

Existing on-site wastewater treatment systems assessment in Darfield

Sanitary survey summary report



Canterbury
District Health Board
Te Poari Hauora o Waitaha

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Executive summary

Background

The population of Selwyn District has increased dramatically over the past several years. This district includes communities (such as Darfield) that do not have a reticulated system for wastewater disposal and treatment.

There is a risk to public health if septic plumes from on-site wastewater treatment systems intersect with the groundwater, or if surface ponding of wastewater occurs. Since 2007 Community and Public Health (C&PH) has been raising the concern over wastewater reticulation as community size and/or density increases.

As part of a larger project, an assessment of on-site wastewater treatment systems was conducted by C&PH in Darfield to gather information on the systems currently in use on residential and non-residential properties. The purpose of this survey was to provide information about the immediate health risks to residents and users by investigating the number of residents having direct contact with effluent via septic tank failure.

Methodology

An on-site wastewater treatment system questionnaire was developed by the Protection Team of C&PH, and a survey was conducted from December 2013 to February 2014. The questionnaire was completed in an interview format with a resident of the property (for residential properties) or the property owner, caretaker or manager (for non-residential properties). A visual inspection of the site was also undertaken by the interviewer.

Findings

Residential property assessment

The 106 residential properties included in this survey covered a wide range of mostly mid-sized properties built in the last 60 years. Most households included 1-3 residents, with more than half of residents over the age of 40. This survey may represent a slightly older sample than the general Darfield and Selwyn District populations.

All residences (except one) had one on-site wastewater treatment (septic) system on their property, and most were less than 60 years old. Knowledge of the septic system on their property was low for many residents. Most systems had been emptied in the last 5 years; however, regular service or maintenance of the system was not undertaken by a large proportion of residents. Some residents (29%) had previously experienced some sort of failure of their septic system (including blockages, overflows, boggy ground outside, slow draining of indoor amenities, and odour). On visual inspection of the properties, there were few obvious signs of current septic system failures/problems.

All residents sourced their household drinking water from the reticulated Darfield supply, and eight residents reported that a member of their household had experienced a gastrointestinal-type illness in the 30 days preceding the survey.

While some residents were happy with the current septic system on their property, others wanted a reticulated system in Darfield. In some cases this was due to concern about population growth and the impact that this rapid development may have on the current wastewater systems. However, the perceived high cost of a new reticulated system was raised as an issue by several residents.

Non-residential (commercial, industrial and school) property assessment

There was a wide range in the functions of the eight non-residential properties surveyed. Interviewees tended to be relatively knowledgeable about the septic system on their property and reported having them emptied regularly (in particular, at properties with a high wastewater load). Few septic system problems were reported by the interviewees, or observed during the site inspection.

Due to the small number of non-residential properties surveyed, and the unique use of each property, it is not possible to make general conclusions about the on-site wastewater systems of non-residential properties.

Conclusions

This survey provides some useful information on the on-site wastewater treatment systems currently in use on residential and non-residential properties in the Darfield area. The findings will contribute towards the overall assessment of the public health risk associated with the un-reticulated disposal of wastewater in Darfield.

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Background

Population growth in the Selwyn District

Selwyn District is the fastest-growing district in New Zealand, and over the past seven years, the population has increased by 32.6% (from 33,642 people in 2006 to 44,595 people in 2013) (Statistics New Zealand, 2014a). At least some of this population growth can likely be attributed to the movement of people out of Christchurch as a consequence of the 2010/2011 Canterbury earthquakes.

Selwyn District (see map, Appendix A) includes communities that are not yet reticulated for wastewater disposal and treatment, and many residents use groundwater as a source of drinking water. The settlement of Darfield is an example of a growing community that uses on-site wastewater treatment systems. The population of Darfield township increased by 15.8% between the 2006 and 2013 censuses - from 1,671 to 1,935 people (Statistics New Zealand, 2014b). The Darfield drinking water supply serves a wider population (including rural components) of 3,283 people (Institute of Environmental Science and Research Limited & Ministry of Health).

There is a risk to public health if septic plumes from on-site wastewater treatment systems intersect with the groundwater. Such events are more likely when the population of unsewered communities increases. Surface ponding of wastewater on properties also presents a direct risk to people via potential contact with effluent.

Concern over wastewater management in growing communities without reticulated wastewater systems

Community and Public Health (C&PH) are concerned about communities without reticulated wastewater systems and the health risk that sewage and wastewater poses, should water or soil contamination occur.

Since 2007 C&PH has been raising the concern over wastewater reticulation as community size and/or density increases in the Selwyn District. It has done this through consultation at the resource consent process and directly with local and regional councils.

