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Section 42A Report

Section 42A of the Resource Management Act 1991

Date: 18 November 2019

To: Aurora Grant
Consents Manager

From: Selva Selvarajah

IRIS ID: APP-20194193

Subject: ***Section 42A Report – Resource Consent Application considered under Delegated Authority***

1. The Application

1.1 The proposed activities

Applicant: Southland District Council

Applications:
1. **APP-20191493-01:** Discharge permit to discharge up to 4,500 m^3/day of treated wastewater and contaminants from the Te Anau Wastewater Treatment Plant, into land where it may enter water via a sub-surface drip irrigation (SDI).

2. **APP-20191493-02:** Discharge permit to discharge contaminants to air arising from the SDI operation.

Site address or location: The discharge area is located immediately North of the Te Anau - Manapouri Airport runway, land known as the Kepler North Block, approximately 5 km north of Manapouri township and
approximately 500 metres east of the Manapouri Te Anau Highway (SH95).

Legal description: Lot 2 DP 410687

Map Reference: NZTM 2000 co-ordinates E1182670 N4944369 (centre point of irrigation area)

Description of the activities:
Following is the description of the activities stated in the application to which the applications relate to:

- Discharge of treated wastewater and other contaminants into land where it may enter water, by sub-surface drip irrigation. The maximum rate of discharge will be 4,500 m^3 per day.
- Discharge of contaminants to air as a result of venting of the SDI balance tank.
- Discharge of a gaseous contaminant into land (soil) from the SDI emitters upon start-up of each individual SDI zone.

- Discharge of a gaseous root inhibitor (herbicide) into land (soil) from the SDI drip emitters.

1.1.1. Brief history

The proposal will replace the existing consents for discharging treated effluent from the Te Anau Wastewater Treatment Plant (Te Anau WWTP) to the Upukerora River near the Lake Te Anau confluence (which expire on 30 November 2020) and the new land discharge consent (**AUTH-302625-01**) and the new air discharge consent (**AUTH-302625-02**) granted on 16 January 2017 to discharge treated wastewater onto land using centre pivot system (CPI) and to discharge contaminants to air and in the Kepler Block respectively.

Despite securing the new CPI discharge consents (AUTH-302625-01 and AUTH-302625-02) which would have used CPI system to irrigate treated wastewater to land, the applicant decided to consider irrigating the membrane filtered wastewater via subsurface using SDI following an extraordinary council meeting held in October 2018.

The resolution passed by the Southland District Council (SDC) at the above meeting to approve the SDI option was based on key considerations from the business cases around environmental outcomes, social acceptability for the community and future development options for the airport. The new applications seek to operate within the same environmental footprint allowed in the CPI consent.

1.1.2. Application to discharge into land where contaminants may enter water

The Te- Anau WWTP wastewater treated by the existing maturation pond systems and filtered by the proposed membrane microfiltration technology (filter pore size <0.001 mm), conveyed via 18 km newly constructed pipeline and irrigated within the Kepler North Block (Figure 1) through a sophisticated SDI system at a soil depth of 150-180 mm using an eight day irrigation cycle. Wastewater quality details including expected quality at the Kepler Block are provided in page 6 and Table 2.4 of the application. Much of the expected wastewater-nitrogen will be in ammoniacal-N form with little or no nitrate-nitrogen and the wastewater total-N has been increasing steadily in the past two decades.

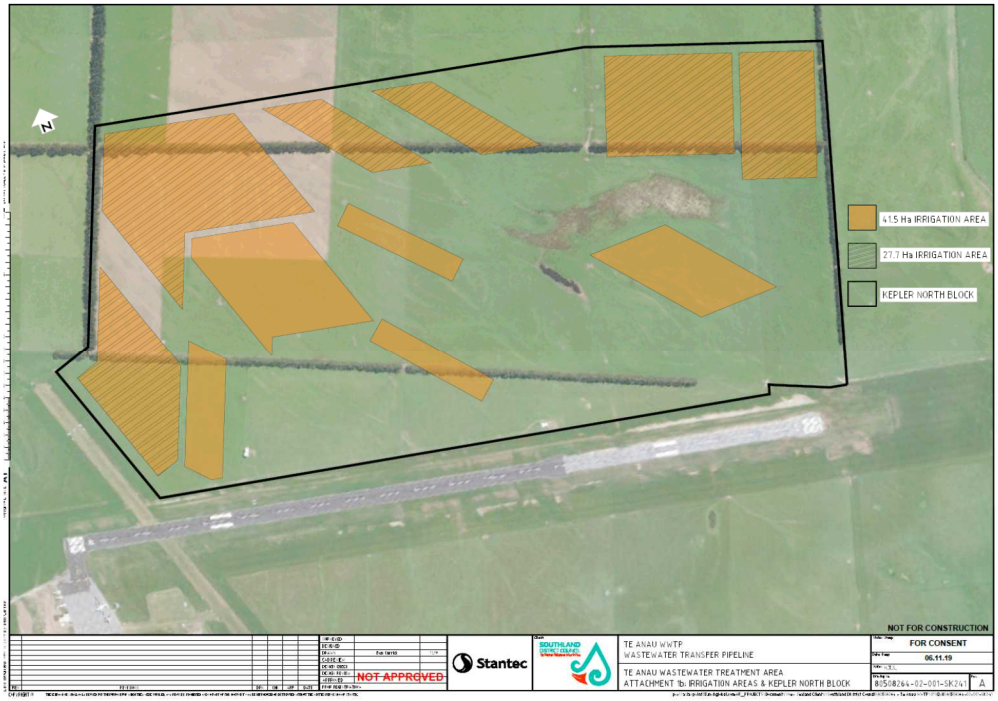


Figure 1. Irrigation area in the North Kepler Block in yellow with stripes Stage 1 and no-stripe Stage 2

The maximum volume of discharge proposed by the applicant is 4500 m^3/day with an initial wastewater total nitrogen loading of 12970 kg/year in a 27.7 ha irrigation area under Stage 1 which could be increased to 16370 kg/year loading and 41.5 ha irrigation area under Stage 2, when the initial wastewater total nitrogen loading is likely to exceed the Stage 1 loading limit. Initially in Stage 1, a total of 768,000 drip emitters approximately 0.6 metre apart are proposed to be used. These are expected to be grouped in 40 irrigation zones and if warranted later, a total of 1.15 million drip emitters (approximately 60 irrigation zones) are proposed based on increasing wastewater nitrogen loading.

The irrigated area will be planted with a high performing pasture and it will be harvested at least four times per year and removed from the area, a land treatment system referred to as 'cut & carry'. A 40 ha land parcel without any wastewater irrigation and livestock grazing contiguous to the irrigation area has been proposed by the applicant to offset a portion of the overall mass annual nitrate-nitrogen leaching into the groundwater as a result of anticipated steady increase in wastewater total-N loading owing to increasing wastewater-N concentration. Table 1 summarises matters relevant to this application.

Table 1. Matters relevant to the application as provided in the application

Property details:-				
Location	Immediately North of the Te-Anau-Manapouri Airport runaway			
Catchment	Waiau River and Lake Manapouri			
Area	Kepler Block and precisely Kepler North Block			
Soils	**Soil type**	**Vulnerability Factors (derived from S-map)**		
		Structural Compaction	**Nutrient Leaching**	**Waterlogging**
	Monowai soil (Yellow brown loams and classified as allophanic brown soils)	Very low	Very high	Very low
Discharge permit details:-				
Activity status	New			
Type of discharge	Maturation ponds treated and membrane microfiltered			
Volume discharged	Maximum 4500 m^3/day and average 1250 m^3/day			
Wastewater quality	Total-N 30 mg/L, ammoniacal-N 29 mg/L, organic-N 1 mg/L, total-P 7 mg/L and trace amounts of trifluralin			
Storage availability	15,000 m^3 with the existing treatment ponds which have continuous outflow			
Land use	Cut and carry pasture irrigated with treated wastewater			
Livestock stocking rate	Nil grazing			
Irrigator proposed	Sub-surface drip irrigation (SDI)			
Subsurface discharge depth	150-180 mm below soil surface			
Disposal area (ha)	Total 'irrigation area' allocated 121 ha, initially 27.7 ha at 12970 kg wastewater total-N/year and later 41.5 ha at 16370 kg wastewater total-N/year			
Land area wetted	31.6 ha (Stage 1)			
Offset area allocated to minimise nitrate leaching into the local aquifer	40 ha (located contiguous of the irrigation area)			
Total number of drippers	From 0.768 million to 1.15 million (0.6 m apart)			
Predicted annual mass nitrate-N leaching from the activity	6124 kg			
Monitoring proposed	Soil, wastewater and groundwater quality, pasture dry matter & total-N and groundwater mounding			

In addition to the typical sewage wastewater contaminants such as ammoniacal-N, organic-N and phosphorus, a plant root growth inhibiting herbicide referred to as trifluralin will also be discharged in gaseous from into soil to avoid clogging of the drips by plant roots. Depending on the application rate and the method of application, consent may or may not be required to discharge trifluralin into soil.

In the description of the activities to which the consents are related, gaseous contaminants from drip emitters into land upon start-up has been stated in the application. Some of the gases such as ammonia (NH_3) and hydrogen sulphide (H_2S) may be adsorbed to soil and treated whilst nitrous oxide (N_2O) and carbon dioxide (CO_2) could dissolve partially or fully in soil water. The above process will be integral part of discharge of contaminants into land where contaminants may enter water RMA process. Gases which escape the above process will be considered under discharges to air RMA process in the following section.

1.1.3. Application to discharge of contaminants arising from the SDI operation to air

There will be minor discharge of contaminants to air from the balance tank connected with the SDI system which is located close to the irrigation area within the Kepler North Block. The balance tank air vent valve will be fitted with activated carbon filter system to reduce the emission of contaminants, particularly odorous gases. As stated in the previous section, some sewage related gases (e.g. hydrogen sulphide, nitrous oxide, ammonia, carbon-dioxide) are also expected to be released through SDI drip emitters into air through soil.

There was no consent applied for the discharge of the herbicide trifluralin into air since this was not anticipated in the application. This will be considered in detail in section 1.3 (planning framework) in my report.

1.2 Description of the affected environment

Owing to the scale and complexity of the application, substantial amount of technical and policy information relevant to s88(2)(c) of the Act has been provided in the application. Most of the technical information relevant to this proposal had been derived from the centre pivot irrigation (CPI) discharge consent application process. Much of the new technical information provided has been specific to the SDI system operation and nitrate leaching and relevant effects assessments. Through the application review/acceptance process under s88 of the Act and throughout the process of the applications until the completion of this s42A report, there had been considerable amount of information obtained through consultation with the applicant.

Owing to the substantial information, much of which is relevant to the preparation of my report, under s42A(1A) of the Act, there is no necessity for me to repeat the information provided. For the above reason, under s42A(1B)(a) of the Act, I will be adopting all of the information provided by the applicant with the application lodged on 12 July 2019 and all information provided including the e-mail correspondences until the date of the submission of my s42A report for decision. Accordingly, I have restricted my report to key information which may assist in making any decision on the application under s104 of the Act.

1.2.1. Land use

The site is referred to as Kepler Block which is located at the Southern end of the Te Anau Basin. Te Anau airport is located to the South of the Kepler North Block whilst the significant wetland Kepler Mire is located on the East with Home Creek to the South of the Te Anau aerodrome. Within the Kepler North Block there is a 4-ha fenced off peat bog. Much of the local area has been under Landcorp ownership and under sheep, deer and cattle grazing. Southland District Council (SDC) purchased the irrigation area from Landcorp in 2008. The irrigation area also has a fenced peat bog (4 ha).

In recent years, an area of the Kepler Farm on the west side of SH 95 had been developed by Landcorp Estates Limited for rural lifestyle purposes. This area is called Moturau Heights which contains 16 sections ranging in size from 1.35 to 3.4 hectares. The subdivision lies approximately 1700 m to the south-west of the proposed irrigation area.

1.2.2. Geology and soil

Kepler Block is located on terraced land comprising Quaternary aged outwash gravels. Old meltwater channels of Lake Manapouri that lie between moraine deposits are evident across a large part of the Kepler Farm including the Kepler Block. The channels were occupied by the former Waiau River. The larger channels are now occupied by elongated, raised mires including the Kepler Mire. The Monowai soil on the site is a well-drained (porous) yellow brown loam formed on morainic deposits and outwash gravels derived from basic volcanic and Fiordland rocks. Consequently, the soil contains considerable sand and gravel.

1.2.3. Hydrology

The significant water bodies in the nearby area are Waiau River and Lake Manapouri, located North West and West of the irrigation block respectively. The groundwater flow direction has been predicted to be towards North West with groundwater discharging into the Waiau River. Home Creek which drains Kepler Mire is located 800 m South of the block. Home Creek flows in a meandering way from the Kepler Mire in a South West direction, discharging into the Waiau Arm of Lake Manapouri near Pearl Harbour while the 'channelised watercourse' within the Kepler farm enters Home Creek near the South-East corner of the Kepler Block.

1.2.4. Groundwater

The aquifer materials of the Kepler Block comprise a mix of gravelly sand, gravel layers and silt beds at lower levels which are Pleistocene river deposits and differ from the more extensive glacial deposits. The depth to groundwater is between 6 and 13.5 m from the surface hence the local aquifer is considered as shallow. The groundwater is under oxidised status, which means oxidised contaminants such as nitrate are less likely to be attenuated or decomposed because of the absence of the reduced conditions. In contrast, reduced groundwater conditions are conducive for nitrate-nitrogen to be used as an oxygen source triggering nitrate decomposition and lower nitrate-nitrogen presence.

The historical livestock farming including winter grazing and offal pits in the area contributed to elevated levels of *E.Coli* (3 to 14 *E.coli* cfu/100 mL) and nitrate-N (1.4 to 6.6 mg/L) in the past. Following destocking and decommissioning offal pits in 2018, both contaminant levels have been reducing with significant reduction in *E.coli* levels resulting in 1-2 cfu *E.coli*/100 mL. Of the bores sampled for water quality, the Airport and Meridian bores were not affected by any grazing activities because of being located downstream to the general groundwater flow direction in the area and upstream of the intensive historical farming activities.

1.2.5. Surface water

Lake Manapouri is in natural state with trophic level index (comprising clarity, phosphorus, nitrogen and chlorophyll as indicators) being 1, the water quality is considered good. Waiau River which is also considered as of good quality has a minimum flow of 115 m^3/s. The Waiau River water quality around the local aquifer discharge area is with a total-N level of <0.11 mg/L. As stated above, historically, the area has been under livestock farming activity. State highway 95 is located to the West with few subdivisions west of the SH95. The proposed irrigation block had been destocked in 2018 but livestock farming continues with the remaining and surrounding areas.

Statutory Acknowledgements apply at a local level with respect to Moturau (Lake Manapouri) and the Waiau River. These are set out in the Ngai Tahu Claims Settlement Act 1998 and represent acknowledgements by the Crown of Te Runanga o Ngai Tahu's cultural, spiritual, historic and traditional

associations with these waterbodies and surrounding areas.

