Appendix 8: Servicing Report

Farmers Corner Development Servicing Report for: Wastewater, Stormwater and Water

Prepared for: Farmers Corner Developments Ltd

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Quality Control Sheet

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Limitations:

This report has been prepared for Farmers Corner Developments Ltd, according to their instructions, for the particular objectives described in the report. The information contained in the report should not be used by anyone else or for any other purposes.

This report has been prepared on the basis of information sourced from the Environment Canterbury GIS Database and information on the site use provided by the client. Whiterock Consulting Ltd has not independently verified the provided information and has relied upon it as being accurate and sufficient for use by Whiterock Consulting Ltd in preparing the report. Whiterock Consulting Ltd accepts no responsibility for errors or omissions in, or the currency or sufficiency of, the provided information.

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Appendices:

1. Introduction

Whiterock Consulting Ltd has been engaged by Farmers Corner Developments Ltd to assess the wastewater disposal, stormwater disposal, and water supply requirements for a proposed expansion of their Farmers Corner site at 12 Longbeach Rd, Ashburton (Appendix A, Figure 1).

This report has been updated based on a Request for Further Information by the Ashburton District Council. It addresses the following:

- Wastewater flows from the accommodation if all 80 units were fully occupied with 4 people.
- All laundry will be undertaken on-site
- Additional information on the discharge of nitrogen to land from the on-site wastewater system.

The site is currently being operated as a tourist-based café and shop. It is proposed to establish accommodation, primarily for bus loads of tourists, so that they can better enjoy the rural environment of South Canterbury, facilitated through a private plan change application to the Ashburton District Plan. This report outlines:

- The expected wastewater flows and options for treatment and disposal;
- Stormwater treatment and disposal options;
- The expected water supply requirements;
- A summary of resource consents required from Environment Canterbury.

2. Description of the Environment

2.1 Soils and Geology

The Institute of Geology & Nuclear Sciences Geology "Aoraki" map (Geological Map K37) shows the site is likely to be underlain by fan deposits comprising grey to brown fan alluvium deposited during the last Glacial Maximum. The Landcare Research S-Maps database shows that the northern part of the site is underlain by a Lismore shallow silty loam that is described as well drained. The remainder of the site is underlain by a Darnley shallow silt loam that is gravelly and moderately well drained.

2.2 Groundwater

A search of Canterbury Maps GIS database found 117 wells within 1,000 m of the proposed disposal area, including 43 active wells. The most relevant wells are summarised in Table 1.

Table 1: Groundwater Water Level Data

Well Number	Well status	Well depth (m)	Distance from centre of site (m)	Groundwater range (m below GL)	Number of readings	Years reading were taken
Wells within 350m of site centre						
K37/2369	Active	12.5	130m NNE (on site)		0	
BY21/0170	Active	59.5	150m NE (on site)	10 – 15.2	2	2016 to 2017
K37/0149	Not Used	7	250m NW	0.5 – 6.04	107	1974 to 1991
K37/2187	Active	51	260m SE	3.9 – 16.6	30	2014 to 2017
K37/1030	Active	30	310m NE (on site)		0	
Other wells with water level data						
K37/0056	Not Used	18	620m SE	1.4 – 2.3	9	2003
K37/0148	Active	12	800m NE	0.8 – 7.1	101	1977 to 1995, 2002(1)
K37/1765	Active	54	890m WSW	2.6 – 29.2	45	2006 to 2018
K37/1200	Capped	16	920m S	1.56 – 2.1(2)	3	1977
K37/0017	Active	9.5	930m S	0.7 - 6(3)	35	2003 to 2006
K37/2252	Active	23.3	950m S	2.8 – 8.4	3	2004 to 2006

Notes:

(1) 100 water level readings were taken between 1977 – 1995, with a single reading [6.84 mbgl] collected in 2002

(2) The ECan well card reports that the measuring point is 1.46 m above ground level, which is unusually high. The well is now capped so the water levels were left as the recorded level.

(3) Note on the well card states that this well is now dry and no longer used.