Two of the sustainable water management priority outcomes identified by the Selwyn Waihora Zone Committee include high quality and secure supplies of drinking water, and best practice nutrient and water management (Environment Canterbury Regional Council, 2012). The proposed Canterbury Land & Water Regional Plan contains activity and resource policies to protect sources of human drinking water from any discharge of contaminants to land or water that may have any actual or potential negative effect on water quality (Environment Canterbury Regional Council, 2012, 2013b). The discharge of wastewater from a new or upgraded on-site domestic wastewater treatment system onto or into land in circumstances where a contaminant may enter water is a permitted activity, provided certain conditions are met. As a result of a submission made by the Canterbury

District Health Board, the proposed plan was updated with the following section, which is of relevance to Darfield:

The disposal of domestic effluent and wastewater shall be managed so as to avoid any adverse effect that is more than minimal on surface and ground waters. Where residential density exceeds 1.5 dwellings per hectare and the total population is greater than 1000 persons, community reticulated systems should be promoted. Alternatively, other measures should be promoted to reduce adverse effects on water bodies from effluent disposal systems, including secondary treatment systems and septic tank warrants of fitness. (Environment Canterbury Regional Council, 2013b, pages 4-10)

In support of this proposal that septic tanks tend to be most suitable for small, low density communities, the Ministry of Health (2001) states that:

Septic tanks should be regarded as suitable only for isolated properties or small dispersed where subsoil absorption is satisfactory [sic]. (Ministry of Health, 2001, page 17)

Another consideration that limits the long-term use of on-site wastewater treatment systems is that once a disposal field ends its useful life, a new field is required. This may not be an issue for larger sections, but the development of smaller sections may mean that space for additional fields is limited.

Groundwater assessment in Darfield

The Selwyn District Council has commissioned several surveys of groundwater quality in the Darfield area, and concludes that:

Currently there is no physical evidence suggesting that the groundwater below Darfield is adversely affected by any discharges (e.g. septic tanks) and thus a reticulated sewerage system is not required. (Selwyn District Council)

However, a report from the Institute of Environmental Science and Research Limited (ESR) suggests that the ability to draw definitive conclusions with respect to the likely effects of on-site wastewater disposal practices is limited by the spatial distribution and screen depths of the wells frequently surveyed (Burbery, 2014).

The current survey

At present, no routine data is collected regarding on-site wastewater treatment systems in the Darfield area. Therefore, an on-site wastewater treatment system survey was conducted by C&PH as part of a larger project in collaboration with ESR to assess the public health risk associated with the un-reticulated disposal of wastewater in Darfield.

The purpose of the survey was to gather information on the systems currently in use, and this report summarises the methodology and findings. It provides information about the immediate public health risks to residents, and the risk of discharge contamination by investigating the number of residents potentially having direct contact with effluent via septic tank failure.

Methodology

Survey methodology

Questionnaire development, survey sampling method design, staff preparation, and survey implementation were all undertaken by the Protection Team of C&PH. External communication was undertaken by the Protection Team in conjunction with a C&PH Communications Advisor. Database development and data analysis were undertaken by the Information Team, C&PH.

Questionnaire development

To develop the questionnaire, various wastewater system background documents were used to guide the type of questions included (Auckland Regional Council, 2008; Environment Canterbury Regional Council, 2013a; Gunn, 2012; New Plymouth District Council, Taranaki Regional Council, South Taranaki District Council, & Stratford District Council, 2006; Oasis Clearwater Environmental Systems; United States Environmental Protection Agency, 2008). These resources were sourced via internet searches. Background information held by the Protection Team was also used to develop the questions.

A draft questionnaire was created and distributed for feedback to others within the Protection Team, and also to a staff member at ESR. Relevant amendments were incorporated into the draft questionnaire.

The draft questionnaire was then trialled by interviewers using two septic tanks of different ages/types and disposal/soil conditions to identify any difficulties in administering the questionnaire. Any further feedback was incorporated into the final version of the questionnaire (see Appendix B).

Survey site

The survey site (Darfield) was visited and areas were categorised according to the age of the properties:

- original (greater than 30 years old),
- older (built within the last 5–30 years approximately), or
- recent (built within the last 5 years).

A total of 10 areas were categorised in this way for surveying within Darfield (nine residential areas and one non-residential area). The 10 adjacent areas were all within the main residential and commercial centre of Darfield.

Database development

A Microsoft SQL Server database was created specifically for this survey to enter and store all questionnaire data.

Interviewer preparation

A presentation was developed to prepare interviewers for what they might expect to see in Darfield, and to provide an introduction to septic tanks in general. This presentation was delivered to all interviewers (who were all Health Protection Officers, or trainee Health Protection Officers), and the training session also involved an opportunity to familiarise interviewers with the questionnaire.