1.3 Planning framework

1.3.1. Discharge of treated wastewater and contaminants into land

1.3.1.1. Resource Management Act

Wastewater discharge to land

Under s15 of the RMA there are three provisions s15(1)(b), s15(1)(d) and s15(2A) which are relevant to the wastewater discharge to land activity. Under s15(1)(b) consent is required to discharge contaminant onto or into land in circumstances it may enter water. Under s15(1)(d), consent is required to discharge contaminant from any industrial or trade premises onto or into land. Under s15(2A), no person may discharge a contaminant into land, from a place or any other source, whether moveable or not, in a manner that contravenes a regional rule unless the discharge is expressly allowed by a resource consent.

The consent for wastewater discharge has been applied for *discharging up to 4,500 m^3/day of treated wastewater and contaminants from the Te Anau Wastewater Treatment Plant, into land where it may enter water*. As stated before the contaminants will include that in the gaseous and liquid discharges into land.

Under s2 of the Act and under the definition of 'industrial or trade premises', I consider the Te Anau WWTP site as an industrial or trade premise hence the wastewater application to land can be considered as from industrial or trade premise. On the above basis s15(1)(d) is applicable to the proposed wastewater discharge. The activity of wastewater discharge into land where contaminant enters water is under s15(1)(b) hence this provision of the Act also applies to the proposed wastewater discharge.

Under s15(2A), if consent is not secured for the proposed activity, it will contravene the discretionary activity rules in the Regional Effluent Land Application Plan and the Proposed Southland Water and Land Plan. On the above basis, in my report the wastewater discharge to land will be considered under s15(1)(b), s15(1)(d) and s15(2A) of the Act.

Herbicide discharge to land

The land discharge proposal includes discharging of the pasture root inhibiting herbicide trifluralin from drip emitters into soil. Trifluralin which has poor solubility in water moves in soil pores or air in gaseous form by volatilisation. The above herbicide is impregnated within the driplines to emit the herbicide during the subsurface irrigation of the wastewater. Usually the above chemical is applied to light soils at the label application rate of 600-800 grams/ha/year whilst the proposed predicted discharge rate is 200 grams/ha/year. At the above rate, it has been anticipated that the impregnated trifluralin in the dripline is enough to provide herbicide discharge to soil for 20 years. Since the herbicide is applied subsurface with wastewater irrigation, there will be no spray drifts.

Technically, the above contaminant (i.e. the herbicide) does not originate from the industrial or trade premises (i.e. Te Anau WWTP) because the SDI driplines which are impregnated with the chemical are located in production land. I consider the irrigation area and surrounding land parcels as production land rather than industrial or trade premises under s2 of the Act since the wastewater irrigated land will be used to produce pastoral products such as livestock animals from the 'cut & carry' pasture produced from the site. On the above basis the application for the herbicide discharge need not be considered under s15(1)(d).

The technical information provided in the application on trifluralin discharge into soil states it is adsorbed to soil strongly and likely to be confined within 15-20 mm distance of the drip emitters in soil. Scientific literature on trifluralin mobility in the environment indicates that it's detection in groundwater is rare but detected in minute quantities in very few cases in Austria, France and the UK[1]. Therefore, whilst the

[1] OSPAR Commission 2005 Update: OSPAR Background Document on Trifluralin.

potential for trifluralin to be discharged into groundwater is very low owing to low application rate, low solubility in water and low mobility, it is difficult to state there will be nil discharge. On the above basis, s15(1)(b) is applicable and if any rules within the relevant plans are breached by the proposed activity, s15(2A) could also be applicable.

1.3.1.2. Regional Effluent Land Application Plan

The discharge of contaminants from the Te Anau WWTP into land at the Kepler North Block is a **discretionary**
activity in accordance with Rule 5.2.1 of the Regional Effluent Land Application Plan (RELAP). Rule 5.2.1 states: "*The discharge of effluent onto or into land from a community sewage scheme is a discretionary activity*.".

1.3.1.3. Regional Water Plan

According to the proposed application, the discharge of the gaseous herbicide trifluralin from the SDI drip emitters into land (soil) to inhibit pasture roots from blocking the drip emitters has been classified as discretionary activity under Rule 16D of the Regional Water Plan (*Discharge of contaminants originating from industrial or trade premises*). As I stated before, since the contaminant (i.e. herbicide) does not originate from the industrial or trade premises, Rule 16D will not apply.

I consider the permitted activity Rule 5 (*Discharge of agrichemicals to land where they may enter water*) of the *Regional Plan Water* is the appropriate rule under the circumstances whose conditions stated below will be met by the activity:

(a) the agrichemical is approved for use within New Zealand under the Hazardous Substances and New Organisms Act 1996, does not persist in the environment and does not bioaccumulate within organisms;
(b) all practicable measures are taken to minimise spray drift beyond the target area;
(c) any person who is likely to be directly affected by the discharge must be notified prior to the discharge occurring;
(d) the discharge shall not result in any destruction of natural aquatic life by reason of a concentration of toxic substances within Natural State Waters, or the Protected Waters of the Water Conservation (Mataura River) Order.

Since the herbicide is applied below soil surface there will be no spray drift or adverse effects on any person outside the boundary of the activity. On the above basis, the proposed activity of the discharge of trifluralin into soil is considered as a **permitted activity**, hence a resource consent or a deemed permitted activity (DPA) notice need not be granted for the proposed activity. Since the activity does not contravene a regional rule, a consent need not be granted under s15(2A). Since the herbicide is released in gaseous form there is potential for it to enter from soil to air and this will be dealt under air discharges.

1.3.3.4. Proposed Southland Water and Land Plan (pSWLP)

The discharge of contaminants from the Te Anau WWTP via SDI into land at the Kepler North Block where it may enter water is a **discretionary activity** in accordance with Rule 33 of the pSWLP (*Community sewerage schemes (discharge to land)*) since the respective setback distances stated in the above rule such as from 20 to 200 m from the natural wetland, lake, river, authorised water abstraction point, modified & artificial water course and place of assembly (i.e. airport) are met, therefore the activity is not considered as a non-complying activity under Rule 33A.

Overall, the treated wastewater discharge into land is a **discretionary** activity. Under Section 104B the Council may grant or refuse consent for a **discretionary activity**, and if it grants the application, may impose conditions under Section 108 of the RMA.

1.3.2. Discharge of contaminants to air

1.3.2.1. Resource Management Act

Under s15(1)(c), discharge of contaminant from any industrial or trade premises into air requires consent whilst under s15(2A), no person may discharge a contaminant into air, from a place or any other source, whether moveable or not, in a manner that contravenes a regional rule unless the discharge is expressly allowed by a resource consent.

Gaseous discharges from the balance tank and drip emitters

The proposed gaseous discharges to air are within the production land but the contaminants could originate from the industrial or trade premises and within the production land where the SDI is located. Since the treated wastewater is membrane filtered before piped from the Te Anau WWTP and since I consider the filtered wastewater as biologically sterile (except for the presence of viruses) I expect little or no biological activity within the 18 km pipeline and the SDI system which under normal conditions (i.e. non-filtered or UV treated wastewater) would have caused significant sewerage related gaseous build-up and the subsequent emissions.

Therefore, the potential for any gaseous emissions from the balance tank and the drip emitters into air is very low, but difficult to conclude as nil. If there is likely to be any gaseous emission, it may be from any gases trapped or dissolved in the treated wastewater at the Te Anau WWTP before being transferred into the 18 km pipeline. The above gases could be released with time via physical processes owing to pressure or temperature differences anywhere in the 18 km pipeline or within the balance tank or the driplines. If so, I consider the main origin of gases (i.e. contaminants) as Te Anau WWTP site hence the contaminants can be considered as from industrial or trade premises.

On the above basis, the most appropriate provisions in the Act are s15(1)(c) and s15(2A) as such, these will be considered in processing the air discharge application **APP-20191493-02**.

Herbicide discharge to air

Since the mode of trifluralin movement in soil and air is by volatilisation (vaporisation), the main herbicide movement in the environment is similar to that of gases. As an herbicide, trifluralin can be surface or subsurface applied to soil. According to the literature, much of the surface applied trifluralin is lost to the atmosphere owing to rapid volatilisation under moist and warm conditions. However, much of the subsurface applied trifluralin or applied trifluralin subsequently covered or incorporated with soil layer will be contained in soil by soil adsorption.

The extent of trifluralin adsorption to soil is dependant mainly on the organic matter (or organic carbon) content of the soil[2]. High organic matter content or high soil colloidal organic matter will favour greater adsorption. High colloidal organic matter has indirect and strong relationship with clay content since clays are the main sources of soil colloids. During biological processes decayed organic matter is adsorbed to colloids thus forming colloidal organic matter.

The application states that the subsurface discharge zone for trifluralin in soil does not extend beyond 20 mm from the drip emitters with concentration gradient being zero beyond 20 mm soil depth. The application also states that because of the strong adsorption properties of trifluralin vapour to soil particles, any emission from the soil surface will be negligible.

Whilst the soil adsorption of the herbicide is high, surface loss of trifluralin has been documented from trifluralin incorporated with soil[3]. There is no literature on 100% soil adsorption of trifluralin resulting in

[2] Ying, G.G and Williams, B. 2000. Laboratory study on the interaction between herbicides and sediments in water systems. *Environmental Pollution* 107, 399-405.

[3] Special Review of Trifluralin: Proposed Decision for Consultation. 2015. Pest Management Regulatory Agency, Health Canada, Onatrio (https://www.canada.ca/en/health-canada/services/consumer-product-safety/pesticides-pest-management/public/consultations/re-evaluation-note/2015/special-review-trifluralin/document.html).

zero emission of trifluralin from soil surface. There is no doubt, owing to much lower trifluralin application rate used in the proposed activity compared to the label rates combined with subsurface application will result in greater containment of trifluralin within the soil layer.

However, it is difficult to ascertain zero emission from soil surface because of its physical behaviour like gases and the uncertainty of the site light soils with unknown level of organic matter and conducive condition such as non-typical soil moisture presence caused by regular drip irrigation. Even if the site soil organic matter content is known, it is difficult to ascertain zero emission unless trifluralin is measured above soil surface using a technically acceptable method.

On the above basis and if in doubt about the potential for trifluralin emissions to air, it is appropriate to consider the proposed activity under s15(2A) since the contaminant is not originating from industrial or trade premises. The applicant has not applied for a resource consent for the above activity with the presumption of nil or negligible discharge of the herbicide into air.

1.3.2.2. Regional Air Plan consideration to gaseous discharges from the balance tank of the SDI system and the drip emitters into air

As stated before, the air discharges related to the proposed activities are release of gaseous contaminants from the balance tank associated with the SDI system which are filtered by the activated carbon filter system and any gaseous contaminants from the SDI drip emitters discharging of contaminants into land and subsequently into air. Rule 5.5.2 of the Regional Air Plan classifies a range of activities involving discharges of contaminants into air from the industrial or trade premises (which include treatment or disposal of waste materials) as discretionary activities.

One of these discretionary activities, Rule 5.5.2(16), is foulwater treatment processes with a design capacity population equivalent for BOD_5 of 10,000 people or more. Since the Te Anau population is projected to exceed 10,000 people during the peak tourism and holiday period within the next 20 to 30 years the discharges of contaminants to air are considered as discretionary activities.

Unlike the *Regional Water Plan* rules, the *Regional Air Plan* rules are not explicit regarding contaminant origin (e.g. contaminants originating from industrial or trade premises). The *Regional Air Plan* Rule 5.5.2 deals with discharges of contaminant into air from industrial or trade premises which is different to "discharge of contaminants originating from industrial or trade premises". The site where the activities are likely to occur is well away from the industrial or trade premise Te Anau WWTP site and is classified as production land.

Although the wastewater is free of biological activities because of membrane filtration resulting potentially little or no gaseous emissions, as stated before any dissolved or trapped gases could be released within the balance tank or driplines because of pressure or temperature changes. If so, such emissions may be considered as originating from industrial or trade premises but may not be considered as emitted immediately from industrial or trade premises.

Since I concur with the applicant that the above discharges to air and their effects are immeasurably small (as stated in Section 5 of the application), such discharges may therefore be considered as deemed permitted activity (DPA) under s87BB(1) of the Act. An activity can be considered as a DPA if s87BB(a) to (c) criteria under the Act are met.

Since there are no explicit rules in the Regional Air Plan on release of contaminants 'originating' from industrial or trade premises, Rules 5.5.2 in the *Regional Air Plan* can be considered as relevant to the proposed activity. Consequently, I will be using the permitted activity Rule 5.5.3.9 and the discretionary activity Rule 5.5.2.16 to process the air discharge application **APP-20191493-02** as a DPA.

Once treated and filtered at the Te Anau WWTP and conveyed to the irrigation area within the Kepler North Block, the BOD_5 content of the wastewater being processed will be substantially lower since BOD_5 will be reduced to less than quarter of the level found in the raw effluent by treatment (average BOD_5 level in treated effluent is expected to be 40 mg/L) and filtration (by membrane filter with effective pore size <0.001 mm). On the above basis, the amount of BOD_5 for discharge within the irrigation area will be substantially less than the design capacity population equivalent for BOD_5 of less than 10,000 people. Since the extent of the BOD_5 loading processed is often related to potential odorous discharges, lower the BOD_5 loading processed at the site is considered to have less potential for odorous discharges. Although odour discharges are neither stated nor controlled in the *Regional Air Plan* rules, I have considered them in my report because typically they are the main cause of the air discharge problems associated with pond treated human wastewater.

Criteria s87BB(1)(a) will be met because the activity would be a permitted activity except for a marginal non-compliance with the rule exceeding the capacity population equivalent for BOD_5 of less than 10,000 people over the term of the consent at the TAWWTP site rather than at the site of the proposed activity. Permitted activity Rule 5.5.3.9 states that "*…There shall be no visible discharges other than smoke and water vapour from chimneys or other outlets…*". All gases to be discharged through the balance tank valve and the SDI drip emitters will be colourless hence will not be visible.

Owing to the activated carbon filter fitted to the balance tank vent, and the treatment of subsurface gaseous discharges by the soil layer, any odour discharges will be considered as negligible, and undetectable at the site or beyond the site boundary. Criteria under s87BB(1)(b) of the Act will be met because any adverse environmental effects of the activity are no different in character, intensity, or scale than they would be in the absence of the marginal non-compliance.

Criteria s87BB(1)(c) will be met because the adverse effects from the emissions from the balance tank and the SDI drip emitters on any person will therefore be less than minor. Accordingly and as required under s87BB(1)(d), I will recommend the issue of a DPA notice by fulfilling requirements under ss87BB(3) and (5) for the above activities through a separate process.

On the above basis and under s87BB(4) of the Act, the application (**APP-20191493-02** discharge permit to discharge contaminants to air arising from the SDI operation) need not be processed further. Since the application has been an integral part of the wastewater discharge application **APP-20191493-01**, it may be unable to be returned physically to the applicant as required in s87BB(4) of the Act.