Two nearby wells (K37/0149, depth 7 m; and K37/1765, depth 12 m) have over 100 water level readings between 1974 to 1995. Both wells recorded high water levels of less than 1 m below ground level. More recent water level data (wells K37/2187, depth 51 m; and K37/1765, depth 54 m) have highest water level readings of 3.9 m and 2.6 m, respectively. Well K37/1765 has a lowest recorded water level of 29.2 m.

Due to the variation in water level information, a request was sent to the ECan groundwater scientists to provide advice on the seasonal high groundwater level at the site. Their assessment was that seasonal high groundwater could be as high as 2.4 m below ground level.

The aquifer type in the area is shown to be either unconfined or semiconfined on Canterbury Maps. The groundwater flow is in a general south-easterly direction towards the coast. The nearest off-site downgradient well recorded as being active is K37/2187 (depth 51 m). It is located approximately 260 m south-east of the site and is recorded as being used for domestic and irrigation purposes.

With respect to groundwater quality, there are several wells with limited water sampling data. However, the data does show that groundwater has elevated concentrations of nitrate nitrogen. Nitrate concentrations in groundwater are generally attributed to the farming practices in the wider catchment upgradient from the site. The area used to be irrigated using border dyke flood irrigation. When this was converted to spray irrigation, in response to more efficient water use practices, there was an increase in nitrate concentrations in the groundwater. The Land and Water Regional Plan has evolving rules relating to the farming operations and these aim to reduce the nitrogen leaching from farming activities through better on farm nutrient management. There is also a managed aquifer recharge project that has the potential to dilute the nitrates via dilution.

Therefore, the high nitrate concentrations are expected to reduce in the long term through better on farm nutrient practices and the managed aquifer recharge project.

The groundwater quality data for nearby wells are summarised in Table 2.

Table 2: Groundwater Quality Data

Well Number	Well status	Well depth (m)	Distance (in metres) and direction from dwelling	Nitrate Nitrogen readings (mg/L)	Pathogen concentration	Years reading were taken
K37/1939	Active	39	710m SSE	<0.002 – 7.3	<1	2004 & 2018
K37/1767	Active	29	1,700m ESE	0.029 – 15.7	<1 - 42	2004 & 2018
K37/1789	Active	18	1,200 m NE	12.7	Not tested	2004
K37/2254	Not used	22	1,700 m N	6.89	Not tested	2004

2.3 Surface Waterways

Canterbury Maps shows a series of water races in the area. A site visit has not been undertaken and these may no longer be present with the shift from border dyke irrigation to spray irrigation. A drain is shown to be located approximately 815 m south-west of the site. Lake Hood is located approximately 7 km to the south-east, in a general downgradient direction.

3. Proposed Activities

The types of activities and development that the proposed Plan Change would enable are set out in full in the Incite Ltd application. This report is a high-level assessment of the wastewater, stormwater and water supply requirements based on the activities that the Plan Change would allow. It is understood that this would provide for the following activities:

- 80 visitor accommodation units;
- Central visitor accommodation hub building (e.g. lobby, restaurant and function centre) and associated car parking;
- Other tourism/visitor activities, such as a chapel or;
- Museum;
- On-site recreational activities such as walking and cycling tracks;

- Landscape areas.

The existing development includes a large café/restaurant and car and bus parking area. This development has its own wastewater system and stormwater system.

4. Wastewater Options

There is no reticulated wastewater that the site can connect into. Therefore, all wastewater needs to be treated and discharged to land on-site. This will require a discharge consent from Environment Canterbury.

4.1 Wastewater Quantity Assessment

Table 3 outlines the preliminary wastewater flow assessment. A full water assessment will need to be undertaken during the detailed design phase and this assessment is solely for the purposes of assessing if there is adequate space within the development area to treat and discharge effluent to land.

The original report presented a flow assessment for half the units accommodating 4 people and the other half accommodating up to 2 people, but with an average at an average occupancy of 1.5 people per accommodation unit. However, the peak flow has been increased in response to a request for an assessment on a more 'worse case' scenario occupancy. The updated assessment therefore assumes:

- 4 people per unit
- On-site laundry

This is presented in Table 3.