From some of the questions asked during the training, and after speaking with Leech Drainage Services Ltd (the company which empties and services the majority of septic tanks in Darfield), a list of 'frequently asked questions' (FAQs, see Appendix C) was prepared for interviewers to help them with questions that interviewees may have.

Prior to commencing the survey, all interviewers trialled the questionnaire with the owners of two properties in the Waimakariri District, each with a different type of septic tank.

All interviewers were given a dossier including:

- a map of the designated area within which they would survey properties,
- numbered questionnaires,
- a copy of the media release prepared by C&PH (see below), and
- a list of FAQs.

Pairs of interviewers conducted the surveys together initially, and experienced personnel were teamed with less experienced partners.

External (community) communication

Prior to survey commencement, a CDHB media release was prepared (December 6, 2013, see Appendix D). This was taken up by the local Malvern News and also placed on the Selwyn District Council website.

Survey implementation

The survey was conducted from December 2013 – February 2014 (summer). The first part of the questionnaire was completed with a resident of the property (for residential properties) or the property owner, caretaker or manager (for non-residential properties) in an interview format. The second part of the questionnaire was completed by the interviewer using a visual inspection of the site, usually accompanied by the interviewee.

Interviews and site inspections took approximately 20-30 minutes each. Interviewees were able to decline if they did not wish to participate in the survey. Properties within each area were not selected in any particular order, and interviewers continued to approach properties until approximately 12 questionnaires were completed in each of the 10 areas.

The same questionnaire was used for both residential and non-residential properties, however some of the questions were not relevant to non-residential properties and were omitted.

Data entry and analysis

Each interviewer entered the data from the surveys that they conducted into the database. Survey data was exported from the database to SPSS 17.0 (SPSS Inc. Chicago, IL) for checking and descriptive analysis. In some instances, percentages do not add up to 100% due to missing questionnaire data. Tabulated descriptive data (where possible) is included in Appendix E.

Survey limitations

There are some limitations to the current survey. Firstly, it is not possible to state whether the residential survey interviewees are truly representative of the Darfield community as a whole. When the age of usual residents in the surveyed residences is compared to data from the 2013 New Zealand Census¹, a lower percentage of people 18-40 years of age, and a higher percentage of people in older age groups have been interviewed than are in the Darfield population. This may be because the survey was conducted during the day on week days, when greater numbers of older people may have been at home, and fewer people working outside of the home available to be surveyed. However, the number (n=106), size and wide age range of residential properties included means that the survey does provide some useful descriptive information about on-site wastewater treatment systems currently in use in the area.

A response rate for the survey could not be calculated as the total number of properties where the potential interviewee declined to participate was not recorded. It is possible that residents may have been disinclined to participate if their septic system was not in good working order, for fear of a wider authority (e.g. Environment Canterbury or Selwyn District Council) being notified.

For some questions in the survey, there is a relatively large number of missing responses. These could be due to a variety of reasons, including: the question was not applicable to the situation, the interviewee did not know the answer to the question, the interviewee preferred not to answer the question, the question was not asked, or the response was not recorded on the survey form. Unfortunately it is not possible to determine the reason(s) for the missing responses. It is therefore important to consider the findings for these questions in light of the reduced sample sizes.

The first part of the questionnaire relies on the interviewee's knowledge of the on-site wastewater treatment system on their property. Though it was not assessed in the current survey, it is likely that some interviewees were tenants, or their residence was part of a body corporate-type arrangement. Therefore, the landlord or other property manager may have been responsible for the installation and maintenance of the system. In addition, some interviewees may not have resided/owned/worked at the property for very long. Knowledge and maintenance behaviours would consequently be low for these interviewees.

¹ The data are not directly comparable due to the use of different age brackets for the two surveys. In the census, 26% of the Darfield population were <18 years old, 35% were 19-49 years old, 18% were 50-64 years old, and 22% were ≥65 years old (Statistics New Zealand, 2014b). Whereas in the current survey, 26% of the population were <17 years old, 17% were 18-40 years old, 22% were 41-60 years old, and 35% were ≥61 years old.

Finally, it was common for non-residential properties with low water use to have one septic tank that served several businesses. In these situations the landlords of the properties were not one of the business owners and none of the business owners had any knowledge that justified completing a questionnaire. Unfortunately this means that a number of non-residential properties could not be included in the survey. Due to the small number of non-residential properties surveyed (n=8), and the unique use of each property, it is not possible to make overall conclusions about the on-site wastewater systems of non-residential properties.