1.3.3.3. Regional Air Plan consideration of discharges herbicide trifluralin from the SDI system into the air

The applicant has not applied for a resource consent for the above activity with the presumption of nil or negligible discharge of the herbicide into air. As stated previously, in the absence of evidence for nil discharge to air, it is difficult to ascertain nil herbicide discharge to air. Therefore, consent may also be required to discharge root growth inhibiting herbicide (trifluralin) impregnated in the SDI pipes from drip emitters into air. A detailed assessment of the *Regional Air Plan* permitted activity Rule 6.2 (Agrichemicals using other than hand-held application methods) indicates that with exception of Rules 6.2.(a), (d) and (e) the activity will comply with the permitted activity rule.

According to Rule 6.2.(a), the discharge must comply with the mandatory requirements of NZS8409:2004. The above extensive standards set out the requirements for the safe, responsible and effective management of agrichemicals by suppliers and users in New Zealand. The discharge is applied substantially less than the label application rate and into the subsurface soil layer rather than into air. Much of the precautions and standards under NZS8409:2004 apply to safe handling, storage, transport and spray application of the agrichemicals at the specified rates. On the above basis it is concluded much of the NZS8409:2004 standards where they apply to this activity will be complied with.

Since it is understood trifluralin is approved under HSNO Act 1996 and the proposed application rate will comply with the requirements, Rule 6.2.(b) will be compliant. The activity will comply fully with Rule 6.2.(c) because it is applied to subsurface soil without any spray drifts.

The activity does not apply to Rule 6.2.(d) (i.e. applicators with GROWSAFE certificates or supervised by GROWSAFE certificate holders), but considered as possessing superior capability in avoiding spray drift, over or unsafe application owing to automated application at substantially lower label application rate into subsurface soil layer. Rule 6.2.(e) does not apply because it is entirely related to aerial application of agrichemicals.

The adjacent land-owner notification by the applicant as required under Rule 6.2.(f) is not warranted in the absence of any spray drifts owing to subsurface application at low application rate and potentially very low emissions from the land surface resulting in no adverse effects on any person beyond the boundary of the activity. Rule 6.2.(g) does not apply since the activity is in a historical production land and into soil subsurface.
Accordingly, the above activity can be considered under s87BB as a DPA rather than processing and granting as a resource consent. Under s87BB(2)(b) of the Act, a consent authority can serve a DPA notice on its own initiative without receiving an application. However, for the DPA notice to be issued, certain criteria under s87BB must be met. Under criteria s87BB(1)(a) of the Act will be met because the activity would be a permitted activity except for a marginal non-compliance with Rules 6.2.(a) and (d), which are about following procedures rather than exceeding the intended permitted activity effects thresholds.

Criteria s87BB(1)(b) will be met because any adverse environmental effects of the activity are no different in character, intensity, or scale than they would be in the absence of the marginal non-compliance. Criteria s87BB(1)(c) will be met because the adverse effects from the emissions to air on any person should be less than minor. Accordingly and as required under s87BB(1)(d), I will recommend the issue of a DPA notice by fulfilling requirements under ss87BB(3) and (5) for the above activities through a separate process.

1.4 Notification and written approvals

A decision was made to process the application non-notified on 24 September 2019 under Sections 95A-95G of the Act because the environmental effects of the discharge were considered to be less than minor and the parties who were potentially affected had already provided written approvals to the application.

The nub of the decision was that the proposal was a replacement consent and that theoretically the difference in the environmental effects arising from the CPI and SDI discharge was negligible. The first four affected parties in the list below are considered as stakeholders hence considered as affected parties. The remainder of the parties (i.e. Fiordland Sewage Options Inc., AJP McDonald and R Shaw) were appellants involved in the previous CPI discharge consent application Environment Court appeal and mediation process hence considered as affected parties.

The applicant has obtained written approvals from the following parties:

- the Guardians of Lakes Te Anau, Manapouri & Monowai,
- Te Ao Marama,
- Department of Conservation,
- Southland Fish and Game Council,
- Fiordland Sewerage Options Inc.,
- Alastair John Paton McDonald; and
- Ruth Shaw

For the purpose of managing any future issues with the consent the applicant has proposed a Liaison Group comprising Fiordland Sewerage Options Group, Fiordland Community Board, Manapouri Community

representative and Te Ao Marama Inc, which has been included in my proposed consent conditions (proposed consent conditions 5 and 17). The purpose of the Liaison Group is to facilitate consultation between the consent holder and the above groups during the term of the consent regarding the operation and compliance of the discharge.

1.5 Effects on the environment

In this section key effects on the environment will be considered along with any appropriate consent conditions or limits to ensure adverse the effects on the environment remain less than minor. Relevant policies and plans against the effects will also be considered briefly.

1.5.1. Surface water contamination

Based on the Environment Southland's State of Environment (SOE) monitoring data of Lake Te Anau at Blue Gum Point the upstream total-nitrogen level in the Waiau River is <0.11 mg/L. Assuming the entire groundwater nitrate-N plume is discharged to the Waiau River and calculating the downgradient total-N level, the background total-N level has been assumed as at the detection limit of 0.11 mg/L with a predicted increase of total-N <0.0047 mg/L. The predicted increases in total-N are insignificant and unlikely to be detectable in real measurement of total-nitrogen level in freshwater system. The proposed land-based discharge will also reduce the current/historical wastewater mass total-nitrogen load (which enters into the Upukerora River) substantially by filtration, plant uptake and other nitrogen loss processes in soil, resulting in less total-N into the surface water catchment.

In order to assess any long-term impacts on surface water such as Waiau River and Lake Manapouri, I proposed to include *Environment Effects Review* (EER) for the above water bodies under draft proposed condition 16 among the others. However, the applicant rejected such a review presumably being onerous and unnecessary given the predicted impact might not be detectable technically. On the above basis I will not recommend to include the above water bodies for EER in the proposed condition (condition 16).

1.5.2. Groundwater mounding

Wastewater irrigation to land will increase groundwater recharge beneath the irrigated area since the overall volume discharged is greater than the historical rainwater recharge volume in the area. This will result in a localised and elevated groundwater levels causing groundwater mounding. The applicant has used groundwater modelling performed for the CPI proposal to compare mounding caused by the proposed SDI system.

The CPI modelling predicted a worst-case scenario groundwater mounding of 0.24 to 1.44 m at the edge of the irrigation area. Whilst not specified the extent of the mounding, it has been predicted that owing to less groundwater recharge by the SDI system, the groundwater mounding has been predicted to be lower than that predicted in the CPI system but much greater than the existing aquifer saturated zone thickness.

Considering the depth to groundwater in the local area being 6 to 13.5 metres, the worst-case scenario for groundwater level is 4.56 m (i.e. shallowest groundwater level of 6 m minus 1.44 m). Even if such a mounding is likely, there is no likely hydrological interference with the proposed SDI operation and the ongoing discharge of the treated effluent.

Such mounding is also considered as likely to have little or no effect on the extent of nitrate leaching and any biochemical processes related to wastewater-nitrogen process within the top 40-60 cm of the soil layer. Despite the mounding, the groundwater direction has been predicted to be towards Waiau River, North West of the irrigation block (i.e. the section of Waiau River between Lake Manapouri and Lake Te Anau).

In short, if groundwater mounding occurs, it will be localised and any effects on the environment will be less than minor. One of the methods to minimise mounding is to spread the wastewater irrigation to larger land area. However, the exercise could be costly and could result in lowered soil nutrient or moisture levels to operate 'cut & carry' pasture system optimally.

The consent conditions will require regular groundwater level monitoring of monitoring wells located in the area to assess the extent of mounding and any changes in groundwater flow direction. Groundwater flow direction will assist in identifying the direction and discharge point of the groundwater contaminant plume (mainly nitrate-nitrogen) which in turn will allow any adaptive measures to deal with emerging issues.

The plan provision which is relevant to managing the groundwater direction is Objective 1 of the pSWALP which requires sustainable management of the integrated natural resources such land and water recognising the connectivity of the groundwater and surface water. The proposed monitoring consent conditions recognise the above Objective and will provide sufficient information for proactive management of any arising adverse effects.

1.5.2. Groundwater nitrate and faecal bacteria contamination

1.5.2.1. Current groundwater quality status

Groundwater nitrate contamination has been the key issue in this proposal as in the consented CPI proposal. Generally, land treatment systems are effective in filtering and processing most of the sewage wastewater related contaminants including wastewater-nitrogen. Of the land treatment systems, cut and carry is the best available land treatment system globally. Whilst cut and carry can assimilate wastewater-nitrogen effectively, particular care is needed in designing and managing the system including the wastewater irrigation and pasture performance to reduce nitrate leaching.

Before introducing a large-scale land treatment system in a catchment, it is critical to gather information on the local aquifer characteristics and the existing groundwater quality. The proposed irrigation area has been under livestock farming for many years. The applicant purchased the irrigation area from Landcorp in 2008. In 2018, the applicant destocked the livestock and decommissioned the historical offal pits. Table 2 shows mean historical (2008-2016) and recent (2018-2019) groundwater quality data for nitrate-N and *E.coli*. Figure 2 shows well locations within the Kepler North and South Blocks.

Wells 1, 2, 7, 8 and 9 are downgradient to the irrigation area hence considered as potentially affected by the proposed SDI irrigation. All bores contaminated with *E.coli* above 1.0 MPN/100 mL have improved in water quality substantially. Except for wells 2, 3 and 4 which showed increasing nitrate-N, the remainder of the wells showed same or reduced levels of nitrate-N.

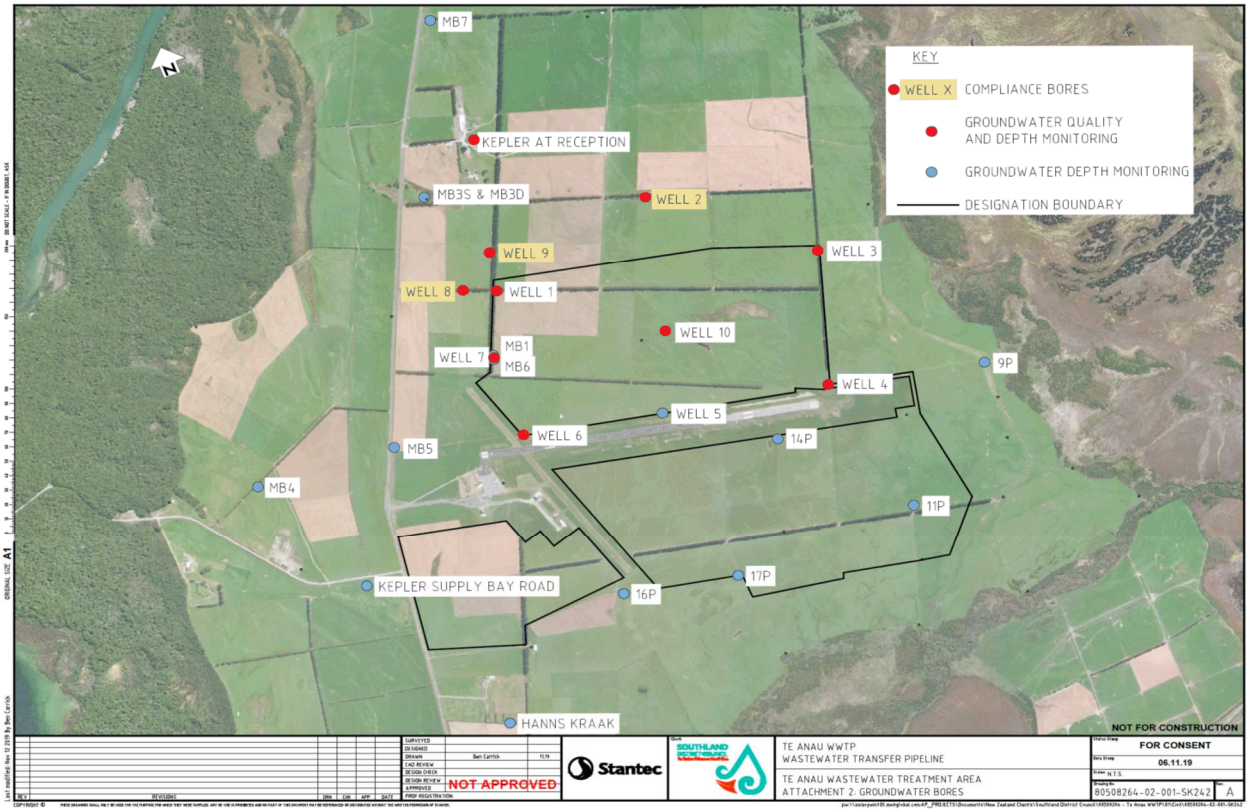
Table 2. Summary of groundwater quality results

				6 Nov 2019 Results	
Location		**Nitrate-N (mg/L)**	***E.coli* (MPN/100 mL)**	**Total oxidised-N (mg/L)**	***E.coli* (MPN/100 mL)**
Airport	Mean historical	0.52	0.6		
	Mean recent	0.36	1.0		
Meridian	Mean historical	3.70	0.5		
	Mean recent	3.70	1.0		
Well 1	Mean historical	6.60	3.0		
	Mean recent	2.80	1.0	3.3	<1.0
Well 2	Mean historical	2.60	4.0		
	Mean recent	3.30	1.0	3.0	1.0
Well 3	Mean historical	3.60	6.0		
	Mean recent	6.00	1.0	5.6	<1.0
Well 4	Mean historical	2.10	4.0		
	Mean recent	4.50	1.0	4.4	<1.0
Well 5	Mean historical	1.40	11.0		

	Mean recent	1.10	1.0		
Well 6	Mean historical	0.75	4.0		
	Mean recent	1.50	1.0	1.3	<1.0
Well 7	Mean historical	5.70	14.0		
	Mean recent	5.40	1.0	6.1	<1.0
Well 8				4.5	2.0
Well 9				0.36	<1.0
Well 10				0.14	<1.0
Average of historical (2008-2016)		2.99	5.2		
Average of recent (2018-2019)		3.18	1.0		
Average of all results		2.90	4.6		
Downgradient wells (1, 2 & 7) historical average		4.96	7.0		
Downgradient wells (1, 2 & 7) recent average		3.83	1.0		

There has been an overall reduction in nitrate-N levels in the downgradient wells 1, 2 and 7 resulting in an average value of 3.83 mg/L. It is noteworthy despite the substantial reduction or elimination of the faecal bacterial contamination of the groundwater, the recent 6 November 2019 results indicated Wells 2 and 8 had detectable *E.coli* levels. The above two downgradient wells have been proposed by the applicant as compliance wells along with downgradient Well 9 which had no *E.coli* detection.

Figure 2. Well locations



1.5.2.2. Estimate of nitrate leaching from the SDI system and the contamination extent assessment

The critical information required to assess predicted groundwater nitrate levels is the modelling estimate of mass nitrogen leached from the proposed system. Given the CPI consent had already been granted with detailed nitrate leaching estimate and the corresponding groundwater nitrate contamination prediction, the input data used in the CPI proposal can be used to assess any further adverse effects caused by the proposed SDI activity. If the proposed activity which is a replacement consent whose leaching is found to be similar or less than that already granted, the adverse effects can be considered as less than minor. This was the principle adopted by the applicant in the SDI proposal to replace the CPI consent.