Table 3: Peak Flow Assessment

Activity	Number of guests/staff	Flow allowance (L/guest/day	Peak flow (L/day)
Accommodation units (80 units)	320(1)	220(2)	70,400
Central hub visitors to restaurant	320	25(3)	8000
Staff (living on-site)	18(4)	200(5)	3,600
Staff (day staff)	17(4)	30(6)	510
TOTAL DAILY PEAK FLOW			**82,510**

Notes:

(1) Assumes all units can accommodate 4 guests
(2) Flow allowance from Table H4, ASNZS 1547:2012 for Motel/hotel guests is 220 L/guest/day. If spa baths or showers with multiple shower heads are used then this number will need to be assessed.
(3) Flow allowance from Table H4, ASNZS 1547:2012 for a restaurant.
(4) There are expected to be 35 full time staff on-site. Assessment looks at half of the staff living on-site to all staff living on-site.
(5) Flow allowance for a domestic house.
(6) Flow allowance from Table H4, ASNZS 1547:2012 for Motel/hotel non-residential staff

Based on the above assessment, the daily wastewater flow could be up to 82,510 L/day. A chapel is also shown on the concept plan and, therefore, for this type of activity, or a similar tourism activity that has peak visitor characteristics, there could be occasional large peak flows that will need to be considered during the detailed design. It is common practice to use a flow balance tank to distribute a peak flow over a few days for such activities. This is where the wastewater is held over a few days and pumped at a controlled rate to the treatment plant. This stops the treatment plant and effluent field from being over designed to cater for infrequent, but large flow activities. This is a matter that should be considered further when specific development is planned.

4.2 Wastewater Treatment Options

The underlying groundwater is considered to be sensitive to the discharge of wastewater to land because groundwater is relatively shallow (seasonal high of 2.4 m) and recent water quality sampling shows high nitrate nitrogen concentrations. Therefore, the following treatment is considered suitable:

- Secondary treatment with additional nitrogen removal.
- Depending on the location of the disposal system to the supply well, ultra violet treatment may also be needed.

There are a variety of suppliers of secondary treatment systems. These include:

- Eloy Oxyfix aerated treatment systems. These are currently supplied by Hynds and supported by process engineering designers based in Belgium. These have been installed at sites with large flows in Canterbury.
- Graff sequencing batch reactor. This is a German product that is currently being installed for sites with large peak flows. They are supported by process engineering designers in Germany. They can be programmed to provide a higher level of nitrogen removal, which will be needed at this site.
- Innoflow packed bed reactor. An Innoflow system similar to this is consented for use at the existing café/restaurant.

It is considered that there are sufficient treatment systems available within New Zealand that can provide the required level of treatment for the expected wastewater flows.