Findings

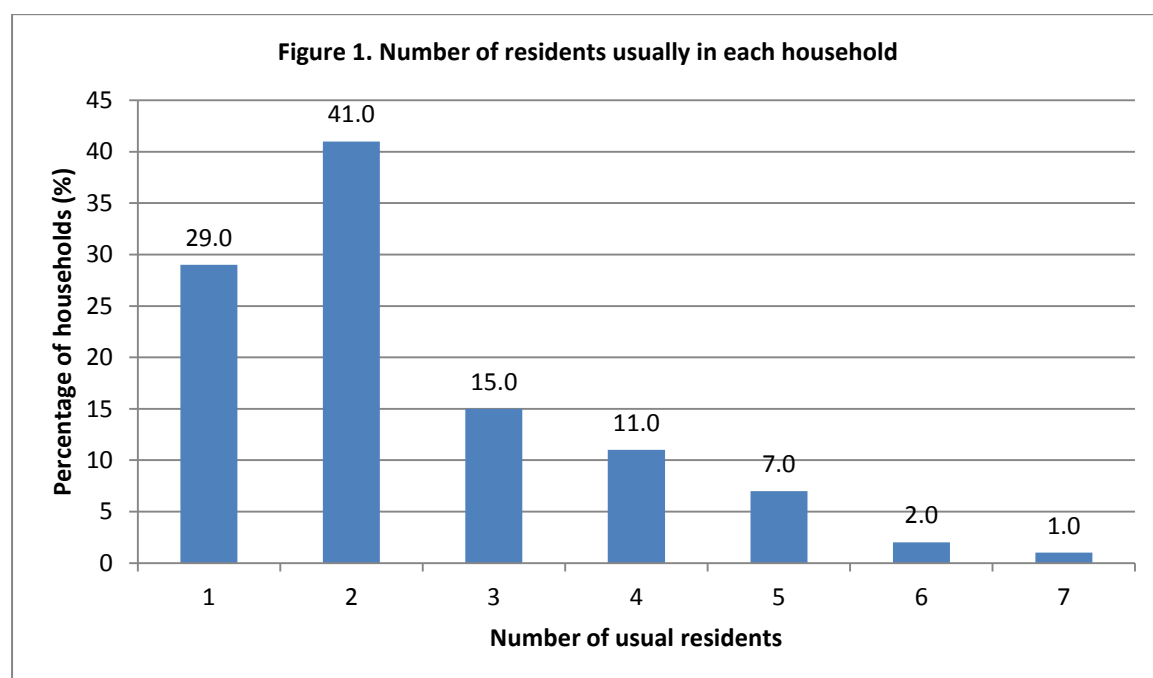
Findings from the survey have been summarised according to the type of property that was visited – either residential or non-residential (including commercial, industrial and school).

Residential property assessment

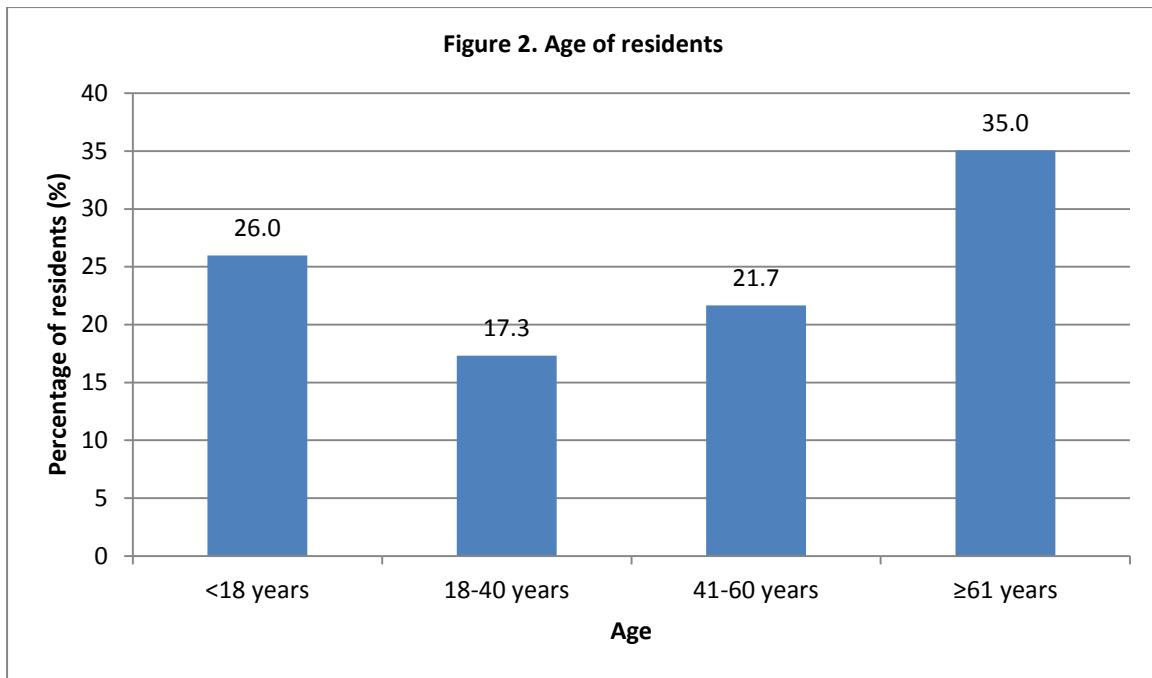
A total of 106 residential properties were surveyed between 12 December 2013 and 20 February 2014. It was not possible to calculate a response rate for the survey as the total number of residential properties that were approached and the resident declined to participate was not recorded.

