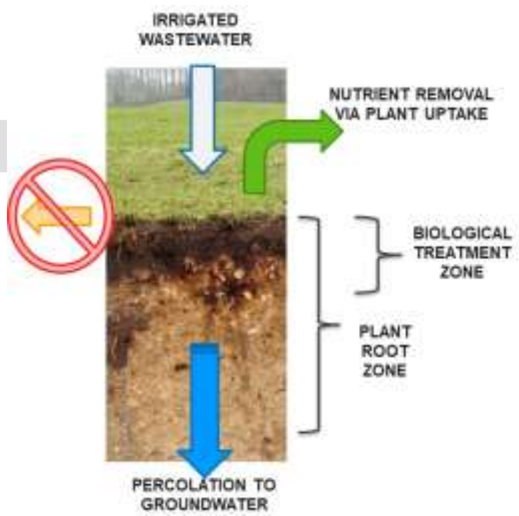
Discharge Option: Irrigation to Land

Description

Irrigation of treated wastewater to land provides an opportunity to not only utilise the wastewater as a water source and nutrient source for beneficial use on land but an opportunity to avoid, or reduce, the need for direct discharge of treated wastewater to surface water. Irrigation of treated wastewater to land, if managed at appropriate levels, can also provide for further treatment of the wastewater, reducing nutrients and pathogen migration to surface water.

Wastewater irrigation can be conducted at varying rates, depending on what the land use, soil type and receiving environment, can manage. Variations include:

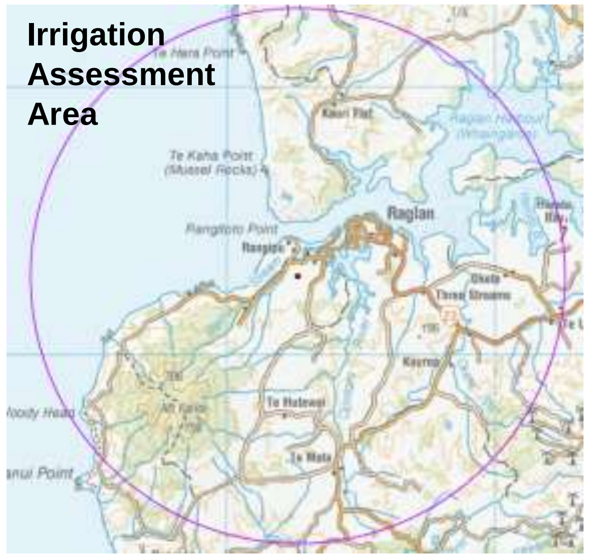
- Rapid infiltration (high rate).
- Non-deficit irrigation (irrigating in excess of soil moisture requirements).
- Deficit irrigation (only irrigating when soil moisture levels demand irrigation).



Location

Irrigation of treated wastewater can occur to suitable land within a reasonable conveyance distance from the wastewater treatment plant. Irrigation of treated wastewater traditionally occurs on well to moderately well drained soils, on rural type land. The soils need to be reasonably well drained to minimise the occurrence of saturated conditions or runoff. The irrigation site also needs to be on land that is away from receptors and on land that can be maintained or developed into a land use in keeping with irrigation, such as pasture or trees. Topography is also a key consideration as steep slopes can promote instability or runoff of the wastewater.

A GIS based assessment has been conducted to identify potentially suitable irrigation locations within a 10 km radius of the wastewater treatment plant.



Irrigation Options	Description
Rapid infiltration	This option would involve construction of a smaller footprint irrigation area over an area of highly permeable ground conditions. Topsoil layers are often removed and replaced with higher permeable gravels to improve infiltration rates. This option was considered previously in the Wainui Reserve and beach frontage (PDP 2001), however, it was considered that underlying geology may limit infiltration, requiring excessive infiltration areas. The existing wastewater treatment system may be suitable for this but with filtration also required.
Non-deficit irrigation (with seasonal storage)	Non-deficit irrigation would involve irrigation to land at slow rates (several mm per day on average) when soil conditions allow. Irrigation could occur when soil moisture levels are elevated (above field capacity) but not at risk of saturation. An indicative soil moisture model indicates that a non-deficit irrigation system at Raglan may require 110 ha to 140 ha of irrigable land but 150,000 m^3 of partial storage would be required during extended wet weather periods (winter months, May to September). The existing wastewater treatment system would likely be suitable for this option.
Close to deficit irrigation (with seasonal storage)	Deficit irrigation would incorporate irrigation of treated wastewater to land at slow rates (several mm per day on average) but generally only when soil moisture levels demand irrigation (below field capacity). When irrigation is not achievable under this scenario, wastewater is stored in a lagoon (likely 300,000 m^3 to 400,000 m^3) and then irrigated when soil conditions allow. This option would likely require an active irrigation area of 300 ha to 550 ha. Irrigation would likely occur from October to April and storage would likely occur from May to September. The existing wastewater treatment system would likely be suitable for this option.
Non-deficit irrigation with alternative disposal location	This non -deficit irrigation option would operate similar to the above non-deficit irrigation option, however, instead of storing treated wastewater during elevated soil moisture conditions, treated wastewater could be discharged via an alternative pathway during wet soil