4.3 Wastewater Disposal Options

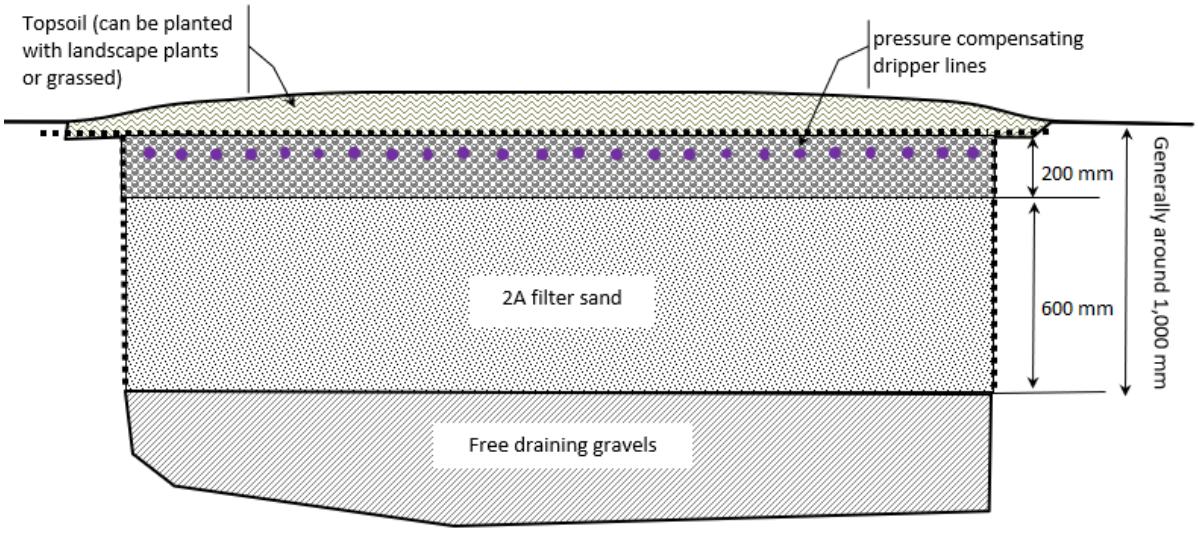
The wastewater will need to be discharged to land within the site. The site is considered to be free draining and therefore there are three possible options.

4.3.1 Option 1: Discharge Control (2A sand) Trench.

A discharge control trench is generally located below ground, however, they can be raised to provide a larger separation from the base of the trench to seasonal high groundwater if needed. They

typically have a 600 mm layer of filter grade (2A) sand that provides additional pathogen removal and some removal of nitrogen.

A general cross section of a discharge control trench is presented in Schematic 1.



Schematic 1: Discharge Control Trench

The recommended loading rate for sites with free draining gravels (as is expected at this site) is 50 mm/day. For a peak daily flow of 82,510 L, a total of 1,650 m^2 will be required for a discharge control trench. This can easily be accommodated within the site.

4.3.2 Option 2: Drip Irrigation Field

Drip irrigation lines are typically installed 150 mm below ground and within the topsoil layer. The effluent is applied over a large area at a rate much lower than a sand trench. The grass or landscape plants throughout the irrigation field increase the uptake of nutrients and moisture. They are typically used at sites where the soils are very poorly drained or the underlying groundwater is sensitive. The underlying soils at this site are free draining, however the underlying groundwater is considered to be sensitive.

The on-site wastewater design for the existing café/restaurant was prepared by Glasson Potts Group (GPG, 2000). The design included a drip irrigation field and the design loading rate used to size this was 3 mm/day (based on the sandy clay loam soils at site). Applying this loading rate to the proposed development, the irrigation field size required is 27,500 m^2.

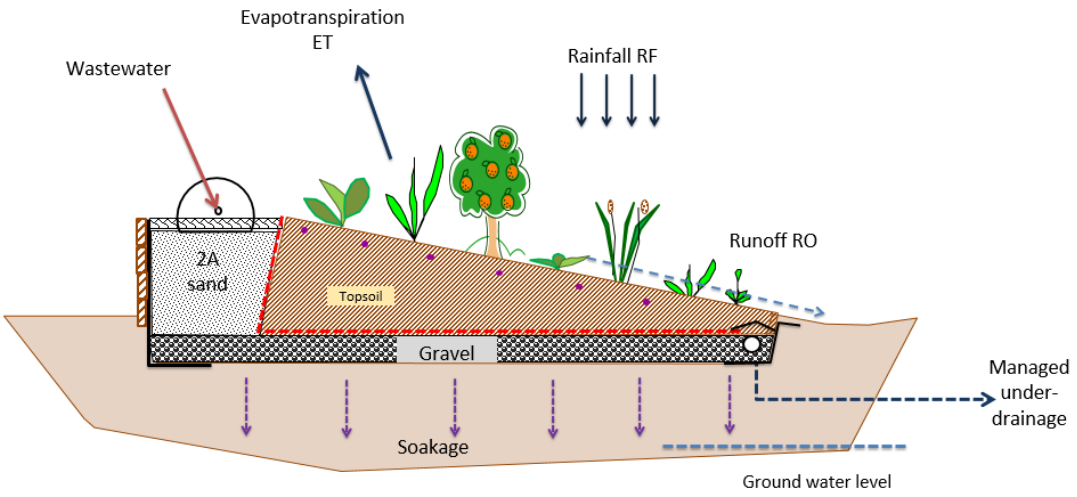
The site has a total area of approximately 16.7 ha (167,000 m^2), and there are limitations on the scale of built form in Area 1 and 2 that mean the majority of the site is likely to be landscaped (planted out in shrubs and trees) or grassed. Therefore, a drip irrigation field could be integrated into any landscaped or grassed area.