The CPI consent leaching estimates were made by using Overseer® nutrient model from the CPI system hence the consent nitrate-nitrogen leaching limit of 32 kg/ha/year was set based on Overseer® assessment. However, the proposed system is SDI which is significantly different to CPI. Technically, although used extensively in the CPI consent proposal and decision, in my opinion the Overseer® model is not suited to assess nitrate leaching from any land-based sewage or industrial wastewater discharge let alone to assess nitrate leaching from the SDI system because it is not fit for purpose.

Because of not being able to use Overseer® model for assessing nitrate leaching from SDI, the applicant proposed to use a solute transport model such as HYDRUS2D model. Fortunately, the above model has been trialled and studied globally for the purpose on numerous occasions in the past. However, in order to make a sensible comparison of the nitrate leaching from the CPI activity under the CPI consent, the applicant used HYDRUS2D model with the same CPI data inputs. Thus, nitrate leaching outputs obtained from HYDRUS2D model using the CPI data inputs were set as a benchmark to manage SDI leaching losses and the environmental effects. The full detail of the modelling and the comparison assessment and leaching losses from a range of SDI scenarios have been provided with the application within the applicant's consultant Freeman Cook's final version of the reports.

Armed with the mass nitrate leaching data obtained from the CPI data inputs, local hydrogeological data and from the proposed SDI system data inputs, background groundwater nitrate-N level can be used to compare any increase in nitrate levels from the proposed SDI discharge. Two (low and high) background groundwater nitrate-N levels such as 2.9 and 6.0 mg/L were used by the applicant with two (low and high) aquifer hydraulic conductivities of 10 and 30 m/d. The groundwater nitrate-N background level of 2.9 mg/L represents the overall average of all bores sampled.

Ideally, for such an assessment, the downgradient well nitrate-nitrogen values should be used as the background levels. If so, the background downgradient nitrate-N value should have been 3.8 mg/L. This is because the greater the background nitrate-N level, the higher the expected plume nitrate-N values. Since a worst-case scenario background nitrate-N level of 6.0 mg/L has been used, I am satisfied with the applicant's assessment which is provided in Table 3.

As seen in Table 3, using the HYDRUS2D modelled nitrate leaching outputs, under all scenarios 6.0 to 8.9 mg/L have been predicted as new groundwater nitrate-N levels after groundwater mixing around the downgradient edge of the SDI irrigated areas. On the above basis and *without considering the CPI related nitrate contamination*, it can be concluded that the proposed SDI discharge will result in significant increase in groundwater nitrate-N level downgradient of the irrigation area. The increase in groundwater nitrate—N level is significant when considering an overall background level of 2.9 mg/L and the downgradient well average level of 3.8 mg/L.

Table 3. Predicted groundwater nitrate-N levels in the downgradient edge of the irrigated areas

Background nitrate-N concentration (mg/L)	Scheme	Aquifer hydraulic conductivity (m/d)	Full vertical mixing (Nitrate-N mg/L) after mixing	Half vertical mixing (Nitrate-N mg/L) after mixing	Quarter vertical mixing (Nitrate-N mg/L) after mixing
2.9	CPI	10	7.5	8.1	8.5
		30	6.0	7.0	7.8
	SDI	10	7.6	8.2	8.6
		30	6.0	7.0	7.9
6.0	CPI	10	8.3	8.6	8.8
		30	7.5	8.0	8.4
	SDI	10	8.3	8.7	8.9

		30	7.6	8.1	8.5

However, the proposal is replacement consent for the newly obtained CPI consent. If so, the appropriate way of assessing any newly arising adverse effects in addition to that caused by the CPI proposal is to assess any increase in nitrate contamination above the CPI allowed contamination. The modelling indicates that the difference or increase in groundwater nitrate-nitrogen under the new SDI scheme above that of the CPI scheme will be negligible (0.1 mg/L) as a replacement consent to the CPI scheme. This is because with the errors associated with the modelling the above increase is considered as not significant. Consequently, the proposed SDI activity's groundwater nitrate footprint can be considered as similar to that has already been granted under the CPI scheme. On the above basis, the adverse effects caused by the new SDI proposal has been considered as less than minor.

Despite the predicted less than minor adverse effects on the groundwater quality, consent conditions will enable the use of various trigger levels and compliance limits to take timely actions to mitigate any arising adverse effects and to maintain the overall water quality for human consumption. The above approach will ensure objectives and policies from the *Regional Water Plan*, *pSWALP* and *Regional Effluent Land Application Plan* related to land discharge of sewage effluent and groundwater quality are met.

1.5.2.3. Trigger levels for adaptive management to reduce nitrate leaching (relevant to proposed consent condition 13)

Trigger levels are not considered as compliance limits but are levels which will trigger mitigation or adaptive management of any emerging adverse effects to continue complying with the compliance limits. Such trigger levels can be imposed on groundwater nitrate-nitrogen, *E.coli* and annual herbage-N uptake.

Groundwater nitrate-nitrogen level

As can be recognised in Table 3, the modelling also indicates nitrate-nitrogen levels may not exceed NZ Drinking Water Maximum Allowable Value of 11.3 mg/L. However, the highest predicted nitrate-nitrogen level of 8.9 mg/L is only 2.5 mg/L from reaching the drinking water standard. The applicant has proposed several mitigation measures and to use 7.5 mg/L as a trigger level for *any* of the wells monitored to initiate mitigation measures. Since the SDI nitrate leaching and the corresponding groundwater nitrate contamination process are dynamic but slow with lag phases, I consider 7.5 mg/L nitrate nitrogen trigger level as slightly high in considering and implementing any adaptive measures to maintain the groundwater nitrate nitrogen level well below 11.3 mg/L. However, given such a level is used on all 10 proposed water quality monitoring wells and on any individual sample I am satisfied with the above trigger level which is proposed in proposed consent condition 13(a).

Pasture nitrogen uptake trigger level

There are two key technical weaknesses with the HYDRUS2D model. It consistently underestimates pasture nitrogen uptake to very low levels and at the same time overestimates denitrification (nitrate decomposition to nitrogen and nitrous oxides gases) losses. In my opinion, the high denitrification rates predicted by HYDRUS2D model are not technically or practically possible under the field conditions unless soil is subjected to sustained saturated conditions followed by soil anoxic/anaerobic conditions. The proposed SDI system is designed to cause neither saturated nor anoxic soil conditions. This is because the wastewater irrigation follows an eight-day cycle with wastewater being applied to porous soil.

Another key factor required for high denitrification is high wastewater applied organic carbon which is required to trigger anoxic conditions along with elevated soil moisture levels. Given the wastewater will be membrane filtered, unless there is substantial dissolved organic carbon available, the likelihood of high presence of organic carbon in the irrigated wastewater is also low.

As stated, the pasture nitrogen uptake predicted by HYDRUS2D model was consistently and substantially lower than that predicted for the CPI system by the applicant's experts using conventional pasture nitrogen

uptake assessments. HYDRUS2D model underestimated pasture nitrogen uptake consistently irrespective of the solute types (e.g. ammoniacal nitrogen as one solute or four combined solutes of nitrate, nitrite, ammonium, organic nitrogen) used in the modelling to assess nitrogen leaching from both CPI data inputs and SDI data inputs.

During the extensive technical consultation over the application's acceptance under Section 88 and Schedule 4 of the RMA process with the applicant's experts, it was decided to consider the combined pasture nitrogen uptake and denitrification loss estimated under SDI system as a potential for pasture nitrogen removal. This technical issue including the above assumption hold low practical significance in assessing the proposal if consent conditions are imposed to promote optimal pasture nitrogen uptake by using optimal herbage-N trigger values to evaluate and improve the system by adaptive management.

The main reason for the above is given the SDI system will be operated under unsaturated soil conditions (which means denitrification potential will be low), herbage-N uptake is considered as the most critical component of the wastewater nitrogen process and nitrate leaching hence should be managed accordingly. The applicant's expert Freeman Cook has recommended the use of suction cup lysimeters to monitor nitrate leaching in combination with adaptive management. In order to obtain sensible data, numerous suctions cup lysimeters are required to be installed to minimise sampling and monitoring errors. Any data obtained need to be assessed regularly by the groundwater modelling experts to estimate the extent of groundwater nitrate contamination using a reliable hydrogeological model.

I consider such a monitoring/exercise as onerous and costly since large number of monitoring sites will be required with many hours of sample collection, analyses, data interrogation and interpretation. If such an approach is considered, technically sound suction cup nitrate-nitrogen leaching trigger levels must be determined and set as consent condition to initiate any adaptive management or mitigation measures. I am aware it will be technically difficult to set suction cup lysimeter monitored nitrate-N levels as trigger levels because of complex and unknown vadose zone (geological layer between topsoil and groundwater level) and aquifer characteristics.

In my opinion the effort, time and resources should be accorded to improve plant uptake of nitrogen to reduce the potential for nitrate leaching. Without having such herbage-N uptake trigger/target and in the absence of nitrate leaching measurements, there is no incentive for the applicant or the operator of the SDI system to treat wastewater applied N effectively. The three-year rolling average of herbage-N uptake can be used as a buffer against any unfavourable seasonal effects such as high rainfall on pasture performance. The above trigger combined with a groundwater nitrate-nitrogen trigger level of 7.5 mg/L will be effective in promoting less nitrate leaching and to trigger any suitable and timely adaptive actions required to reduce any increase in groundwater nitrate-N levels.

According to the *Beef & Sheep Pasture Quality Principles and Management manual*[4], the greatest N uptake from unirrigated pasture in the Te Anau area is during November (59 kg DM/ha/day) and over the winter around 4-5 kg DM/ha/day. On the above basis the estimated annual DM production for the Te Anau area is determined as around 9600 kg/ha/year.

During high growth period (i.e. spring and summer), the major pasture growth limitation factor is soil moisture deficit owing to high evapotranspiration water losses. In contrast, during winter months temperature is the major limiting factor. With the proposed SDI system moisture deficit will be unlikely (8-day irrigation rotation) hence pasture performance should be much greater over the growth period of spring and summer.

[4] Beef + Lamb Pasture Quality Principles and Management – the Q-graze manual by Beef + Lamb New Zealand. 2012. https://beeflambnz.com/knowledge-hub/PDF/pasture-quality-q-graze

Whilst HYDRUS2D model had predicted high N leaching and denitrification losses it must be born that the applied annual wastewater-N is 468 kg N/ha/year which is substantially greater than the recommended conventional fertiliser-N application of 200 kg N/ha/year in hay producing pasture system. The combined high wastewater-N input with the absence of moisture deficit I expect good pasture performance and high N uptakes. In my proposed draft conditions, the herbage-N trigger level was set as 350 kg/ha/year. This was based on 12,000 kg/ha dry matter production and 3% herbage-N for unirrigated pasture. The above uptake is much lower than the 420 kg N/ha/year predicted by the consultants during the CPI consent process, hence considered as conservative.

During the draft consent condition consultation with the applicant, the applicant pointed out any pasture sampling to determine pasture removal of N should be from the SDI area. On the above basis, for Stage 1 pasture sampling should be from the 27.7 ha SDI area or 'irrigation area' (not the wetted area of 21.7 ha) and for Stage 2 from the 41.5 ha SDI area or 'irrigation area'. The wetted areas are immediately wetted by the SDI drip emitters in circular patterns leaving unwetted areas between drip emitters. Pasture growing in the unwetted areas will access soil moisture by extending roots into the wetted areas. Any pasture samples taken outside the SDI area and between the 'irrigation areas' will result in underestimation of the pasture-N removal, hence should be avoided.

Since N modelling was performed for the wetted area of 21.7 ha and if herbage-N is derived from 27.7 ha, the expected annual herbage-N removal is considered as 274 kg/ha (350 kg x 21.7 ha ÷ 27.7 ha). On the above basis and as recommended by the applicant the annual herbage-N removal trigger level was set as the monitored herbage-N removal being lower of 274 kg herbage-N/ha or 72% of the total annual applied-N load.

Wastewater total-N level

There had been steady increase in wastewater-N concentration of the wastewater, particularly ammoniacal-N in the past two decades. The average monitored total wastewater-N level at the Te Anau WWTP pond outlet was 29 mg/L between 2005-2018 and the average of the intensive sampling undertook over the 2018 summer period was 46 mg/L. The dominant N species detected was ammoniacal-N with 26 mg/L level assessed during the intensive summer 2108 monitoring (Table 2.4 of the application). The predicted average wastewater total-N following membrane filtration was <30 mg/L. In anticipation of the above, the applicant's solute transport model used 30 mg/L as wastewater total-N level in the AEE.

Exceeding the above wastewater-N level (i.e. annual average) may increase total mass-N loading into the irrigation area in excess of the capped total mass-N loading (e.g. 12,970 kg/27.7 ha). In anticipation of the increasing wastewater-N trend, the applicant has proposed a 40-ha offset area set aside without any livestock grazing. This was accounted for in the leaching modelling in the applicant's AEE. Given no other nitrogen input was included in the modelling, in addition to stock grazing-N input, fertiliser-N input also has to be avoided. For the above reason, I have recommended the restriction of fertiliser-N use and livestock grazing in the offset area of 40 ha. The provision of the 40-ha offset area and the restriction on N use in the area are provided in the proposed consent conditions 2(c), 2(e) and 6(d).

In light of the increasing wastewater-N trend and if warranted, the applicant has also proposed to upgrade the Te Anau WWTP to reduce wastewater-N output. Prior to considering this measure, the applicant has Stage 2 as an option to increase wastewater-N loading as stated in the next section of the report (i.e. 16,370 kg N/41.5 ha). The applicant will consider the cost benefits against the above options and implement an appropriate option accordingly. On the above basis I have recommended to cap the annual wastewater total-N concentration at 30 mg/L as trigger level in the proposed consent condition 13(c). According to the above condition, the Environmental Management Plan (EMP) shall be reviewed and modified as necessary to identify appropriate measures to ensure the annual applied nitrogen load is compliant.

Fertiliser-N use and stock grazing

The applicant wished to use fertiliser-N in the irrigation area to promote optimum pasture growth. This intention was stated in the application, however, the fertiliser-N input was not included in the HYDRUS2D modelling of the nitrogen leaching assessment in the applicant's AEE. For the optimum performance of pasture growth other essential nutrients are also vital which the applicant did not consider. This is because sewage wastewater may be deficient in certain essential nutrients depending on the pasture species used. I am not concerned about the use of other nutrients including phosphorus, but improper use of fertiliser-N could cause unexpected nitrogen leaching losses.

In the context of a complex and detailed N leaching assessment by modelling, if fertiliser-N inputs were to be contemplated, such inputs should have been considered in the AEE to assess any impacts of additional N inputs such as fertiliser-N to wastewater-N loading. This is because the total wastewater-N annual loading will be restricted along with other N inputs such as any stock grazing inputs. To demonstrate, even a one-off application of 25 kg fertiliser-N/ha/year will increase the total mass-N input to the irrigation area by 692 kg/year for Stage 1 process (27.7 ha x 25 kg N). It is difficult to predict the fertiliser-N related N leaching unless trialled by using ^{15}N labelled (stable isotope) fertiliser-N.

