingseat requires a daisy chain of pumping stations including an intermediate PS located adjacent Taihiki River • Long pipeline to the outfall (including an additional Taihiki River crossing) • Two pipes in Glenbrook Beach Road, through Kahawai point development and up Boyd road. Very narrow road corridors in places. • South of the Taihiki River – construction and commissioning of raw wastewater pipelines south of Clarks Beach will require extra assets to address low start up populations (two pipes or cross connections pumping treated effluent around in circles). These are also the pipelines with the greatest risk of resident times and septicity. • Two marine crossings. **Opportunities** • Kahawai Point development could directly connect to new WWTP (LPS and gravity) instead of daisy chain from the Glenbrook Beach PS. • Located at the bottom of the “Waiuku” hill – means that the wastewater from Waiuku can gravitate from the top of the hill • The WWTP site is located adjacent Glenbrook Beach Rd (and the main conveyance pipe from Waiuku)	4

Option	Potential effects and opportunities	MCA score (1-9)
	5b. Construction risk **Constraints/values** • Conveyance – Extra drilled marine crossing increases construction risk. – Extra pipe in narrow road corridors • WWTP **Opportunities** • Conveyance • WWTP – Open farmland, no obvious constraints	7
	5c. WWTP Construction **Constraints/values** • 5cm bands of sandiness. • Water table is generally low, but pockets may be present. • Distance from residential centres for utilities. **Opportunities** • Open farmland, no obvious constraints. • May be opportunity to reuse existing ponds.	8
Option W	**5a. Wastewater conveyance – Constructability** **Constraints** • Long pipeline from Clarks Beach/Kingseat requires a daisy chain of pumping stations including an intermediate PS located adjacent Taihiki River • Long pipeline to the outfall (including an additional Taihiki River crossing) • Two pipes through Kahawai point development and up Boyd Road. Very narrow road corridors in places. • South of the Taihiki River – construction and commissioning of raw wastewater pipelines south of Clarks Beach will require extra assets to address low start up populations (two pipes or cross connections pumping treated effluent around in circles). These are also the pipelines with the greatest risk of resident times and septicity. • Two marine crossings. **Opportunities** • Kahawai Point development could directly connect to new WWTP (LPS and gravity) instead of daisy chain from the Glenbrook Beach PS. • Located at the bottom of the “Waiuku” hill – means that the wastewater from Waiuku can gravitate from the top of the hill • The WWTP site is located adjacent Glenbrook Beach Rd (and the main conveyance pipe from Waiuku)	5

Option	Potential effects and opportunities	MCA score (1-9)
	5b. Construction risk **Constraints/values** • Conveyance – Extra drilled marine crossing increases construction risk. – Extra pipe in narrow road corridors • WWTP – Lower flexibility due to smaller site. Limited scope to move elements to avoid difficult areas e.g. near water. May be able to get more space in combination with Site X. **Opportunities** • Conveyance • WWTP – Open farmland.	5
	5c. WWTP Construction **Constraints** • No easy build platform leading to high cut and fill. • Some assets close to river. May be able to get more space in combination with Site X. **Opportunities** • Open farmland.	7

Option	Potential effects and opportunities	MCA score (1-9)
Option X	**5a. Wastewater conveyance – Constructability** **Constraints** • Long pipeline from Clarks Beach/Kingseat requires a daisy chain of pumping stations including an intermediate PS located adjacent Taihiki River • Long pipeline to the outfall (including an additional Taihiki River crossing) • Two pipes through Kahawai point development and up Boyd Road. Very narrow road corridors in places. • South of the Taihiki River – construction and commissioning of raw wastewater pipelines south of Clarks Beach will require extra assets to address low start up populations (two pipes or cross connections pumping treated effluent around in circles). These are also the pipelines with the greatest risk of resident times and septicity. • Two marine crossings. • There is a high point in the topology that means you cannot easily gravitate down the Waiuku hill to the WWTP site. Long syphon or extra PS may be needed. **Opportunities** • Kahawai Point development could directly connect to new WWTP (LPS and gravity) instead of daisy chain from the Glenbrook Beach PS. • The WWTP site is located adjacent Glenbrook Beach Rd (and the main conveyance pipe from Waiuku)	4
	5b. Construction risk **Constraints/values** • Conveyance – Extra drilled marine crossing increases construction risk. – Extra pipe in narrow road corridors • WWTP – Lower flexibility due to smaller site. Limited scope to move elements to avoid difficult areas e.g. near cliffs. **Opportunities** • Conveyance • WWTP – Open farmland.	5
	5c. WWTP Construction **Constraints** • Close to cliffs and no easy build platform leading to high cut and fill. **Opportunities** • Open farmland.	3

Option	Potential effects and opportunities	MCA score (1-9)
Option Z	**5a. Wastewater conveyance – Constructability** **Constraints** • Long pipeline from Clarks Beach/Kingseat requires a daisy chain of pumping stations including an intermediate PS located adjacent Taihiki River • Longest distance from the outfall (including an additional Taihiki River crossing). • Two pipes in between Clarks Beach and Waiuku WWTP. Very narrow road corridors in places. • South of the Taihiki River – construction and commissioning of raw wastewater pipelines south of Clarks Beach will require extra assets to address low start up populations (two pipes or cross connections pumping treated effluent around in circles). These are also the pipelines with the greatest risk of resident times and septicity. • Two marine crossings. **Opportunities** • The Waiuku community is connected to the site via an existing pipe.	1
	5b. Construction risk **Constraints/values** • Conveyance – Extra drilled marine crossing increases construction risk. – Extra pipe in narrow road corridors • WWTP – Construction on an operational WWTP. Need to ensure continued consent compliance and safe operations. – Contaminated land risk (HAIL site). – Laydown areas limited **Opportunities** • Conveyance • WWTP	2
	5c. WWTP Construction **Constraints** • Geotech - more competent than other sites. • Very far from utilities. Significant upgrades required to get these to site. **Opportunities** • Existing ponds may be able to be reused.	7

12.3 Recommendation

Sites B and C ranked best from a constructability perspective. This is due to the benefits on both the treatment plant and network sides.

The network assets are significantly reduced simplifying their construction and commissioning. The benefits include:

- Reduces the space used in the road corridors,
- Avoiding further duplication of pipes or installation of complex assets for flushing to manage the difference in start-up and ultimate flows.
- Avoiding extra higher risk drilling.

On the treatment side these sites are relatively large and open sites. They have space within them to optimise the arrangement and have good access to utilities

Site T is also a good option from a WWTP constructability perspective, but scores lower on the network side due to the difficulties with the construction and commissioning of the extra pipework and directional drill between Clarks Beach.

12.4 Assumptions and limitations

- Based on a high level (GIS based) assessment of the conveyance scheme.
- No detailed hydraulic calculations have been completed to confirm the scheme design. The pipeline sizes are indicative and are based on targeting a velocity of 0.9 – 2m/s (preferably <1.5m/s)
- Pipeline alignments are based on following the nearest road where available and are subject to optimisation and further design in the next stages including consideration of pipeline alignments in private property and directional drilling options.
- A separate geotechnical specialist summary sheet is available however the geotechnical impacts are included in the WWTP constructability scores alongside the other criteria for assessment in that category.
- For the WWTP constructability category given the wide range of criteria within the category we first ranked the sites from 1 to 7 based on their access, cut and fill volumes, and closeness to utilities. The geotechnical considerations were also scored. This provided a high level indication of the better and worse sites to help guide the scoring. The ultimate scores were then agreed among the team.

During the MCA workshop, the following scores were changed:

- Option B: 5c changed from 7 to 8.
- Option C: 5a changed from 6 to 7; 5c changed from 9 to 8
- Option Z: 5a changed from 2 to 1.

13 Operability/network design summary sheet – technical specialist assessment

Technical discipline:	Operability / Network design
Criteria:	*6a. Operation and maintenance* *6b. Hydraulic Considerations - Operability* *6c. Short-term serviceability – Operability*
Date:	3/12/2021
Author:	Will Dufour (Beca), Kirsten Dickson (Fulton Hogan), Graham Nairn, Andre Stuart and Haydee Allan (Watercare).

13.1 Purpose

This summary sheet has been prepared to assist with the assessment of short list options for the Southwest Wastewater Treatment Plant and for the statutory process under the Resource Management Act for the Notices of Requirement.

13.2 Summary of assessment

Option	Potential effects and opportunities	MCA score (1-9)
Option B	**6a. Operation and Maintenance** **Constraints** • Reuse plant possibly too close to the sloping ground. Could be relocated. **Opportunities** • Potential expansion options available	8

Option	Potential effects and opportunities	MCA score (1-9)
	6b. Hydraulic Considerations - Operability **Constraints** • Long pipeline from Waiuku. **Opportunities** • Minimise total pipe length. • Located near areas of population growth in the north – this means the length of pipelines with the greatest variability in base flow over time are minimised. This helps ensure the design velocities in the pipes are appropriate over their life. • Natural syphons (e.g. Taihiki crossing) will be pumped and will have more similar start up and ultimate flows making management of hydraulics easier. • Located closest to the outfall with minimal head between the site and outfall - Shorter pipes. May have opportunity to avoid treated effluent pump station and use permeate pumps to convey to Clarks Beach depending on location within site and tidal storage solution. May be more difficult to achieve this than site C. • Waiau Beach and Crispe Rd can pump direct to new WWTP (rather than daisy chain via Clarks Beach PS) • May be able to gravitate Kingseat flows from Waiau Pa helping manage start up flows and septicity.	9
	6c. Short-term serviceability **Constraints/values** • Servicing short term growth in this area will be difficult so no sites have scored well for this criterion. **Opportunities** • Can use Waiuku pipeline to convey current Kahawai Point flows but would need pre-treatment as velocities will not be sufficient to convey solids.	4
Option C	**6a. Operation and Maintenance** **Constraints** • Natural streams onsite that restrict land use • Future expansion options seem restricted. • Long access drive. **Opportunities** • Alternative location south of that shown possibly better but appropriate bridging over streams required	8

Option	Potential effects and opportunities	MCA score (1-9)
	6b. Hydraulic Considerations - Operability **Constraints** • Long pipeline from Waiuku. **Opportunities** • Located near areas of population growth in the north – this means the length of pipelines with the greatest variability in base flow over time are minimised. This helps ensure the design velocities in the pipes are appropriate over their life. • Natural syphons (e.g. Taihiki crossing) will be pumped and will have more similar start up and ultimate flows making management of hydraulics easier. • Located near outfall and on elevated land with minimal head between the site and outfall - Shorter pipes. May have opportunity to use permeate pumps to convey to Clarks Beach depending on location within site and tidal storage solution. • Waiau Beach and Crispe Rd can pump direct to new WWTP (rather than daisy chain via Clarks Beach PS) • May be able to gravitate Kingseat flows from Waiau Pa helping manage start up flows and septicity.	8
	6c. Short-term serviceability **Constraints/values** • Servicing short term growth in this area will be difficult so no sites have scored well for this criterion. • The Waiuku pipeline may need to be modified if it is to operate in the other direction. **Opportunities** • Could use Waiuku pipeline to convey current Kahawai Point flows but would need pre-treatment as velocities will not be sufficient to convey solids.	4
Option S	**6a. Operation and Maintenance** **Constraints** • Rather long access drive. • Exiting the Plant with slow trucks is a possible H&S issue. • Possible coastal erosion **Opportunities** • Good expansion potential	8

Option	Potential effects and opportunities	MCA score (1-9)
	6b. Hydraulic Considerations - Operability **Constraints** • Long total pipeline length. • Located away from residential areas. • Long pipeline from Clarks Beach/Kingseat requires a daisy chain of pumping stations including an intermediate PS located adjacent Taihiki River • Far from growth areas in Kingseat and Clarks Beach. The length of pipelines with the greatest variability in base flow over time are longer. This makes ensuring the design velocities in the pipes are appropriate over their life difficult. • Management of raw wastewater velocities through the Taihiki syphon will be difficult. • To achieve flushing velocities in the pipeline from the north we may require two raw wastewater pipes and two Taihiki river crossings or a cross connection with the treated effluent line and associated valves and controls to enable treated effluent to be used achieve flushing velocities and carry the wastewater solids through the pipeline. **Opportunities** • Located at the bottom of the "Waiuku" hill – means that the wastewater from Waiuku can gravitate from the top of the hill	4
	6c. Short-term serviceability **Constraints/values** • Servicing short term growth in this area will be difficult so no sites have scored well for this criterion. • There would be additional complexity to joint Kahawai Point to the Waiuku pipeline. This may include a cross connection of the between the Clarks Beach raw wastewater pipe and the Waiuku pipeline. This may add to the programme. • The Waiuku pipeline may need to be modified if it is to operate in the other direction. **Opportunities** • Can use Waiuku pipeline in combination with another pipeline to convey current Kahawai Point flows but would need pre-treatment as velocities will not be sufficient to convey solids.	2
Option T	**6a. Operation and Maintenance** **Constraints** • Natural streams onsite restrict land use • Future expansion options seem restricted	8

Option	Potential effects and opportunities	MCA score (1-9)
	6b. Hydraulic Considerations - Operability **Constraints** • Long total pipeline length. • Located away from residential areas. • Long pipeline from Clarks Beach/Kingseat requires a daisy chain of pumping stations including an intermediate PS located adjacent Taihiki River • Far from growth areas in Kingseat and Clarks Beach. The length of pipelines with the greatest variability in base flow over time are longer. This makes ensuring the design velocities in the pipes are appropriate over their life difficult. • Management of raw wastewater velocities through the Taihiki syphon will be difficult. • To achieve flushing velocities in the pipeline from the north we may require two raw wastewater pipes and two Taihiki river crossings or a cross connection with the treated effluent line and associated valves and controls to enable treated effluent to be used achieve flushing velocities and carry the wastewater solids through the pipeline. **Opportunities** • Located at the bottom of the "Waiuku" hill – means that the wastewater from Waiuku can gravitate from the top of the hill	4
	6c. Short-term serviceability **Constraints/values** • Servicing short term growth in this area will be difficult so no sites have scored well for this criterion. • There would be additional complexity to joint Kahawai Point to the Waiuku pipeline. This may include a cross connection of the between the Clarks Beach raw wastewater pipe and the Waiuku pipeline. This may add to the programme. • The Waiuku pipeline may need to be modified if it is to operate in the other direction. **Opportunities** • Can use Waiuku pipeline in combination with another pipeline to convey current Kahawai Point flows but would need pre-treatment as velocities will not be sufficient to convey solids.	2
Option W	**6a. Operation and Maintenance** **Constraints** • Rather long access drive. **Opportunities** • Good expansion potential	7

Option	Potential effects and opportunities	MCA score (1-9)
	6b. Hydraulic Considerations - Operability **Constraints** • Pipeline from Clarks Beach/Kingseat requires a daisy chain of pumping stations including an intermediate PS located adjacent Taihiki River • Other side of the Taihiki River from growth areas in Kingseat and Clarks Beach. The length of pipelines with the greatest variability in base flow over time are longer. This makes management of raw wastewater velocities through the Taihiki syphon difficult. • To achieve flushing velocities in the pipeline from the north we may require two raw wastewater pipes and two Taihiki river crossings or a cross connection with the treated effluent line and associated valves and controls to enable treated effluent to be used achieve flushing velocities and carry the wastewater solids through the pipeline. **Opportunities** • Located near the bottom of the "Waiuku" hill – May be able to gravitate Waiuku wastewater from the top of the hill. • Kahawai Point development could directly connect to new WWTP (LPS and gravity) instead of daisy chain from the Glenbrook Beach PS.	5
	6c. Short-term serviceability **Constraints/values** • Servicing short term growth in this area will be difficult so no sites have scored well for this criterion. • There may be some minor additional complexity to joint Kahawai Point to the Waiuku pipeline. This may include a cross connection of the between the Clarks Beach raw wastewater pipe and the Waiuku pipeline. This may add to the programme. • The Waiuku pipeline may need to be modified if it is to operate in the other direction. **Opportunities** • Can use Waiuku pipeline in combination to convey current Kahawai Point flows but would need pre-treatment as velocities will not be sufficient to convey solids.	3
Option X	**6a. Operation and Maintenance** **Constraints** • Rather long access drive. • Exiting the Plant with slow trucks is a possible H&S issue. • Possible coastal erosion **Opportunities** • Good expansion potential	6

Option	Potential effects and opportunities	MCA score (1-9)
	6b. Hydraulic Considerations - Operability **Constraints** • Pipeline from Clarks Beach/Kingseat requires a daisy chain of pumping stations including an intermediate PS located adjacent Taihiki River • Other side of the Taihiki River from growth areas in Kingseat and Clarks Beach. The length of pipelines with the greatest variability in base flow over time are longer. This makes management of raw wastewater velocities through the Taihiki syphon difficult. • To achieve flushing velocities in the pipeline from the north we may require two raw wastewater pipes and two Taihiki river crossings or a cross connection with the treated effluent line and associated valves and controls to enable treated effluent to be used achieve flushing velocities and carry the wastewater solids through the pipeline. • There is a high point in the topology that means you can't easily gravitate down the Waiuku hill to the WWTP site. Long syphon or extra pump station may be needed to lift the wastewater to the inlet works at the WWTP. **Opportunities** • Kahawai Point development could directly connect to new WWTP (LPS and gravity) instead of daisy chain from the Glenbrook Beach PS.	3
	6c. Short-term serviceability **Constraints/values** • Servicing short term growth in this area will be difficult so no sites have scored well for this criterion. • There may be some minor additional complexity to joint Kahawai Point to the Waiuku pipeline. This may include a cross connection of the between the Clarks Beach raw wastewater pipe and the Waiuku pipeline. This may add to the programme. • The Waiuku pipeline may need to be modified if it is to operate in the other direction. **Opportunities** • Can use Waiuku pipeline in combination to convey current Kahawai Point flows but would need pre-treatment as velocities will not be sufficient to convey solids.	3
Option Z	**6a. Operation and Maintenance** **Constraints** • Steep driveway, some coastal erosion **Opportunities** • Large space, existing site.	7

Option	Potential effects and opportunities	MCA score (1-9)
	6b. Hydraulic Considerations - Operability **Constraints** • Pipeline from Clarks Beach/Kingseat requires a daisy chain of pumping stations including an intermediate PS located adjacent Taihiki River • Away from growth areas in the North. The length of pipelines with the greatest variability in base flow over time are longer. This makes management of raw wastewater velocities difficult. This will be particularly difficult at the Taihiki river crossing and the long hill prior to the Waiuku site. • To achieve flushing velocities in the pipeline from the north we may require two raw wastewater pipes and two Taihiki river crossings or a cross connection with the treated effluent line and associated valves and controls to enable treated effluent to be used achieve flushing velocities and carry the wastewater solids through the pipeline. **Opportunities** • Closer to Waiuku if there is higher than expected growth there.	1
	6c. Short-term serviceability **Constraints/values** • Servicing short term growth in this area will be difficult so no sites have scored well for this criterion. **Opportunities** • Can bring forward the construction of the pipeline to Waiuku to convey current Kahawai Point flows but would need pre-treatment as velocities will not be sufficient to convey solids.	5

13.3 Recommendation

Sites B and C ranked best from a network operability perspective followed by W and T.

The northern sites are favoured due to their vicinity to the major growth areas. The population in the northern areas will grow to 5 to 6 times their current populations over the next 30 years (from ~2,500 to ~15,000).

In order to ensure pipes operate effectively the wastewater needs to move fast enough at least some of the day to carry the solids through the line and avoid them settling at the bottom. There is also a maximum speed the water can travel through the pipes to avoid putting too much force on the pipes and to ensure the pumps operate efficiently.

These minimum and maximum flows limit the pipes ability to cater to large changes in population. In order to operate large pipes sized for future populations with small starting flows additional assets can be installed to ensure the system works. These could include:

- Installing flushing systems. One option is to install large tanks to hold back wastewater generated over a period of time and then to release it all at once. This could also be a connection to another water supply (such as a potable water line or in this case the treated

effluent pipe) with associated controls that can be turned on periodically to convey the solids through the system.

- Installation of two pipes. One designed for the initial populations and a larger one that will be used once the population growth has occurred.

13.4 Assumptions and limitations

- Based on a high level (GIS based) assessment of the conveyance scheme.
- No detailed hydraulic calculations have been undertaken to confirm the scheme design. The pipeline sizes are indicative and are based on targeting a velocity of 0.9 – 2m/s (preferably <1.5m/s)
- Pipeline alignments are based on following the nearest road where available and are subject to optimisation and further design in the next stages including consideration of pipeline alignments in private property and directional drilling options.
- The scores for the short-term serviceability are low as this will be difficult with all options. We also should avoid putting too much weighting on short term constraints when making decisions that will have long term impacts.
- The short term servicing assumes the developers will install a temporary MBR.

Note – following the MCA workshop, the 6b score for site Z changed from 2 to 1.

14 Greenhouse gas emissions summary sheet – technical specialist assessment

Technical discipline:	Greenhouse Gas Emissions
Criteria:	*7a: Greenhouse gas emissions generated from the construction of the wastewater treatment and conveyance infrastructure* *7b: Operational greenhouse gas emissions*
Date:	29/11/2021
Author:	Haydee Allan, Chris Allen, Andre Stuart (Watercare), Natasha Neeve (Watercare)

14.1 Purpose

This summary sheet has been prepared to assist with the assessment of short list options for the Southwest Wastewater Treatment Plant and for the statutory process under the Resource Management Act for the Notices of Requirement.

14.2 Summary of assessment

Option	Potential effects and opportunities	MCA score (1-9)
Option B	***7a Greenhouse gas emissions*** **Potential effects** • The capital carbon impact from the construction is estimated at 26.62 M kg/CO_2	7
	7b Operational greenhouse gas emissions **Potential effects** • The 2050 comparative operational carbon emissions are estimated at 81 CO_2e t/year	6
Option C	***7a Greenhouse gas emissions*** **Potential effects** • The capital carbon impact from the construction is estimated at 27.15 M kg/CO_2	6
	7b Operational greenhouse gas emissions **Potential effects** • The 2050 comparative operational carbon emissions are estimated at 89 CO_2e t/year	5
Option S	***7a Greenhouse gas emissions*** **Potential effects**	3

Option	Potential effects and opportunities	MCA score (1-9)
	• The capital carbon impact from the construction is estimated at 32.65 M kg/CO_2	
	7b Operational greenhouse gas emissions **Potential effects** • The 2050 comparative operational carbon emissions are estimated at 92 CO_2e t/year	5
Option T	***7a Greenhouse gas emissions*** **Potential effects** • The capital carbon impact from the construction is estimated at 29.41 M kg/CO_2	5
	7b Operational greenhouse gas emissions **Potential effects** • The 2050 comparative operational carbon emissions are estimated at 92 CO_2e t/year	5
Option W	***7a Greenhouse gas emissions*** **Potential effects** • The capital carbon impact from the construction is estimated at 28.88 M kg/CO_2	5
	7b Operational greenhouse gas emissions **Potential effects** • The 2050 comparative operational carbon emissions are estimated at 88 CO_2e t/year	5
Option X	***7a Greenhouse gas emissions*** **Potential effects** • The capital carbon impact from the construction is estimated at 27.52 M kg/CO_2	6
	7b Operational greenhouse gas emissions **Potential effects** • The 2050 comparative operational carbon emissions are estimated at 74 CO_2e t/year	7
Option Z	***7a Greenhouse gas emissions***	2

Option	Potential effects and opportunities	MCA score (1-9)
	• The capital carbon impact from the construction is estimated at 35.37 M kg/CO_2	
	7b Operational greenhouse gas emissions **Constraints/values** **Potential effects** • The 2050 comparative operational carbon emissions are estimated at 191 CO_2e t/year	3

14.3 Recommendation

The capital carbon emissions are the main differentiator between site, with the differences in pipeline lengths being the main contributor. Given this, and that site B has the lowest capital carbon emissions associated with it, this is the preferred site. Sites C and X are the next preferred.