	conditions, such as one of the other disposal options. This would reduce the required irrigation area to 90 ha to 130 ha, with limited storage required (20,000 m^3), to minimise discharge during summer storm events. Irrigation would primarily occur between October and April. The existing wastewater treatment system would likely be suitable for this option, depending on requirements of alternative discharge location.
Deficit irrigation with alternative disposal location	This deficit irrigation option would operate similar to the above deficit irrigation option, however, instead of storing treated wastewater during elevated soil moisture conditions, treated wastewater could be discharges via an alternative pathway, such as one of the other disposal options. This would reduce the required irrigation area to 240 ha to 280 ha, while still maintaining soil moisture levels below field capacity during irrigation periods. Limited storage (20,000 m^3) would be required to minimise discharge during summer storm events. Irrigation would primarily occur between October and April when deficit conditions generally occur. The existing wastewater treatment system would likely be suitable for this option, depending on requirements of alternative discharge location.

Options Assessment Criteria

Criteria	Issue/Topic	Description/Explanation
Public Health	Microbiological quality of treated wastewater	Risk of public exposure to waterborne pathogens through:
		- Direct contact with the conveyance or treatment process
		- Direct contact with the receiving environment, for example through contact recreation
		- Indirect exposure, through food gathering (such as shellfish, fish, watercress, etc) and groundwater use.
	Health effects from irrigation	Risk of public exposure to pathogens from irrigation.
	Treated wastewater re-use	Risk of contamination from treated water for non-potable re-use.
Environment	Water quality	Potential effects on freshwater (surface and ground) and coastal/marine receiving environments
	Aquatic ecology	Potential effects on aquatic ecosystems
	Terrestrial ecology	Potential effects on terrestrial ecosystems and soils
	Coastal environment and resources	Potential effects on significant coastal and marine areas, existing harbour and coastal processes, and physical footprint within the harbour and coastal marine area.
Cultural	Mauri	Potential effects on mauri of land, water and air
	Kai moana	Potential effects on kai moana and the kaitiaki management of customary fishing
	Cultural values	Potential effects on the relationship of Maori and their culture and traditions with their ancestral lands, water, sites, waahi tapu and other taonga
	Health and Wellbeing	Potential effects on the ability of the land, sea and air to support wairua in order to maintain health and wellbeing for Maori
Social and community	Amenity value and aesthetics	Potential effects on the natural and built environment (e.g. visual, odour, noise)
	Urban development	Extent to which the option enables residential and commercial development within the projected timeframe
	Recreation	Extent to which the project enhances or detracts from local recreational activities and opportunities
	Food gathering	Extent to which the project enhances or detracts from people's ability to collect food within the area
	Access to the coast	Extent to which an option effects access to the coastal marine area.
	Re-use potential of option	Extent that treatment by-products can be utilised beneficially now and into the future (i.e. irrigation/nutrients for food production)
Sustainability	Carbon footprint	Potential embodied and operational carbon footprint
Constructability	Geology, soil, groundwater conditions	Option suited to local environmental conditions
	Land availability, accessibility	Adequate and secure land must be available for the required infrastructure, timescales that fit within project timing
	Existing infrastructure	Potential to maximise use of existing infrastructure that has a valuable remaining economic life, e.g. power supply, treatment plants, pumps, conveyance pipes and existing sites.
Technology	Reliable, proven and robust technology	To be sustainable, an option should be based on proven technology and have adequate redundancy (spare operational capacity to provide back-up in case of failure)
	Adaptable and flexible	Due to the uncertainty associated with future growth, a feasible option must be able to adapt to changing conditions such as increased flows and loads, discharge quality requirements, input requirements, and energy availability.
	Able to be staged	The extent to which an option could be staged (e.g. through modularised components).
	Operational and engineering resilience	The option must be sufficiently resilient to natural hazards and operational failure.
Financial Implications	Capital cost	Is the cost of the project appropriate for the project area and the population served?
	Operating and maintenance cost	Can the capital infrastructure be maintained and operated in a cost-effective manner?
	Whole of life cost	How do the whole of life costs pf the various options compare?
	Financial risk	Is the option affordable even if growth does not occur as predicted?
Opportunities and Benefits	Opportunity for resource recovery	The provision of beneficial reuse of treated wastewater. (i.e. with emphasis on food production)
		The potential for beneficial reuse of biosolids. (i.e. with emphasis on food production)
Statutory Policy Considerations	Consistency of the option with National Policy Statements (NPS)	Includes consistency with the New Zealand National Coastal Policy Statement (NZCPS), National Policy Statement for Freshwater Management (NPS-FM) and any other relevant NPS

	Consistency of the option with any other relevant legislation outside of the Resource Management Act	Includes consistency with the Reserves Act, and any other relevant Act

Options Assessment

Land treatment options are assessed based on the above criteria in the following table.