Under zero irrigation conditions and based on 3% herbage-N, my estimate of the monthly herbage-N uptake in the Te Anau area has been 3.6 to 53 kg in a given year. The annual maximum wastewater-N applied under Stage 1 is 468 kg/ha which means the average monthly wastewater-N input is considered as 39 kg/ha. Since for 5 months (May to September), the monthly predicted pasture-N uptake is only 3.6 to 13.5 kg (based on 9600 kg DM/ha/year but the above figures over winter will not be substantially greater for 12,000 kg DM/ha) there will be a substantial N surplus in the soil. Given 90% of the wastewater-N is ammoniacal-N, leaching and denitrification will be very low owing to lack of or very low nitrification of ammoniacal-N over winter months despite the overall over prediction of denitrification and leaching by HYDRUS2D.

In short, there is very low risk to N being a limiting nutrient to pasture performance because of regular ammoniacal-N rich wastewater irrigation and the relatively high quantity of monthly and annual wastewater-N applied compared to normal fertiliser-N input under hay making pastoral farming conditions. Despite the above assessment, I considered this issue carefully and decided to allow fertiliser-N provided it does not increase the overall mass annual-N loading rate and as per the proposed condition 6(g)(i)(7) which requires description and technical rationale for the use, type, mode, timing and rate of fertiliser-nitrogen and other essential nutrient applications and methods to monitor the use of fertiliser-nitrogen and other essential nutrients. Under the proposed condition 2(d), I have recommended stock grazing of the irrigation area be restricted to avoid additional N input in the area. The applicant had accepted the above condition.

1.5.2.4. Wastewater loading compliance level (proposed consent condition 4)

The maximum wastewater volume applied at any given time was capped at 4,500 m^3/d based on the wastewater production under wet weather flow. Excessive hydraulic loading will result in ponding, heavy nitrogen leaching and runoff of the wastewater. On the above basis and as proposed by the applicant and as provided in the CPI consent, the proposed consent condition 6(a) required a minimum of additional 15,000 cubic metres of wastewater storage shall be provided at the Te Anau WWTP.

Based on the modelling in the AEE, annual total-N loading was capped at 12,970 kg per 27.7 irrigation area and 16,370 kg per 41.5 ha irrigation area. Since the applicant has proposed the use of fertiliser-N to promote optimal pasture growth, the above loading will also include fertiliser-N as described in s1.5.2.3 of this report. Accordingly and as described, the fertiliser-N use is only justified if herbage-N removal is found to be lower than the trigger level as in the proposed condition 13(b).

1.5.2.5. Groundwater quality compliance limits (proposed consent condition 12 and 14)

Groundwater nitrate-nitrogen

The applicant has also proposed compliance limit of 11.3 mg/L groundwater nitrate-nitrogen. The above limit applies to the three bores (bores 2, 8 and 9) immediately downstream of the discharge. The limit is proposed to be calculated across all three bores as annual average. The existing CPI consent condition is, however, different and as follows: "…*21(a) The wastewater discharge shall not cause the groundwater quality outside of the irrigation area (as measured in wells identified for this purpose in the GMP in condition 15) to exceed the following standards: (i) the nitrate nitrogen concentration shall be below 11.3 mg/l; and…"*.

The new SDI application is a replacement of the CPI consent. The CPI condition does not promote the use of annual average for groundwater nitrate-nitrogen in the selected compliance bores. Given the new SDI proposal is defined to be within the environmental footprint allowed in the CPI consent, the groundwater nitrate-nitrogen standard must also be similar.

Moreover, given the recent groundwater nitrate-N level data from Wells 2, 8 and 9 have been 3.0, 4.5 and 0.36 mg/L respectively (Table 2), and based on the prediction made in the application provided in Table 3, any sample exceeding 11.3 mg/L should be unlikely. Accordingly, I proposed the following condition (12(a) of the proposed condition) which was accepted by the applicant: "…*The wastewater discharge and the fertiliser-nitrogen use shall not cause the groundwater quality as determined by monitoring from the three compliance wells Numbers 2, 8 and 9 identified in Attachment 2 to exceed the following standards: (a) Nitrate-nitrogen shall not exceed 11.3 mg/L*;…"

E.coli

E.coli level not exceeding 10 cfu/100 mL has been proposed by the applicant as compliance limit for bores 2, 8 and 9 (which are nitrate-N limit compliance bores) under the proposed condition 12(b). The above level was also allowed in the CPI consent presumably because the quality of groundwater was poor at that time. As stated in section 1.5.2.1. of this report (Table 2), since the applicant began to prepare the land for wastewater irrigation by destocking and eliminating the historical offal pits, the extent of faecal contamination dropped substantially. The faecal contaminated wells had only 1 MPN *E.coli*/100 mL hence I proposed the above level as compliance standard in my draft proposed conditions for consultation with the applicant. *E.coli* level of 1 cfu/100 mL is also considered as the detection level for *E.coli*, and the applicant was concerned about this level being too stringent.

Having reviewed the recent groundwater quality laboratory data on 6 November 2019 obtained from the applicant (Table 2) there were two compliance wells namely No.2 and 8 contaminated with *E.coli* with levels of 1 and 2 MPN/100 mL respectively. It is difficult to explain why the above two wells are still contaminated with *E.coli* given there is no current potential faecal sources in the area. My proposed condition not exceeding 1 MPN/100 mL does allow *E.coli* contamination of the groundwater.

To avoid any faecal contamination the conditions must be "…*E-coli shall not exceed <1 cfu or MPN/100 mL…*" OR "…*E.coli shall not be detected*…" given the detection of even 1 cfu (colony forming unit) or MPN (most probable number)/100 mL makes the water unpotable. Because of the membrane filtered bacteria free wastewater irrigation and no livestock grazing in the irrigation area, I am confident there is little or no likelihood of future or ongoing *E.coli* contamination of the groundwater.

However, given the recent laboratory tests detecting *E.coli* contamination and for the avoidance of any doubt I accepted the 10 *E.coli*/100 mL level as proposed by the applicant and as in the CPI consent. Consequently, I recommend the condition wording in 12(b) be "…*E-coli shall not exceed 10 cfu or MPN/100 mL…*". Having stated the above, I hope with time, all wells will be free of *E.coli* even during the full scale SDI operation. In the event of the above compliance limits in condition 12 exceeding, proposed condition 14 requires a range of actions to ensure compliance.

1.5.2.6. Environment Management Plan (EMP) (proposed consent condition 6(g)(i))

The proposed SDI system is sophisticated in terms of durability, root growth inhibition, anti-slime build-up within the drip lines and delivery and application of filtered wastewater through drip emitters. There is pressure monitoring system which will detect any uncontrolled discharges (i.e. leakages). However, unlike the CPI system, I consider SDI as risky since the driplines are buried in soil permanently and any repairs within the dripline requires soil disturbance and unearthing the driplines for inspection. CPI system which is operated above the soil is free from any major risks of irrigation system failure since it can be easily remedied.

Once buried at or below 15 cm below soil surface, any repair of driplines, including replacement can be laborious, disruptive and costly. In the event of such breakdowns or large scale repairs or replacement (it is understood SDI system may need to be replaced every 10 years) there should be contingency measures provided over the term of the consent since treated wastewater discharges to surface water under s330 of the Act (*Emergency works and power to take preventive or remedial* action) will not be an option and hence emergency discharge of pond treated and micro-filtered wastewater into any water body or land outside the consent conditions is not possible. The 3-5-day wastewater storage proposed in the application may not be sufficient to deal with large scale replacement or repair of the SDI system.

The drip emitter spacing has already been modelled and determined extensively based on the available soil parameters but the real extent of wetted area, applied wastewater migration, N leaching, pasture performance can only be realised once the system is installed and operated. Any overlapping of the wetted circles will result in greater soil drainage and N leaching. Conversely, lower wetted areas will result in poor pasture performance owing to low soil moisture and nutrient levels.

Generally, SDI systems are managed under high pressure water/wastewater delivery are known to cause preferential flow pathways in soils which could result in tunnelling or chimney effects. Chimney effect is caused by smaller soil particles migrating away from the dripper. If caused, such effect could be permanent and may even be difficult to remove after tillage. Preferential flow pathways are known to cause rapid contaminant migration without undergoing adequate soil treatment process which could cause increased N leaching.

Disinfectants used to inhibit slime growth within the driplines, if discharged into soil may not be conducive to soil microbial activity hence the levels used must be safe to promote normal soil microbial activities. Whilst root inhibiting herbicide is predicted to be confined within 20 mm of the drip emitters, it is difficult to predict any inhibition resulting in poor pasture performance.

Owing to the proposed membrane filtration at the Te Anau WWTP site there will be substantial sewage solids (i.e. sludge) retained by the membrane filter to be disposed of. The applicant has proposed to return the sludge to the ponds or managed separately, if necessary, to ensure the discharge remains within the consented conditions for N loss.

Using the conservative daily wastewater volume of 1000 m^3 and the most recent pond outlet wastewater quality data (Table 2.4, page 7 of the application) my estimate of the annual filtered sludge-N (total-N (46) – SIN (26) = 20 mg/L, assuming the filtered-N is entirely undissolved organic-N, which may not be the case since a proportion of the organic-N may be in dissolved form) is likely to be 7300 kg and the total corresponding suspended solids discharged back into the pond has been estimated as 21,900 kg based on 60 mg SS/L.

Since maturation ponds are unable to fully digest wastewater solids (owing to lack of aerobic/anaerobic digestion), if the filtered solids are recycled in the treatment ponds, they are likely to contribute additional ammoniacal-N to the pond outlet water quality, hence could accentuate the increasing wastewater-N

levels. Given steadily increasing wastewater-N level is an issue, the management of the filtered solids must account for any increasing wastewater-N.

In order to deal with much of the risks outline above, I consider the development and management of an EMP as essential which has also been proposed by the applicant. On the above basis several key conditions are proposed in the proposed condition 6(g)(i). The proposed conditions require the development and forwarding of the EMP prior to the commencement of the wastewater irrigation to Compliance Manager of the consent authority to ensure sufficient proactive plans are in place before the full operation of the SDI system.

1.5.2.7. Monitoring (proposed conditions 7, 8, 9, 10, 11 and 15)

In order to assess compliance and performance of the consent, monitoring of the wastewater, soil and groundwater quality, groundwater levels, wastewater flow, herbage production & nitrogen and complaints are required. These are proposed in the consent conditions. For soils, baseline and ongoing monitoring is required for assessing soil quality and heavy metal levels. Much of the above conditions has been proposed by the applicant and all proposed monitoring conditions have been agreed to and accepted by the applicant through my consultation with the applicant which required increasing the frequency and type of monitoring.

Of interest the wastewater total-N which is critical to monitoring wastewater-N load can be performed by automation or by laboratory analysis. But the choice is restricted to each year of herbage-N monitoring to ensure consistency.

1.5.2.8. Environmental effects review (proposed condition 16)

Environmental Effects Review (EER) is essential to collate monitoring and other relevant information to review the overall performance of the consent including any arising adverse effects, how such effects are mitigated and compliance management. The review will cover the Te Anau WWTP system, the SDI system, the irrigation area, the Kepler North Block, the offset area and the local aquifer. This was proposed by the applicant and I accepted with modifications which in turn were accepted by the applicant and included in the proposed consent condition 16. According to the above condition, the review will be performed 3 years following the commencement of the SDI irrigation and every 5 years thereafter.

1.5.2.9 Reporting

Often with large scale consents such as this with numerous consent conditions, reporting can be confusing to the applicant and the monitoring compliance officer because the respective reporting is scattered throughout the consent conditions. To avoid confusion and to promote timely and targeted reporting, I have dedicated condition 17 to all reporting required in the consent with the respective timing of reporting. The above condition has been accepted by the applicant with minor changes.

2. Statutory Considerations

2.1 Part 2 of the Resource Management Act 1991

This application is consistent with the purpose and the principles of the Act, as set out in Section 5. The proposed activities will have no more than minor adverse effects on the ability of the receiving environment to meet the reasonably foreseeable needs of future generations, or on the life-supporting capacity of the land or any ecosystem associated with it. The proposed consent conditions will ensure that any potential adverse effects of the activities will be avoided, remedied or mitigated.

There are no matters of national importance, as outlined in Section 6 of the Act, that may be affected by the proposed activities. Since the human waste discharge is to land, national importance with respect to Te

Mana o te Wai and the relationship of Maori and their culture and traditions with their ancestral lands, water, sites, waahi tapu, and other taonga has been recognised. The application is also consistent with Section 7 of the Act, by taking climate change effects into consideration and maintaining the amenity values and the rural nature of the area. There may be localised increase in groundwater nitrate levels similar to that allowed under the CPI consent, however, given the direct human waste discharge is entirely removed from the Upukerora River, the overall environmental outcome is enhancement of the environment for the catchment which is in line with 7(f) (*maintenance and enhancement of the quality of the environment*).

With regard to Section 8 of the Act, the proposed activities are not inconsistent with the principles of the Treaty of Waitangi and achieving spiritual and cultural values since the historical human waste direct discharge to the Upukerora River will be removed and the proposal is discharge to land. In recognising the above, the local iwi has given its written approval.

2.2 Actual and potential effects (Section 104(1)(a))

As stated before, the key effects are related to the elevation of groundwater nitrate levels downstream of the discharge area and groundwater mounding. Groundwater nitrate contamination is likely and unavoidable with regular wastewater irrigation coupled with porous soils and shallow aquifer in the area. The cut and curry pasture system will help remove much of the discharged nitrogen thus minimising the potential for nitrate leaching. The nitrate leaching and groundwater nitrate modelling indicates the extent of the groundwater nitrate contamination is similar to that allowed under the CPI consent. Therefore, the adverse effects of the proposed SDI system on groundwater nitrate quality is considered as less than minor. Despite the porous soils and high hydraulic loadings, the potential for faecal bacteria contamination is low because of the use of membrane filter technology can filter most bacteria.

Whilst groundwater mounding is a possibility, any effects related to mounding will be minimal. According to the worst-case predictions, the mounding is unlikely to affect the long-term SDI system performance and operation or any nutrient processes in the top soil. The key issue associated with groundwater mounding is any effect on groundwater flow direction and as stated before, this can be monitored with large number of proposed monitoring wells by the applicant.

Recommended conditions of consent will ensure that any emerging adverse effects are avoided, remedied or mitigated.

2.3 Positive effects on the environment to offset adverse effects (Section 104(1)(ab))

As stated before, because of the proposal there may be elevated groundwater nitrate level in the local aquifer. This was already considered and allowed in the CPI consent granted by the Southland Regional Council. The proposed SDI system is predicted to have the same effects allowed in the CPI consent from the groundwater nitrate leaching perspective. For the above reason, the adverse effects of the proposed activity are considered as less than minor. As stated before, there will be positive effects by removing direct discharge of the historical wastewater discharge to the Upukerora River which was identified and recognised by the application.

Substantial amount of pasture will be produced by removing wastewater-N from SDI irrigated wastewater, which would have otherwise been disposed into the surface water system. The harvested pasture will be used to produce livestock in the adjacent farmlands like that in Taupo. The utilisation and any cycling of herbage-N will be spread out in the area hence considered as not causing any measurable increase in the catchment groundwater.