14.4 Assumptions and limitations

- The operational carbon emissions from each site over the next 30 years account for only 5 to 8% of the differences between the sites on a whole of life basis.
- The emissions exclude the power from the TE pipeline which may changes which sites have lower emissions.
- Some sites have better carbon offset options. These are the sites that have been access to the Awhitu where we could look to grow trees such as sites B, C and X.
- The scoring has not been adjusted to allow for the offset potential but have noted it in the comments.

15 Reuse summary sheet – technical specialist assessment

Technical discipline:	Reuse / Strategy
Criteria:	8. Reuse
Date:	30/11/2021
Author:	Chris Allen, Haydee Allan, Andre Stuart (Watercare)

15.1 Purpose

This summary sheet has been prepared to assist with the assessment of short list options for the Southwest Wastewater Treatment Plant and for the statutory process under the Resource Management Act for the Notices of Requirement.

15.2 Summary of assessment

Option	Potential effects and opportunities	MCA score (1-9)
Option B	**Constraints/values** • Further from Kaawa aquifer for indirect potable reinjection • Development of the land **Opportunities** • **Potable** • Space for reuse • Brine treatment difficult for all potable reuse options – Brine to outfall? Diluted with stormwater – Brine to land – large site. • Coastal – inundation creating salt marsh. Could do brine treatment where inundation is expected for sea level rise. • Ponds to store • Close to communities • Close to existing ring main from metropolitan supply. Could feed back to Pukekohe • Longer term could build second WWTP around Waiuku and convey MBR treated WW south for indirect potable reuse (aquifer reinjection). • **Land** • Potable to crops • Growing crops with indirect contact (e.g. kiwifruit) • Vicinity to Awhitu – Cut and carry on Awhitu – Carbon sink on Awhitu, convert dairy, plant trees, using water and nutrients, could plant natives. • **Industrial** • Could take south in future (deferral of pipeline rather than removal).	7

Option	Potential effects and opportunities	MCA score (1-9)
	• Could take off either raw WW or treat a portion at Waiuku for reuse. • Longer term could build second WWTP around Waiuku and convey MBR treated WW south for reuse (lower CH4 emissions than raw conveyance)	
Option C	**Constraints/values** • Further from Kaawa aquifer for indirect potable reinjection **Opportunities** • **Potable** • Space for reuse • Brine treatment difficult for all potable reuse options – Brine to outfall? Diluted with stormwater – Brine to land – large site. • Coastal – inundation creating salt marsh. Could do brine treatment where inundation is expected for sea level rise. • Ponds to store • Close to communities • Close to existing ring main from metropolitan supply. Could feed back to Pukekohe • Longer term could build second WWTP around Waiuku and convey MBR treated WW south for indirect potable reuse (aquifer reinjection). • **Land** • Potable to crops. • Growing crops with indirect contact (e.g. kiwifruit, citrus) • Vicinity to Awhitu (slightly further than B) – Cut and carry on Awhitu – Carbon sink on Awhitu, convert dairy, plant trees, using water and nutrients, could plant natives. • **Industrial** • Could take south in future (deferral of pipeline rather than removal). • Could take off either raw WW or treat a portion at Waiuku for reuse. • Longer term could build second WWTP around Waiuku and convey MBR treated WW south for reuse (lower CH_4 emissions than raw conveyance)	7
Option S	**Constraints/values** • Mid distance from Kaawa aquifer for indirect potable reinjection. Anecdotally Kaawa aquifer is saline in this area. • Hard to get to Awhitu and Tasman compared to B, C and Z. • Not close to larger residential areas. Pipe either under Taihiki or over hills to Waiuku. **Opportunities** • **Potable**	8

Option	Potential effects and opportunities	MCA score (1-9)
	• Space for reuse • Brine treatment difficult for all potable reuse options – Brine to outfall? Diluted with stormwater – Brine to land – large site. – Coastal – inundation creating salt marsh. Could do brine treatment where inundation is expected for sea level rise. • Ponds to store • Longer term could build second WWTP around Waiuku and convey MBR treated WW south for indirect potable reuse (aquifer reinjection). • Aquifer reinjection locally may have benefits for wider aquifer, but this would require modelling to understand the impacts. • **Land** • Currently in deer farming • Potable to crops. • Growing crops with indirect contact with food (e.g. kiwifruit, citrus). Slightly further than site T to these land uses. • Furthest from Awhitu – Cut and carry on Awhitu – Carbon sink on Awhitu, convert dairy, plant trees, using water and nutrients, could plant natives. • **Industrial** • Could take south in future closer than B/C (deferral of pipeline rather than removal). • Could take off either raw WW or treat a portion at Waiuku for reuse. • Longer term could build second WWTP around Waiuku and convey MBR treated WW south for reuse (higher CH4 emissions than B/C due to raw conveyance).	
Option T	**Constraints/values** • Mid distance from Kaawa aquifer for indirect potable reinjection. Anecdotally Kaawa aquifer is saline in this area. • Hard to get to Awhitu and Tasman compared to B, C and Z. • Not close to larger residential areas. Pipe either under Taihiki or over hills to Waiuku. **Opportunities** • **Potable** • Space for reuse • Brine treatment difficult for all potable reuse options – Brine to outfall? Diluted with stormwater – Brine to land – large site. – Coastal – inundation creating salt marsh. Could do brine treatment where inundation is expected for sea level rise. This site has a good area that could work for this. • Ponds to store	9

Option	Potential effects and opportunities	MCA score (1-9)
	• Longer term could build second WWTP around Waiuku and convey MBR treated WW south for indirect potable reuse (aquifer reinjection). • Aquifer reinjection locally may have benefits for wider aquifer, but this would require modelling to understand the impacts. • **Land** • Potable to crops. The landowner/farmer is keen to work with us on this. • Growing crops with indirect contact with food (e.g. kiwifruit, citrus). Lots of nearby opportunity. • Furthest from Awhitu – Cut and carry on Awhitu – Carbon sink on Awhitu, convert dairy, plant trees, using water and nutrients, could plant natives. • **Industrial** • Could take south in future closer than B/C (deferral of pipeline rather than removal). • Could take off either raw WW or treat a portion at Waiuku for reuse. • Longer term could build second WWTP around Waiuku and convey MBR treated WW south for reuse (lower CH4 emissions than raw conveyance). Less benefit from this than for B/C	
Option W with X	**Constraints/values** • Mid distance from Kaawa aquifer for indirect potable reinjection. Anecdotally Kaawa aquifer is saline in this area. • Hard to get to Awhitu and Tasman compared to B, C and Z, but better than S and T. • Not close to larger residential areas. Pipe either under Taihiki or over hills to Waiuku. • Smallest land area available of northern sites • Immediately next to medium intensity residential use. May limit land application. Visual impact from industrial looking plant on neighbours. **Opportunities** • **Potable** • Space for reuse • Brine treatment difficult for all potable reuse options – Brine to outfall? Diluted with stormwater – Brine to land – large site. – Coastal – inundation creating salt marsh. Could do brine treatment where inundation is expected for sea level rise. Less area than site T. • Ponds to store • Longer term could build second WWTP around Waiuku and convey MBR treated WW south for indirect potable reuse (aquifer reinjection). • Aquifer reinjection locally may have benefits for wider aquifer, but this would require modelling to understand the impacts.	7

Option	Potential effects and opportunities	MCA score (1-9)
	• **Land** • Currently in pastoral farming • Potable to crops. • Growing crops with indirect contact with food (e.g. kiwifruit, citrus). Slightly further than site T to these land uses. • Distance from Awhitu is better than T and S. – Cut and carry on Awhitu – Carbon sink on Awhitu, convert dairy, plant trees, using water and nutrients, could plant natives. • **Industrial** • Could take south in future closer than B/C (deferral of pipeline rather than removal). • Could take off either raw WW or treat a portion at Waiuku for reuse. • Longer term could build second WWTP around Waiuku and convey MBR treated WW south for reuse (higher CH4 emissions than B/C due to raw conveyance).	
Option X	• Assessed in combination with site W	7
Option Z	**Constraints/values** • Furthest from outfall for partial discharge (but pipe will be built as part of initial scheme) • Pipe oversized if we are taking flow out for reuse. Low velocities could cause operational problems. • Distance from utilities, access, contaminated land? • Smallest land area available • Not near wider metropolitan supply for export. Could only use what Waiuku needs. **Opportunities** • **General** • This site was identified as having good reuse opportunities during consenting • **Potable** • We own the land and its designated. • Similar distance to larger residential areas as B and C. • Brine treatment difficult for all potable reuse options – Brine to outfall? Diluted with stormwater – Brine to land would need to work with neighbouring sites. Nearest sites are zoned industrial. • Reuse of existing ponds to store water prior to reuse • Close to Kaawa Aquifer for potable reinjection. Removes the constraint around direct potable as you may be able reinject all of the reuse water. • Potential capacity constraints on the Kaawa Aquifer post 2050. • **Land** • Potable to crops but distance is further.	9

Option	Potential effects and opportunities	MCA score (1-9)
	• Growing crops with indirect contact with food (e.g. kiwifruit, citrus). Slightly further than site T to these land uses. • Good access to Awhitu and Tasman. – Cut and carry on Awhitu – Carbon sink on Awhitu, convert dairy, plant trees, using water and nutrients, could plant natives. • **Industrial** • There is more industrial zoned land in the area. • At this stage the main water using industry is the steel mill. They could use most of the water generated. The viability of this has not been confirmed Financial and technical constraints may limit this. Risk of closure. • Longer term could build second WWTP around Clarks Beach for use locally.	

15.3 Recommendation

Sites B, C, S, T, and Z provide good reuse options with each site slightly favouring a different outcome.

Sites B and C has good potential for land reuse both on the site itself, on nearby land and on the Awhitu where we could look to use the WW on forestry planted as a carbon sink to offset emissions. It is close to a residential area and the metropolitan water supply ring main.

Sites S and T have good immediate term prospects with reuse on crops or non-contact foods. These are further from the Awhitu peninsula reducing the potential for carbon or cut and carry crops. It is part way between the residential centres for potable reuse in the longer term.

Site Z is closest to the most likely Kaawa aquifer reinjection sites for reuse post 2050. There is industrial zoned land nearby. It is slightly further from land where it can be applied to crops but is close to Awhitu for carbon crops or cut and carry feed crops.

15.4 Assumptions and limitations

- All options have good reuse potential with different sites slightly favouring different reuse pathways.
- Reuse needs to be discussed culturally.
- Recovery of 60 to 70% would mean potable reuse could supply an amount roughly equivalent to Waiuku's water demand. Transfer between catchments needs to be considered.

Note: no changes to the scores were made following MCA workshop #3.

G

Appendix G – Short List Assessment

SOUTHWEST WWTP - SHORT LIST

Assessment Criteria		OPTION B		OPTION C		OPTION S		OPTION T		OPTION W		OPTION X		OPTION Z - Waiuku WWTP	
		Ranking	Rationale	Ranking	Rationale	Ranking	Rationale	Ranking	Rationale	Ranking	Rationale	Ranking	Rationale	Ranking	Rationale
1. Cultural values	1a Cultural Values														
2. Heritage	2a. Heritage	7	There are no sites and places of known value, heritage buildings, notable trees or sites and places of European cultural heritage value on site.	7	There are no sites and places of known value, heritage buildings, notable trees or sites and places of European cultural heritage value on site.	7	There are no sites and places of known value, heritage buildings, notable trees or sites and places of European cultural heritage value on site	7	There are no sites and places of known value, heritage buildings, notable trees or sites and places of European cultural heritage value on site	7	There are no sites and places of known value, heritage buildings, notable trees or sites and places of European cultural heritage value on site	7	There are no sites and places of known value, heritage buildings, notable trees or sites and places of European cultural heritage value on site	7	There are no sites and places of known value, heritage buildings, notable trees or sites and places of European cultural heritage value on site
	2b. Archaeology	7	The project will avoid the coast, which is the most likely location of archaeological sites (pre-European Māori middens), but there remains the possibility that both Māori and pre-1900 European sites may be discovered away from the coast	7	The project will avoid the coast, which is the most likely location of archaeological sites (pre-European Māori middens), but there remains the possibility that both Māori and pre-1900 European sites may be discovered away from the coast	7	The project will avoid the coast, which is the most likely location of archaeological sites (pre-European Māori middens), but there remains the possibility that both Māori and pre-1900 European sites may be discovered away from the coast	7	The project will avoid the coast, which is the most likely location of archaeological sites (pre-European Māori middens), but there remains the possibility that both Māori and pre-1900 European sites may be discovered away from the coast	7	The project will avoid the coast, which is the most likely location of archaeological sites (pre-European Māori middens), but there remains the possibility that both Māori and pre-1900 European sites may be discovered away from the coast	7	The project will avoid the coast, which is the most likely location of archaeological sites (pre-European Māori middens), but there remains the possibility that both Māori and pre-1900 European sites may be discovered away from the coast	7	The project will avoid the coast, which is the most likely location of archaeological sites (pre-European Māori middens), but there remains the possibility that both Māori and pre-1900 European sites may be discovered away from the coast
3. Social and community	3a. Land requirement	6	Watercare would be buying land at residential value (developer bought the block assuming it would be rezoned to residential). However, developers wish to accommodate Watercare.	7	No constraints identified to date, most likely to acquire rear portion of land with easement to access. Rural zoned land, and surrounded by lifestyle blocks. Rural rate $/m2 less than area B	7	Discussion on whether owner happy to sell yet to be had, however, potentially a willing vendor. The land is also zoned as rural, with surrounding land also zoned as rural.	8	Negligible constraints and effects. Potentially willing vendor - discussed selling 3 to 4 ha to Watercare and continuing to use the buffer land (with Watercare covenant), reducing purchase price. Owner also asked if the treated wastewater could be used to irrigate the crop - a positive outcome if feasible. Rural zoned land with surrounding rural zoned land	4	Resistance likley to be strong to sell.	4	Resistance likley to be strong to sell.	9	Land already owned by Watercare. No constraints, values, effects or opportunities have been identified.
	3b. Social impact	7	The potential Taihiki Trail is adjacent to the site, along the coast. Opportunity to enhance the trail - could contribute to the upgrade if within buffer. Currently direct access is not provided to the trail. If the opportunity was realised, could be scored higher	6	The potential Taihiki Trail is adjacent to the site, along the coast. Opportunity to enhance the trail - could contribute to the upgrade if within buffer. Site adjacent to the Karaka Point vineyard, which also includes a functioing lodge. However, the property was recently sold and the future of the site is uncertain.	7	Option S will have not direct impact on social, community or recreational facilities.	7	Option T will have not direct impact on social, community or recreational facilities, but several businesses are adjacent to the site. But on the assumption the proposed WWTP is located 300m away, impacts are likely to be low.	7	There are no community, social or recreational facilities located onsite or within close proximity to the site. If community or recreational facilities are developed in the adjacent FUZ, a sufficient distance has been maintained to minimise any adverse effects, however, they still may be felt.	7	There are no community, social or recreational facilities located onsite or within close proximity to the site. If community or recreational facilities are developed in the adjacent FUZ/SHZ a sufficient distance has been maintained to minimise adverse effects, however, they still may be felt.	7	Potential adverse impacts on esplanade reserve, with much of the plant positioned to the southern portion of the site. However, it does not look like there is defined public access. There are no effects on other community facilities.
	3c. Odour amenity	7	It is possible to locate the proposed WWTP at least 300m from existing rural dwellings and with a 200m site odour buffer distance. The current residential developments to the north and those proposed by the developer would over time increase the sensitivity of the receiving environment to nuisance odour. However, at present there is sufficient area to maintain a good level of separation between nearby residents and the proposed plant.	6	It is possible to locate the proposed WWTP at least 300m from existing rural dwellings and with a 200m site odour buffer distance. Although a 300m separation distance could be maintained between the WWTP and nearby sensitive receptor, given the number of nearby sensitive receptors there is a higher risk than a nuisance odour could at time be experienced by neighbours, particularly during abnormal operating conditions. Odours from the WWTP can at time be expected to travel more than 300m, particularly during plant upsets.	8	It is possible to locate the proposed WWTP at least 300m from existing rural dwellings and with a 200m site odour buffer distance. Overall, the receiving environment has a relatively low sensitivity to odour nuisance effects.	8	It is possible to locate the proposed WWTP at least 300m from existing rural dwellings and with a 200m site odour buffer distance. Overall, the receiving environment has a relatively low sensitivity to odour nuisance effects.	5	It is possible to locate the proposed WWTP at least 300m from existing rural dwellings and with a 200m site odour buffer distance. FUZ located 300m to the west of WWTP, and areas north of the WWTP are zoned residential. Over time the sensitivity of the receiving environment to nuisance odour would also be expected to increase. The potential for nuance odours to be experienced would similarly be expected to increase	4	It is possible to locate the proposed WWTP at least 300m from existing rural dwellings and with a 200m site odour buffer distance. However, 200m west of the WWTP the FUZ is expected to develop over time. The proximity of future residential area to the site would substantially increase the sensitivity of the receiving environment	8	It is possible to locate the proposed WWTP at least 300m from existing rural dwellings and with a 200m site odour buffer distance. Surrounding zoning of heavy industry and rural coastal zone help maintain low sensitivity of receiving environment.
	3d. Operational effects	7	Set away from public view. Site large enough to mitigate effect to neighbours. Space for extension. Driveway right beside small private property an issue. Midge & odour from Tidal Pond potential issue if not covered. Lighting at night (during call-outs could be an issue)	7	Few more residential properties closer to this site. Site is narrower and building odour boundaries closer to neighbours. Plant might have to be located very close to slopes. Very long drive way.	8	Good distance from other residence and coast is good portion of the boundary. Neighbouring properties are to the west with south westerlies being the prevailing winds. Space for extension.	7	Has more property boundaries than option S. Building odour boundaries closer to neighbours. Space for extension. Development on site S could impact this site and odour concerns may arise.	6	Has a more property boundaries than option S. Building odour boundaries closer to neighbours. Overall relatively close to main settlement. Could be seen as area for future developments. Neighbouring properties are to the west with south westerlies being the prevailing winds.	6	Good distance from other residence and coast is good portion of the boundary. Treatment Plant area seems quite steep. Neighbouring properties are to the west with south westerlies being the prevailing winds.	8	Good distance from residences and coast is good portion of the boundary. Existing site. Very little odour impact on neighbouring properties. Neighbours are used to a wwtp. Good access as long as road is modified.
4. Natural environment	4a. Landscape / visual	7	Several properties along the site boundaries. Screening should be able to screen the site.	7	Several properties along the site boundaries. Screening should be able to screen the site.	6	Big site, with two lifestyle properties situated to the south with potential overlooking impacts. Screening is also possible, however unsure whether this would be totally effective given the site is slightly elevated.	7	The southern side of the property is screened by a bamboo shelterbelt. There is one farm cottage to the north owned by the site owner, with several other properties to the north west. Screening would likley be effective.	5	The plant is to be located on an elevated portion of the site, exacerbating adverse visual impacts. Lifestyle properties to the south of the site have a clear view onto the site.	5	Site is clearly seen from the other side of the Tahiki River over a wide area. In addition, the proposed location of the plant is 200m from a live residential zone.	8	Several lifestyle properties to the southeast of the site (across the river) with potential impacts. However, these are quite far away from the site, and there is already existing screening present onsite.
	4b. Ecology	6	Several potential natural wetlands and potential streams are located within the proposed works footprint. Several potential natural wetlands are within 100m of the proposed works footprint. Potential effects include wetland reclamation, several triggers for consent, and possible stream culverting to provide for site access. Opportunities include potential natural wetland restoration, and potential stream restoration.	6	Appears to contain native restored stream, potential linked to past consents (possible covenants), with other potential streams occurring in the works footprint. Several potential natural wetlands within 100m of the proposed works footprint. Potential effects include the removal of protected riparian vegetation, several triggers for consent, and possible stream culverting to provide site access. There is an opportunity for restoration of the potential natural wetland.	8	Several Potential Natural Wetland within 100m of the proposed Works footprint. Several triggers for consent identified, however, proposal is not likely to result in any effects. Potential Natural Wetland that can be restored and used as a eco credit (subject to agreement with regulatory) for other project (cost saving). Stream length that could be restored, potential used as Ecobank stream.	8	Several Potential Natural Wetland within 100m of the proposed Works footprint. Several triggers for consent identified, however, proposal is not likely to result in any effects. Potential Natural Wetland that can be restored and used as a eco credit (subject to agreement with regulatory) for other project (cost saving)	7	Several Potential Natural Wetland within 100m of the proposed Works footprint and several triggers for resource consent noted with potential for adverse effects on a wetland. Potential Natural Wetland that can be restored and used as a eco credit (subject to agreement with regulatory) for other project (cost saving)	3	Several potential natural wetlands within the proposed works footprint and within 100m of the proposed works footprint. Effects include potential wetland reclamation and several reasons for consent. Potential Natural Wetland that can be restored and used as offset/compensation either for this project or an eco credit (subject to agreement with regulatory) for other project (cost saving)	9	No ecological values or constraints within the site. No considered ecological impacts. There is an opportunity to naturalise the existing pond into an ecological wetland.
	4c. Flooding risk	5	Accessway over permanent streams and flood prone areas and OLFP	5	Flood plain areas within future Plant area (localised low points)	7	Wider flooding on local and access roads crossing OLFP	7	Wider flooding on local and access roads crossing OLFP	4	Flood prone areas within future plant area. Access crossing OLFP	6	Some minor OLFPs and streams on the site and localised ponding and flood prone areas nearer the road frontage. Plant area closer to a gully	7	Existing site with some flooding prone/ ponding issues shown on GIS.
	4d. Risk of coastal inundation	8	Minor foreshore retreat expected	8	Minor foreshore retreat expected	7	Coastal inundation present within wider site boundaries but not impacted plant location.	7	Coastal inundation expected and low laying land on water frontage. Foreshore retreat expected	8	Minor foreshore retreat expected	7	Very minor coastal inundation at edges of section but not impacting plant location.	7	Coastal inundation present within wider site boundaries but not impacted plant location.
	4e. Highly Productive Land	5	Loss of up to 4ha of LUC 2 land.	5	Loss of up to 4ha of LUC 2 land.	5	Loss of up to 4ha of LUC 2 land.	5	Loss of up to 4ha of LUC 2 land.	5	Loss of up to 4ha of LUC 2 land.	5	Loss of up to 4ha of LUC 2 land.	9	Site currently a WWTP and could not be used for arable farming purposes.