Household demographics

Two thirds of households (66.0%) usually had one or two residents (Figure 1). The median number of usual residents per household was 2.0 (range=1-7 residents).

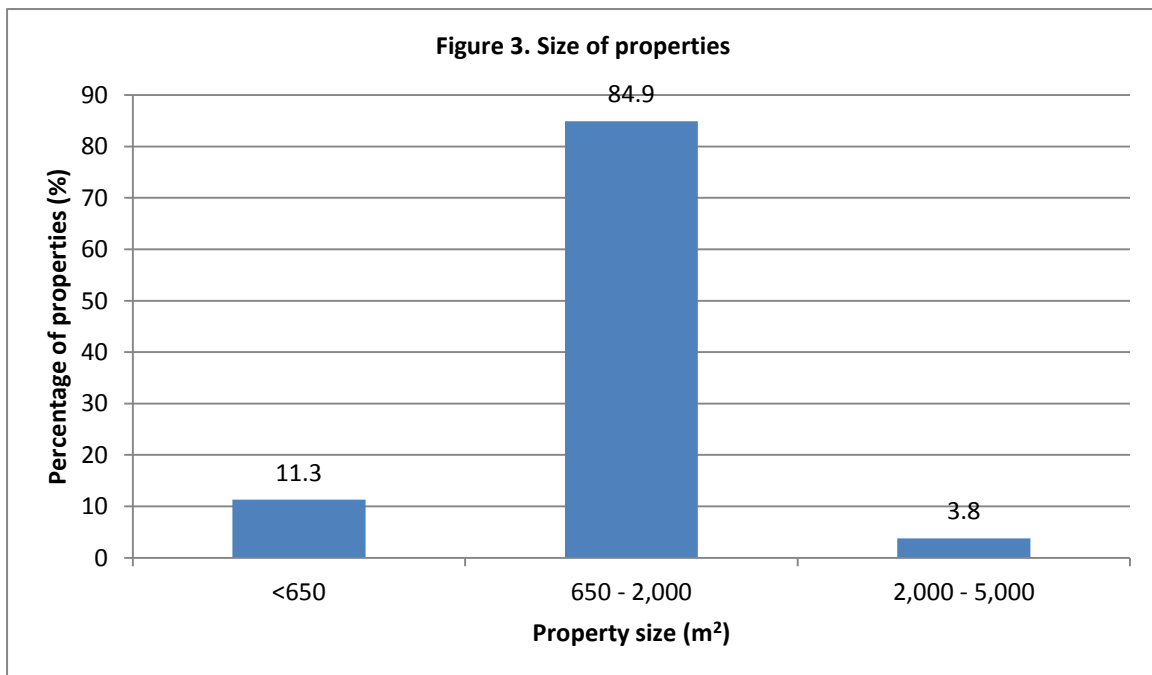


A total of 254 people lived in the 106 residences surveyed. Of these, over one third (35.0%) were 61 years of age or older (Figure 2).