In addition to the removal of substantial nitrogen loading from the surface water system, a wide range of other wastewater related contaminants such as faecal bacteria, viruses, BOD, phosphorus, suspended solids, heavy metals and any emerging contaminants such as pharmaceuticals or endocrine disrupting compounds (EDC) will also be eliminated from the surface water system. Given the soil processes are conducive to high microbial activity and long retention time available to breakdown a range of physical, biological and chemical contaminants, the overall effects should be positive.

2.4 Relevant provisions of National Environmental Standards and other regulations (Section 104(1)(b)(i) and (ii))

The National Environmental Standard for Sources of Human Drinking Water (NES) is a regulation made under
the Resource Management Act (1991) that sets requirements for protecting sources of human drinking water
from becoming contaminated. The above NES is more relevant to community water supplies being affected by any discharges. There are no community groundwater supplies in the area except for that of the airport. The airport well is upstream of the likely groundwater nitrate plume path hence considered as unaffected. Despite the above, in its application the applicant has provided contingencies for alternate water supply and monitoring measures.

The municipal water supply for the Manapouri township (located close to the foreshore of Lake Manapouri to the south west of the township close to the confluence with the Waiau River) will not be affected by the proposal because of no faecal bacteria discharge and relatively lower load of total-N in the local surface water bodies. As stated before, most chemicals, physical and biological contaminants discharged to soil subsurface will be processed onsite except for nitrate-N which is unlikely to cause any adverse effects offsite owing to relatively low mass-N loading into the catchment coupled with large water bodies with low existing nutrient levels.

2.5 Relevant provisions of national policy statements (Section 104(1)(b)(iii))

NPS Freshwater Management

A full assessment against the objectives and policies of the NPS Freshwater Management have been provided in the application in Appendix K and I concur with that assessment. Overall, the assessment found the proposal would achieve the relevant objectives and is consistent with the policies of the NPS-FM in providing for the maintenance and improvement of water quality and achieving the sustainable management of water. As stated before, whilst there may be localised increase in groundwater nitrate similar to that allowed under the CPI consent, since the direct discharge of the pond treated human effluent will be removed from the catchment, the net effect is enhancement of the environment.

NPS Urban Development Capacity

The proposal is consistent with the above NPS as it will better serve the needs of Te Anau urban environment by providing higher level of treatment of wastewater while removing the historical discharge to the Upukerora River near the town. The proposal will also provide for future growth of Te Anau and will be able meet projected peak flows (and projected population growth) up to 2044 within the proposed consent limits.

2.6 Relevant provisions of the Southland Regional Policy Statement 2017 (Section 104(1)(b)(v))

An assessment of the provisions in the RPS is contained in Appendix K of the application. Having reviewed the above the assessment, I concur with the assessment and conclude that the proposal will achieve the objectives of the RPS and is consistent with the relevant policies.

2.7 Relevant provisions of the relevant regional plan objectives, policies and rules (Section 104(1)(b)(v))

Regional Effluent Land Application Plan (RELAP)
As was determined from the assessment of the activity in the context of the RELAP's policy framework in Appendix K of the application, the proposal will achieve the RELAP's objectives, and will be consistent with the relevant policies.

Regional Water Plan (RWP)
The proposal was considered against the relevant objectives and policies of the RWP in Appendix K in the application. I concur with the assessment that the proposal will achieve the objectives and is consistent with the relevant policies.

Proposed Southland Water and Land Plan (pSWLP)
The proposal was considered against the relevant objectives and policies of the pSWLP in Appendix K in the application. I concur with the assessment that the proposal will achieve the objectives and is consistent with the relevant policies in their current form.

Regional Air Quality Plan (RAQP)
The proposal was considered against the relevant objectives and policies of the RAQP in Appendix K in the application. My assessment of the applicant's assessment found that the proposal achieves the objectives and is consistent with the relevant policies owing to the absence of any odour producing gases released from the SDI system.

2.8 Any other matters considered relevant and reasonably necessary to determine the application (Section 104(1)(c))

Te Tangi a Tauira
The proposal was considered against the objectives, policies and outcomes sought by the tangata whenua of Murihiku in the assessment in Appendix K provided in the application. My assessment indicates that the proposal will achieve the objectives and is consistent with the relevant policies.

Ngai Tahu Fresh Water Policy Statement (Ngai Tahu FWPS)
The proposal was considered against the relevant objectives and policies of the Ngai Tahu FWPS in Appendix
K provided in the application. My assessment of the applicant's assessment found that the proposal will achieve the objectives and is consistent with the relevant policies.

2.9 Section 107 restriction on grant of certain discharge permits

Under s107 of the Act, a discharge permit shall not be granted *allowing a discharge of a contaminant onto or into land in circumstances which may result in that contaminant (or any other contaminant emanating as a result of natural processes from that contaminant)* entering water (except for under s107(2)),*…if after reasonable mixing, the contaminant or water discharged (either by itself or in combination with the same, similar, or other contaminants or water), is likely to give rise to all or any of the following effects in the receiving waters:*

(c) the production of any conspicuous oil or grease films, scums or foams, or floatable or suspended materials:

Since the discharge is membrane filtered and discharged to land, the effects will be unlikely.

(d) any conspicuous change in the colour or visual clarity:
As stated above since the treated wastewater is membrane filtered and land discharged, the above effect will be unlikely.

(e) any emission of objectionable odour:
Since the potential for gaseous discharges from the SDI drip emitters are small because of bacterially sterile filtered (effective pore size <0.001 mm) wastewater and since any discharges are emitted through the soil layer, there will be little or no odour discharges into air. Owing to the expected low odorous gaseous emissions from the SDI balance chamber because of the sterile filtered wastewater and the use of activated carbon filter system to release any gases, any odorous emissions are unlikely to be detected at the site or outside the boundary of the site.

(f) the rendering of fresh water unsuitable for consumption by farm animals:
Since the treated wastewater will be membrane filtered almost all bacteria will be eliminated from entering soil with the wastewater subsurface irrigation. The above coupled with zero livestock grazing and in the absence of any other faecal sources should result in little or no faecal bacteria entry into the groundwater from the irrigation area. The ANZECC guidelines for faecal bacteria level in animal drinking water < 100 faecal coliforms cfu units/100 mL, hence the proposed activity rendering of the freshwater unsuitable for consumption by animals is impossible.

Nitrate-N levels are predicted to be at elevated levels but are predicted to be less than 11.3 mg/L. The above level is the New Zealand drinking water standard for human. There are no livestock drinking water standards or guidelines in New Zealand. The FAO guidelines for nitrate-N in livestock drinking water is 100 mg/L. Based on the above livestock drinking water guidelines, rendering of any surface water bodies such as Waiau River or Lake Manapouri unsuitable for consumption by farm animals from the groundwater discharge from the irrigation area is considered as nil.

(g) any significant adverse effects on aquatic life
As discussed before, the impacts on the Waiau River water quality, particularly any increase in total nitrogen levels may not be detectable by monitoring hence any nutrient related impacts on the aquatic life will be less than minor.

2.10 Section 105 Matters relevant to certain applications

2.10.1. S105 …give regard to "…(a) *the nature of the discharge and the sensitivity of the receiving environment to adverse effects*;…"
The proposed discharge is through a sophisticated SDI system in combination with a cut & carry pasture system. If used properly, the cut & carry system has been proven to be one of the best wastewater treatment options. The immediate receiving environments at the proposed sites are porous soils and shallow groundwater. When a cut and carry system is managed properly by promoting optimum plant uptake of nitrogen, the potential for nitrate leaching and groundwater contamination will be minimal. There will be little or no adverse effects on soil quality as a result of the proposed discharge.

Any calcium-magnesium imbalance by regular calcium leaching causing poor soil structure can be reversible easily. Any lost soil calcium can be supplemented by inputs of suitable calcium minerals (e.g. gypsum or lime) through the SDI system which has been recognised and provided for in the proposed consent conditions. The addition of lime as calcium supplement must be considered carefully in light of maintaining optimum soil pH since lime addition can increase soil pH.

The groundwater is likely to have elevated nitrate-N but predicted to be below the human drinking water standard in New Zealand. Such a level of contamination has already been authorised in the CPI consent and the proposal prediction indicates little or no further increase in groundwater nitrate from the proposed SDI

system. As stated before, any faecal bacterial contamination of the groundwater is unlikely. The receiving surface water system Waiau River which drains the local aquifer is unlikely to be affected because of high natural flow of the river draining an extensive catchment and relatively low mass nitrate-N loading entry to trigger any measurable total nitrogen levels.

2.10.2. Section 105 *give regard to* "…(b) *the applicant's reasons for the proposed choice;…*"
The long-term community consultation of the applicant indicated there was community preference to land based discharge of the treated effluent as against the ongoing direct discharge to the Upukerora River. Following extensive data collection, investigation and consultation the applicant had already secured a consent to discharge treated wastewater onto land via CPI through a publicly notified hearing and the Environment Court appeal process.

During the above consent processes, the applicant recognised community concerns on visual effects of the CPI and the negative community perception on the potential odour/aerosol human health effects. Through the council business case study, the applicant decided the proposed SDI system as a solution to address the above community concerns whilst retaining all the benefits associated with the use of land-based discharge.

2.10.3. Section 105 *give regard to "…(c) any possible alternative methods of discharge, including discharge into any other receiving environment…"*
A detailed description of the alternatives has been provided in the application in Section 9 of the application and I am satisfied with the consideration of the wide-ranging alternatives and the assessment. Despite the SDI proposal being one of the costly options, the applicant selected the above option because land treatment system had been the preferred option by the applicant and the wider local community and within the land treatment options (e.g. CPI and SDI), SDI better addressed the visual amenity and spray drift issues for the local community.

3. Conclusions and Recommendations

3.1 Whether to grant

3.1.1. Conclusions:

- The proposed SDI wastewater irrigation is similar to the CPI scheme granted by the Southland Regional Council in 2017, except for smaller irrigation wetted area and subsurface irrigation of the superior membrane filtered wastewater. By being filtered and subsurface irrigated, the issues associated with visual amenity, spray drift with aerosols containing harmful pathogens and odour emissions from the discharge have been dealt with effectively. I also conclude any gaseous discharges associated with the activity including that from the root inhibiting herbicide trifluralin is minor and unlikely to be detected outside the land boundary of the activity.

- Since the anticipated likely minor sewage and the herbicide gaseous discharges are slightly outside the relevant permitted activities in the *Regional Air Plan*, they can be considered as deemed permitted activities (DPA) under s88BB of the Act. Consequently, there is no need to grant application APP20191493-2 to discharge contaminants to air under 104B of the Act.

- As for the herbicide trifluralin discharge into land, I consider the activity as a permitted activity under Rule 5 of the *Regional Water Plan*, therefore there is no need to grant consent under s104B of the Act or issue DPA notice under s88BB of the Act.

- Due to membrane filtration of the wastewater prior to irrigation and the use of 'cut and carry' system without any livestock grazing, any faecal bacteria entry to soil and groundwater and

subsequently to surface water has been avoided. On the above basis the only remaining contaminant to be dealt with is nitrate-N.

- Extensive nutrient leaching and groundwater nitrate modelling performed by the applicant's experts using the CPI data inputs had shown the extent of the groundwater nitrate contamination by the proposed SDI system was similar to that of the granted CPI consent. Since the proposed SDI application is a replacement of the CPI scheme consent, the adverse effects of the proposal are considered as less than minor. Any adverse effects on the Waiau River has also been considered as less than minor since the applicant's modelling indicated negligible or technically non-detectable surface water total-N increase.

- Because of the ongoing Te Anau population growth coupled with the increasing wastewater-N levels and wastewater volumes, mitigations such as staged additional SDI field installation, reduction in wastewater-N by additional onsite treatment at the Te Anau WWTP and maintaining offset area (40 ha) contiguous to the irrigation area (without any livestock grazing, fertiliser-N application and wastewater irrigation) by adaptive management have been proposed by the applicant to manage any potential or actual increase in nitrate leaching and groundwater contamination. I consider the above approaches as appropriate, practical and sensible hence have included them in my recommended draft consent conditions.

- Extensive groundwater and wastewater quality, groundwater mounding and pasture monitoring has also been proposed by the applicant with compliance limits/standards set for groundwater nitrate-N (11.3 mg/L), *E.coli* (10 cfu/100 mL), wastewater nitrogen mass annual loading (e.g. 12,970 kg N/27.7 ha) and maximum daily wastewater volume discharged (4,500 m^3/day).

- As trigger level for early action on potential exceedance of the above compliance limits, the applicant has also proposed 7.5 mg/L for any monitoring well to exceed. I concur with the above approach and recommended to include herbage-N removal and wastewater total-N triggers. This was because increasing herbage-N removal will reduce nitrate leaching and to deal with increasing wastewater-N levels effectively. The trigger levels will trigger appropriate adaptive actions in the Environmental Management Plan.

- In light of the risks associated with the management of the SDI system and the prevailing light soils at the proposed site, extensive Environmental Management Plan (EMP), Environmental Effects Review (EER), monitoring of the receiving environment and reporting processes have been all been included in the proposed consent conditions.

- As for the proposed consent conditions, much of which was proposed by the applicant, I consulted extensively and thoroughly with the applicant. The proposed attached conditions have all been accepted by the applicant. The two draft DPA notices were also consulted with the applicant and were reviewed and accepted by the applicant.

- As discussed before, the proposal and its adverse effects which are considered as less than minor are in line with the Southland Regional Council's policies and objectives of the plans/proposed plan and the policy statements.

3.1.2. Recommendations

I recommend the following:

1. The application APP20191493-1 under sections 15(1)(b) & (d) and 15(2A) be granted pursuant to Sections 104B and 108 of the Resource Management Act 1991, subject to the conditions attached.

2. There is no need to grant application APP20191493-2 for gaseous discharges to air under 15(1)(c) and 15(2A) since the activities can be considered as DPAs under s88BB.

3. Since APP21091493-2 was an integral part of APP20191493-1 with the full application submitted, it may not be possible to return APP20191493-2 back to the applicant under s87BB(4) of the Act. However, if the return is possible physically, I recommend the return of application APP20191493-2 back to the applicant.

4. There is no need to grant consent for the discharge of the herbicide trifluralin into land (which is production land) under s15(1)(b) since I consider the proposal as a permitted activity under Rule 5 of the *Regional Water Plan*.

5. The recommended two DPA notices for sewage gaseous discharge into air from industrial or trade premises and discharge of herbicide into air (in the production land area) be served on the applicant under s87BB.

3.2 Term of consent

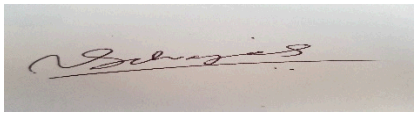
The applicant as requested a consent term of 25 years. A consent term of 25 years is hereby recommended for the following reasons:

- Twenty five years is the maximum term promoted by Te Ao Marama hence longer term is not possible (Under *Te Tangi a Tauira* section 3.5 – Te Ra a Takitimu: Wastewater Disposal, Nga Kaupapa, Provision 18, "…*Recommend a duration not exceeding 25 years, for discharge consents relating to wastewater disposal, with an assumption that upon expiry (if not before), the quality of the system will be improved as technological improvements become available. In some instances a lesser term may be appropriate, with a condition requiring the system is upgraded within a specified time period…*".