5. Constructability	5a. Wastewater conveyance	**8**	- daisy chain PS - near population growth - Close to outfall - Shorter pipes	**7**	- Similar to B, Close to outfall but not as close a B	**3**	- Not ideal furthest from direct line between GB and Waiuku - South of Taihiki so extra river crossing. - Gravity from Waiuku	**4**	- Third longest distance. - South of Taihiki so extra river crossing. - Gravity from Waiuku	**5**	- extra crossing - Can drain down hill from Waiuku - Close to direct line	**4**	- extra crossing - Can drain down hill from Waiuku, but would result in a syphon through low point - Close to direct line	**1**	- Longest distance, Duplicate pipeline - Daisy chains of PS
	5b. Construction risk	**8**	**Conveyance** - no extra crossing, one pipe in road **WWTP** - open farmland	**8**	**Conveyance** - no extra crossing, one pipe in road **WWTP** - open farmland	**7**	**Conveyance** - Extra crossing - Two pipelines in road corridor btw GB and new WWTP **WWTP** - good open site	**7**	**Conveyance** - extra crossing - two pipelines in road corridor btw GB and new WWTP **WWTP** - good open site	**5**	**Conveyance** - extra crossing **WWTP** - Lower flexibility. Limited scope to move elements to avoid difficult areas e.g. near cliffs. - open farmland	**5**	**Conveyance** - Extra crossing **WWTP** - lower flexibility - spare space.	**2**	**Conveyance** - Extra crossing - Two pipelines. Wider use of road corridor **WWTP** - Operational WWTP - WWTP consent compliance. - Contaminated land risk - Laydown area limited.
	5c. WWTP construction footprint and other engineering considerations	**8**	**Access 3** - long access route **Cut / Fill 3** **Utilities 6** **Geotech 5**	**8**	**Access** 7 - long access route or very short. **Cut / Fill 5** **Geotech lower 3** - Pockets of sandiness (site C) - 6000 cut / 2000 fill (for southern site. 6 **Utilities 7**	**5**	**Access 2** - long access route **Cut / Fill 6** **Geotech lower 3** - 5cm bands of sandiness. - Water table is low ~ 0 RL but pockets may be present. **Utilities 2**	**8**	**Access 6** **Cut / Fill 4** **Geotech 5** - 5cm bands of sand. - Water table is low ~ 0 RL but pockets may be present. **Utilities 3** **Existing ponds onsite may be able to be reused**	**7**	**Access 5** **Cut / Fill 2** **Utilities 5** **Geotech 5**	**3**	**Access 1** **Cut / Fill 1** **Utilities 4** **Geotech 3**	**7**	**Access 4** **Cut / Fill 7** Geotech - More competent than other sites **Utilities 1** - very poor **Geotech 5** **Existing ponds onsite may be able to be reused**
6. Operability	6a. Operation and maintenance	**8**	Future expansion options available. Reuse plant possibly too close to ground that slopes away. Could be relocated.	**8**	Natural streams on site restrict land use. Alternative location south of that shown possibly better but appropriate bridging over streams required. Future expansion options seem restricted. Long access drive.	**8**	Rather long access drive (access gate control). Exiting out of plan with slow trucks possible H&S issue. Good expansion potential.	**8**	Natural streams on site restrict land use. Future expansion options seem restricted.	**7**	Future expansion options available. Rather long access drive (access gate control)	**6**	Rather long access drive (access gate control). Future expansion would put new plant close to boundary, sloping land.	**7**	Steep Driveway needs work. Some coastal erosion. A lot of space. Existing site
	6b. Hydraulic considerations	**9**	- Shortest pipes - minimize air valves on TE pipe and total pipe length - pumping syphons so we can manage velocity - Growth areas have shortest length of pipe and don't need to go under Taihiki. Down hill from Kingseat.	**8**	- Shortest pipes - minimize air valves on TE pipe and total pipe length - pumping syphons so we can manage velocity - Growth areas have shortest length of pipe and don't need to go under Taihiki. Down hill from Kingseat.	**4**	- Longer pipe - start up hydraulics difficult due to low starting population in the north - Design of Taihiki syphon.	**4**	- Longer pipe - start up hydraulics difficult due to low starting population in the north - Design of Taihiki syphon.	**5**	- Longer pipe - start up hydraulics difficult due to low starting population in the north - Effect on design of Taihiki syphon.	**3**	- Longer pipe - start up hydraulics difficult due to low starting population in the north - effect on design of Taihiki syphon. - creates potential syphon or extra PS along GB beach road.	**1**	- Longer pipe - start up hydraulics difficult due to low starting population in the north - Design of Taihiki syphon and crossing of the hill.
	6c. Short-term serviceability	**4**	Servicing short-term growth in this area will be difficult, however Waiuku pipeline could be used to convey Kahawai Point flows but would need pre-treatment.	**4**	Servicing short-term growth in this area will be difficult, however Waiuku pipeline could be used to convey Kahawai Point flows but would need pre-treatment.	**2**	- The Waiuku pipeline wont get to Kahawai Point. - would need to consider temporary pipe or installation of raw pipe from CB, Kingseat and Glenbrook. Would need to work out cross connections.	**2**	- The Waiuku pipeline wont get to Kahawai Point or Kingseat connection point. - would need to consider temporary pipe or installation of raw pipe from CB, Kingseat and Glenbrook. Would need to work out cross connections.	**3**	- The Waiuku pipeline wont get to Kingseat connection point. - would need to consider temporary pipe or installation of raw pipe from CB, Kingseat and Glenbrook. Would need to work out cross connections.	**3**	- The Waiuku pipeline wont get to Kingseat connection point. - would need to consider temporary pipe or installation of raw pipe from CB, Kingseat and Glenbrook. Would need to work out cross connections.	**5**	- Slightly smaller pipe - pipe will be designed for reverse flow.
7. Greenhouse gas emissions	7a. Capital greenhouse gas emissions	**7**	The capital carbon impact from the construction is estimated at 26.62 M kg/CO2	**6**	The capital carbon impact from the construction is estimated at 27.15 M kg/CO2	**3**	The capital carbon impact from the construction is estimated at 32.65 M kg/CO2	**5**	The capital carbon impact from the construction is estimated at 29.41 M kg/CO2	**5**	The capital carbon impact from the construction is estimated at 28.88 M kg/CO2	**6**	The capital carbon impact from the construction is estimated at 27.52 M kg/CO2	**2**	The capital carbon impact from the construction is estimated at 35.37 M kg/CO2
	7b. Operational greenhouse gas emissions	**6**	The 2050 comparative operational carbon emissions are estimated at 81 CO2e t/year.	**5**	The 2050 comparative operational carbon emissions are estimated at 89 CO2e t/year.	**5**	The 2050 comparative operational carbon emissions are estimated at 92 CO2e t/year	**5**	The 2050 comparative operational carbon emissions are estimated at 92 CO2e t/year	**5**	The 2050 comparative operational carbon emissions are estimated at 88 CO2e t/year	**7**	The 2050 comparative operational carbon emissions are estimated at 74 CO2e t/year	**3**	The 2050 comparative operational carbon emissions are estimated at 191 CO2e t/year.
8. Reuse	8a. Wastewater Reuse	**7**	**Short term** - Land for crops - Close to Awhitu **Long term** - Metropolitan ring main close. - Long term industrial or aquifer reinjection maintain CB plant and take treated WW south to new WKO plant with reuse.	**7**	**Short term** - Land for crops - Close to Awhitu **Long term** - Metropolitan ring main close. - Long term industrial or aquifer reinjection maintain CB plant and take treated WW south to new WKO plant with reuse.	**8**	- Same as T but slightly further to crops. **Short term** - slightly better for non contact crops, slightly further from Awhitu. **Long term** - still can connect to ring main but further than C	**9**	**Short term** - slightly better for non contact crops, slightly further from Awhitu. **Long term** - still can connect to ring main but further than C	**7**	Assessed in combination with X **Short term** - smaller land, slightly further to crops and Awhitu . **Long term** - still can connect to ring main but further than C	**7**	Assessed in combination with W **Short term** - smaller land, slightly further to crops and Awhitu . **Long term** - still can connect to ring main but further than C	**9**	**Short term** - Vicinity to Awhitu **Long term** - Aquifer reinjection potential higher - close to Awhitu

Appendix H – Geotechnical Assessment

REPORT

Tonkin+Taylor

Southwest Waste Water Pump Station Options Study

Prepared for
Watercare Services Limited
Prepared by
Tonkin & Taylor Ltd
Date
May 2022
Job Number
1012888.2000.v1

Exceptional thinking together
www.tonkintaylor.co.nz

Document Control

Title: Southwest Waste Water Pump Station Options Study					
Date	Version	Description	Prepared by:	Reviewed by:	Authorised by:
May 2022	V1	FINAL	Ben Westgate	Troy McAlister	Jason Kelly

Distribution:

Watercare Services Limited	1 PDF copy
Beca Ltd	1 PDF copy
Tonkin & Taylor Ltd (FILE)	1 PDF copy

Table of contents

1 Introduction

Tonkin & Taylor (T+T) was engaged by Watercare Service Limited (Watercare) through the Beca Design Service Panel agreement to undertake an optioneering study to assess the ground conditions for the Southwest Wastewater Alternate Scheme - Southwest Waste Water Treatment Plant (SWWW TP) site.

Watercare is developing a wastewater servicing scheme that will service the communities of Kingseat, Clarks Beach, Glenbrook Beach and Waiuku. The scheme is based on providing a high level of sewage treatment and then discharging the treated effluent at the end of the Waiuku River near Clarks Beach (refer Figure 1.1 below).

An options study has been completed by Watercare in co-ordination with Beca Ltd, which indicates seven (7) options areas progressing to short list assessment (dark blue Figure 1.1 - B, C, X, W, T, S, Z) from the initial 24 areas (light blue). These 7 options require physical ground investigations and a site walkover to be completed, followed by a review workshop prior to a final option being chosen for preliminary design.

There were no previous records of ground investigations being undertaken on six (6) areas (C, S, T, W, X, Z), with a land developer's investigations on one area (B).

Site descriptions will be provided in the wider reports submitted as part of the optioneering and have not been duplicated in this report.

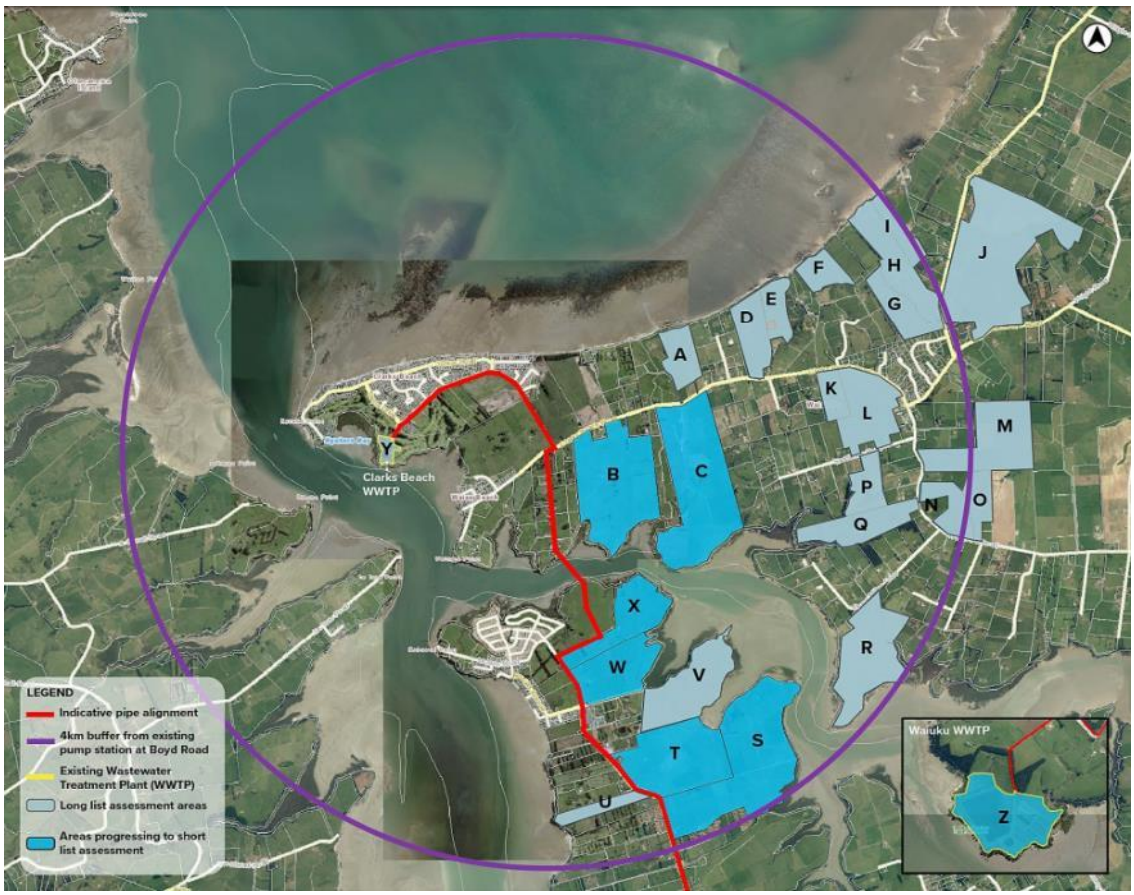


Figure 1.1: Indicative Southwest Waste Water Scheme, including the final 7 options.

2 Ground Conditions

2.1 Geology

The published geological map[1] of the area indicates that the potential pump station sites are predominantly East Coast Bays Formation (Mwe). Near to the site, Puketoka Formation (Pup) as part of the Tauranga Group sediments, is expected to overly the East Coast Bays Formation (ECBF). The units are shown on Figure 2.1: below and the materials are described as:

- Puketoka Formation (Pup), Tauranga Group – Pumiceous mud, sand, and gravel with muddy peat and lignite. Rhyolite pumice, including non-welded ignimbrite, tephra, and alluvial pumice deposits (from SAVF), massive micaceous sand.
- East Coast Bays Formation (Mwe) – Alternating sandstone and mudstone with variable volcanic content (volcanic poor lower in the sequence and mixed volcanic content higher) and interbedded volcaniclastic grit beds.
- South Auckland Volcanic Field (SAVF) – range of materials from Basalt lava, Scoria, Ash, Lithic Tuff and Lapilli.

2.2 Geomorphology

The potential pump station Options are within an inland coastal and estuarine environment. Options B and C are located on the south facing slopes to the north of the Taihiki River sloping from north to south. The elevation of these two options ranges between the estuarine edge at 10 m RL to a maximum of 24 m RL in the centre of the site. Options S and T are at a lower elevation, both facing north into the Taihiki River, between 3 and 12 m RL. Drainage networks and surface channels are low angle flowing to the north. Option S is bounded by a high angle slope to the east (estuary bank) with elevation change of these slopes approximately 4 to 7 m. Option Z is a low-lying area, at an elevation of between 3 to 8 m RL where construction activity has developed the area to form a series of water treatment ponds. The surface morphology of the site has been significantly altered from its natural condition. The elevations provided for the options above are based on information sourced from Geomaps[2], and are approximate only.

The current land use for all options is predominantly agricultural (excluding Option Z), with multiple meandering streams and overland flow paths. The topography for all options is generally undulating with a gradual slope inland.

2.3 Groundwater

At the pump station locations, groundwater should be expected to be at approximately at or near ground level, depending on the material encountered on each site. It is expected that the groundwater could have a range of 0-3 m between summer and winter months. This range has been observed in similar Tauranga Group and SAVF soils around Auckland.

Due to the identification of streams and overland flow paths, the soil at the surface is expected to be moist to wet, locally saturated, when encountering either perched or regional groundwater.

[1] Edbrooke, S.W. (compiler) 2001. Geology of the Auckland area. Institute of Geological and Nuclear Sciences 1:250,000 geological map 3.
[2] https://geomapspublic.aucklandcouncil.govt.nz/viewer/index.html

2.4 Potential geotechnical challenges

After review of the available geotechnical information, multiple gaps in knowledge of the ground conditions are apparent. Therefore, the following challenges have resulted:

1 Geotechnical parameters:

- There are no available shear strengths or SPT N-values to estimate the soil parameters. Foundation design will be very conservative.

2 Ground profile:

- The nearest geological information is 250 m from the current alignment option for the northern side of the estuary, and over 1000 m for any other potential pump station location. The depth to rock could vary considerably, resulting in conservatism in the pump stations foundation design.
- Due to the geomorphological nature of the area and Tauranga Group sediments being present, it is possible that peat materials could be encountered. Peat is very susceptible to consolidation when loaded.

3 Seismic hazards:

- Liquefaction of Tauranga Group materials when a high percentage of silty material. Depending on the thickness, strength and material make up of this soft layer, lateral spreading and liquefaction could be an issue.
- Tauranga Group material will be underlain by East Coast Bays Formation, which may be weathered to a residual soil. Residual soil properties have the potential to be similar to the Tauranga Group with unconsolidated poorly cemented silt and fine sand material. It is interpreted to be near the surface at the pump station locations and is likely to have a thin cap of soft sediments.

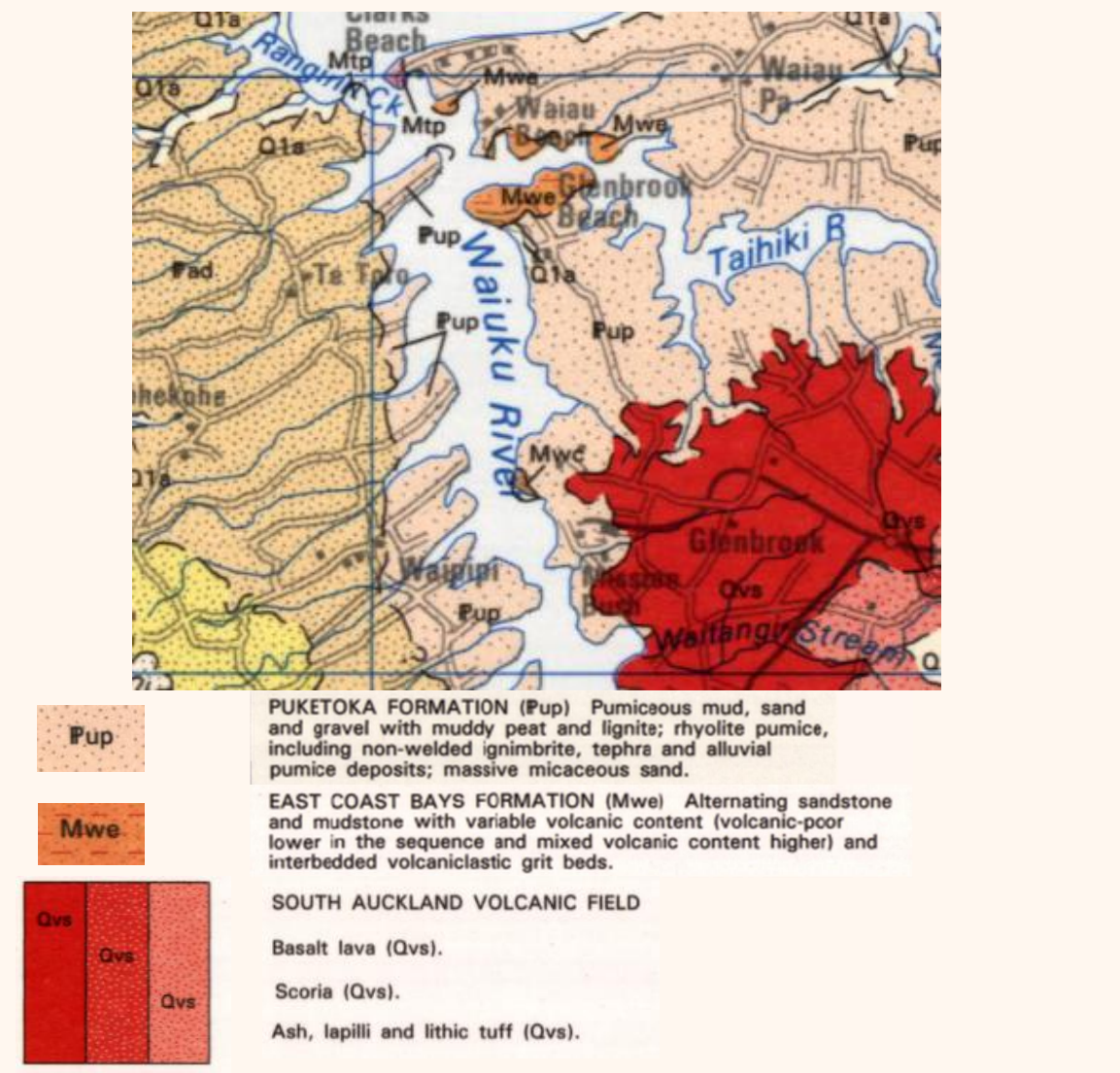


Figure 2.1: Geological Map of Clarks Beach to Waiuku

3 Options

Seven (7) options areas were scheduled for ground truthing (B, C, X, W, T, S, Z), of which four (4) were visited (C, T, S, Z) with three (C, T, S) intrusive ground investigations being undertaken. Option B was not visited but a previous ground investigation report was reviewed for context on the other four (4) sites. The locations of the investigations are shown in Appendix A.

Access onto two (2) locations (W, X) were not possible from the landowner. A road adjacent to Option W was driven for a geomorphological review of the site. The following sections describe the works undertaken on each option site.

A combined summary table for the geological, geotechnical, and hydrogeological properties of each option with ground investigation data is shown in Table 3.3.

3.1 Option B

Lander (2021) undertook a ground investigation and interpretative report for Option B for a private land developer (Appendix B). The ground investigations included eighteen (18 No.) hand augers which were bored into the site are shown in Figure Appendix A.2. Tauranga Group materials were recovered throughout the investigations.

The main consideration and geotechnical hazard with this option is the trafficability and re-working and re-use of the silty and pumicious materials, as shown in Appendix B.

3.2 Option C, S and T

As part of our current assessment, four (4) hand augers (HA's) were bored Option C and another four (4) at Option T, with three (3) into Option S, shown in Table 3.1. Each option HA's were positioned at strategic locations from the concept design drawings to understand the sub-soil profile and material properties. All hand augers were bored by a T+T engineering geologist on November 11 to November 26 2021 and the recovered material was logged to NZGS guidelines.

The HA logs from Option S and T were very similar in material properties and engineering behaviour. This was expected due to the geological and geomorphological conditions observed on site. Option C was at a higher elevation and contained slightly different geological properties, along with the residual soils of the SAVF not being encountered.

The main consideration and geotechnical hazard with these options is the trafficability and material re-working and re-use of the silty and pumicious materials, as shown in Appendix C.

Table 3.1: Investigation locations

Ground Investigation Location	NZTM (GPS)		Auckland 1946 mRL (GPS)	Termination Depth (m)	Reason for Termination
	Easting	Northing	Elevation		
C-HA01	1753561.21	5887989.15	24	3.1	Refusal.
C-HA02	1753570.80	5887817.57	24	4	End depth reached.
C-HA03	1753677.00	5887140.00	24	2.9	Refusal.
C-HA04	1753633.66	5887128.15	23	4	End depth reached.
S-HA01	1754260.00	5885054.00	12	4	End depth reached.
S-HA02	1754288.00	5884948.00	13	4.2	End depth reached.
S-HA03	1754419.00	5884987.00	12	4	End depth reached.
T-HA01	1753488.00	5885112.00	12	4.2	End depth reached.
T-HA02	1753430.00	5885213.00	10	4.2	End depth reached.
T-HA03	1753608.00	5885263.00	9	4.2	End depth reached.
T-HA04	1753631.00	5885139.00	9	4.2	End depth reached.