4.3.3 Option 3: Engineered Mound (ecoTrench)

An engineered mound is typically used on sites with poorly drained soils or where the underlying groundwater is very sensitive. It is located above ground and planted out to increase nutrient update and evapotranspiration. At this site an ecoTrench could be used with its base located on the topsoil (topsoil can provide an additional level of treatment when compared to a discharge control trench, which is installed below the topsoil and into the underlying free draining gravels).

The ecoTrench was developed by Andrew Dakers of ecoEng Ltd and an example cross section is presented below. The ecoTrench has the following features:

- Effluent from the secondary treatment plant is split between the ecoTrench sand filter manifold and the dripper lines on the ecoTrench slope.
- An underdrain collects any water in excess of the soakage capacity of the natural soils. The underdrain will flow back to the pump/balance tank.
- The ecoTrench is planted with landscape plants and can be made to be a feature in a garden area.



Schematic 2: ecoTrench

The loading rate for an ecoTrench is generally 20 mm/day. The area required for the ecoTrench is 4,126 m^2. This could easily be integrated into landscaped areas.

4.3.4 Nutrient Assessment

The underlying groundwater has elevated nitrate nitrogen concentrations due to the wider farming activities upgradient of the site. Whilst on-site wastewater systems contribute nitrogen to the groundwater, their contribution is low when compared to the farming activities. A preliminary assessment of the total nitrogen load has been undertaken and is summarised below:

- **Total nitrogen concentration in raw effluent: 100 mg/L**. This is stronger than domestic effluent, which is typically around 60 mg/L because of the increased proportion of flow from toilets.
- **Total nitrogen removal via secondary treatment plant: 60%.** In discussion with technology suppliers, it is generally easy to achieve a 60 % reduction of total nitrogen and then with additional treatment components, it can be possible to achieve up to 80% removal. This assessment has only assumed 60% removal.
- **Daily total nitrogen load: 3.3 kg N/day**

It is common to assess the annual nitrogen load in kg N/ha/yr. When assessing the annual load it is important to account for low flow days and peak flow days. If the peak daily flow is used then an unrealistically high annual nitrogen load will be calculated. For this site it is assumed that the average flow is half the peak flow. This results in a daily total nitrogen load of 1.65 kg/day, or 602 kg/year. The development area is 16.7 ha, so the total nitrogen load for the property can be averaged at 37 kg/ha/yr. This is considered to be relatively low when compared to the nitrogen loading from farming activities, which can apply fertiliser at a rate exceeding 200 kg N/ha/yr.

The land application system will provide further removal of nitrogen, with the drip irrigation field (Option 2) providing the highest removal via uptake from plants (grass or landscape) as well as denitrification in the underlying soil.

In summary, nitrogen entering the environment is essential to sustain plant life. Nitrogen can become a risk to sensitive ecosystems with the cumulative loads are out of balance. The nitrogen loading from an on-site wastewater system can be utilised as a resource on-site such that it will not put at risk the underlying groundwater. During the design and ECan consenting, a more detailed nitrogen assessment will be undertaken. If needed, a higher level of treatment can be provided and management of the land application system can be adjusted to improve the nutrient uptake. This could include collecting grass clippings from mown areas and clearing fallen vegetation from landscape areas to reduce the reintroduction of nitrogen via plants.