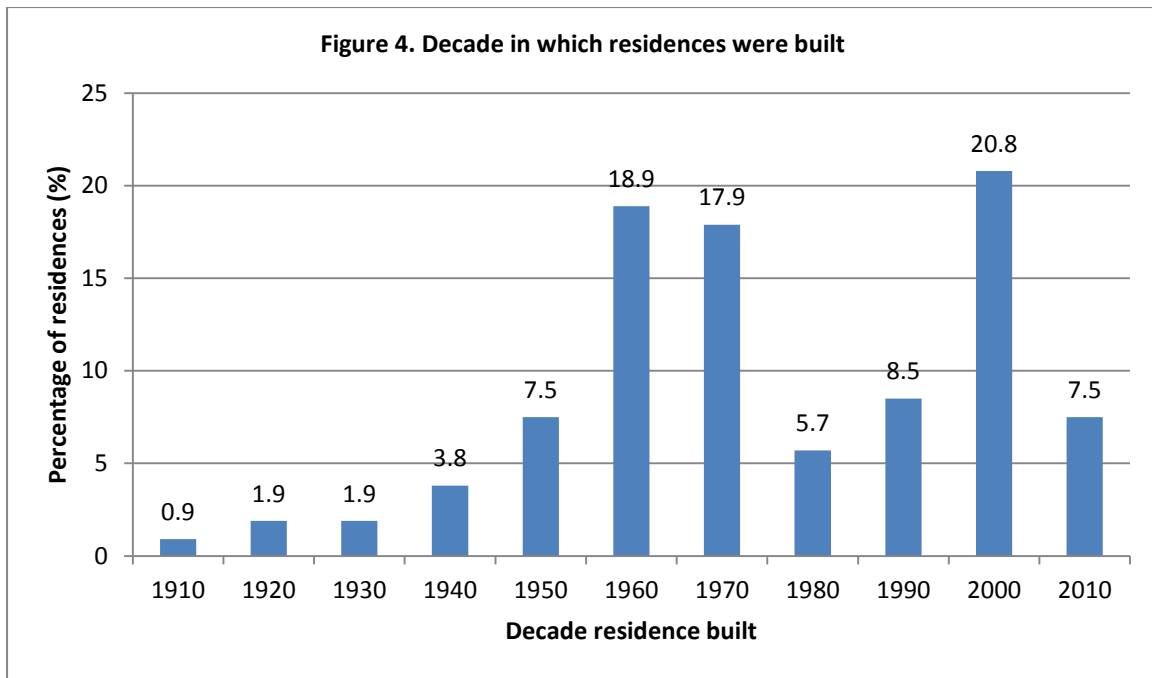


Property and residence characteristics

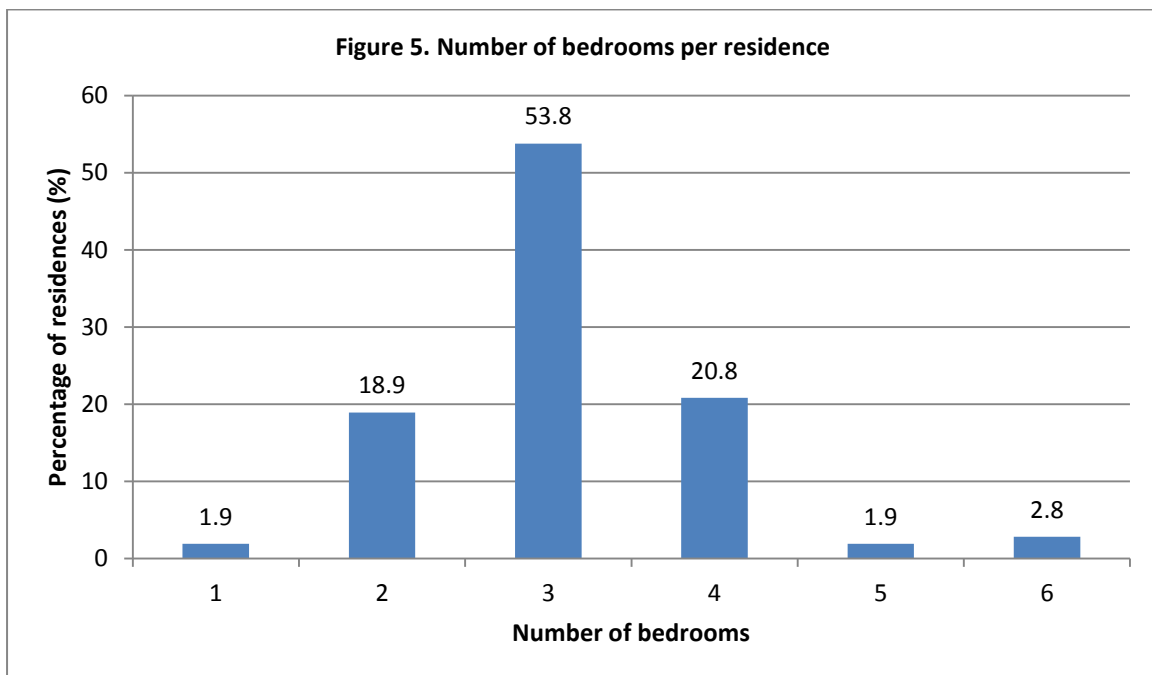
The majority of properties surveyed were mid-sized ($650\text{--}2,000\text{m}^2$, 84.9%), with relatively few small ($<650\text{m}^2$) or very large ($2,000\text{--}5,000\text{m}^2$) properties (Figure 3).