3.3 Option Z

Five (5) Waiuku Riverbank section profiles were logged surrounding the Waiuku Wastewater Treatment Plant site, termed Option Z by a two-person team of T+T Engineering Geologists on November 12 2021. These were logged from the crest of the estuary bank to the foreshore based on visual descriptions where access was not possible for physical testing. The profiles indicate a tephra type material associated with the SAVF with a different type of clast welding to provide minor differences in material strength/density, as shown in Appendix C.

The main consideration and geotechnical hazard with this Option is the erosion potential created by the proximity to the estuary.

Table 3.2: Waiuku Riverbank section profiles

Ground Investigation Location	NZTM (GPS)		Auckland 1946 mRL (GPS)	Termination Depth (m)	Reason for Termination
	Easting	Northing	Elevation		
Z-S1	1753696.93	5878881.01	1	4.8	Crest to toe of slope.
Z-S2	1753683.93	5878852.16	1	9	Crest to toe of slope.
Z-S3	1753660.61	5878839.37	1	3.5	Crest to toe of slope.
Z-S4	1753536.56	5878824.98	1	5.8	Crest to toe of slope.
Z-S5	1753477.48	5878773.62	1	9.5	Crest to toe of slope.

Table 3.3: Summary of Geotechnical parameters from ground investigations.

Geotechnical Factors	Details	Option				
		B	C	S	T	Z
Material shear strength (kPa) from shear vanes	Lower	45, HA03 @2.5 m)	49, HA01 @4 m	61, HA02 @4 m	52, HA04 @4 m	NA
	Upper	>212	>212	221, HA01 @1.5	234, HA03 @2.5	NA
Material Strength increase with depth.		No. Uniform.	No Slight decrease in HA01.	No. HA03 decrease from 3m bgl	No. Decrease at 4 m bgl.	NA
Geological Unit	Tau Grp / Puke Form	Yes	Yes	Yes	Yes	No
	SAVF	No	No	Yes	Yes	Yes
	Residual ECBF	No	No	No	No	No
	ECBF	No	No	No	No	No
Groundwater	Depth bgl (m)	1.9 to 2.2 m bgl.	2.5 m bgl (21.5 m RL) in HA01.	3.75 m bgl (9.25 m RL) in HA02 2.0 m bgl (10 m RL) in HA03.	4 m bgl (8.0 m RL) in HA01 & HA02.	Dry on sections, minor seepage at the toe.
Presence of Silt/Ash	Depth bgl (m)	3	4	4	4	NA
	Thickness (m)	3	4	4	4	NA
Presence of Pumice	Depth bgl (m)		1.9 HA03, 3.3 HA04.	1.45 HA01.	2.9 HA04.	NA
	Thickness (m)		2.1+	2.55+	1.1	NA
Presence of Peat	Depth bgl (m)	None	None	None	None	None
	Thickness (m)	None	None	None	None	None
Hazards		Weathered Ash may be difficult to re-work. Liquefaction of material under seismic conditions. Low re-use potential due to Ash content.	Running Sands in HA01 @2.15 m. Allophane like material in HA03/04.	High to very high plasticity clays which may require treatment if working in the winter months if heavily trafficked.	High to very high plasticity clays which may require treatment if working in the winter months if heavily trafficked.	Proximity of site to river estuary with Climate change may need an engineered solution to the perimeter.

4 Option Summary

The Project multi-criteria assessment template has been utilised and is presented in Error! Reference source not found.. This is further divided into geotechnical risk and future works in the sections below.

4.1 Geotechnical risk

The main geotechnical risks that we have identified at this stage of the project for the Options are:

- Variable depth to rock if the Pump Station is required to be founded on competent material.
- Ash in the upper soil material, which has the potential to be sensitive and require drying out prior to emplacement and compaction.
- Pumice in the soil will degrade with a potential volume loss when trafficked. Sands and silts once remoulded will turn to silty clays, which will change the engineering behaviour of the material.
- Groundwater on Options S and T, which are at a lower elevation, proximal to the Taihiki River, may be elevated. This may impact on construction if groundwater is elevated.

These geotechnical risks have been determined based on our site walkovers and a limited site investigation. Further work will be required to understand these risks and how they relate to the proposed works, as outlined below.

4.2 Future works

The preferred Option will need to have a more detailed ground investigation undertaken on key areas of the site. This is expected to comprise a minimum of:

- Two to three (2 to 3 No.) machine boreholes between 10 to 15 m bgl with groundwater monitoring for resource consent.
- Three to six (3 to 6 No.) cone penetration tests for deep structures or tanks. This will be focusing on liquefaction and stability analysis.
- Hand augers may be required for the access road to provide bearing capacities and trafficability assessments.
- Material testing for shrink-swell through Atterberg limits and moisture content, particle size distribution (PSD) for liquefaction analysis, reuse of excavated material for construction.
- Allophane laboratory testing will be required to determining chemical and physical properties of the material.
- Contamination testing of recovered material for re-use and disposal.

5 Conclusions and Recommendations

The following conclusions can be drawn from the ground investigations at the specific Option locations, and general engineering knowledge of the underlying ground conditions from previous work by T+T. The Options study was to rank them in the preferred sequence in a hazard/risk matrix for ground conditions and construction. The following Option sequence is therefore proposed, as shown in Table 5.1. Although we have ranked the options below based on geotechnical considerations, development of the less favourable options is not necessarily precluded. However, given our understanding of the locations at this stage we consider that these options would require more engineering input.

A more detailed assessment of Options W and X would be required when site access is possible with potentially physical investigations to understand the geotechnical risks.

Table 5.1: Favourability of Options

Favourability / MCA	Option	Shear Strength (kPa)	Geology	Elevation (m RL) (GeoMaps)	Groundwater (m bgl)	Comments
High / 7	B and C	>80kPa (stiffer soils), locally higher.	Residual Ash and pumice on site.	>15mRL	>3m	Ash/Pumice has a possibly negative impact on material reuse. Low erosion and inundation risks.
	Z	>80 kPa, expected to be locally higher due to the underlying geology.	Wielded Tephra.	<5m RL	>5m	Elevated erosion and inundation risk.
Moderate / 5	S and T	>80 kPa.	Residual Ash and pumice.	<5m RL, but does rise to the west to 15m RL.	>3m	Ash/Pumice has a possibly negative impact on material reuse.
Low* / 4	W and X	Unknown.	Expected Residual ash and pumice on site.	<5m RL	NA	NA.
* Site not inspected						

6 Applicability

This report has been prepared for the exclusive use of our client Watercare Services Limited, with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose, or by any person other than our client, without our prior written agreement.

Recommendations and opinions in this report are based on data from discrete investigation locations. The nature and continuity of subsoil away from these locations are inferred but it must be appreciated that actual conditions could vary from the assumed model.

Tonkin & Taylor Ltd

Report prepared by:

.....

Ben Westgate
Senior Engineering Geologist

Authorised for Tonkin & Taylor Ltd by:

.....

Jason Kelly
Project Director

6-May-22
c:\users\ceda\downloads\1012888-2000 geotechnical assessment_options study_final_v1_20220209_.docx

Appendix A: Figures

- Figure Appendix A.1: Site Plan for Options B, C, S, T, W, X, Z
- Figure Appendix A.2: Site Plan for Options B and C
- Figure Appendix A.3: Site Plan for Options S and T
- Figure Appendix A.4: Site Plan for Option Z

LEGEND

Options Study GI Locations

- HA
- Lander (2021)
- Approximate Site Boundaries
- Site Boundary 200m Offset
- Options

A3 SCALE: 1:7,500

0 100 200 300 400 500 Meters

Location Plan

Notes:

Aerial Photography Sourced from the LINZ Data Service and licensed for re-use under the Creative Commons Attribution 4.0 New Zealand licence
Land Information New Zealand, Eagle Technology

DRAWN	BEWE	Jan.22
CHECKED		
APPROVED		
ARCFILE	1012888-200_OS GI_FINAL_20220127_.mxd	
SCALE (AT A3 SIZE)	1:7,500	
PROJECT No.	1012888.2000	

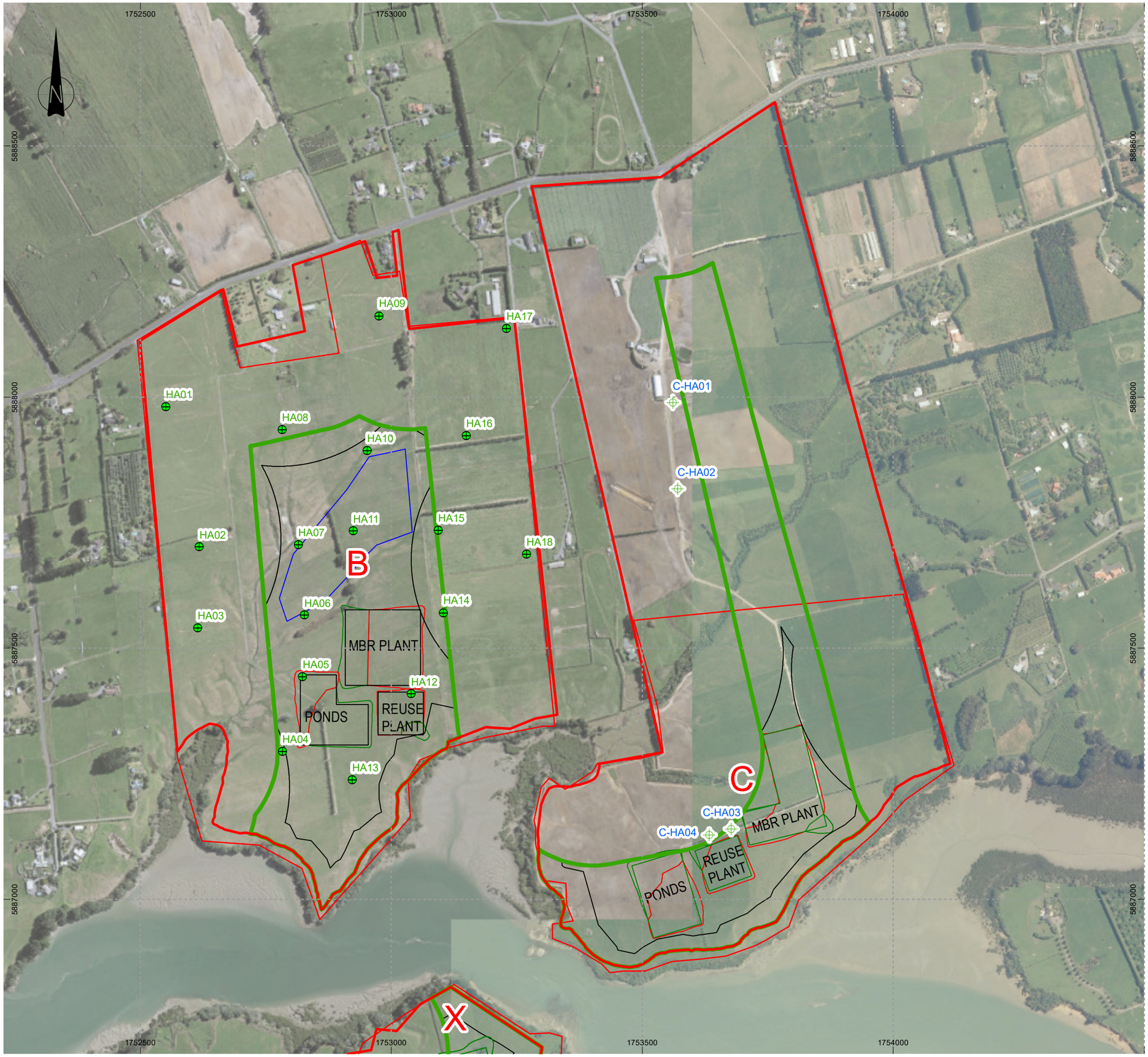
Tonkin+Taylor
105 Carlton Gore Road, Newmarket, Auckland
www.tonkintaylor.co.nz

WATERCARE SERVICES LTD.

Southwest Wastewater Conveyance
Option Study Ground Investigation Locations

Figure A2

Path: P:\1012888\1012888.2000\WorkingMaterial\ArcGIS\1012888-200_OS GI_FINAL_20220127_.mxd Date: 27/01/2022 Time: 6:28:13 PM



LEGEND

Options Study GI Locations

- HA
- Lander (2021)
- Approximate Site Boundaries
- Site Boundary 200m Offset
- Options

A3 SCALE: 1:7,500

0 100 200 300 400 500 Meters

Location Plan

Notes:

Aerial Photography Sourced from the LINZ Data Service and licensed for re-use under the Creative Commons Attribution 4.0 New Zealand licence
Land Information New Zealand, Eagle Technology

DRAWN	BEWE	Jan.22
CHECKED		
APPROVED		

ARCFILE 1012888-200_OS GI_FINAL_20220127 .mxd

SCALE (AT A3 SIZE) 1:7,500

PROJECT No. 1012888.2000

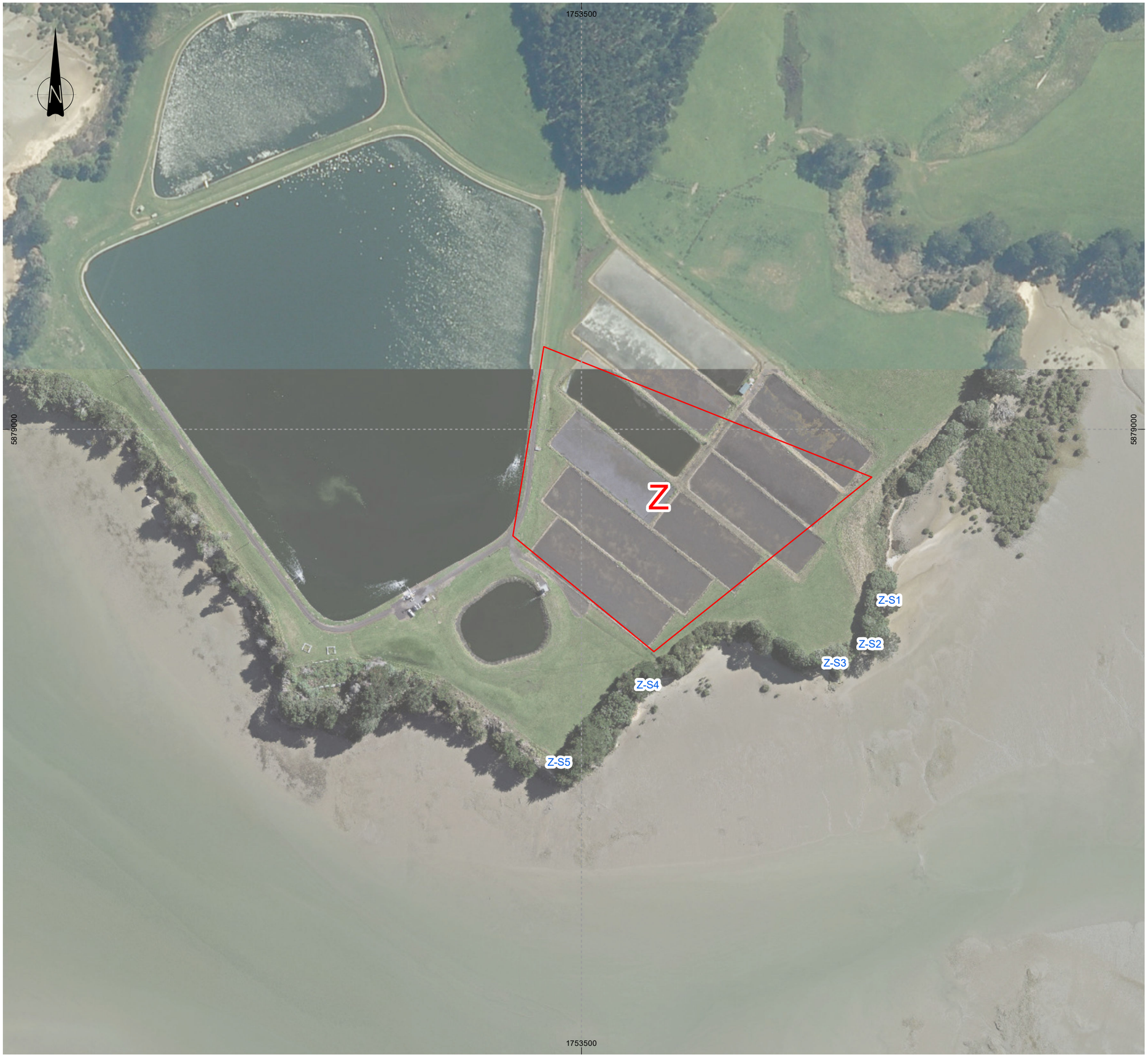
Tonkin+Taylor
105 Carlton Gore Road, Newmarket, Auckland
www.tonkintaylor.co.nz

WATERCARE SERVICES LTD.

Southwest Wastewater Conveyance
Option Study Ground Investigation Locations

Figure A1

Path: P:\1012888\1012888.2000\WorkingMaterial\ArcGIS\1012888-200_OS GI_FINAL_20220127 .mxd Date: 27/01/2022 Time: 7:10:15 PM



LEGEND

Options Study GI Locations

- HA
- Lander (2021)
- Approximate Site Boundaries
- Site Boundary 200m Offset
- Options

A3 SCALE: 1:2,500

0 30 60 90 120 150 Meters

Notes:

Aerial Photography Sourced from the LINZ Data Service and licensed for re-use under the Creative Commons Attribution 4.0 New Zealand licence
Land Information New Zealand, Eagle Technology

DRAWN	BEWE	Jan.22
CHECKED		
APPROVED		

ARCFILE: 1012888-200_OS GI_FINAL_20220127_.mxd

SCALE (AT A3 SIZE): 1:2,500

PROJECT No.: 1012888.2000

Tonkin+Taylor
105 Carlton Gore Road, Newmarket, Auckland
www.tonkintaylor.co.nz

WATERCARE SERVICES LTD.

Southwest Wastewater Conveyance Option Study Ground Investigation Locations

Figure A3

Path: P:\1012888\1012888.2000\WorkingMaterial\ArcGIS\1012888-200_OS GI_FINAL_20220127_.mxd Date: 27/01/2022 Time: 7:22:46 PM

Appendix B: Previous ground investigation results

- Option B

  Lander Geotechnical. 2021. Geotechnical Report for Earthworks Consent at 162 Clarks Beach Road Kingseat. 28 September 2021.

28 September 2021 Ref No: J01842

Knight Investments Limited
C/- doyle@nakhlegroup.co.nz

Dear Doyle

RE: Geotechnical Report for Earthworks Consent at 162 Clarks Beach Road, Kingseat

1 PROJECT BRIEF

This report has been prepared for Knight Investments Limited in support of an application to the Auckland Council for Earthworks consent in accordance with the requirements of the Resource Management Act 1991.

2 SITE DESCRIPTION AND EARTHWORKS PROPOSAL

The site, legally described as Lot 3 DP 337204 which consists of an area of approximately 73Ha. Currently the site contains four dwellings with a number of sheds and accompanying driveways, the remaining area is divided into paddocks. It is bounded along the western, northern, and eastern by similar rural residential properties and Taihiki River to the south.

The site falls from RL28 on the north-eastern boundary to RL5 towards the southern boundary where relatively short, but steep coastal cliffs are present. Several shallow gullies and overland flowpaths are situated through the centre of the site which lead to a main gully which trends in south-west direction toward the river. Land gradients are typically flat, although steepen around the flanks of the gully and as the land approaches the coastal foreshore cliffs.

The attached bulk earthworks concept plan shows the land will be modified by cuts and fills of up to 1.0m and 0.5m depth respectively to create a gently contoured landscape to better facilitate its future land use for grazing animals.

3 FIELDWORK AND FINDINGS

3.1 Fieldwork Programme

Our fieldwork was conducted on 13-14 July 2021 and involved the drilling of 18 hand auger boreholes to target depths of 3.0m in the positions indicated on the appended site plan (refer Figure 01).

Results of all in-situ tests and detailed descriptions and depths of strata encountered during drilling of the boreholes are appended.

3.2 Geology

The institute of Nuclear and Geological Sciences Ltd Google Earth QMAP's indicates the sites main underlying geology unit is Puketoka Formation which is typically described as pumiceous mud, sand

and gravel with muddy peat and lignite: rhyolite pumice, including non-welded ignimbrite, tephra and alluvia.

The maps also indicate the geology along the coastal slopes on the southern boundary is East Coast Bays Formation. These deposits are described as alternating sandstone and mudstone with variable volcanic content and interbedded volcaniclastic grits.

3.3 Findings

3.3.1 Topsoil

Topsoil was found in all hand auger boreholes to a depth of between 0.1m to 0.3m. A buried topsoil layer was encountered in HA07 between 0.5m and 0.9m depth.

3.3.2 Filling

Fill was encountered within HA07 below the surficial topsoil layer and above the buried topsoil layer to a depth of 0.5m. This fill consisted of orange and grey clays and silts and is considered non-engineered due to the presence of the buried topsoil.

Although no other filling was detected at our borehole locations, it is common within farm environments to have presence of old offal pits or rubbish pits, so this can never be discounted.

3.3.3 Ash

Natural ash deposits were encountered below the surficial topsoil and fill deposits to a depth of typically between 0.5m to 2.3m. However, the exception to this is HA07 and HA11 where no ash deposits were found. The weathered ash soils consisted of red, brown and orange silts and clays. Undrained shear strengths were between 85kPa (Stiff) to over 216kPa (Hard) with values generally greater than 120kPa (Very stiff).

3.3.4 Puketoka Formation

Natural Puketoka Formation soils were encountered within all the hand auger boreholes (except HA04 which did not penetrate the ash). These soils consisted of inorganic orange, brown, red and grey silts, clays and sands. Undrained shear strengths were typically between 45kPa (Firm) to over 270kPa (Hard) but were generally over 130kPa (Very stiff).

Medium dense silts and sands were encountered within the western boundary (HA01, HA03-07) at depths of between 0.6m to 2.5m.

3.3.5 Groundwater

Groundwater was encountered in some hand auger boreholes (HA01, HA03, HA05, HA06, HA07, HA08 and HA11) at depths of 1.3m to 2.4m. The standing groundwater level at the completion of drilling was between 1.9m to 2.8m depth.

4 PROJECT EVALUATIONS AND RECOMMENDATIONS

4.1 General

The undertaking of earthworks construction generally in accordance with NZS 4431:1989, should ensure that the completed earthworks / land form is generally suitable for its intended end use (e.g. livestock grazing etc).

The supplied bulk earthworks concept plan (attached) indicates that the completed works will, when completed, provide in most places for a significantly easing of the steeper contours throughout the site and will involve the cutting down of the high ground and the filling of the gullies to create a gently contoured landscape.

Sensitivities to disturbance were typically low to moderate, although some sensitive deposits are apparent which can cause trafficking issues for heaving earthworks machinery under certain conditions (i.e. wet ground conditions).

Specific comments and recommendations follow:

4.2 Earthworks Operations

4.2.1 Site Preparation

Within areas of the site affected by earthworks, all vegetation should be cleared. Outside the extent of the earthworks, vegetation cover should be disturbed as little as possible and reinstated wherever practical.

Topsoil should be stripped from all cut and fill areas; stripping operations being planned to extend well beyond cut and fill lines to avoid peripheral fill contamination. Stockpiles of topsoil and unsuitable materials should be sited well clear of the works on suitable areas of natural ground.