4.3.5 Wastewater Disposal Summary

There are three options that can be considered for this site. There is sufficient space for each option and the selection of the final option will be determined during the detailed design phase of the project.

5. Stormwater Options

There is no reticulated stormwater system that the site can discharge into. The discharge of stormwater to land will need to be authorised by a resource consent from Environment Canterbury.

5.1 Stormwater Quality and Treatment

The following catchments need to be considered in the stormwater management system:

- **Roof water:** Roof water is considered to be relatively clean and can be discharged to land via a soak pit without treatment. This assumes that the roof and gutter materials do not introduce contaminants, such as copper spouting.
- **Paved areas with no vehicle activity (e.g. general paved areas for sitting):** These can be either:
    - graded to the adjacent grassed or landscaped areas for passive discharge to land, or
    - graded to a collection sump which discharges to a soak pit. The building code (E1 Surfacewater) requires a small sump with a submerged outlet to trap floating contaminants (leaves etc). No additional treatment is considered necessary.
- **Car parks, drives and general vehicle movement areas**: Stormwater from these catchments will require some form of treatment prior to being discharged to land. This is because the stormwater will contain heavy metals (from brake lining and tyre wear), hydrocarbons (from exhaust emissions and oil leaks) and sediment (tracked on in tyres). Treatment options for this site are:
    - Treatment in either a rain garden or infiltration basin. These are designed with an engineered topsoil which provides a high level of treatment as the stormwater drains through it. The treated stormwater would then drain away into the underlying gravels. Due to the large amount of green space available, it would be easy to integrate these into the landscape around the hardstand areas.
    - Treatment using an inground proprietary filter. There are a variety of stormwater filtration devices that target the contaminants from these catchments. These include the Stormwater360 Stormfilter and Hynds Upflo Filter. These would be hidden below ground and the treated stormwater would discharge to ground via a soak pit.
- **Hydrocarbon storage and handling areas**: If an emergency generator is used at the site then it is likely there will be a diesel storage tank on-site. These are generally sized to provide fuel for three days, so the storage tank will depend on the site of the generator. The hardstand area where the diesel delivery truck parks will need to be designed so that a spill is contained and does not discharge either into a soak pit or onto the adjacent grassed or landscaped areas. This can be easily achieved by either:
    - Installing an oil interceptor, or
    - Grading the hardstand area to a central sump and installing a shut off valve after the sump and prior to the soak pit. If there is a spill the shut off valve is closed and the hardstand area contains the spill. This is commonly used for sites with infrequent fuel transfer, such as for emergency generators. Special design of the hardstand area is required to ensure it can contain the expected spill volume.

5.2 Stormwater Quantity and Disposal

The size of stormwater treatment devices will depend on the size of the catchment area and the design rainfall. Two treatment options for the car parking and general vehicle movement areas were discussed above and both have different design requirements. These are:

- **Rain garden and infiltration basin**. Both of these options are designed to contain a certain volume of stormwater, which will soak though the engineered topsoil for treatment. The treatment volume is based on the theory that the first flush of stormwater contains the majority of the contaminants and the subsequent stormwater (during a single event) is cleaner and does not need to be treated. The common first flush treatment volume is based on the runoff from the first 25 mm of rain. Stormwater in excess of the capacity of the rain garden or infiltration basin will flow directly to a soak pit.
- **Inground treatment filter**. These are designed to treat a certain flow of water before bypassing additional flow straight to a soak pit. The treatment flow is generally based on treating 90% of all rainfall intensities. In Christchurch this equates to 5 mm/hr. The Selwyn District Council requires treatment for 10 mm/hr. No information was found on the Ashburton District Council website regarding the required treatment flow for the district. If a flow-based treatment system is selected then an assessment of the treatment rainfall intensity will be required.

Final discharge to land will be via soak pits. On-site soakage testing will be needed to determine a design soakage rate.