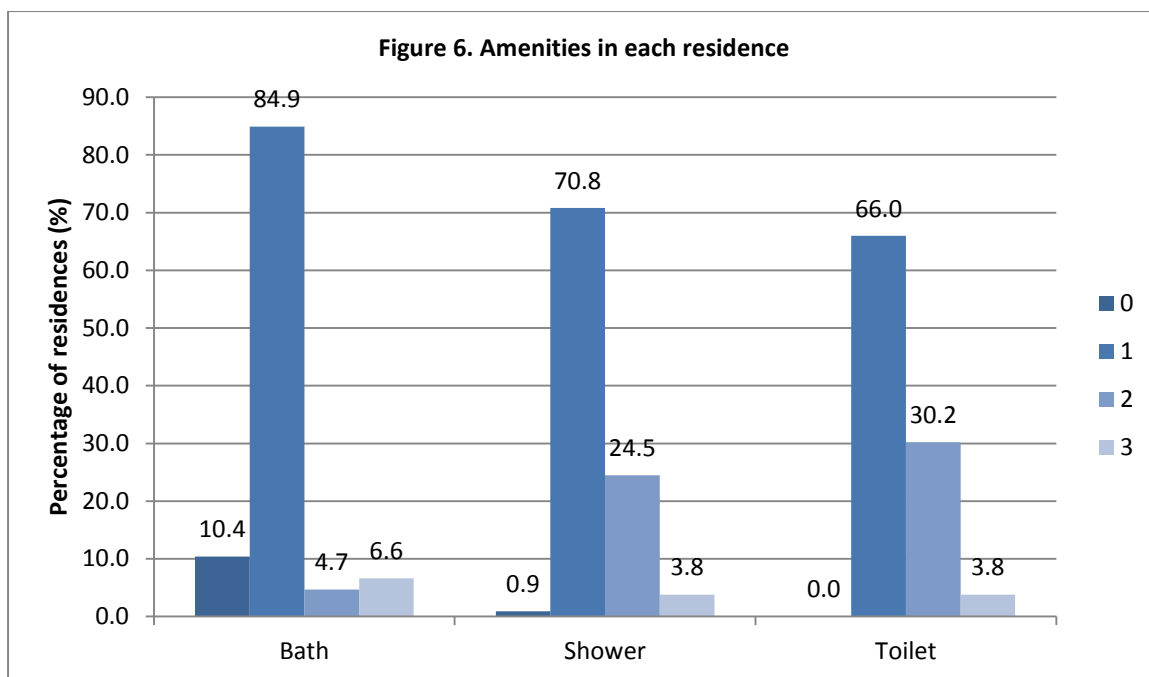
Most properties (97.2%) had the original residence, and residences were built predominantly after 1960 (Figure 4).



Most residences had 2-4 bedrooms (Figure 5). The median number of bedrooms per residence was 3 (range=1-6 bedrooms).



Most residences had one bath, one or two showers, and one or two toilets (Figure 6). Only one residence had an in-sink kitchen waste disposal unit.