4.2.2 Material Suitability

Earthworks operations involving borrow materials, usually from the elevated portions of the site, should be relatively straightforward. Generally, earthworks will involve Puketoka Formation soils and weathered Ash deposits that, with conditioning, should be suitable for handling and compaction by conventional earthmoving plant.

Due to the typically variable nature of the site materials, allowance should always be made for the presence of layers of soft sensitive clays and silts, together with groundwater, especially in the deeper cuts. These can cause problems for earthmoving plant but usually the materials become suitable for inclusion in the earthworks after drying and/or mixing.

However, based on our experience with bulk earthworks in similar geology, it is anticipated that optimum water contents will most likely be lower than the range of natural water contents and accordingly it will probably be necessary for some drying to take place before compaction, by taking thin cuts over broad areas, or by discing in-situ before transportation, or by carrying out the earthworks at a relatively slow and controlled rate with minimal plant.

Bedrock should not be encountered in the cuts (over the depths proposed).

4.2.3 Pumiceous Silts in Earthworks

As discussed earlier, the pumiceous materials encountered along the western boundary exhibited relatively stiff shear strengths.

However, highly pumiceous silts are very troublesome when exposed to the elements as their weakly cemented structure rapidly collapses when wet. Therefore, benching and cut operations which involve these materials should be completed as rapidly as possible and any exposures should be covered with a compacted clay layer to prevent erosion, scour and possible piping upon completion of the site development works.

When layers of pumiceous silts are exposed during cut to fill operations they should be well mixed with the more clayey materials and compacted in the normal manner.

4.2.4 Benching of Slopes

All benching of slopes prior to the placement and compaction of filling should be in accordance with the normal requirements of NZS 4431.

4.2.5 Existing Fill

Although only minimal fill was encountered within our hand auger boreholes, if these materials are encountered and are deemed not suitable for re-use as engineered fills, then they should be undercut completely and disposed of in an approved manner.

4.2.6 Unsuitables

Any identifiable deposits of unsuitable materials (including existing uncertified filling and the organic/ soft soils requiring undercutting) that are considered unfit for reuse on site should be disposed of off the site or on topsoil stockpiles if appropriate.

4.3 Land Drainage

4.3.1 Underfill Drains

Perforated underfill drains should be installed in narrow trenches cut into competent strata within the existing gullies. Localised seepages must be tapped and drained using heavy grade perforated pipes and adequate amounts of approved drainage material such as SAP 50, or graded melter slag from the nearby Glenbrook Steel Mill (if permitted).

We recommend that these drains are covered in a suitable geotextile (eg. Permathene 401, Terram 1000, Bidim A14, Permathene GNS180 or Bidim A19) being 500mm wider than the scoria on each side of the drain to help prevent migration of silts and to help maintain long term control of groundwater conditions. In this case the drainage material must be SAP50 or approved TNZ/F2 specification aggregate.

If a SAP50 or similar grade drainage media cannot be procured, then the drain will likely need to be fully wrapped by geotextile to preserve its function and minimise long term clogging.

4.3.2 Subsoil Drainage

Subsoil drainage may also be required in areas remote from the gullies if a water table is encountered near to the ground surface. The positions of such drains are best determined during earthworks construction.

Given the gentle site topography and limited depths of cut to fill operations, only minimal subsoil drainage should be required on this site away from the existing drainage features.

4.3.3 Groundwater Disposal

All groundwater from subsoil drains should be collected by means of sealed pipes and discharged either into the reticulated stormwater system or into properly designed outfall structures. In addition, regular inspections of all accessible subfill drain sumps and outfalls should be carried out during subdivision construction to ensure no damage occurs as a result of earthworks operations.

All subsoil drains, including normal underfill drains and associated discharge points, should be carefully recorded on as-built plans by a Registered Surveyor and the details forwarded to us for inclusion in our Geotechnical Completion Report.

4.4 Fill Induced Settlements in Alluvial Soils

It can be stated at this stage that provided all mullock and soft natural soils (if any are encountered) are effectively undercut during the earthworks, then any consolidation settlement is of limited magnitude and of relatively short duration.

4.5 Compaction Control

Laboratory testing should be undertaken in the near future to establish specific compaction control criteria, but at this stage it is envisaged that earthworks control will be in terms of maximum allowable air voids (say 10%) and minimum allowable shear strengths (say 140 kPa) for the bulk fills. However, the criteria of 95% of the maximum dry density within the appropriate water content range could also have some relevance and most likely we would control the works using a combination of both methods.

Upon instruction we will undertake compaction control testing prior to commencement of the Earthworks.

4.6 Imported Fill

If imported filling is to be used in conjunction with the insitu materials, it is essential that we are given the opportunity of examining its source or sources and determining its suitability for inclusion in the earthworks on the basis of observation, investigation and testing as considered necessary.

5 PLAN REVIEW AND FURTHER WORK

We reserve the right to revisit our evaluations and recommendations if any changes are made to the proposed earthworks concept.

It is important that a geotechnical professional is given an opportunity to observe the ground conditions during earthworks operations to confirm ground conditions are in accordance with the recommendations given in above sections, observe the potential undercutting of organic and/or soft soils and provide geotechnical supervision and testing services for the bulk earthworks, following which a Geotechnical Completion Report should be prepared. Lander Geotechnical confirm our availability to undertake this work and consider continuity of geotechnical input will be beneficial to the project.

6 LIMITATIONS

This report has been prepared solely for the use of our client, Knight Investments Limited, their professional advisers and the relevant Territorial Authorities in relation to the specific project described herein. No liability is accepted in respect of its use for any other person or entity. All future

owners of this property should seek professional geotechnical advice to satisfy themselves as to its ongoing suitability of their intended use.

The opinions, recommendations and comments given in this report result from the application of normal methods of site investigation. As factual evidence has been obtained solely from boreholes which by their nature only provide information about a relatively small volume of subsoils, there may be special conditions pertaining to this site which have not been disclosed by the investigation and which have not been taken into account in the report.

If variations in the subsoils occur from those described or assumed to exist, then the matter should be referred back to us immediately.

For and on behalf of Lander Geotechnical Consultants Limited

Report Prepared By:

pp. P Land
Graduate Project Engineer

Reviewed By:

T. Tiavare
Geotechnical Project Engineer

Authorised By:

S.G. Lander
Principal Geotechnical Engineer
CMEngNZ, CPEng

Attachments: Preliminary Cut and Fill Programme
Figure 01: Site Investigation Plan
Hand Auger Borehole Records

0 40 80 120
Meters

Scale @ A3
= 1:5,000

Date Printed:
30/06/2021

Auckland Council
Te Kaunihera o Tāmaki Makaurau

Legend and/or Notes:

Hand Auger Borehole

BASEMAP: AUCKLAND COUNCIL GEOMAPS [RETRIEVED 15.07.21]

revision	description	drawn	approved	date

0 100 200 300
Horizontal Scale (metres)
0 100 200 300
Vertical Scale (metres)

drawn	PL
approved	TT
date	15.07.21
scale	1:5000
original size	A3

LANDER geotechnical

client: KNIGHT INVESTMENTS LIMITED

project: 162 CLARKS BEACH ROAD, CLARKS BEACH

title: SITE INVESTIGATION PLAN

project no: J 01842 figure no: 01

Template revision: 1:2000 (10/12/14)

Client : KNIGHT INVESTMENTS LIMITED

Project Location : 162 CLARKS BEACH ROAD
CLARKS BEACH

Job Number: J01842

Auger Borehole No. HA 01

Sheet 1 of 18

Vane Head:	Logged By:	Processor :	Date:
2153	NM	AH	14.07.21

Borehole Location: mN | mE | Ground R.L.

Description: Refer to site plan

SOIL DESCRIPTION

Legend	Depth (m)	Standing Water Level	Vane Shear(kPa) peak / residual	Soil Sensitivity	Sample and Laboratory / Other Test Details
TOPSOIL					
silty CLAY, orange/brown. Very stiff, moist, medium plasticity, insensitive [ASH]	0.5		157/83	1.9	
silty CLAY, orange streaked grey. Very stiff, moist, medium plasticity, insensitive [PUKETOKA FORMATION]	1.0		136/93	1.5	
becoming wet					
becoming moderately sensitive becoming light grey	1.5		139/59	2.4	
with trace fine to medium sand					
becoming hard	2.0		216+		
becoming orange streaked light grey		▽			
clayey SILT, orange streaked light grey. Very stiff, saturated, low plasticity, with fine to medium sand, moderately sensitive	2.5		176/89	2.0	
becoming red and orange streaked light grey					
at 3.0m, becoming hard	3.0		216+		
EOB at 3.0m. Target Depth					
	3.5				
	4.0				
	4.5				
	5.0				
	5.5				
	6.0				

LANDER geotechnical

Comments:
Groundwater encountered at 2.4m.
UTP = unable to penetrate.
EOB = end of borehole.

Borehole Diameter: 50mm

Checked: PL

Topsoil	Sand	Sandstone	Plutonic		
Fill	Gravel	Siltstone	No Core		
Clay	Organic	Limestone			
Silt	Pumice	Volcanic			

Client : KNIGHT INVESTMENTS LIMITED

Project Location : 162 CLARKS BEACH ROAD
CLARKS BEACH

Job Number: J01842

Auger Borehole No. HA 02

Vane Head:	Logged By:	Processor :	Date:
3195	AT	AH	14.07.21

Borehole Location: mN | mE | Ground R.L.

Description: Refer to site plan

SOIL DESCRIPTION

Depth (m)	Soil Description	Standing Water Level	Vane Shear(kPa) peak / residual	Soil Sensitivity	Sample and Laboratory / Other Test Details
	TOPSOIL				
	clayey SILT, orange/brown streaked brown. Very stiff, moist, low plasticity, insensitive [ASH]				
0.5			154/85	1.8	
1.0	becoming stiff		98/71	1.4	
	clayey SILT, light brown streaked orange/brown. Very stiff, moist, low to medium plasticity, moderately sensitive [PUKETOKA FORMATION				
1.5			154/74	2.1	
2.0			191+		
2.5			151/71	2.1	
3.0	EOB at 3.0m. Target Depth		191+		
3.5					
4.0					
4.5					
5.0					
5.5					
6.0					

LANDER geotechnical

Comments:
Groundwater not encountered .
UTP = unable to penetrate.
EOB = end of borehole.

Borehole Diameter: 50mm

Checked:

Topsoil	Sand	Sandstone	Plutonic		
Fill	Gravel	Siltstone	No Core		
Clay	Organic	Limestone			
Silt	Pumice	Volcanic			

Client : KNIGHT INVESTMENTS LIMITED

Project Location : 162 CLARKS BEACH ROAD
CLARKS BEACH

Job Number: J01842

Auger Borehole No. HA 03

Sheet 3 of 18

Vane Head:	Logged By:	Processor :	Date:
2007	AH	AH	14.07.21

Borehole Location: mN | mE | Ground R.L.

Description: Refer to site plan

SOIL DESCRIPTION

Depth (m)	Legend	Standing Water Level	Vane Shear(kPa) peak / residual	Soil Sensitivity	Sample and Laboratory / Other Test Details
	TOPSOIL				
	clayey SILT, mottled orange/brown. Very stiff, moist, medium to high plasticity, insensitive [ASH]				
0.5			128/67	1.9	
	silty CLAY, brown mottled grey/orange. Very stiff, moist, high plasticity, moderately sensitive [PUKETOKA FORMATION]				
1.0			135/58	2.3	
	slight fine sandy clayey SILT, brown mottled yellow/orange. Very stiff, moist, medium plasticity, moderately sensitive, with trace pumice				
1.5			164/64	2.6	
	becoming grey/pink mottled orange/brown, moist to wet				
	silty CLAY, mottled grey/pink. Hard, moist to wet, high plasticity, insensitive				
2.0			212/112	1.9	
	becoming streaked pink/red/grey				
	silty SAND, grey/red and orange/brown mottled. Firm, saturated, no plasticity, moderately sensitive, with trace fine gravel				
2.5			45/22	2.0	
	slightly fine sandy silty CLAY, streaked orange/pink/grey. Hard, wet to saturated, medium to high plasticity	▽			
3.0			224+		
	EOB at 3.0m. Target depth				
3.5					
4.0					
4.5					
5.0					
5.5					
6.0					

LANDER geotechnical

Comments:
Groundwater encountered at 2.4m.
UTP = unable to penetrate.
EOB = end of borehole.

Borehole Diameter: 50mm

Checked: PL

Topsoil	Sand	Sandstone	Plutonic		
Fill	Gravel	Siltstone	No Core		
Clay	Organic	Limestone			
Silt	Pumice	Volcanic			

Client : KNIGHT INVESTMENTS LIMITED

Project Location : 162 CLARKS BEACH ROAD
CLARKS BEACH

Job Number: J01842

Auger Borehole No. HA 04

Sheet 4 of 18

Vane Head:	Logged By:	Processor :	Date:
2007	AH	AH	14.07.21

Borehole Location: mN | mE | Ground R.L.

Description: Refer to site plan

SOIL DESCRIPTION

Depth (m)	Legend	Standing Water Level	Vane Shear(kPa) peak / residual	Soil Sensitivity	Sample and Laboratory / Other Test Details
	TOPSOIL				
	silty CLAY, mottled orange/brown. Stiff, moist, high plasticity, insensitive [ASH]				
0.5			99/51	1.9	
	with trace fine sand				
1.0	becoming moderately sensitive		93/38	2.4	
	slightly fine sandy clayey silt, mottled orange/brown. Stiff, moist, medium to high plasticity moderately sensitive				
	fine gravelly SAND, dark orange/brown. Hard, wet to saturated, no plasticity				
1.5	limited sample recovery		UTP		Scala Penetrometer Test (Blows/100mm) — 18 — 20+ (ER)
	EOB at 1.7m. Too hard to auger further. Scala penetrometer test commenced and found effective refusal (ER) at 1.9m.				
2.0					
2.5					
3.0					
3.5					
4.0					
4.5					
5.0					
5.5					
6.0					

LANDER geotechnical

Comments:
Groundwater encountered at 1.3m.
UTP = unable to penetrate.
EOB = end of borehole.

Borehole Diameter: 50mm

Checked:

Topsoil	Sand	Sandstone	Plutonic		
Fill	Gravel	Siltstone	No Core		
Clay	Organic	Limestone			
Silt	Pumice	Volcanic			

Client : KNIGHT INVESTMENTS LIMITED

Project Location : 162 CLARKS BEACH ROAD
CLARKS BEACH

Job Number: J01842

Auger Borehole No. HA 05

Sheet 5 of 18

Vane Head:	Logged By:	Processor :	Date:
2007	AH	AH	14.07.21

Borehole Location: mN | mE | Ground R.L.

Description: Refer to site plan

SOIL DESCRIPTION

Depth (m)	Soil Description	Standing Water Level	Vane Shear(kPa) peak / residual	Soil Sensitivity	Sample and Laboratory / Other Test Details
	TOPSOIL				
0.5	clayey SILT, mottled orange/brown. Very stiff, dry to moist, medium plasticity, moderately sensitive [ASH]		147/58	2.5	
	becoming moist				
	becoming grey mottled orange/brown				
1.0	becoming stiff		93/42	2.2	
	sandy SILT, grey mottled orange/brown. Very stiff, moist, low plasticity, sensitive [PUKETOKA FORMATION]				
	becoming mottled orange/grey, wet				
1.5	silty SAND, grey. Very stiff, wet, no plasticity, extra sensitive		160/19	8.4	
	limited sample recovery				
2.0	becoming stiff, saturated, sensitive	▽	93/16	5.8	
2.5	becoming very stiff, extra sensitive		131/13	10	
3.0	EOB at 3.0m. Target Depth		192/16	11.9	
3.5					
4.0					
4.5					
5.0					
5.5					
6.0					

LANDER geotechnical

Comments:
Groundwater encountered at 2.0m.
UTP = unable to penetrate.
EOB = end of borehole.

Borehole Diameter: 50mm

Checked:

Topsoil	Sand	Sandstone	Plutonic		
Fill	Gravel	Siltstone	No Core		
Clay	Organic	Limestone			
Silt	Pumice	Volcanic			

Client : KNIGHT INVESTMENTS LIMITED

Project Location : 162 CLARKS BEACH ROAD
CLARKS BEACH

Job Number: J01842

Auger Borehole No. HA 06

Sheet 6 of 18

Vane Head:	Logged By:	Processor :	Date:
2007	AH	AH	14.07.21

Borehole Location: mN | mE | Ground R.L.

Description: Refer to site plan

SOIL DESCRIPTION	Depth (m)	Vane Shear(kPa) peak / residual	Soil Sensitivity	Sample and Laboratory / Other Test Details
TOPSOIL				
clayey SILT, dark orange/brown. Very stiff, dry to moist, low plasticity, moderately sensitive [ASH]	0.5	141/42	3.4	
sightly sandy SILT, light grey/brown. Very stiff, dry to moist, no plasticity, moderately sensitive [PUKETOKA FORMATION]				
becoming moist	1.0	128/42	3.0	
becoming wet				
becoming stiff	1.5	90/19	3.1	
becoming light grey, saturated, with trace fine gravel				
becoming sensitive limited sample recovery	2.0	87/19	5.1	
becoming moderately sensitive	2.5	87/26	3.3	
becoming orange				
EOB at 3.0m. Target Depth	3.0	51/16	3.2	
	3.5			
	4.0			
	4.5			
	5.0			
	5.5			
	6.0			

LANDER geotechnical

Comments:
Groundwater encountered at 1.7m.
UTP = unable to penetrate.
EOB = end of borehole.

Borehole Diameter: 50mm

Checked:

Topsoil	Sand	Sandstone	Plutonic		
Fill	Gravel	Siltstone	No Core		
Clay	Organic	Limestone			
Silt	Pumice	Volcanic			

Client : KNIGHT INVESTMENTS LIMITED

Project Location : 162 CLARKS BEACH ROAD
CLARKS BEACH

Job Number: J01842

Auger Borehole No. HA 07

Sheet 7 of 18

Vane Head:	Logged By:	Processor :	Date:
3175	AH	AH	14.07.21

Borehole Location: mN | mE | Ground R.L.

Description: Refer to site plan

SOIL DESCRIPTION

Depth (m)	Legend	Standing Water Level	Vane Shear(kPa) peak / residual	Soil Sensitivity	Sample and Laboratory / Other Test Details
	TOPSOIL				
	clayey SILT, orange mottled light grey. Stiff, dry, low plasticity, sensitive, with trace limonite [FILL]				
0.5	BURRIED TOPSOIL		82/18	4.5	
	clayey SILT, orange/brown streaked light grey. Very stiff, moist, low plasticity, moderately sensitive, with trace limonite [PUKETOKA FORMATION]				
1.0			115/49	2.4	
1.5			116/51	2.3	
	becoming wet, low to medium plasticity				
2.0	becoming stiff		61/30	2.0	
	with silt clast inclusions				
	becoming saturated	▽			
2.5	silty fine grained SAND, orange/brown. Hard, saturated, no plasticity, with minor limonite		UTP		
3.0	EOB at 3.0m. Target Depth		UTP		
3.5					
4.0					
4.5					
5.0					
5.5					
6.0					

LANDER geotechnical

Comments:
Groundwater encountered at 2.4m.
UTP = unable to penetrate.
EOB = end of borehole.

Borehole Diameter: 50mm

Checked: PL

Topsoil	Sand	Sandstone	Plutonic		
Fill	Gravel	Siltstone	No Core		
Clay	Organic	Limestone			
Silt	Pumice	Volcanic			

Client : KNIGHT INVESTMENTS LIMITED

Project Location : 162 CLARKS BEACH ROAD
CLARKS BEACH

Job Number: J01842

Auger Borehole No. HA 08

Vane Head:	Logged By:	Processor :	Date:
2153	NM	AH	14.07.21

Borehole Location: mN | mE | Ground R.L.

Description: Refer to site plan

SOIL DESCRIPTION

Depth (m)	Soil Description	Standing Water Level	Vane Shear(kPa) peak / residual	Soil Sensitivity	Sample and Laboratory / Other Test Details
	TOPSOIL				
	silty CLAY, orange/brown. Hard, moist, medium plasticity [ASH]				
0.5			216+		
	silty CLAY, grey streaked orange/brown. Hard, moist, medium plasticity [PUKETOKA FROMATION]				
1.0			216+		
	becoming orange streaked light grey				
1.5			216+		
2.0	becoming very stiff, insensitive		185/120	1.5	
	becoming saturated	▽			
2.5	becoming hard		216+		
3.0	EOB at 3.0m. Target Depth		216+		
3.5					
4.0					
4.5					
5.0					
5.5					
6.0					

LANDER geotechnical

Comments:
Groundwater encountered at 2.4m.
UTP = unable to penetrate.
EOB = end of borehole.

Borehole Diameter: 50mm

Checked: PL

Topsoil	Sand	Sandstone	Plutonic		
Fill	Gravel	Siltstone	No Core		
Clay	Organic	Limestone			
Silt	Pumice	Volcanic			

Client : KNIGHT INVESTMENTS LIMITED

Project Location : 162 CLARKS BEACH ROAD
CLARKS BEACH

Job Number: J01842

Auger Borehole No. HA 09

Vane Head:	Logged By:	Processor :	Date:
2153	NM	MB	14.07.21

Borehole Location: mN | mE | Ground R.L.

Description: Refer to site plan

SOIL DESCRIPTION	Depth (m)	Standing Water Level	Vane Shear(kPa) peak / residual	Soil Sensitivity	Sample and Laboratory / Other Test Details
TOPSOIL					
clayey SILT, orange. Hard, moist, low plasticity [ASH]					
becoming orange/grey	0.5		216+		
clayey SILT, orange streaked grey. Hard, moist, low plasticity [PUKETOKA FORMATION]	1.0		216+		
silty CLAY, orange streaked light grey. Hard, moist, medium plasticity	1.5		216+		
clayey SILT, orange streaked light grey. Hard, moist, low plasticity					
becoming wet	2.0		216+		
silty CLAY, orange streaked light grey. Very stiff, wet, medium to high plasticity, moderately sensitive	2.5		123/46	2.7	
EOB at 3.0m. Target Depth.	3.0		139/71	2.0	
	3.5				
	4.0				
	4.5				
	5.0				
	5.5				
	6.0				

LANDER geotechnical

Comments:
Groundwater not encountered .
UTP = unable to penetrate.
EOB = end of borehole.

Borehole Diameter: 50mm

Checked: PL

Topsoil	Sand	Sandstone	Plutonic		
Fill	Gravel	Siltstone	No Core		
Clay	Organic	Limestone			
Silt	Pumice	Volcanic			

Client : KNIGHT INVESTMENTS LIMITED

Project Location : 162 CLARKS BEACH ROAD
CLARKS BEACH

Job Number: J01842

Auger Borehole No. HA 10

Sheet 10 of 18

Vane Head:	Logged By:	Processor :	Date:
2153	NM	MB	14.07.21

Borehole Location: mN | mE | Ground R.L.