Key: Red – Largely fails to meet the criteria, Amber - Marginally meets the criteria, Green - Meets criteria well

Irrigation Option	Public Health	Environment	Cultural	Social & Community	Sustainability	Constructability	Technology	Financial Implications	Opportunities and Benefits	Statutory Policy Considerations	Comments	Carry forward to short list?
Rapid Infiltration	Can be isolated from public and spray irrigation can be avoided	May result in excessive groundwater mounding/ break out	Hapū have reiterated opposition to marine options and support for re-use options. Avoidance of adverse public health and environmental effects obviously aligns with hapū ethics. Any option with elevated risk wouldn't be supported	No direct discharge to surface water but risk of groundwater mounding may cause community concern	Will likely require excessive disposal bed and associated earthworks resulting in a larger carbon footprint.	Unlikely to be feasibly constructed given previous assessments (PDP 2001) $11m^3/d/100m$	Not a suitable technology for the location	Likely high cost due to excessive earthworks	Potential site at Wainui Reserve close to WWTP	Potential for discharge to coastal waters if located in proximity to the coast. Policy 23(2)(b)(ii) of the New Zealand Coastal Policy Statement 2010 (NZCPS) has relevance -see notes	Not carried forward due to geological limitations	No
Non-deficit irrigation (with seasonal storage)	Risk of spray drift but disinfection and buffer distances will mitigate this	Potential to promote nutrient migration but can be managed with appropriate land use	Hapū have reiterated opposition to marine options and support for re-use options. Avoidance of adverse public health and environmental effects obviously aligns with hapū ethics. Any option with elevated risk wouldn't be supported	Generally well thought of but land purchase and opposition from neighbours may be challenging	Generally sustainable but need to be careful not to displace key food production land. Potential carbon sink if trees utilised.	Moderate land requirement and may be challenges in obtaining access and pipeline route.	Common Technology. Treatment: Pond system and UV	Land purchase may be high cost. Irrigation construction and pipeline costs moderate. Large storage volume cost may be high.	Beneficial Reuse	Potential for adverse effects on freshwater quality as a result of nutrient migration. Further work required to assess consistency with the National Policy Statement for Freshwater Management 2014 (NPS-FM). Given groundwater discharge will potentially flow	Carried forward due to smaller land area (compared with other land treatment options) while not requiring a seasonal alternative disposal options.	Yes

Key: Red – Largely fails to meet the criteria, Amber - Marginally meets the criteria, Green - Meets criteria well												
Irrigation Option	Public Health	Environment	Cultural	Social & Community	Sustainability	Constructability	Technology	Financial Implications	Opportunities and Benefits	Statutory Policy Considerations	Comments	Carry forward to short list?
										to the coastal environment, . Policy 23(2)(b)(ii) of the New Zealand Coastal Policy Statement 2010 (NZCPS) has relevance -see notes		
Close to deficit irrigation (with seasonal storage)	Risk of spray drift but disinfection and buffer distances will mitigate this	Nutrient migration reduced, less risk of runoff	Hapū have reiterated opposition to marine options and support for re-use options. Avoidance of adverse public health and environmental effects obviously aligns with hapū ethics. Any option with elevated risk wouldn't be supported	Generally well thought of but land purchase and opposition from neighbours may be challenging	Generally sustainable but need to be careful not to displace key food production land. Potential carbon sink if trees utilised	Large land requirement and may be challenges in obtaining access and pipeline route.	Common Technology. Treatment: Pond system and UV	Very high cost: Land purchase may be high cost. Irrigation construction, pipeline and storage costs moderate. Large storage volume cost may be high.	Beneficial Reuse	Potential for adverse effects on freshwater quality as a result of nutrient migration (although lower than non-deficit irrigation). Further work required to assess consistency with the NPS-FM. Given groundwater discharge will potentially flow to the coastal environment, . Policy 23(2)(b)(ii) of the New Zealand Coastal Policy Statement 2010 (NZCPS) has relevance -see notes	Not carried forward due to large land area requirements.	No

Key: Red – Largely fails to meet the criteria, Amber - Marginally meets the criteria, Green - Meets criteria well