- The applicant has requested a 25-year term.
- The proposal demands significant capital investment in excess of $25 million and significant maintenance cost both of which require certainty for unimpeded implementation and operation.

- Much of the environmental effect assessment (AEE) provided by the applicant under Schedule 4 of the Act is related to 25-year modelling (performed until 2042 or 2044).

- The proposal is a long-term community aspiration to remove the historical Te Anau WWTP wastewater direct discharge to the Upukerora River hence should be supported and promoted as a long-term project by the consent authority.



Selva Selvarajah
Consents Officer

Attached below: *Discharge permit AUTH20194193 with proposed conditions*
Attached separately in the email: *Deemed permitted activities for the discharge of contaminants from balance tank and driplines into air and discharge of herbicide into air*

RECOMMENDATIONS IN COUNCIL REPORTS ARE NOT TO BE CONSTRUED
AS COUNCIL POLICY UNLESS ADOPTED BY COUNCIL

Discharge Permit

Pursuant to Section 104B of the Resource Management Act 1991, a resource consent is hereby granted by the Southland Regional Council (the "Council") to Southland District Council (the “consent holder”) of P O Box 903, Invercargill 9840 from……

Please read this Consent carefully, and ensure that any staff or contractors carrying out activities under this Consent on your behalf are aware of all the conditions of the Consent.

Details of Permit

Purpose for which permit is granted: To discharge treated wastewater into land from the Te Anau Wastewater Treatment Plant where contaminants may enter water

Location	- site locality	1701 Manapouri -Te Anau Highway, Te Anau
	- map reference	NZTM2000 E1182670 N4944369
	- groundwater zone	Te Anau
	-catchment	Waiau
Legal description of land at the site:		Lot 2 DP 410687
Expiry date:		November 2044 (insert date)

Schedule of Conditions

Consent Period and Lapse

1. This resource consent:
   (a) shall expire in [November 2044]; but
   (b) shall lapse if not given effect to within five years of it commencing.

Purpose

2.
   (a) This consent authorises the discharge of treated wastewater from the Te Anau Wastewater Treatment Plant (“Te Anau WWTP”), via a sub-surface drip irrigation system (“SDI system”), generally in accordance with that described in the application for the resource consent, to the north of the Te Anau - Manapouri Airport runway, into land known as the Kepler North Block and legally described as Lot 2 DP 410687 at or about map reference NZTM 2000 co-ordinates E1182670 N4944369.

   (b) The ‘irrigation area’ which is covered by the SDI field is within an area designated by the Southland District Council for public utility purposes, also shown on Attachment 1. The designated area located north of the Te Anau - Manapouri Airport which includes the irrigation area, is referred to in these conditions as the “Kepler North Block” and the remainder of the designated area is referred to as “Kepler South Block”.

(c) A total offset land area of 40 hectares referred to in these consent conditions as "offset area" shall be established contiguous with the Kepler North Block and/or within Kepler South Block.

(d) There shall be no livestock grazing in the Kepler North Block and in the irrigation area.

(e) There shall be no wastewater irrigation, livestock grazing and inorganic and/or organic fertiliser nitrogen application in the offset area.

(f) There shall be no wastewater irrigation in the wetland area within the Kepler North Block.

(g) This consent does not authorise the disposal of sludges or untreated sewage.

Accidental or Emergency Discharges

3. In the event of an emergency or accidental discharge of sewage or partially treated or treated wastewater into or onto land, including outside of the irrigation area, the consent holder (or the consent holder's agent) shall without undue delay, notify:

    (a) Southland Regional Council's Pollution Response Hotline (phone 0800 76 88 45);

    (b) the Medical Officer, or Health Protection Officer (phone (03) 211 0900); and

    (c) Te Ao Marama Inc (phone (03) 931 1242).

Wastewater irrigation and nutrient loading limits

4. The SDI system operation is restricted to the following parameters:

    (a) the discharge shall not exceed a maximum application rate of 4,500 m^3 per day;

    (b) the annual total nitrogen loading rate by wastewater irrigation and fertiliser application shall not exceed
        (i) 12970 kilograms nitrogen per year per 27.7 hectares of irrigation area, or
        (ii) 16,370 kilograms nitrogen per year per 41.5 hectares of irrigation area; and

    (c) the discharge shall be filtered by microfilter with effective pore size diameter not exceeding 1 micron or 0.001 millimetre prior to irrigation.

System Requirements

5. Within three months of the granting of this consent, the consent holder shall invite the following bodies to provide one representative each to form a Liaison Group:
    (a) Fiordland Sewerage Options Group;
    (b) Fiordland Community Board;
    (c) Manapouri Community representative; and
    (d) Te Ao Marama Inc.

The purpose of the Liaison Group shall be to facilitate consultation between the consent holder and the above groups during the term of the consent regarding the operation and compliance of the discharge.

(a) The Liaison Group shall have the following functions:
    (i) To receive and review the Environmental Management Plan (EMP), monitoring data and reports relevant to the consent. If necessary, a reasonable level of technical expertise shall be made available by the consent holder to interpret technically complex information such as monitoring data.
    (ii) To receive and review the reports provided to the Southland Regional Council relevant to this consent.
    (iii) To liaise with the consent holder on management actions to avoid, remedy or mitigate any adverse effects of the wastewater treatment and the SDI system.

(b) The consent holder shall, at least annually, invite the Liaison Group to a meeting to discuss any matter relating to the exercise and monitoring of this consent and the consent holder shall
    (i) meet reasonable costs of attending meetings of the Liaison Group members; and
    (ii) keep minutes of any meeting of the Liaison Group.

6. Prior to commencement of the wastewater discharge in the irrigation area and during the term of the consent,

(a) a minimum of additional 15,000 cubic metres of wastewater storage shall be provided at the Te Anau WWTP;

(b) the consent holder shall erect and maintain signage at the irrigation area warning the public that the area is used for the irrigation of treated Te Anau WWTP wastewater;

(c) the consent holder shall install the SDI system in the irrigation area with minimum soil disturbance;

(d) an offset area of 40 hectares without wastewater irrigation, livestock grazing and fertiliser-nitrogen application for the purpose of offsetting nitrate-nitrogen leaching from the SDI system to be provided contiguous with the Kepler North Block and/or within the Kepler South Block;

(e) the consent holder shall maintain a log of the SDI layout, installation steps, inspections, maintenance and works carried out on the SDI system;

(f) the consent holder shall establish cut and carry pasture system in the irrigation area to minimise nitrogen leaching;

(g) The consent holder shall:

    (i) prepare an Environmental Management Plan (EMP) for the Kepler North Block and the offset area in consultation with the Liaison Group. The EMP shall include:

(1) the name and contact details of a suitably qualified person responsible for the day-to-day operation of the irrigation system, as a point of contact for Southland Regional Council;
(2) the functions of the Operations Manager who will meet with Southland Regional Council staff twice in the first year of operation and annually thereafter to present information relating to the operation of the subsurface drip irrigation system and compliance of consent conditions;
(3) a description of how the SDI system is to be operated and maintained including the layout to ensure that the discharge is optimised at all times;
(4) how the SDI system is to be operated to optimise pasture uptake of nitrogen and minimise nitrogen leaching including fertiliser-nitrogen and other essential nutrient use;
(5) how the cut and carry system is operated to ensure minimal damage to the SDI system, soil structure and pasture performance including optimum uptake of nitrogen;
(6) a description of the method of representative pasture sampling during each cut to determine annual dry matter production and sampling and analyses to determine total herbage nitrogen content at each cut from the irrigation area;
(7) a description and technical rationale for the use, type, mode, timing and rate of fertiliser-nitrogen and other essential nutrient applications and methods to monitor the use of fertiliser-nitrogen and other essential nutrients;
(8) defining the location of the 40-hectare offset area and how the offset area is managed to offset nitrogen leaching from the irrigation area;
(9) the adaptive management measures to be adopted in response to the consented wastewater total nitrogen loading to the SDI system, pasture uptake of nitrogen and groundwater and soil monitoring results, including but not limited to;
    (a) extending the irrigation area by installing more drip emitters grouped in additional irrigation zones,
    (b) increasing the offset area,
    (c) undertaking further treatment of wastewater at the Te Anau WWTP to reduce total nitrogen concentrations in the wastewater,
    (d) using different pasture types to minimise nitrogen leaching, and
    (e) application of soil conditioners such as gypsum to improve soil structure.
(10) an assessment of risk and potential events including emergency events that could disrupt operation. The EMP is to identify options to manage and plan for that risk, including provision for any redundant capacity. The EMP is to provide for a review of the EMP by the consent holder following any significant event or disruption to determine if any changes should be made to incorporate any improvements learned from the experience of such an event;
(11) actions to be taken, including listing of possible mitigation measures such as provision of potable water supply to well-users affected by contamination; and
(12) controlling birds in the vicinity of the airport to minimise the risk of bird strike by planes using the airport in accordance with the Bird Management Plan.

(ii) forward a copy of the EMP to the Southland Regional Council's Compliance Manager before commencing wastewater irrigation;

(iii) review the EMP annually and whenever there are significant changes to the Te Anau WWTP and SDI system or their operation and changes associated with complying with the standards and trigger values specified in this consent; and

(iv) operate and maintain the Te Anau WWTP and SDI system in accordance with the EMP.

Monitoring

7. Herbage and wastewater nitrogen

To assess wastewater irrigation nitrogen loading and herbage-nitrogen removal from the irrigation area, the consent holder shall

(a) maintain a record of treated wastewater total nitrogen content in accordance with condition 8 in grams per cubic metre and daily volume irrigated in the irrigation area in cubic metres and calculate the wastewater total nitrogen irrigated in kilograms per hectare and per year;

(b) monitor the annual cut pasture dry matter and total nitrogen content of the cut pasture in accordance with the methods in the EMP. Herbage-nitrogen content shall be analysed by an accredited laboratory;

(c) record the mass of herbage removed in dry matter and mass of total nitrogen removed in kilograms per hectare per cut and per hectare per year and the total herbage nitrogen removed per hectare per year; and

(d) monitor the fertiliser-nitrogen and any other essential nutrient use in accordance with the methods in the EMP and record the type of fertiliser and timing, rate and mode of application.

8. Wastewater quantity and quality

The consent holder shall monitor:

(a) the daily volume of treated wastewater discharged into land in the irrigation area;

(b) treated wastewater from the feedmain immediately prior to the irrigation area
   (i) for treated wastewater total nitrogen by automation every 10 hours or 10 hourly samples composited for the preceding week in a month analysed following the use of a laboratory prescribed storage and/or preservative. The choice of 10 hourly automated monitoring or monthly composite sample analysis shall be restricted to the year corresponding to herbage-nitrogen assessment year;
   (ii) for the following parameters every two months:
      - pH;
      - Electrical conductivity;
      - Total ammoniacal nitrogen;
      - Total oxidised nitrogen;
      - Total phosphorus; and
      - E-coli and

(iii) for total copper, total zinc, total chromium, total cadmium, total arsenic, total nickel and total lead before the first irrigation event and thereafter once every five years, for the duration of the consent.

9. Groundwater quality and levels

The consent holder shall undertake sampling of groundwater from the wells identified in Attachment 2 for the purposes of monitoring the effects of the discharge of treated wastewater into land on groundwater quality (referred to in the attachment as "groundwater quality and depth monitoring") and groundwater level monitoring (all wells in the attachment, as available) as follows:

(a) groundwater depth and groundwater quality samples as required, shall be taken on a three-monthly basis from within one month of the consent commencement date for at least three years from the first irrigation event and every 6 months for the remainder of the consent term;

(b) groundwater level shall be recorded at each well and each sample as required, shall be analysed for:

- pH;
- Electrical conductivity;
- Total ammoniacal nitrogen;
- Total nitrogen;
- Total oxidised nitrogen;
- Total phosphorus
- E-coli.

(c) within one month of the commencement of the consent and thereafter once every five years, for the duration of the consent, samples shall be taken and analysed for total copper, total zinc, total chromium, total cadmium, total arsenic, total nickel and total lead;

10. Soil quality

(a) All soil samples shall be collected at the soil depth of 100-250 mm and shall be a composite of sub-samples taken from 10 locations to represent the irrigation area and a composite of sub-samples taken from a further 10 locations to represent the area outside the irrigation area within the remainder of the Kepler North Block.

(b) All soil samples shall be stored and analysed in accordance with an accredited soil testing laboratory.

(c) Under baseline and biennial soil monitoring all samples shall be analysed for:

- pH;
- total phosphorous;
- Olsen-P
- total nitrogen
- total organic carbon
- nitrate nitrogen
- potassium;
- calcium;
- magnesium;

- chloride;
- sodium;
- sulphate sulphur.

(d) Baseline soil monitoring: The soil samples shall be collected prior to commencing the wastewater irrigation and the samples shall be analysed for the parameters in condition 10(c) and for zinc, copper, nickel, cadmium, chromium, lead and arsenic.

(e) Biennial soil monitoring: The soil samples shall be collected every two years after the first irrigation event and analysed for the parameters in condition 10(c).

(f) Soil heavy metal monitoring: The soil samples shall be analysed for copper, zinc, chromium, cadmium, arsenic, nickel and lead every 5 years following the commencement of the wastewater irrigation.

11. Groundwater and wastewater quality sample collection, preservation and analysis
    (a) Sample collection, preservation and analysis, as required by conditions 8 and 9 shall be carried out in accordance with the most recent edition of APHA "Standard Methods for the Examination of Water and Wastewater" or another equivalent standard method.

    (b) The monitoring and analyses are to be carried out by a laboratory with IANZ registration or equivalent.

Monitoring actions

12. Standards:
    The wastewater discharge and the fertiliser-nitrogen use shall not cause the groundwater quality as determined by monitoring from the three compliance wells Numbers 2, 8 and 9 identified in Attachment 2 to exceed the following standards:
    (a) Nitrate-nitrogen shall not exceed 11.3 mg/L; and
    (b) *E-coli* shall not exceed 10 cfu or MPN/100 mL.

13. Trigger levels:
    The following trigger levels will be used to trigger a review of the EMP in accordance with the Condition 6(g)(iii) and in the reporting required by Conditions 16 and 17:
    (a) when the groundwater nitrate-nitrogen concentration exceeds 7.5 mg/l in any individual sample, the reporting required by Conditions 16 and 17 shall identify any measures required to ensure the standards in Condition 12 are complied with;
    (b) when the three-year rolling average of the annual herbage-nitrogen load removed across the irrigation area calculated under condition 7(b) is below the lower of either a trigger level of 274 kilograms per hectare per year or 72% of the total annual applied-nitrogen load, the EMP shall be reviewed and modified as necessary to improve herbage-nitrogen uptake including consideration to the use of fertiliser-nitrogen and/or other essential nutrients;
    (c) When the annual average of the irrigated treated wastewater total nitrogen exceeds 30 mg/L, the EMP shall be reviewed and modified as necessary to identify appropriate measures to ensure the annual applied nitrogen load is less than the limit specified in Condition 4(b).