Description: Refer to site plan

SOIL DESCRIPTION

Depth (m)	Vane Shear(kPa) peak / residual	Soil Sensitivity	Sample and Laboratory / Other Test Details
TOPSOIL			
silty CLAY, orange. Very stiff, moist, medium plasticity, insensitive [ASH]			
0.5	188/127	1.5	
1.0	130/93	1.4	
becoming wet			
1.5	154/102	1.5	
becoming hard			
2.0	216+		
clayey SILT, grey streaked orange. Very stiff, wet, low plasticity, insensitive [PUKETOKA FORMATION]			
becoming red/orange streaked grey			
2.5	154/89	1.7	
silty CLAY, red and orange streaked grey. Very stiff, wet, medium plasticity, insensitive			
3.0	130/77	1.7	
EOB at 3.0m. Target Depth			
3.5			
4.0			
4.5			
5.0			
5.5			
6.0			

LANDER geotechnical

Comments:
Groundwater not encountered .
UTP = unable to penetrate.
EOB = end of borehole.

Borehole Diameter: 50mm

Checked: PL

Topsoil	Sand	Sandstone	Plutonic		
Fill	Gravel	Siltstone	No Core		
Clay	Organic	Limestone			
Silt	Pumice	Volcanic			

Client : KNIGHT INVESTMENTS LIMITED

Project Location : 162 CLARKS BEACH ROAD
CLARKS BEACH

Job Number: J01842

Auger Borehole No. HA 11

Sheet 11 of 18

Vane Head:	Logged By:	Processor :	Date:
3175	AT	MB	14.07.21

Borehole Location: mN | mE | Ground R.L.

Description: Refer to site plan

SOIL DESCRIPTION

Legend	Depth (m)	Standing Water Level	Vane Shear(kPa) peak / residual	Soil Sensitivity	Sample and Laboratory / Other Test Details
TOPSOIL					
clayey SILT, orange mottled grey. Very stiff, moist, low plasticity, with trace limonite, with topsoil leaching to 0.5m [PUKETOKA FORMATION]	0.5		191+		
becoming orange mottled light grey becoming moderately sensitive	1.0		173/67	2.6	
with trace fine sand	1.5		191/51	3.7	
becoming wet					
becoming saturated	2.0	▽	136/37	3.7	
with minor fine sand, with minor limonite becoming hard	2.5		UTP		
EOB at 3.0m. Target Depth	3.0		UTP		
	3.5				
	4.0				
	4.5				
	5.0				
	5.5				
	6.0				

LANDER geotechnical

Comments:
Groundwater encountered at 2.1m.
UTP = unable to penetrate.
EOB = end of borehole.

Borehole Diameter: 50mm

Checked: PL

Topsoil	Sand	Sandstone	Plutonic		
Fill	Gravel	Siltstone	No Core		
Clay	Organic	Limestone			
Silt	Pumice	Volcanic			

Client : KNIGHT INVESTMENTS LIMITED

Project Location : 162 CLARKS BEACH ROAD
CLARKS BEACH

Job Number: J01842

Auger Borehole No. HA 12

Sheet 12 of 18

Vane Head:	Logged By:	Processor :	Date:
1750	PL	PL	14.07.21

Borehole Location: mN | mE | Ground R.L.

Description: Refer to site plan

SOIL DESCRIPTION	Depth (m)	Standing Water Level	Vane Shear(kPa) peak / residual	Soil Sensitivity	Sample and Laboratory / Other Test Details
TOPSOIL					
clayey SILT with trace fine sand, orange streaked orange/brown. Stiff, moist, no plasticity, moderately sensitive [ASH]	0.5		85/42	2.0	
with minor fine sand					
becoming very stiff	1.0		158/73	2.2	
silty CLAY with trace fine sand, orange streaked orange/brown. Very stiff, moist, medium plasticity, insensitive	1.5		154/100	1.5	
becoming orange/light brown, hard	2.0		204/108	1.9	
silty CLAY with trace fine sand, orange streaked light brown/orange. Very stiff, moist, medium plasticity, insensitive [PUKETOKA FORMATION]	2.5		181/119	1.5	
becoming orange and brown streaked light grey, medium to low plasticity					
at 3.0m, becoming hard	3.0		223/127	1.8	
EOB at 3.0m. Target Depth.	3.5				
	4.0				
	4.5				
	5.0				
	5.5				
	6.0				

LANDER geotechnical

Comments:
Groundwater not encountered.
UTP = unable to penetrate.
EOB = end of borehole.

Borehole Diameter: 50mm

Checked: RZ

Topsoil	Sand	Sandstone	Plutonic				
Fill	Gravel	Siltstone	No Core				
Clay	Organic	Limestone					
Silt	Pumice	Volcanic					

Client : KNIGHT INVESTMENTS LIMITED

Project Location : 162 CLARKS BEACH ROAD
CLARKS BEACH

Job Number: J01842

Auger Borehole No. HA 13

Sheet 13 of 18

Vane Head:	Logged By:	Processor :	Date:
1750	PL	PL	14.07.21

Borehole Location: mN | mE | Ground R.L.

Description: Refer to site plan

SOIL DESCRIPTION	Depth (m)	Vane Shear(kPa) peak / residual	Soil Sensitivity	Sample and Laboratory / Other Test Details
TOPSOIL				
silty CLAY with trace fine sand, orange streaked brown/orange. Very stiff, moist, medium plasticity, insensitive, with trace topsoil leaching to 0.4m [ASH]				
	0.5	193/112	1.7	
becoming moderately sensitive	1.0	181/77	2.4	
becoming orange				
becoming hard, insensitive	1.5	204/123	1.7	
silty CLAY with trace fine sand, light grey/orange streaked orange. Hard, moist, medium plasticity, insensitive [PUKETOKA FORMATION]				
becoming light grey and orange/red streaked orange/light brown	2.0	227/135	1.7	
clayey SILT with trace fine sand, red and orange streaked light grey/white. Very stiff, moist, low plasticity				
becoming very stiff, medium to low plasticity, insensitive	2.5	173/104	1.7	
becoming low plasticity				
at 3.0m, becoming moderately sensitive				
EOB at 3.0m. Target Depth.	3.0	135/69	2.0	
	3.5			
	4.0			
	4.5			
	5.0			
	5.5			
	6.0			

LANDER geotechnical

Comments:
Groundwater not encountered.
UTP = unable to penetrate.
EOB = end of borehole.

Borehole Diameter: 50mm

Checked: RZ

Topsoil	Sand	Sandstone	Plutonic		
Fill	Gravel	Siltstone	No Core		
Clay	Organic	Limestone			
Silt	Pumice	Volcanic			

Client : KNIGHT INVESTMENTS LIMITED

Project Location : 162 CLARKS BEACH ROAD
CLARKS BEACH

Job Number: J01842

Auger Borehole No. HA 14

Sheet 14 of 18

Vane Head:	Logged By:	Processor :	Date:
1750	PL	PL	14.07.21

Borehole Location: mN | mE | Ground R.L.

Description: Refer to site plan

SOIL DESCRIPTION	Depth (m)	Standing Water Level	Vane Shear(kPa) peak / residual	Soil Sensitivity	Sample and Laboratory / Other Test Details
TOPSOIL					
clayey SILT with trace fine sand, orange/brown. Very stiff, moist, low plasticity, sensitive [ASH]	0.5		189/39	4.8	
silty CLAY with trace fine sand, orange streaked light brown/orange. Very stiff, moist, medium plasticity, insensitive [PUKETOKA FORMATION]					
becoming orange/brown	1.0		158/92	1.7	
becoming orange streaked orange/brown					
becoming orange streaked light grey, hard, moderately sensitive	1.5		208/100	2.1	
becoming orange and brown streaked white, with trace pumiceous inculsions					
becoming very stiff	2.0		185/77	2.4	
becoming white streaked light brown	2.5		169/62	2.7	
EOB at 3.0m. Target Depth.	3.0		173/81	2.1	
	3.5				
	4.0				
	4.5				
	5.0				
	5.5				
	6.0				

LANDER geotechnical

Comments:
Groundwater not encountered.
UTP = unable to penetrate.
EOB = end of borehole.

Borehole Diameter: 50mm

Checked: RZ

Topsoil	Sand	Sandstone	Plutonic		
Fill	Gravel	Siltstone	No Core		
Clay	Organic	Limestone			
Silt	Pumice	Volcanic			

Client : KNIGHT INVESTMENTS LIMITED

Project Location : 162 CLARKS BEACH ROAD
CLARKS BEACH

Job Number: J01842

Auger Borehole No. HA 15

Sheet 15 of 18

Vane Head:	Logged By:	Processor :	Date:
2007	AH	PL	13.07.21

Borehole Location: mN | mE | Ground R.L.

Description: Refer to site plan

SOIL DESCRIPTION	Depth (m)	Vane Shear(kPa) peak / residual	Soil Sensitivity	Sample and Laboratory / Other Test Details
TOPSOIL				
silty CLAY, dark brown/grey. Very stiff, dry to moist, medium plasticity, moderately sensitive [ASH]	0.5	119/58	2.1	
silty CLAY, grey mottled orange/brown. Very stiff, dry to moist, high plasticity, moderately sensitive [PUKETOKA FORMATION]	1.0	106/48	2.2	
clayey SILT, light grey. Very stiff, moist, medium plasticity, moderately sensitive	1.5	147/38	3.9	
with limited to no sample recovery	2.0	128/38	3.4	
becoming insensitive	2.5	144/112	1.3	
at 3.0m, becoming moderately sensitive	3.0	109/51	2.1	
EOB at 3.0m. Target Depth.	3.5			
	4.0			
	4.5			
	5.0			
	5.5			
	6.0			

LANDER geotechnical

Comments:
Groundwater not encountered.
UTP = unable to penetrate.
EOB = end of borehole.

Borehole Diameter: 50mm

Checked: RZ

Topsoil	Sand	Sandstone	Plutonic		
Fill	Gravel	Siltstone	No Core		
Clay	Organic	Limestone			
Silt	Pumice	Volcanic			

Client : KNIGHT INVESTMENTS LIMITED

Project Location : 162 CLARKS BEACH ROAD
CLARKS BEACH

Job Number: J01842

Auger Borehole No. HA 16

Sheet 16 of 18

Vane Head:	Logged By:	Processor :	Date:
3195	AT	PL	14.07.21

Borehole Location: mN | mE | Ground R.L.

Description: Refer to site plan

SOIL DESCRIPTION	Legend	Depth (m)	Standing Water Level	Vane Shear(kPa) peak / residual	Soil Sensitivity	Sample and Laboratory / Other Test Details
TOPSOIL						
clayey SILT, dark brown streaked orange/brown. Very stiff, dry, low plasticity, with trace topsoil leaching to 0.4m [ASH]		0.5		191+		
becoming moderately sensitive becoming moist		1.0		112/45	2.5	
becoming light grey, low to medium plasticity, with trace silt clast inculsions		1.5		135/58	2.3	
silty SAND, grey/brown. Hard, moist, low plasticity		2.0		UTP		
clayey SILT with trace fine sand, light grey. Very stiff, wet, low plasticity, moderately sensitive, with trace silt clast inculsions		2.5		140/40	3.6	
EOB at 3.0m. Target Depth.		3.0		134/38	3.5	
		3.5				
		4.0				
		4.5				
		5.0				
		5.5				
		6.0				

LANDER geotechnical

Comments:
Groundwater not encountered.
UTP = unable to penetrate.
EOB = end of borehole.

Borehole Diameter: 50mm

Checked:

Topsoil	Sand	Sandstone	Plutonic		
Fill	Gravel	Siltstone	No Core		
Clay	Organic	Limestone			
Silt	Pumice	Volcanic			

Client : KNIGHT INVESTMENTS LIMITED

Project Location : 162 CLARKS BEACH ROAD
CLARKS BEACH

Job Number: J01842

Auger Borehole No. HA 17

Sheet 17 of 18

Vane Head:	Logged By:	Processor :	Date:
3195	AT	PL	12.07.21

Borehole Location: mN | mE | Ground R.L.

Description: Refer to site plan

SOIL DESCRIPTION

Legend	Depth (m)	Standing Water Level	Vane Shear(kPa) peak / residual	Soil Sensitivity	Sample and Laboratory / Other Test Details
TOPSOIL					
clayey SILT, orange/brown. Very stiff, moist, low plasticity, moderately sensitive [ASH]	0.5		150/74	2.0	
	1.0		191+		
	1.5		191+		
becoming wet					
becoming red streaked orange/brown					
becoming saturated	2.0		191+		
clayey SILT, orange/brown streaked light grey. Very stiff, moist, low plasticity, with trace limonite [PUKETOKA FORMATION]					
at 2.3m, becoming white mottled red, no plasticity, with trace silt clast inculsions	2.5		191+		
at 2.0m, becoming stiff, moderately sensitive					
EOB at 3.0m. Target Depth.	3.0		58/24	2.0	
	3.5				
	4.0				
	4.5				
	5.0				
	5.5				
	6.0				

LANDER geotechnical

Comments:
Groundwater not encountered.
UTP = unable to penetrate.
EOB = end of borehole.

Borehole Diameter: 50mm

Checked: RZ

Topsoil	Sand	Sandstone	Plutonic		
Fill	Gravel	Siltstone	No Core		
Clay	Organic	Limestone			
Silt	Pumice	Volcanic			

Client : KNIGHT INVESTMENTS LIMITED

Project Location : 162 CLARKS BEACH ROAD
CLARKS BEACH

Job Number: J01842

Auger Borehole No. HA 18

Sheet 18 of 18

Vane Head:	Logged By:	Processor :	Date:
1750	PL	PL	14.07.21

Borehole Location: mN | mE | Ground R.L.

Description: Refer to site plan

SOIL DESCRIPTION	Depth (m)	Vane Shear(kPa) peak / residual	Soil Sensitivity	Sample and Laboratory / Other Test Details
TOPSOIL				
clayey SILT with trace fine sand, orange/brown. Very stiff, moist, low plasticity [ASH]				
silty CLAY, orange/brown streaked light grey/orange. Very stiff, moist, medium plasticity, insensitive [PUKETOKA FORMATION]	0.5	116/73	1.6	
becoming red and orange streaked orange/light grey				
with trace fine sand, with trace fine gravel sized silt clast inculsions				
becoming hard	1.0	270+		
becoming orange and white streaked red	1.5	270+		
clayey SILT with trace fine sand, red streaked white. Very stiff, moist, low to no plasticity, insensitive	2.0	139/81	1.7	
silty CLAY, black, orange and light grey streaked red/brown. Very stiff, wet, medium plasticity at 2.4m, becoming white and red streaked orange/brown, medium to low plasticity at 2.5m, becoming red and orange streaked white	2.5	143/89	1.6	
clayey SILT with trace fine sand, orange/brown streaked white. Stiff, moist, low plasticity, moderately sensitive, with trace fine gravel sized silt clast inculsions	3.0	96/42	2.3	
EOB at 3.0m. Target Depth.	3.5			
	4.0			
	4.5			
	5.0			
	5.5			
	6.0			

LANDER geotechnical

Comments:
Groundwater not encountered.
UTP = unable to penetrate.
EOB = end of borehole.

Borehole Diameter: 50mm

Checked: RZ

Topsoil	Sand	Sandstone	Plutonic		
Fill	Gravel	Siltstone	No Core		
Clay	Organic	Limestone			
Silt	Pumice	Volcanic			

Appendix C: Current ground investigation results

- Option C – Hand Auger logs
- Option S – Hand Auger logs
- Option T – Hand Auger logs
- Option Z – Sections

HAND AUGER LOG

Tonkin+Taylor

HOLE Id: **C-HA01**

SHEET: 1 OF 1

PROJECT: SWWW Options Study | LOCATION: | JOB No.: 1012888.2000

CO-ORDINATES: (NZTM2000) 5887989 mN 1753561 mE

R.L.: 24m

DATUM: NZVD2016

DRILL TYPE: HA

METHOD: Hand auger with dynamic cone

HOLE STARTED: 23/11/2021

HOLE FINISHED: 23/11/2021

DRILLED BY: T+T

LOGGED BY: TRMC

CHECKED: BEWE

Geological unit	Depth (m)	Method	Core recovery (%)	Tests	Moisture	Consistency	Description
Topsoil	0.00	HA	100		D	F	*0.00m:* Sandy SILT, minor clay; brown. Firm, dry, non-plastic
Puketoka Formation	0.30	HA	100	120/58 kPa Insitu (0.5m)	M	St	*0.30m:* Clayey SILT, minor sand; brown. Stiff, moist, low plasticity. Sand, fine.
	0.80	HA	100	>212 kPa Insitu (1.0m)		VSt	*0.80m:* Silty CLAY, minor sand; brown grey. Very stiff, moist, high plasticity. Sand, fine and coarse, is pumice, some mold to clay.
	1.05	HA	100	>212 kPa Insitu (1.5m)			*1.05m:* CLAY, some silt, trace sand; white grey. Very stiff, moist, high plasticity. Sand, fine, is pumice, molds to clay.
	1.90	HA	100	102/51 kPa Insitu (2.0m)		St	*1.90m:* SILT, some clay, minor sand; grey. Stiff, moist, low plasticity. Sand, fine, quartz.
	2.05	HA	100				*2.05m:* Clayey SILT; light yellow brown. Stiff, moist, high plasticity.
	2.15	HA	100	142/46 kPa Insitu (2.5m); 49/12 kPa Insitu (3.0m)	W	L	*2.15m:* Silty fine and coarse SAND, minor clay; white grey. Loose, wet, slighty dilatant. Sand, poorly graded, is pumice and quartz. *2.25 - 2.50m:* Orange staining. *2.90 - 3.10m:* Saturated
	3.10	DCP	0				3.1m: Collapse

Water: 23/11/2021 at completion (approx. 2.7m)

Scala penetrometer (Blows/50mm), 3.1–4.0m: 0, 3, 3, 3, 2, 3, 3, 3, 3, 3, 2, 3, 3, 2, 3, 2, 2

RL (m): 23 (1.0m), 22 (2.0m), 21 (3.0m), 20 (4.0m)

COMMENTS: Collapse due to swelling cohesive material.

Hole Depth 3.1m

Scale 1:25

Rev.: A

HAND AUGER PHOTOS

BOREHOLE No.: **C-HA01**

SHEET: 1 OF 1

PROJECT: SWWW Options Study		LOCATION:	JOB No.: 1012888.2000
CO-ORDINATES: (NZTM2000)	5887989 mN 1753561 mE	DRILL TYPE: HA METHOD: Hand auger with dynamic cone	HOLE STARTED: 23/11/2021 HOLE FINISHED: 23/11/2021
R.L.:	24m		DRILLED BY: T+T
DATUM:	NZVD2016		LOGGED BY: TRMC CHECKED: BEWE

0.00-1.50m

1.50-3.10m

HAND AUGER LOG

HOLE Id: **C-HA02**

SHEET: 1 OF 1

PROJECT: SWWW Options Study	LOCATION:	JOB No.: 1012888.2000
CO-ORDINATES: 5887818 mN (NZTM2000) 1753571 mE	DRILL TYPE: HA	HOLE STARTED: 23/11/2021
	METHOD: Hand auger	HOLE FINISHED: 23/11/2021
R.L.: 24m		DRILLED BY: T+T
DATUM: NZVD2016		LOGGED BY: TRMC CHECKED: BEWE

GEOLOGICAL	METHOD OBSERVATIONS								ENGINEERING DESCRIPTION					
STRATIGRAPHY / ENG GEOLOGICAL UNIT / ADDITIONAL OBSERVATIONS	WATER	CORE RECOVERY (%)	METHOD	SCALA PENETROMETER (Blows/100mm) 0 1 2 3 4 5 6 7 8 9	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	WEATHERING CLASSIFICATION	MOISTURE CLASSIFICATION	CONSISTENCY / DENSITY CLASSIFICATION	ESTIMATED SOIL SHEAR STRENGTH (Su, kPa) VS 12 25 50 100 200 H	DESCRIPTION
Topsoil											D	F		*0.00m:* Silty SAND; brown. Firm, dry. Sand, poorly sorted.
Puketoka Formation	DRY 23/11/2021	100	HA		130/46 kPa Insitu 200/64 kPa Insitu 167/43 kPa Insitu 132/27 kPa Insitu >212 kPa Insitu 148/70 kPa Insitu 188/82 kPa Insitu 148/46 kPa Insitu		23 22 21 20	0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5			D-M M M-W M	VSt St VSt		*0.30m:* SILT, some clay, minor sand; red brown. Very stiff, dry to moist, low plasticity. Sand, fine. *0.80m:* Silty CLAY, minor sand; red brown. Very stiff, moist, medium plasticity. Sand, fine, quartz. *1.50m:* CLAY, some silt, trace sand; orange brown. Very stiff, moist, high plasticity. Sand, fine, is pumice, molds to clay. *2.10m:* CLAY, minor silt, trace sand; light brown. Stiff, moist to wet, medium plasticity. Sand, fine. *2.55m:* Clayey SILT, trace sand; light grey stained red. Very stiff, moist, medium plasticity. Sand, fine and coarse, is pumice, molds to clay. *3.50m:* Clayey SILT, some sand; light grey stained red. Very stiff, moist, medium plasticity. Sand, fine and coarse, is quartz/pumice, pumice molds to clay. 4m: Target depth

0.0-3.0m

3.0-4.0m

COMMENTS:

Hole Depth 4m

Scale 1:25

Rev.: A

HandAugerLog_CANDIDATE_v018 - ATOMIC LOSS DETL - 1/02/2022 8:11:07 AM - Produced with Core-GS by GeRoc

HAND AUGER PHOTOS

BOREHOLE No.: **C-HA02**

PROJECT: SWWW Options Study		LOCATION:	JOB No.: 1012888.2000
CO-ORDINATES: (NZTM2000)	5887818 mN 1753571 mE	DRILL TYPE: HA METHOD: Hand auger	HOLE STARTED: 23/11/2021 HOLE FINISHED: 23/11/2021 DRILLED BY: T+T
R.L.:	24m		
DATUM:	NZVD2016		LOGGED BY: TRMC CHECKED: BEWE

0.00-3.00m

3.00-4.00m

HAND AUGER LOG

HOLE Id: **C-HA03**

SHEET: 1 OF 1

PROJECT: SWWW Options Study	LOCATION:	JOB No.: 1012888.2000
CO-ORDINATES: 5887140 mN (NZTM2000) 1753677 mE	DRILL TYPE: HA	HOLE STARTED: 22/11/2021
	METHOD: Hand auger with dynamic cone	HOLE FINISHED: 22/11/2021
R.L.: 24m		DRILLED BY: T+T
DATUM: NZVD2016		LOGGED BY: TRMC CHECKED: BEWE

GEOLOGICAL	METHOD OBSERVATIONS									ENGINEERING DESCRIPTION					
STRATIGRAPHY / ENG GEOLOGICAL UNIT / ADDITIONAL OBSERVATIONS	WATER	CORE RECOVERY (%)	METHOD	SCALA PENETROMETER (Blows/50mm) 0 2 4 6 8 10 12 14 16 18	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	WEATHERING CLASSIFICATION	MOISTURE CLASSIFICATION	CONSISTENCY / DENSITY CLASSIFICATION	ESTIMATED SOIL SHEAR STRENGTH (Su, kPa) VS 12 25 50 100 200 H	DESCRIPTION
Topsoil											D	St		*0.00m:* Sandy SILT, minor clay; dark brown. Stiff, dry, non-plastic. Sand, fine.
											M			*0.20m:* CLAY, some silt; orange brown. Stiff, moist, high plasticity.
					91/30 kPa Insitu			0.5						
Fill		100	HA		191/64 kPa Insitu		23	1.0				VSt		*0.80m:* CLAY, minor silt, trace sand; yellowish brown. Very stiff, moist, high plasticity. Sand, fine, pumice, molds to clay.
					>212 kPa Insitu			1.5						*1.30m:* Clayey SILT, minor sand, trace gravel; brownish orange mottled red. Very stiff, moist, medium plasticity. Sand, fine; gravel, fine, angular, basalt.
Puketoka Formation	DRY 22/11/2021				73/23 kPa Insitu		22	2.0				St		*1.90m:* SILT, some clay and some sand; reddish brown. Stiff, moist, low plasticity. Sand, fine to medium, pumice, molds to clay.
					UTP Insitu			2.5						*2.50m:* Sandy SILT, some clay; light grey streaked red. Stiff, moist, low plasticity. Sand, fine to coarse, pumice, some molds to clay. Coarse sand remains intact.
		0	DCP	3 1 2 1 2 2 2 3 3 3 3 2 3 6 6 6 6 10 8 4 5 6			21	3.0						2.9m: Collapse
							20	3.5						
								4.0						
								4.5						

0.0-2.9m

COMMENTS: Collapse due to swelling cohesive material.