Irrigation Option	Public Health	Environment	Cultural	Social & Community	Sustainability	Constructability	Technology	Financial Implications	Opportunities and Benefits	Statutory Policy Considerations	Comments	Carry forward to short list?
Non-deficit irrigation with alternative disposal method (either marine outfall or DBI during wet winter months- see notes)	Risk of spray drift but disinfection and buffer distances will mitigate this	Potential to promote nutrient migration but can be managed with appropriate land use	Hapū have reiterated opposition to marine options (i.e. potentially an 'alternative disposal method') and support for re-use options. Avoidance of adverse public health and environmental effects obviously aligns with hapū ethics. Any option with elevated risk wouldn't be supported. Greater understanding on the alternative disposal method would be required	Generally well thought of but land purchase and opposition from neighbours may be challenging	Generally sustainable but need to be careful not to displace key food production land. Potential carbon sink if trees utilised	Smaller land requirement but may be challenges in obtaining access and pipeline route.	Common Technology. Treatment: Depends on alternative discharge	Land purchase may be moderate cost. Irrigation construction and pipeline costs moderate. Costs of supporting disposal pathway needs consideration.	Beneficial Reuse	Potential for adverse effects on freshwater quality as a result of nutrient migration. Further work required to assess consistency with the NPS-FM. Other effects dependent on alternative disposal location, however given groundwater discharge will potentially flow to the coastal environment, . Policy 23(2)(b)(ii) of the New Zealand Coastal Policy Statement 2010 (NZCPS) has relevance -see notes	Carried forward due to smaller land area (compared with other land treatment options). Feasibility depends on availability of suitable seasonal alternative disposal options. This will realistically be limited to marine outfall or DBI. (see notes on DBI)	**TBD**
Close to deficit irrigation with alternative disposal method (either	Risk of spray drift but disinfection and buffer distances will	Nutrient migration reduced, less risk of runoff. Supporting seasonal disposal	Hapū have reiterated opposition to marine options (i.e. potentially an 'alternative disposal method')	Generally well thought of but land purchase and opposition from neighbours	Generally sustainable but need to be careful not to displace key food production	Moderate land requirement and may be challenges in obtaining access and pipeline route.	Common Technology. Depends on alternative discharge	Very high cost. Land purchase may be high cost. Irrigation construction and pipeline	Beneficial Reuse	Potential for adverse effects on freshwater quality as a result of nutrient migration	Not carried forward due to large land area requirements.	No

Key: Red – Largely fails to meet the criteria, Amber - Marginally meets the criteria, Green - Meets criteria well

Irrigation Option	Public Health	Environment	Cultural	Social & Community	Sustainability	Constructability	Technology	Financial Implications	Opportunities and Benefits	Statutory Policy Considerations	Comments	Carry forward to short list?
marine outfall or DBI during wet winter months- see notes)	mitigate this	method needs to be included.	and support for re-use options. Avoidance of adverse public health and environmental effects obviously aligns with hapū ethics. Any option with elevated risk wouldn't be supported. Greater understanding on the alternative disposal method would be required	may be challenging	land. Potential carbon sink if trees utilised			costs moderate. Costs of supporting disposal pathway needs consideration.		(although lower than non-deficit irrigation). Further work required to assess consistency with the NPS-FM. Other effects dependent on alternative disposal location, however given groundwater discharge will potentially flow to the coastal environment, . Policy 23(2)(b)(ii) of the New Zealand Coastal Policy Statement 2010 (NZCPS) has relevance -see notes		

Notes

Either
Option dismissed after ELT review

Scenario 1 (If DBI is to be completely dismissed)
DBI has been dismissed as a primary option for full discharge of treated wastewater, given:

- a strong community and hapū view toward land/re-use option investigation discharge options.

DBI has also been dismissed as a potential ‘alternative disposal method’ during winter months

Option to be retained after ELT review

Scenario 3 (If DBI is to be retained fully after WDC consideration)
No short list wording would be needed

Scenario 2 (If DBI is to be costed only, with no feasibility testing undertaken- refinement toward a BPO couldn’t occur without bore testing
DBI has been dismissed as a primary option for full discharge of treated wastewater, given:

- a strong community and hapū view toward land/re-use option investigation discharge options.

Inclusion within the short list as a supplement to non-deficit (summer) irrigation allows for a potential re-visit with the community and hapu, should feasibility of preferred options be ruled out. It is recognised that other disposal options have closer alignment to the consenting project objectives, where investigative priority is to sit with these. Given that DBI is however a non-marine disposal, it is practical to include the option for DBI costing only for contingency planning. Any progression would need additional engagement between WDC/ hapū and community. A test bore would have been appropriate to establish DBI feasibility if greater favour had been offered. - In reference to Policy 23(2)(b)(ii) of the New Zealand Coastal Policy Statement 2010 (NZCPS), a clear understanding from Raglan tangata whenua after engagement is that the present treated wastewater marine discharge is offensive to their values, with a substantial adverse effect resulting. Any alternative discharge method that enables satisfactory whenua contact and re-use potential, should have in principle support.