5.3 Stormwater Summary

Roof water and general hardstand areas (not used by vehicles) can discharge directly to land. All vehicle parking areas, drives and general vehicle movement areas will need to be treated prior to discharging to ground. The site is underlain by free draining gravels and there is plenty of space available to integrate the treatment systems into the landscaped areas. Therefore, it is considered stormwater can be managed on-site.

6. Water Supply

The site has an existing groundwater take consent (CRC183036) which allows for the following abstraction:

- Maximum pumping rate: 13.6 L/s
- Maximum volume over 10 days: 7,344 m^3
- Maximum annual volume: 77,870 m^3 (this equates to an average daily volume of 213.3 m^3)

This consented take is for irrigation purposes and the resource consent will need to be varied to accommodate the change in use. The expected water use at the site will be for the following activities:

- Water usage by staff and guests (assumed to be the same as the wastewater flow): 82.5 m^3/day
- Irrigation water for the landscaped areas: The water demand will be greater during the establishment of the area. However, under the consented take, there is on average 130.8 m^3 available for irrigation purposes. This is far more than will be used at the site.

Therefore, it is considered that there is sufficient water available and consented at the site to be used for the development.

7. Environment Canterbury Planning Summary

The relevant regional plan is Environment Canterbury's Land and Water Regional Plan (LWRP). Based on the proposed site activities, the following consents will be required from Environment Canterbury.

- **Discharge of wastewater to land.** Rule 5.8 of the LWRP sets out the permitted activity conditions. Condition 1 limits the peak daily flow to 2,000 L or less. The expected peak daily flow is greater than 2,000 L and therefore the discharge of wastewater to land is a **restricted discretionary activity** under Rule 5.9 and a resource consent is required.

- **Discharge of stormwater to land (construction phase).** Rule 5.94A sets out the permitted activity conditions for the discharge of construction phase stormwater. Given the site is underlain by free draining gravels it is expected that all construction phase stormwater will easily be managed on-site. If the site is not contaminated and not more than 2 ha is disturbed at any one time, then the discharge of construction phase stormwater to land is a **permitted activity** and no resource consent will be required.

- **Discharge of stormwater to land (developed site).** Rule 5.96 sets out the permitted activity conditions for the discharge of stormwater to land. Condition 2(e) states that the stormwater can only be from a site used for residential, educational or rural activities. The site is used for commercial purposes and therefore the discharge of stormwater to land is a **discretionary activity** under Rule 5.97 and a resource consent is required.

- **Groundwater Use:** The site has an existing groundwater abstraction consent (CRC183036). This needs to be varied so that the water can be used for the development. An investigation into this is being undertaken by Irricon Ltd.

8. Conclusion

Whiterock Consulting Ltd has been engaged by Farmers Corner Developments Ltd to assess the wastewater disposal, stormwater disposal, and water supply requirements for a proposed expansion of their Farmers Corner site at 12 Longbeach Rd, Ashburton. The site is currently being operated as a tourist-based café and shop. It is proposed to establish accommodation, primarily for bus loads of tourists, so that they can better enjoy the rural environment of South Canterbury, facilitated through a private plan change application to the Ashburton District Plan.

The types of activities and development that the proposed Plan Change would enable are set out in full in the Incite Ltd application. This report is a high-level assessment of the wastewater, stormwater and water supply requirements based on the activities that the Plan Change would allow.

The key findings of this report are as follows:

- **Wastewater:** there are multiple wastewater treatment and disposal options that can be considered for this site. A resource consent will need to be obtained from Environment Canterbury before the system is constructed.
- **Stormwater:** there is adequate space available to integrate stormwater treatment systems and manage stormwater on-site. A resource consent will need to be obtained from Environment Canterbury before these stormwater treatment systems are constructed.
- **Water supply:** the site has an existing groundwater take consent (CRC183036). It is considered that there is sufficient water available under the current consented take. A consent will be required to change the use of the groundwater take.

APPENDIX A: FIGURES

Figure 1: Site Location

N

0 0.35 0.7 1.05 1.4 Kilometres

Scale: 1:25,000 @A4

Map Created by Environment Canterbury on 23/04/2019 at 9:38:04