Hole Depth 2.9m

Scale 1:25

Rev.: A

HAND AUGER PHOTOS

BOREHOLE No.: **C-HA03**

SHEET: 1 OF 1

PROJECT: SWWW Options Study		LOCATION:	JOB No.: 1012888.2000
CO-ORDINATES: (NZTM2000)	5887140 mN 1753677 mE	DRILL TYPE: HA METHOD: Hand auger with dynamic cone	HOLE STARTED: 22/11/2021 HOLE FINISHED: 22/11/2021
R.L.:	24m		DRILLED BY: T+T
DATUM:	NZVD2016		LOGGED BY: TRMC CHECKED: BEWE

0.00-2.90m

HAND AUGER LOG

HOLE Id: **C-HA04**

SHEET: 1 OF 1

PROJECT: SWWW Options Study	LOCATION:	JOB No.: 1012888.2000
CO-ORDINATES: 5887128 mN (NZTM2000) 1753634 mE	DRILL TYPE: HA	HOLE STARTED: 22/11/2021
	METHOD: Hand auger	HOLE FINISHED: 22/11/2021
R.L.: 23m		DRILLED BY: T+T
DATUM: NZVD2016		LOGGED BY: TRMC CHECKED: BEWE

GEOLOGICAL	METHOD OBSERVATIONS								ENGINEERING DESCRIPTION					
STRATIGRAPHY / ENG GEOLOGICAL UNIT / ADDITIONAL OBSERVATIONS	WATER	CORE RECOVERY (%)	METHOD	SCALA PENETROMETER (Blows/100mm) 0 1 2 3 4 5 6 7 8 9	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	WEATHERING CLASSIFICATION	MOISTURE CLASSIFICATION	CONSISTENCY / DENSITY CLASSIFICATION	ESTIMATED SOIL SHEAR STRENGTH (Su, kPa) VS 12 25 50 100 200 H	DESCRIPTION
Topsoil											D	F		*0.00m:* SILT, some sand; brown. Firm, dry, non-plastic. Sand, fine.
Puketoka Formation	DRY 22/11/2021	100	HA		161/75 kPa Insitu		22	0.5			M	VSt		*0.20m:* Silty CLAY, trace sand; yellowish brown. Very stiff, moist, high plasticity. Sand, fine.
					170/94 kPa Insitu			1.0						*1.50 - 1.90m:* becomes reddish brown
					120/51 kPa Insitu		21	1.5						*1.90m:* Clayey SILT, minor sand; reddish brown streaked white. Very stiff, moist, medium plasticity. Sand, fine and coarse, Pumice and molds to clay.
					>212 kPa Insitu			2.0						*2.40m:* Silty CLAY, trace sand; reddish brown mottled grey. Very stiff, moist, high plasticity. Sand, fine, quartz.
					102/45 kPa Insitu		20	2.5				St		*2.80m:* Sandy CLAY, minor silt; red spotted white & grey. Stiff, moist, high plasticity. Sand, fine to medium, quartz. 0.0-3.0m
								3.0						*3.00m:* CLAY, some silt; orange. Stiff, moist, high plasticity.
					120/75 kPa Insitu		19	3.5				St-VSt		*3.30m:* Clayey SILT, trace sand; reddish brown spotted white. Stiff to very stiff, moist, medium plasticity. Sand, fine to medium, pumice and quartz. 3.0-4.0m
					163/58 kPa Insitu			4.0						4m: Target depth
								4.5						

COMMENTS:

Hole Depth 4m

Scale 1:25

Rev.: A

HAND AUGER PHOTOS

BOREHOLE No.: **C-HA04**

SHEET: 1 OF 1

PROJECT: SWWW Options Study		LOCATION:	JOB No.: 1012888.2000
CO-ORDINATES: (NZTM2000)	5887128 mN 1753634 mE	DRILL TYPE: HA METHOD: Hand auger	HOLE STARTED: 22/11/2021 HOLE FINISHED: 22/11/2021
R.L.:	23m		DRILLED BY: T+T
DATUM:	NZVD2016		LOGGED BY: TRMC CHECKED: BEWE

0.00-3.00m

3.00-4.00m

HAND AUGER LOG

HOLE Id: **S-HA01**

SHEET: 1 OF 1

PROJECT: SWWW Options Study	LOCATION:	JOB No.: 1012888.2000
CO-ORDINATES: 5885054 mN (NZTM2000) 1754260 mE	DRILL TYPE: HA	HOLE STARTED: 11/11/2021
	METHOD: Hand auger	HOLE FINISHED: 11/11/2021
R.L.: 12m		DRILLED BY: T+T
DATUM: NZVD2016		LOGGED BY: TRMC CHECKED: BEWE

GEOLOGICAL	METHOD OBSERVATIONS								ENGINEERING DESCRIPTION					
STRATIGRAPHY / ENG GEOLOGICAL UNIT / ADDITIONAL OBSERVATIONS	WATER	CORE RECOVERY (%)	METHOD	SCALA PENETROMETER (Blows/100mm) 0 1 2 3 4 5 6 7 8 9	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	WEATHERING CLASSIFICATION	MOISTURE CLASSIFICATION	CONSISTENCY / DENSITY CLASSIFICATION	ESTIMATED SOIL SHEAR STRENGTH (Su, kPa) VS 12 S 25 F 50 St 100 VSt 200 H	DESCRIPTION
Fill					135/33 kPa Insitu			0.5			D	VSt		*0.00m:* Sandy SILT, minor gravel; brown. Very stiff, dry, non-plastic. Sand, fine to coarse; gravel, fine to medium, sub-angular to angular, basalt.
South Auckland Volcanic Field	DRY 11/11/2021	100	HA		140/31 kPa Insitu		11	1.0			D-M			*0.50m:* Sandy SILT, minor clay; orange brown. Very stiff, dry, medium plasticity. Sand, fine. Non-dilatant. *1.15m:* Silty CLAY; light brown. Very stiff, dry to moist, medium plasticity.
					221/43 kPa Insitu			1.5			M	VSt-H		*1.45m:* Clayey SILT, trace sand; light yellow brown. Very stiff to hard, moist, medium plasticity. Sand, fine to medium. Sand is pumice, non-dilatant.
					133/41 kPa Insitu		10	2.0				VSt		*1.95m:* Silty CLAY, trace sand; orange brown. Very stiff, moist, high plasticity. Sand, fine. Sand is pumice, non-dilatant. *2.10m:* Clayey SILT, trace sand; light yellow brown. Very stiff, moist, medium plasticity. Sand, fine to medium. Sand is pumice, non-dilatant.
					133/55 kPa Insitu			2.5						*2.70m:* Silty CLAY, minor sand; light grey streaked red. Very stiff, moist, high plasticity. Sand, fine to coarse. Sand is pumice, non-dilatant.
					121/60 kPa Insitu		9	3.0						
					145/73 kPa Insitu			3.5						
					155/70 kPa Insitu		8	4.0						4m: Target depth
								4.5						

0.0-4.0m

COMMENTS:

Hole Depth 4m

Scale 1:25

Rev.: A

HAND AUGER PHOTOS

BOREHOLE No.: **S-HA01**

SHEET: 1 OF 1

PROJECT: SWWW Options Study	LOCATION:	JOB No.: 1012888.2000
CO-ORDINATES: 5885054 mN (NZTM2000) 1754260 mE R.L.: 12m DATUM: NZVD2016	DRILL TYPE: HA METHOD: Hand auger	HOLE STARTED: 11/11/2021 HOLE FINISHED: 11/11/2021 DRILLED BY: T+T LOGGED BY: TRMC CHECKED: BEWE

0.00-4.00m

HAND AUGER LOG

HOLE Id: **S-HA02**

SHEET: 1 OF 1

PROJECT: SWWW Options Study	LOCATION:	JOB No.: 1012888.2000
CO-ORDINATES: 5884948 mN (NZTM2000) 1754288 mE	DRILL TYPE: 50mm Hand Auger	HOLE STARTED: 12/11/2021
	METHOD: Hand auger	HOLE FINISHED: 12/11/2021
R.L.: 13m		DRILLED BY: T+T
DATUM: NZVD2016		LOGGED BY: CMCD CHECKED: BEWE

GEOLOGICAL	METHOD OBSERVATIONS								ENGINEERING DESCRIPTION					
STRATIGRAPHY / ENG GEOLOGICAL UNIT / ADDITIONAL OBSERVATIONS	WATER	CORE RECOVERY (%)	METHOD	SCALA PENETROMETER (Blows/100mm) 0 1 2 3 4 5 6 7 8 9	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	WEATHERING CLASSIFICATION	MOISTURE CLASSIFICATION	CONSISTENCY / DENSITY CLASSIFICATION	ESTIMATED SOIL SHEAR STRENGTH (Su, kPa) VS 12 25 50 100 200 H	DESCRIPTION
Fill								0.5			D	TP		*0.00m:* Silty fine to coarse GRAVEL; brown. Tightly packed, dry, well graded. Gravel, sub-angular to angular, basalt.
Puketoka Formation	11/12/2021	100	HA		63/32 kPa 164/103 kPa 181/103 kPa 152/92 kPa 152/118 kPa 151/109 kPa 61/35 kPa		12 11 10 9	1.0 1.5 2.0 2.5 3.0 3.5 4.0			W	St VSt St		*0.50m:* Clayey SILT, trace sand; orange brown. Stiff, wet, medium plasticity. Sand, fine. *1.20m:* Silty CLAY; light grey streaked pink. Very stiff, wet, high plasticity. *2.90 - 3.70m:* grey brown with trace fine sand. *3.70m:* CLAY, some silt; white streaked pink. Stiff, wet, high plasticity.
								4.5						4.2m: Target depth

COMMENTS:

Hole Depth 4.2m

Scale 1:25

Rev.: A

0.0-4.2m

HAND AUGER PHOTOS

BOREHOLE No.: **S-HA02**

SHEET: 1 OF 1

PROJECT: SWWW Options Study		LOCATION:	JOB No.: 1012888.2000
CO-ORDINATES: (NZTM2000)	5884948 mN 1754288 mE	DRILL TYPE: 50mm Hand Auger METHOD: Hand auger	HOLE STARTED: 12/11/2021 HOLE FINISHED: 12/11/2021 DRILLED BY: T+T
R.L.:	13m		
DATUM:	NZVD2016		LOGGED BY: CMCD CHECKED: BEWE

0.00-4.20m

HAND AUGER LOG

HOLE Id: **S-HA03**

SHEET: 1 OF 1

PROJECT: SWWW Options Study	LOCATION:	JOB No.: 1012888.2000
CO-ORDINATES: 5884987 mN (NZTM2000) 1754419 mE	DRILL TYPE: HA	HOLE STARTED: 12/11/2021
	METHOD: Hand auger	HOLE FINISHED: 12/11/2021
R.L.: 12m		DRILLED BY: T+T
DATUM: NZVD2016		LOGGED BY: TRMC CHECKED: BEWE

GEOLOGICAL	METHOD OBSERVATIONS									ENGINEERING DESCRIPTION				
STRATIGRAPHY / ENG GEOLOGICAL UNIT / ADDITIONAL OBSERVATIONS	WATER	CORE RECOVERY (%)	METHOD	SCALA PENETROMETER (Blows/100mm) 0 1 2 3 4 5 6 7 8 9	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	WEATHERING CLASSIFICATION	MOISTURE CLASSIFICATION	CONSISTENCY / DENSITY CLASSIFICATION	ESTIMATED SOIL SHEAR STRENGTH (Su, kPa) VS 12 25 50 100 200 H	DESCRIPTION
Fill								0.0			D	'D'		*0.00m:* Silty fine to coarse SAND, minor gravel, trace rootlets; brown mottled orange. "Dense", dry, poorly graded, non-dilatant. Gravel, fine to medium, sub-angular to angular, basalt.
											D-M	St		*0.30m:* Silty CLAY, minor sand; grey streaked red. Stiff, dry to moist, medium plasticity. Sand, fine. Sand is pumice, non-dilatant.
					63/21 kPa Insitu			0.5			M			*0.70m:* Sandy SILT, some clay; light grey. Stiff, moist, low plasticity. Sand, fine. Sand is pumice, non-dilatant.
					113/68 kPa Insitu		11	1.0				VSt		*0.90m:* Clayey SILT, trace sand; orange brown. Very stiff, moist, medium plasticity. Sand, fine. Sand is pumice, non-dilatant.
														1.10m: Silty CLAY, minor sand; light grey streaked red. Very stiff, moist, high plasticity. Sand, fine. Sand is pumice, molds to silt, non-dilatant.
					168/81 kPa Insitu			1.5						*1.80 - 2.00m:* orange mottling.
	12/11/2021													
South Auckland Volcanic Field		100	HA		183/110 kPa Insitu		10	2.0						
					135/95 kPa Insitu			2.5						*2.70m:* Clayey SILT; orange. Very stiff, moist, low plasticity.
	12/11/2021													
					153/71 kPa Insitu		9	3.0			M-W			*3.05m:* CLAY, some silt, minor sand; light greyish white mottled pink. Very stiff, moist to wet, high plasticity. Sand, fine. Sand is pumice, molds to silt, non-dilatant.
					78/40 kPa Insitu			3.5						*3.50 - 3.90m:* Stiff.
											W	St		*3.90m:* Silty CLAY; orange grey. Stiff, wet, low plasticity.
					65/36 kPa Insitu		8	4.0						4m: Target depth
								4.5						

0.0-4.0m

COMMENTS:

Hole Depth 4m

Scale 1:25

Rev.: A

HAND AUGER PHOTOS

BOREHOLE No.: **S-HA03**

SHEET: 1 OF 1

PROJECT: SWWW Options Study		LOCATION:	JOB No.: 1012888.2000
CO-ORDINATES: (NZTM2000)	5884987 mN 1754419 mE	DRILL TYPE: HA METHOD: Hand auger	HOLE STARTED: 12/11/2021 HOLE FINISHED: 12/11/2021 DRILLED BY: T+T
R.L.:	12m		
DATUM:	NZVD2016		LOGGED BY: TRMC CHECKED: BEWE

0.00-4.00m

HAND AUGER LOG

HOLE Id: **T-HA01**

SHEET: 1 OF 1

PROJECT: SWWW Options Study	LOCATION:	JOB No.: 1012888.2000
CO-ORDINATES: 5885112 mN (NZTM2000) 1753488 mE	DRILL TYPE: 50mm Hand Auger	HOLE STARTED: 11/11/2021
	METHOD: Hand auger	HOLE FINISHED: 11/11/2021
R.L.: 12m		DRILLED BY: T+T
DATUM: NZVD2016		LOGGED BY: CMCD CHECKED: BEWE

GEOLOGICAL	METHOD OBSERVATIONS								ENGINEERING DESCRIPTION					
STRATIGRAPHY / ENG GEOLOGICAL UNIT / ADDITIONAL OBSERVATIONS	WATER	CORE RECOVERY (%)	METHOD	SCALA PENETROMETER (Blows/100mm) 0 1 2 3 4 5 6 7 8 9	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	WEATHERING CLASSIFICATION	MOISTURE CLASSIFICATION	CONSISTENCY / DENSITY CLASSIFICATION	ESTIMATED SOIL SHEAR STRENGTH (Su, kPa) VS 12 25 50 100 200 VSt S St H	DESCRIPTION
Topsoil									TS		D	VSt		*0.00m:* SILT, some clay; brown. Very stiff, dry, low plasticity.
								0.5			M			*0.30m:* Clayey SILT; orange brown. Very stiff, moist, medium plasticity.
					132/72 kPa									
					149/81 kPa		11	1.0			M-W			*1.00m:* Silty CLAY; light brown. Very stiff, moist to wet, high plasticity.
														1.50 - 1.90m: Hand auger grinding on hard silts - barely able to penetrate.
					UTP			1.5			W	H		*1.50m:* SILT, trace clay and trace sand; light grey white. Hard, wet, non-plastic. Sand, fine. Friable.
Puketoka Formation		100	HA		172/89 kPa		10	2.0				VSt		*1.95m:* Silty CLAY; grey streaked orange. Very stiff, wet, high plasticity.
					164/124 kPa			2.5						
					129/92 kPa		9	3.0						
					83/46 kPa			3.5				St		*3.40m:* CLAY, some silt; white mottled orange. Stiff, wet, high plasticity.
	11/11/2021				78/29 kPa		8	4.0						
								4.5						4.2m: Target depth

COMMENTS:

Hole Depth 4.2m

Scale 1:25

Rev.: A

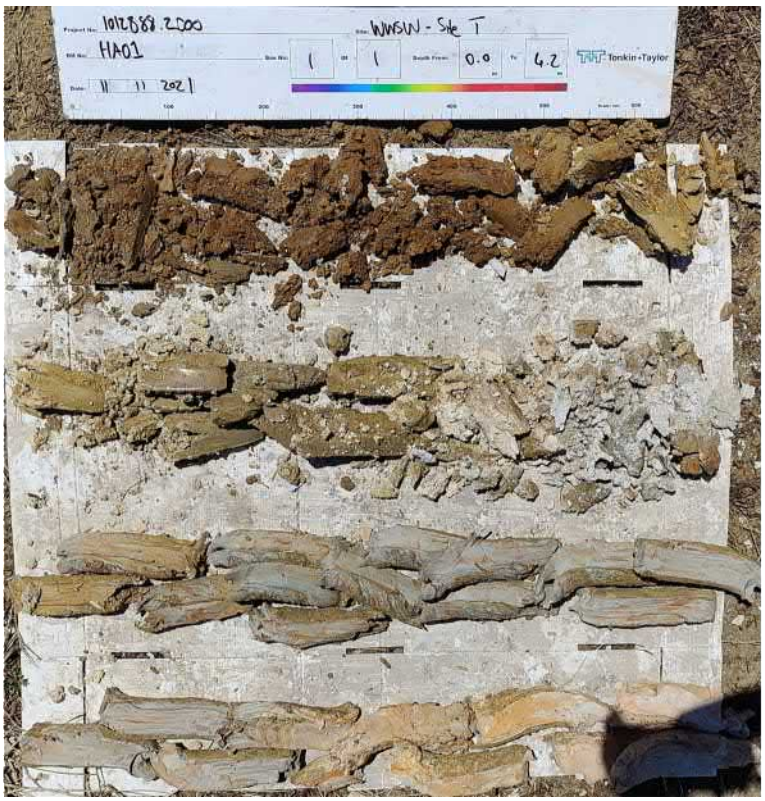
0.0-4.2m

HAND AUGER PHOTOS

BOREHOLE No.: **T-HA01**

SHEET: 1 OF 1

PROJECT: SWWW Options Study		LOCATION:	JOB No.: 1012888.2000
CO-ORDINATES: (NZTM2000)	5885112 mN 1753488 mE	DRILL TYPE: 50mm Hand Auger METHOD: Hand auger	HOLE STARTED: 11/11/2021 HOLE FINISHED: 11/11/2021
R.L.:	12m		DRILLED BY: T+T
DATUM:	NZVD2016		LOGGED BY: CMCD CHECKED: BEWE



0.00-4.20m

HAND AUGER LOG

HOLE Id: **T-HA02**

SHEET: 1 OF 1

PROJECT: SWWW Options Study	LOCATION:	JOB No.: 1012888.2000
CO-ORDINATES: 5885213 mN (NZTM2000) 1753430 mE	DRILL TYPE: 50mm Hand Auger	HOLE STARTED: 11/11/2021
	METHOD: Hand auger	HOLE FINISHED: 11/11/2021
R.L.: 10m		DRILLED BY: T+T
DATUM: NZVD2016		LOGGED BY: CMCD CHECKED: BEWE

GEOLOGICAL	METHOD OBSERVATIONS								ENGINEERING DESCRIPTION					
STRATIGRAPHY / ENG GEOLOGICAL UNIT / ADDITIONAL OBSERVATIONS	WATER	CORE RECOVERY (%)	METHOD	SCALA PENETROMETER (Blows/100mm) 0 1 2 3 4 5 6 7 8 9	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	WEATHERING CLASSIFICATION	MOISTURE CLASSIFICATION	CONSISTENCY / DENSITY CLASSIFICATION	ESTIMATED SOIL SHEAR STRENGTH (Su, kPa) VS 12 25 50 100 200 VSt H	DESCRIPTION
Topsoil									TS		D	VSt		*0.00m:* Clayey SILT; dark brown. Very stiff, dry, low to medium plasticity.
											M			*0.25m:* Silty CLAY; brown. Very stiff, moist, high plasticity.
					166/46 kPa			0.5						*0.70m:* Clayey SILT; grey brown. Very stiff, moist, medium to high plasticity.
					164/72 kPa		9	1.0						*0.90 - 1.10m:* Becoming wet.
											W			*1.10m:* Silty CLAY; grey. Very stiff, wet, high plasticity.
					>207 kPa			1.5						*1.30 - 2.00m:* with orange streaks and becoming hard.
Puketoka Formation		100	HA		164/43 kPa		8	2.0						*1.80 - 2.00m:* Very stiff.
														2.00m: SILT, some clay; white streaked orange. Very stiff, wet, low plasticity. Friable.
					152/52 kPa			2.5						*2.40m:* Silty CLAY; light grey streaked orange. Very stiff, wet, high plasticity.
					132/63 kPa		7	3.0						
					101/52 kPa			3.5						*3.40m:* CLAY, some silt; light grey white. Very stiff, wet, high plasticity.
	11/11/2021				55/32 kPa		6	4.0						*3.60 - 4.00m:* Stiff.
								4.5						4.2m: Target depth

0.0-4.2m

COMMENTS:

Hole Depth 4.2m

Scale 1:25

Rev.: A

HAND AUGER PHOTOS

BOREHOLE No.: **T-HA02**

SHEET: 1 OF 1

PROJECT: SWWW Options Study		LOCATION:	JOB No.: 1012888.2000
CO-ORDINATES: (NZTM2000)	5885213 mN 1753430 mE	DRILL TYPE: 50mm Hand Auger METHOD: Hand auger	HOLE STARTED: 11/11/2021 HOLE FINISHED: 11/11/2021 DRILLED BY: T+T
R.L.:	10m		LOGGED BY: CMCD CHECKED: BEWE
DATUM:	NZVD2016		