14. If the monitoring of the three compliance wells Numbers 2, 8 and 9 identified in Attachment 2 required by Condition 9 downgradient of the irrigation area exceed the standards for nitrate-nitrogen and/or *E.coli* specified in condition 12 the consent holder shall undertake one or more of the following:
    (a) check for anomalous results and if required resample and reanalyse;

    (b) assess monitoring results from the up-gradient wells to determine whether the exceedance of the standard values for nitrate-nitrogen and *E.coli* under condition 12 is the result of other land uses or activities outside the consented activities;

    (c) identify any mitigation measures that are considered necessary to maintain at or below the standard value for nitrate-nitrogen and *E.coli* under condition 12 and the timeline within which the measures will be implemented;

    (d) determine any change in groundwater flow direction and the associated environmental impacts from that assessed before the discharge; and

    (e) implement any measures identified in condition 14(c) within the timeline identified in Condition 14 (c).

Complaints

15. The consent holder shall maintain a register of complaints received about the SDI system. The register shall record the response and actions taken to each complaint.

Environmental Effects Review

16. Three years after the commencement of operation of the SDI system and thereafter every five years, the consent holder shall prepare an "Environmental Effects Review" for the Te Anau WWTP system, the SDI system, the irrigation area, the Kepler North Block, the offset area and the local aquifer. Each review shall assess, but not be limited to the following:
    (a) the operation and performance of the wastewater treatment at the Te Anau WWTP and irrigation systems;
    (b) the results and the technical interpretation of all monitoring undertaken in association with this consent including an assessment against the standards in Condition 4(b) and Condition 12 and trigger levels in Condition 13;
    (c) any other relevant data that is available and of relevance to the discharge;
    (d) whether there is any adverse effect on the environment that can be "avoided, remedied or mitigated" by changes to the treatment and/or irrigation system;
    (e) any additional monitoring needed or identifying any existing monitoring not required;
    (f) the nature of any improvements, if considered necessary (including the viability and proven track record of any technology improvements that might be required to achieve compliance with the consent or dealing with any adverse effects that are not addressed by adaptive management); and
    (g) impacts of any changes on compliance with these resource consent conditions.

Reporting to the consent authority and to the Liaison Group

17. The following shall be forwarded to the Compliance Manager, Southland Regional Council:

(a) Liaison Group minutes made under condition 5(b)(ii), within one month of each meeting;

(b) the log in condition 6(e), upon request;

(c) a copy of the EMP specified in condition 6(g)(i) prior to the commencement of the wastewater irrigation and within one month of any changes to the EMP thereafter;

(d) Condition 7 results provided annually within two months following each anniversary of the wastewater irrigation commencement;

(e) Report of the actions undertaken under condition 14 which identifies any mitigation measures and a programme for implementing these measures, within two months of detecting any exceedance of standards under condition 12 and at six monthly intervals until exceedance stops;

(f) The sample results and the results of analyses carried out under conditions 8, 9 and 10 submitted with the methods of analyses not later than 20 working days from the receipt of the sample results from the laboratory except for the total nitrogen results required by Condition 8(b)(i) which are to be forwarded with the results from condition 8(b)(ii);

(g) The complaints register under Condition 15 submitted annually or upon request; and

(h) The Environmental Effects Review report with review outcomes under condition 16 submitted within three months following the completion of each review.

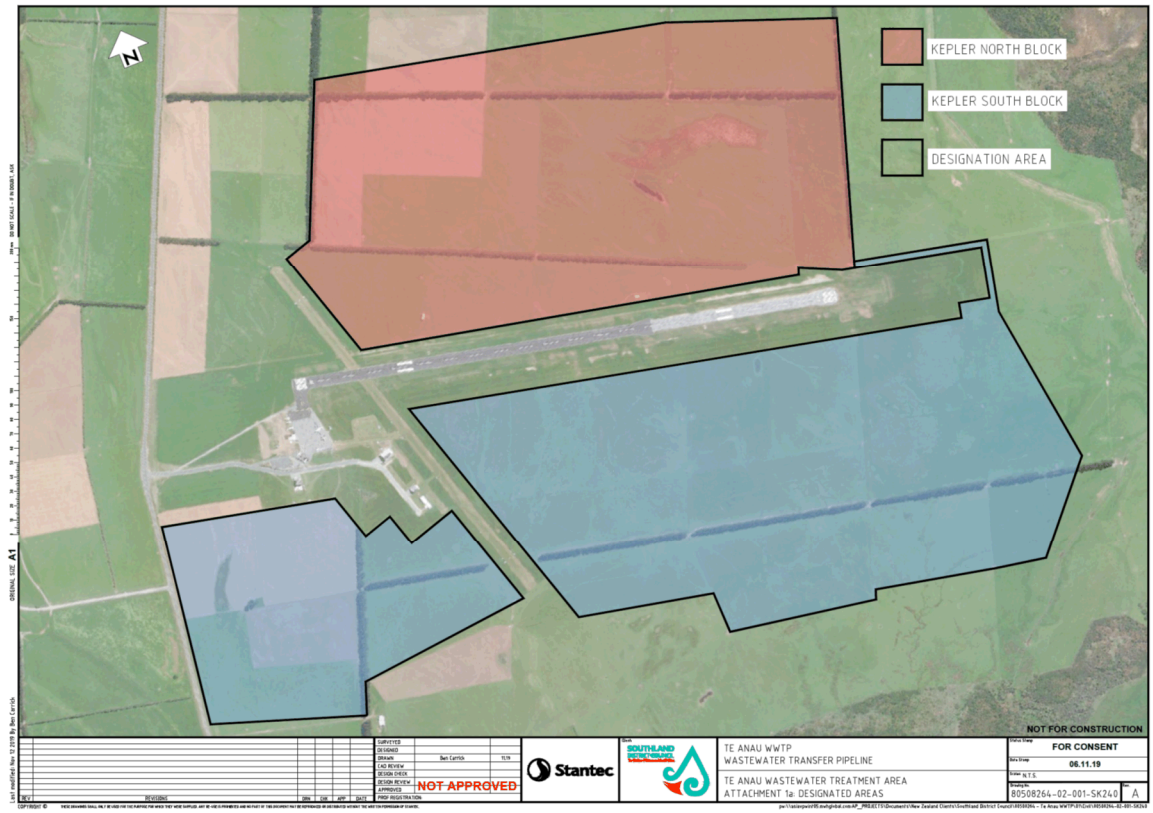
Annual Charges

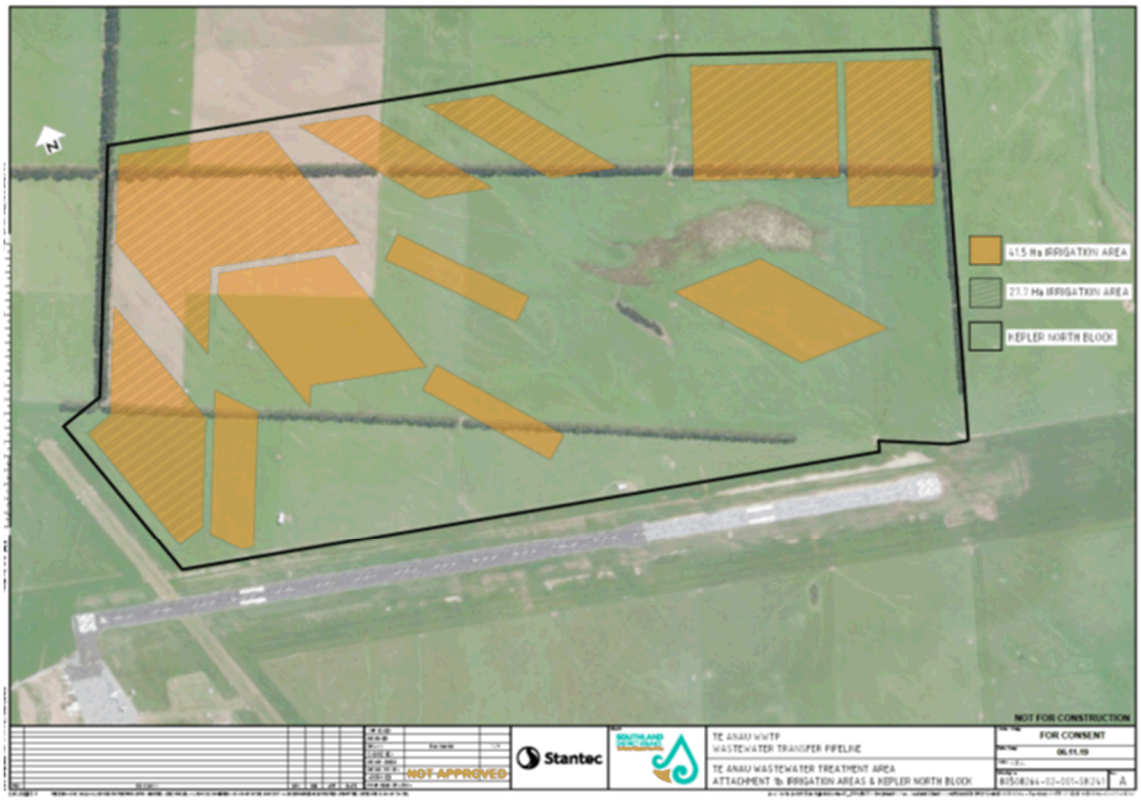
18. The consent holder shall pay an annual administration charge to the Southland Regional Council, collected in accordance with Section 36 of the Resource Management Act, payable in advance on the first day of July each year.

Review

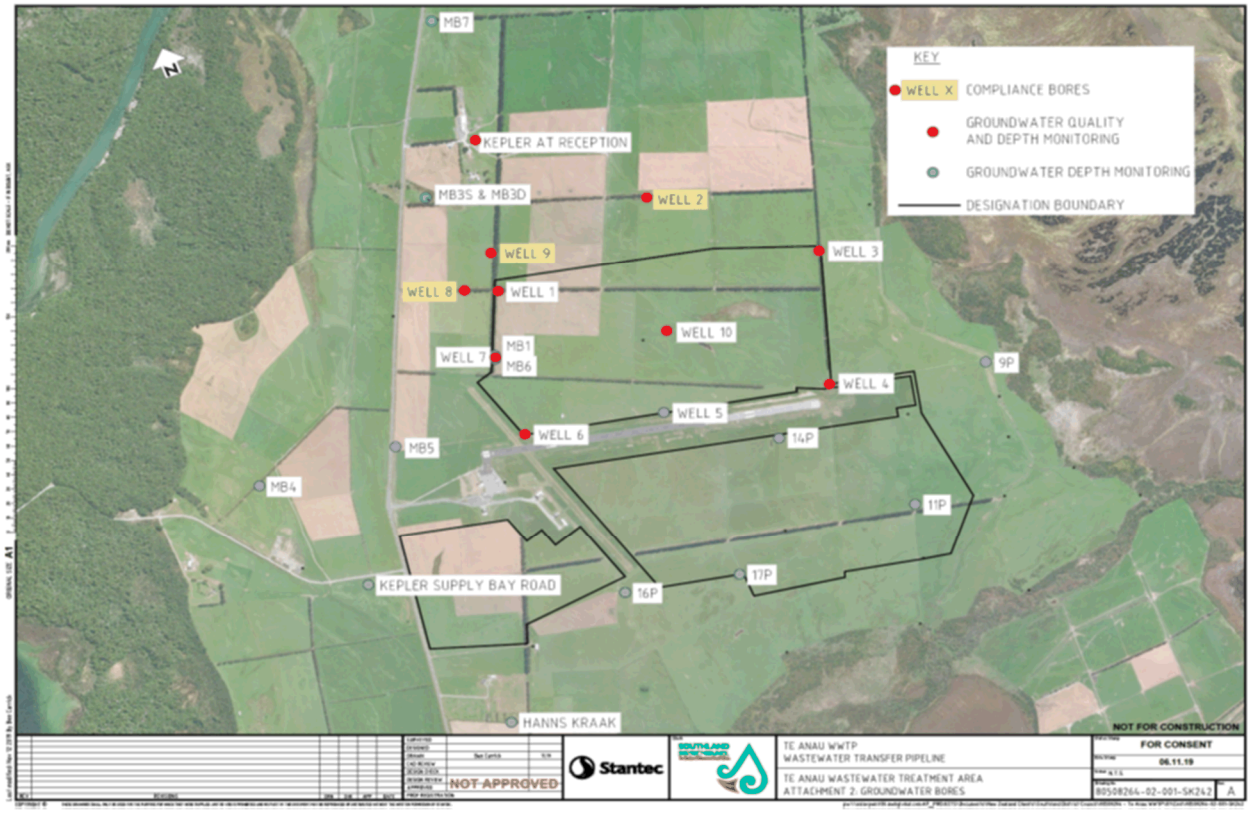
19. The Consent Authority may serve notice, in accordance with the conditions of this resource consent and Sections 128 and 129 of the Resource Management Act 1991 in the period 1 February to 30 September each year of its intention to review the conditions of this consent for the purpose of:
    (a) determining whether the conditions of this consent are adequate to deal with any adverse effects on the environment which may arise from the exercise of the consent and which it is appropriate to deal with at a later stage, or which became evident after the date of commencement of the consent;
    (b) amending any monitoring if the monitoring results indicate that the monitoring is not adequate;
    (c) adding or adjusting compliance limits;
    (d) requiring the adoption of the best practicable option to remove, reduce or mitigate any adverse effect on the environment arising as result of the exercise of this consent; or
    (e) without limiting the statutory powers of review, to achieve consistency with any future changes to the Consent Authority's plans and policies.

Attachment 1. Irrigation area and designated area boundary for public utility purpose under condition 2(b)





Attachment 2. Location and list of groundwater quality and groundwater level monitoring wells under conditions 9, 12 and 13.



Well number	Easting (NZTM 2000)	Northing (NZTM 2000)	Status
Groundwater quality and depth monitoring			
Well 3	1183536	4944552	Upgradient
Well 4	1183379	4943887	Upgradient
Well 6	1181948	4944068	Upgradient
Well 10	1182738	4944371	Within the irrigation area upgradient
Well 1	1182046	4944799	Downgradient
Well 7	1181933	4944493	Downgradient
Well 2	1182850	4945050	Downgradient, compliance point
Well 8	1181893	4944838	Downgradient, compliance point
Well 9	1182072	4944999	Downgradient compliance point
Kepler at Reception	1182175	4945566	Drinking water, downgradient

Well number	Easting (NZTM 2000)	Northing (NZTM 2000)	Status
Groundwater depth only monitoring			
9p	1184108	4943777	Southern
11p	1183578	4943185	Southern
14p	1183073	4943695	Southern
16p	1182153	4943158	Southern
17p	1182690	4943087	Southern
Hans Kraak	1181451	49442689	Southern Drinking Water
MB4	1180688	4944187	Western
MB5	1181353	4944187	Western
Kepler at Supply Bay Road	1181021	4943553	Northern Drinking Water
Well 5	1182599	4943980	Northern
MB1	1181933	4944481	Northern
MB6	1181929	4944472	Northern
MB7	1182160	4946203	Northern
MB3D	1181874	4945344	Northern
MB3S	1181866	4945356	Northern