0.00-4.20m

HAND AUGER LOG

HOLE Id: **T-HA03**

SHEET: 1 OF 1

PROJECT: SWWW Options Study	LOCATION:	JOB No.: 1012888.2000
CO-ORDINATES: 5885263 mN (NZTM2000) 1753608 mE	DRILL TYPE: HA	HOLE STARTED: 11/11/2021
	METHOD: Hand auger	HOLE FINISHED: 11/11/2021
R.L.: 9m		DRILLED BY: T+T
DATUM: NZVD2016		LOGGED BY: TRMC CHECKED: BEWE

GEOLOGICAL	METHOD OBSERVATIONS								ENGINEERING DESCRIPTION					
STRATIGRAPHY / ENG GEOLOGICAL UNIT / ADDITIONAL OBSERVATIONS	WATER	CORE RECOVERY (%)	METHOD	SCALA PENETROMETER (Blows/100mm) 0 1 2 3 4 5 6 7 8 9	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	WEATHERING CLASSIFICATION	MOISTURE CLASSIFICATION	CONSISTENCY / DENSITY CLASSIFICATION	ESTIMATED SOIL SHEAR STRENGTH (Su, kPa) VS 12 25 50 100 200 H	DESCRIPTION
Topsoil								0.0	TS		M	F		*0.00m:* SILT, some clay and some sand, minor organics; brown. Firm, moist, non-plastic. Sand, fine.
South Auckland Volcanic Field	DRY 11/11/2021	100	HA		101/50 kPa Insitu 196/76 kPa Insitu 184/35 kPa Insitu 135/25 kPa Insitu >234 kPa Insitu 166/63 kPa Insitu 148/61 kPa Insitu 160/58 kPa Insitu		8 7 6 5	0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5			D-M M	VSt VSt-H VSt		*0.50m:* Silty CLAY; red brown. Very stiff, dry to moist, medium plasticity. *1.30m:* Silty CLAY, minor sand; orange brown. Very stiff, moist, high plasticity. Sand, fine to medium. Sand is pumice, molds to silt/clay, non-dilatant. *2.10m:* Clayey SILT, trace sand; light orange brown. Very stiff, moist, medium plasticity. Sand, fine to medium. Sand is pumice, molds to silt. Non-dilatant. *2.80m:* Sandy SILT, some clay; light brown streaked pink. Very stiff to hard, moist, low plasticity. Sand, medium to coarse. Sand is pumice, does not mold, slow dilatancy. *2.90m:* Silty CLAY, minor sand; light grey streaked red. Very stiff, moist, high plasticity. Sand, fine to coarse. Sand is pumice, molds to silt/clay, non-dilatant. 4m: Target depth

0.0-4.0m

COMMENTS:

Hole Depth 4m

Scale 1:25

Rev.: A

HAND AUGER PHOTOS

BOREHOLE No.: **T-HA03**

SHEET: 1 OF 1

PROJECT: SWWW Options Study		LOCATION:	JOB No.: 1012888.2000
CO-ORDINATES: (NZTM2000)	5885263 mN 1753608 mE	DRILL TYPE: HA METHOD: Hand auger	HOLE STARTED: 11/11/2021 HOLE FINISHED: 11/11/2021 DRILLED BY: T+T
R.L.:	9m		
DATUM:	NZVD2016		LOGGED BY: TRMC CHECKED: BEWE

0.00-4.00m

HAND AUGER LOG

HOLE Id: **T-HA04**

SHEET: 1 OF 1

PROJECT: SWWW Options Study	LOCATION:	JOB No.: 1012888.2000
CO-ORDINATES: 5885139 mN (NZTM2000) 1753631 mE	DRILL TYPE: 50mm Hand Auger	HOLE STARTED: 11/11/2021
	METHOD: Hand auger	HOLE FINISHED: 11/11/2021
R.L.: 9m		DRILLED BY: T+T
DATUM: NZVD2016		LOGGED BY: CMCD CHECKED: BEWE

GEOLOGICAL	METHOD OBSERVATIONS							ENGINEERING DESCRIPTION						
STRATIGRAPHY / ENG GEOLOGICAL UNIT / ADDITIONAL OBSERVATIONS	WATER	CORE RECOVERY (%)	METHOD	SCALA PENETROMETER (Blows/100mm) 0 1 2 3 4 5 6 7 8 9	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	WEATHERING CLASSIFICATION	MOISTURE CLASSIFICATION	CONSISTENCY / DENSITY CLASSIFICATION	ESTIMATED SOIL SHEAR STRENGTH (Su, kPa) VS 12 25 50 100 200 H	DESCRIPTION
Topsoil									TS		D	St		*0.00m:* SILT; brown. Stiff, dry, low plasticity.
											M	VSt		*0.10m:* Clayey SILT; orange brown. Very stiff, moist, medium plasticity.
					118/69 kPa			0.5						
											M-W			*0.60m:* Silty CLAY; brown. Very stiff, moist to wet, high plasticity.
					86/49 kPa		8	1.0						*1.00 - 1.20m:* Stiff.
											W			*1.20m:* Clayey SILT; grey brown. Very stiff, wet, medium plasticity.
					126/43 kPa			1.5						
Puketoka Formation		100	HA		101/63 kPa		7	2.0						*1.80m:* Silty CLAY; grey streaked orange. Very stiff, wet, high plasticity.
					124/69 kPa			2.5						
					149/86 kPa		6	3.0						*2.90m:* Clayey SILT, trace sand and trace gravel; brown mottled orange. Very stiff, wet, medium plasticity. Sand, fine; gravel, fine to medium, rounded, Pumice.
					201/75 kPa			3.5						*3.20m:* Silty CLAY; grey streaked orange. Very stiff, wet, high plasticity.
	DRY 11/11/2021				52/38 kPa		5	4.0				St		*3.80m:* CLAY, some silt; white streaked pink. Stiff, wet, high plasticity.
								4.5						4.2m: Target depth

0.0-4.2m

COMMENTS:

Hole Depth 4.2m

Scale 1:25

Rev.: A

HAND AUGER PHOTOS

BOREHOLE No.: **T-HA04**

SHEET: 1 OF 1

PROJECT: SWWW Options Study		LOCATION:	JOB No.: 1012888.2000
CO-ORDINATES: (NZTM2000)	5885139 mN 1753631 mE	DRILL TYPE: 50mm Hand Auger METHOD: Hand auger	HOLE STARTED: 11/11/2021 HOLE FINISHED: 11/11/2021 DRILLED BY: T+T
R.L.:	9m		
DATUM:	NZVD2016		LOGGED BY: CMCD CHECKED: BEWE

0.00-4.20m

EXCAVATION LOG

Excavation Id.: **Z-S1**

Hole Location: Waiuku WWTP: Site 1 - South-eastern Sea Cliff

PROJECT: SWWW Options Study	LOCATION:		JOB No.: 1012888.2000
CO-ORDINATES: 5878881 mN (NZTM2000) 1753697 mE	METHOD: Logged exposure	EXCAV. STARTED:	12/11/2021
	EQUIPMENT: N/A	EXCAV. FINISHED:	12/11/2021
R.L.: 1m	OPERATOR: T+T	LOGGED BY:	CMCD
DATUM: NZVD2016	DIMENSIONS:	CHECKED BY:	TRMC

EXCAVATION TESTS					ENGINEERING DESCRIPTION					GEOLOGICAL	
PENETRATION	SUPPORT	WATER	SAMPLES, TESTS	SAMPLES	RL (m) / DEPTH (m)	GRAPHIC LOG	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	WEATHERING CLASSIFICATION	MOISTURE CLASSIFICATION	CONSISTENCY / DENSITY CLASSIFICATION	DEFECTS, STRUCTURE, COMMENTS	UNIT
1 2 3					0.5 / 0	TS	*0.00m:* Clayey SILT, some organics; brown. Firm to stiff, dry, low plasticity. Organics, roots greater than 2mm diameter.	RS	D	F-St		TSoil
					1.0 / 0.5		*0.40m:* Sandy SILT; red grey. Very stiff to hard, moist, non-plastic. Sand, fine to medium.		M	VSt-H		Puketoka Formation
			● 164/35 kPa		1.5 / 1.0							
					2.0 / 1.5							
					2.5 / 2.0		*2.20m:* Highly weathered, grey, SANDSTONE. Extremely weak. Soil description: Silty fine to coarse SAND; grey. Dense, moist, well graded.	HW		EW		
					3.0 / 2.5							
					3.5 / 3.0		*3.10m:* Highly weathered, yellow grey, SANDSTONE. Extremely weak. Soil description: Fine to medium SAND, some silt; yellow grey. Dense, moist, well graded.					
					4.0 / 3.5							
					4.5 / 4.0		*4.40m:* Highly weathered, yellow grey, SANDSTONE. Extremely weak. Soil description: Coarse SAND, minor silt; yellow grey. Very dense, moist, well graded.					
							4.8m: Target depth					

SKETCH / PHOTO:

0.0 - 4.8m:

COMMENTS: Logged exposure, no water level measured or support used.

Hole Depth 4.8m

Scale 1:42

Rev.: A

EXCAVATION LOG

Excavation Id.: **Z-S2**

Hole Location: Waiuku WWTP: Site 2 - South-eastern Sea Cliff

SHEET: 1 OF 3

PROJECT: SWWW Options Study	LOCATION:		JOB No.: 1012888.2000
CO-ORDINATES: 5878852 mN (NZTM2000) 1753684 mE	METHOD: Logged exposure	EQUIPMENT: N/A	EXCAV. STARTED: 12/11/2021
R.L.: 1m	OPERATOR: T+T		EXCAV. FINISHED: 12/11/2021
DATUM: NZVD2016	DIMENSIONS:		LOGGED BY: CMCD
			CHECKED BY: TRMC

EXCAVATION TESTS | ENGINEERING DESCRIPTION | GEOLOGICAL

PENETRATION	SUPPORT	WATER	SAMPLES, TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	WEATHERING CLASSIFICATION	MOISTURE CLASSIFICATION	CONSISTENCY / DENSITY CLASSIFICATION	ESTIMATED SOIL SHEAR STRENGTH (Su, kPa)	DEFECTS, STRUCTURE, COMMENTS	UNIT
-1 -2 -3					0 -1 -2 -3	0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5	TS	*0.00m:* Clayey SILT, some organics; brown. Stiff, moist, medium plasticity. Organics, roots greater than 2mm diameter	RS	M	St	VS 12 S 25 F 50 St 100 VSt 200 H		Puketoka Formation
								0.50m: Sandy SILT, some clay; red orange. Very stiff to hard, moist, low plasticity. Sand, fine to medium.			VSt-H			
								3.00m: Highly weathered, yellow grey, SANDSTONE. Extremely weak. Soil description: Silty fine to coarse SAND; grey. Dense, moist, well graded.	HW		EW			

SKETCH / PHOTO:

0.0 - 9.0m:

COMMENTS: Logged exposure, no water level measured or support used.

Hole Depth 9m

Scale 1:42

Rev.: A

EXCAVATION LOG

Excavation Id.: **Z-S2**

Hole Location: Waiuku WWTP: Site 2 - South-eastern Sea Cliff

PROJECT: SWWW Options Study	LOCATION:		JOB No.: 1012888.2000
CO-ORDINATES: 5878852 mN (NZTM2000) 1753684 mE	METHOD: Logged exposure	EXCAV. STARTED:	12/11/2021
	EQUIPMENT: N/A	EXCAV. FINISHED:	12/11/2021
R.L.: 1m	OPERATOR: T+T	LOGGED BY:	CMCD
DATUM: NZVD2016	DIMENSIONS:	CHECKED BY:	TRMC

EXCAVATION TESTS | ENGINEERING DESCRIPTION | GEOLOGICAL

PENETRATION	SUPPORT	WATER	SAMPLES, TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	WEATHERING CLASSIFICATION	MOISTURE CLASSIFICATION	CONSISTENCY / DENSITY CLASSIFICATION	ESTIMATED SOIL SHEAR STRENGTH (Su, kPa)	DEFECTS, STRUCTURE, COMMENTS	UNIT
1 2 3						5.5		[CONT] *3.00m:* Highly weathered, yellow grey, SANDSTONE. Extremely weak. Soil description: Silty fine to coarse SAND; grey. Dense, moist, well graded.	HW		EW	VS 12 S 25 M 50 St 100 VSt 200 H		
					-5	6.0								
						6.5		*6.40m:* Highly weathered, yellow grey, SANDSTONE. Extremely weak. Soil description: Fine to coarse SAND, some silt; yellow grey. Dense, moist, well graded.						
					-6	7.0								
						7.5								
					-7	8.0		*7.80m:* Highly weathered, yellow grey, SANDSTONE. Extremely weak. Soil description: Coarse SAND, minor silt; yellow grey. Very dense, moist, well graded.						
						8.5								
					-8	9.0		9m: Target depth						
						9.5								

Puketoka Formation

SKETCH / PHOTO:

0.0 - 9.0m:

COMMENTS: Logged exposure, no water level measured or support used.

Hole Depth 9m

Scale 1:42

Rev.: A

EXCAVATION LOG

Excavation Id.: **Z-S3**

Hole Location: Waiuku WWTP: Site 3 - South-eastern Sea Cliff

SHEET: 1 OF 2

PROJECT: SWWW Options Study	LOCATION:		JOB No.: 1012888.2000
CO-ORDINATES: (NZTM2000) 5878839 mN 1753661 mE	METHOD: Logged exposure	EXCAV. STARTED:	12/11/2021
	EQUIPMENT: N/A	EXCAV. FINISHED:	12/11/2021
R.L.: 1m	OPERATOR: T+T	LOGGED BY:	CMCD
DATUM: NZVD2016	DIMENSIONS:	CHECKED BY:	TRMC

EXCAVATION TESTS | ENGINEERING DESCRIPTION | GEOLOGICAL

PENETRATION	SUPPORT	WATER	SAMPLES, TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	WEATHERING CLASSIFICATION	MOISTURE CLASSIFICATION	CONSISTENCY / DENSITY CLASSIFICATION	ESTIMATED SOIL SHEAR STRENGTH (Su, kPa)	DEFECTS, STRUCTURE, COMMENTS	UNIT
1 2 3					0 -1 -2 -3	0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5	TS	*0.00m:* Clayey SILT, some organics; brown. Stiff, dry, medium plasticity. Organics, rootlets (fresh).	RS	D	St	VS 12 S 25 50 St 100 VSt 200 H		Top
								0.20m: Sandy SILT; grey. Very stiff, moist, non-plastic.		M	VSt			
								1.00m: Highly weathered, light brown, SANDSTONE. Extremely weak. Soil description: Silty fine to coarse SAND; light brown. Dense, moist, well graded.	HW		EW			Pukekoka Formation
								2.20m: Highly weathered, yellow grey, SANDSTONE. Extremely weak. Soil description: Silty fine to coarse SAND; yellow grey. Dense, moist, well graded.						
								2.80 - 3.50m: Strike/ Dips on SANDSTONE bedding: 7/40, 8/70, 9/69, 10/46, 11/35, 8/70.						
								3.10m: Moderately weathered, yellow grey, SANDSTONE. Extremely weak. Soil description: Fine to coarse SAND, minor silt; yellow grey. Very dense, moist, well graded.	MW					
								3.5m: Target depth						

SKETCH / PHOTO:

0.0 - 3.5m:

COMMENTS: Logged exposure, no water level measured or support used.

Hole Depth 3.5m

Scale 1:42

Rev.: A

EXCAVATION LOG

Excavation Id.: **Z-S4**

Hole Location: Waiuku WWTP: Site 4 - South-eastern Sea Cliff

SHEET: 1 OF 3

PROJECT: SWWW Options Study	LOCATION:		JOB No.: 1012888.2000
CO-ORDINATES: 5878825 mN (NZTM2000) 1753537 mE	METHOD: Logged exposure	EXCAV. STARTED:	12/11/2021
	EQUIPMENT: N/A	EXCAV. FINISHED:	12/11/2021
R.L.: 1m	OPERATOR: T+T	LOGGED BY:	CMCD
DATUM: NZVD2016	DIMENSIONS:	CHECKED BY:	TRMC

EXCAVATION TESTS | ENGINEERING DESCRIPTION | GEOLOGICAL

PENETRATION	SUPPORT	WATER	SAMPLES, TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	WEATHERING CLASSIFICATION	MOISTURE CLASSIFICATION	CONSISTENCY / DENSITY CLASSIFICATION	ESTIMATED SOIL SHEAR STRENGTH (Su, kPa)	DEFECTS, STRUCTURE, COMMENTS	UNIT
1 2 3							TS	*0.00m:* Clayey SILT, some organics; brown. Firm, moist, medium plasticity. Organics, rootlets (fresh).		M	F			TSoil
						0.5		*0.40m:* Sandy SILT; brown grey. Very stiff, moist, non-plastic.			VSt			
					0	1.0								
						1.5		*1.50m:* Highly weathered, grey brown, SANDSTONE. Extremely weak. Soil description: Silty fine to coarse SAND, some clay; grey brown. Dense, moist, well graded.	HW		EW			
					-1	2.0								
						2.5								
					-2	3.0		*3.00m:* Highly weathered, pink grey, SANDSTONE. Extremely weak. Soil description: Clayey SILT, some sand; pink grey. Moist, well graded, medium plasticity. Sand, fine to medium.						
						3.5								
					-3	4.0								
						4.5								Puketoka Formation

SKETCH / PHOTO:

0.0 - 5.8m:

COMMENTS: Logged exposure, no water level measured or support used.

Hole Depth 5.8m

Scale 1:42

Rev.: A

EXCAVATION LOG

Excavation Id.: **Z-S4**

Hole Location: Waiuku WWTP: Site 4 - South-eastern Sea Cliff

PROJECT: SWWW Options Study	LOCATION:		JOB No.: 1012888.2000
CO-ORDINATES: 5878825 mN (NZTM2000) 1753537 mE	METHOD: Logged exposure	EXCAV. STARTED:	12/11/2021
	EQUIPMENT: N/A	EXCAV. FINISHED:	12/11/2021
R.L.: 1m	OPERATOR: T+T	LOGGED BY:	CMCD
DATUM: NZVD2016	DIMENSIONS:	CHECKED BY:	TRMC

EXCAVATION TESTS | ENGINEERING DESCRIPTION | GEOLOGICAL

PENETRATION	SUPPORT	WATER	SAMPLES, TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	WEATHERING CLASSIFICATION	MOISTURE CLASSIFICATION	CONSISTENCY / DENSITY CLASSIFICATION	ESTIMATED SOIL SHEAR STRENGTH (Su, kPa)	DEFECTS, STRUCTURE, COMMENTS	UNIT
1 2 3						5.5		[CONT] *3.00m:* Highly weathered, pink grey, SANDSTONE. Extremely weak. Soil description: Clayey SILT, some sand; pink grey. Moist, well graded, medium plasticity. Sand, fine to medium.	HW		EW	VS 12 S 25 M 50 St 100 VSt 200 H		Puketoka Formation
					-5	6.0		*5.10m:* Highly weathered, brown, SANDSTONE. Extremely weak. Soil description: Medium to coarse SAND, minor silt; brown. Very dense, moist, well graded.						
								5.8m: Target depth						
						6.5								
					-6	7.0								
						7.5								
					-7	8.0								
						8.5								
					-8	9.0								
						9.5								

SKETCH / PHOTO:

0.0 - 5.8m:

COMMENTS: Logged exposure, no water level measured or support used.

Hole Depth 5.8m

Scale 1:42

Rev.: A

EXCAVATION LOG

Excavation Id.: **Z-S5**

Hole Location: Waiuku WWTP: Site 5 - South-eastern Sea Cliff

SHEET: 1 OF 3

PROJECT: SWWW Options Study	LOCATION:		JOB No.: 1012888.2000
CO-ORDINATES: 5878774 mN (NZTM2000) 1753477 mE	METHOD: Logged exposure	EXCAV. STARTED:	12/11/2021
	EQUIPMENT: N/A	EXCAV. FINISHED:	12/11/2021
R.L.: 1m	OPERATOR: T+T	LOGGED BY:	CMCD
DATUM: NZVD2016	DIMENSIONS:	CHECKED BY:	TRMC

EXCAVATION TESTS | ENGINEERING DESCRIPTION | GEOLOGICAL

PENETRATION	SUPPORT	WATER	SAMPLES, TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	WEATHERING CLASSIFICATION	MOISTURE CLASSIFICATION	CONSISTENCY / DENSITY CLASSIFICATION	ESTIMATED SOIL SHEAR STRENGTH (Su, kPa)	DEFECTS, STRUCTURE, COMMENTS	UNIT
1 2 3						0.5	TS	*0.00m:* Clayey SILT, some organics; brown. Firm, dry, low plasticity. Organics, rootlets (fresh).	RS	D	F	VS S F St VSt H 12 25 50 100 200		TSoil
					0	1.0		*0.30m:* Sandy SILT, some clay; red orange. Very stiff, moist, low plasticity.		M	VSt			
						1.5								
					-1	2.0		*1.80m:* Slightly weathered, white grey, SANDSTONE. Very weak. Soil description: Silty fine to coarse SAND; white grey. Very dense, moist.	SW		VW			Puketoka Formation
						2.5								
					-2	3.0								
						3.5								
					-3	4.0								
						4.5								

SKETCH / PHOTO:

0.0 - 9.5m:

COMMENTS: Logged exposure, no water level measured or support used.

Hole Depth 9.5m

Scale 1:42

Rev.: A

EXCAVATION LOG

Excavation Id.: **Z-S5**

Hole Location: Waiuku WWTP: Site 5 - South-eastern Sea Cliff

PROJECT: SWWW Options Study	LOCATION:		JOB No.: 1012888.2000
CO-ORDINATES: 5878774 mN (NZTM2000) 1753477 mE	METHOD: Logged exposure	EXCAV. STARTED:	12/11/2021
	EQUIPMENT: N/A	EXCAV. FINISHED:	12/11/2021
R.L.: 1m	OPERATOR: T+T	LOGGED BY:	CMCD
DATUM: NZVD2016	DIMENSIONS:	CHECKED BY:	TRMC

EXCAVATION TESTS					ENGINEERING DESCRIPTION					GEOLOGICAL	
PENETRATION (1 2 3)	SUPPORT	WATER	SAMPLES, TESTS	SAMPLES	RL (m) / DEPTH (m)	GRAPHIC LOG	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	WEATHERING CLASSIFICATION	MOISTURE CLASSIFICATION	CONSISTENCY / DENSITY CLASSIFICATION	ESTIMATED SOIL SHEAR STRENGTH (Su, kPa)	DEFECTS, STRUCTURE, COMMENTS	UNIT
					-5 / 5.5		[CONT] *1.80m:* Slightly weathered, white grey, SANDSTONE. Very weak. Soil description: Silty fine to coarse SAND; white grey. Very dense, moist.	SW		VW			Puketoka Formation
					-6 / 6.0, 6.5, 7.0								
					-7 / 7.5, 8.0								
					-8 / 8.5, 9.0		*8.50m:* Moderately weathered, grey white, SANDSTONE. Very weak. Soil description: Coarse SAND, some silt; grey white. Dense, moist, well graded.	MW					
					9.5		9.5m: Target depth						

SKETCH / PHOTO:

0.0 - 9.5m:

COMMENTS: Logged exposure, no water level measured or support used.

Hole Depth 9.5m

Scale 1:42

Rev.: A

www.tonkintaylor.co.nz