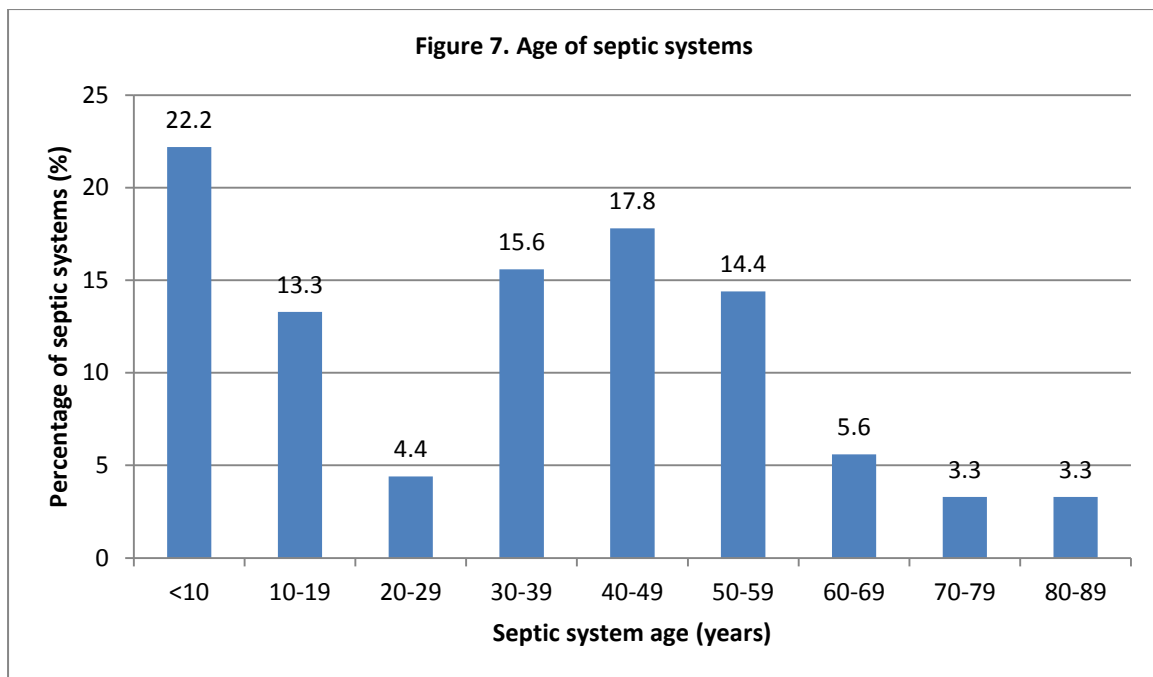


On-site wastewater treatment (septic) system

In this section of the questionnaire related to on-site wastewater treatment (septic) systems, there were many missing responses (see Survey limitations). Therefore, for each question, results are presented as a percentage of those residents for whom a response was recorded.

All residences had an on-site wastewater treatment (septic) system on their property, except for one residence, which shared its septic system with a neighbouring property. All residences that had a septic system on their property (n=105) had only one system.

The median age of the septic systems was 35.5 years (range=1-85 years, n=90, 15 missing responses), with the majority of systems (87.7%) being less than 60 years old (Figure 7).



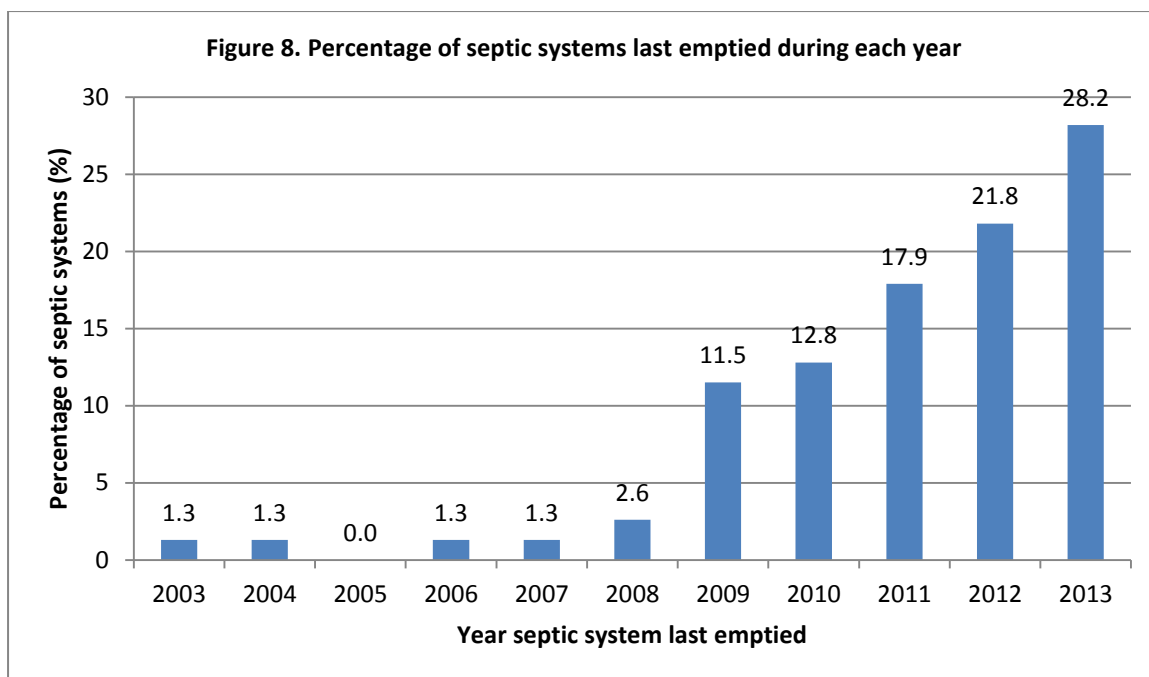
Over half of residents (56.7%, n=55) did not know under what rules the septic system on their property was installed. However, 24.7% of residents (n=24) reported that their system was covered by resource consent and 18.6% of residents (n=18) reported that their system was covered by permitted activity. Responses were missing for eight residents.

Of the 89 responses, residents reported that their septic system tanks were predominantly made of concrete (79.8%, n=71), or plastic (4.5%, n=4). Some residents (15.7%, n=14) did not know what material the tank was made of.

The majority of residents (93.8%, n=76) did not know the brand of the septic system at their residence. Of those who did know the brand - four systems were (or “probably” were) Oasis and one system was Hynds. Responses were missing for 24 residents.

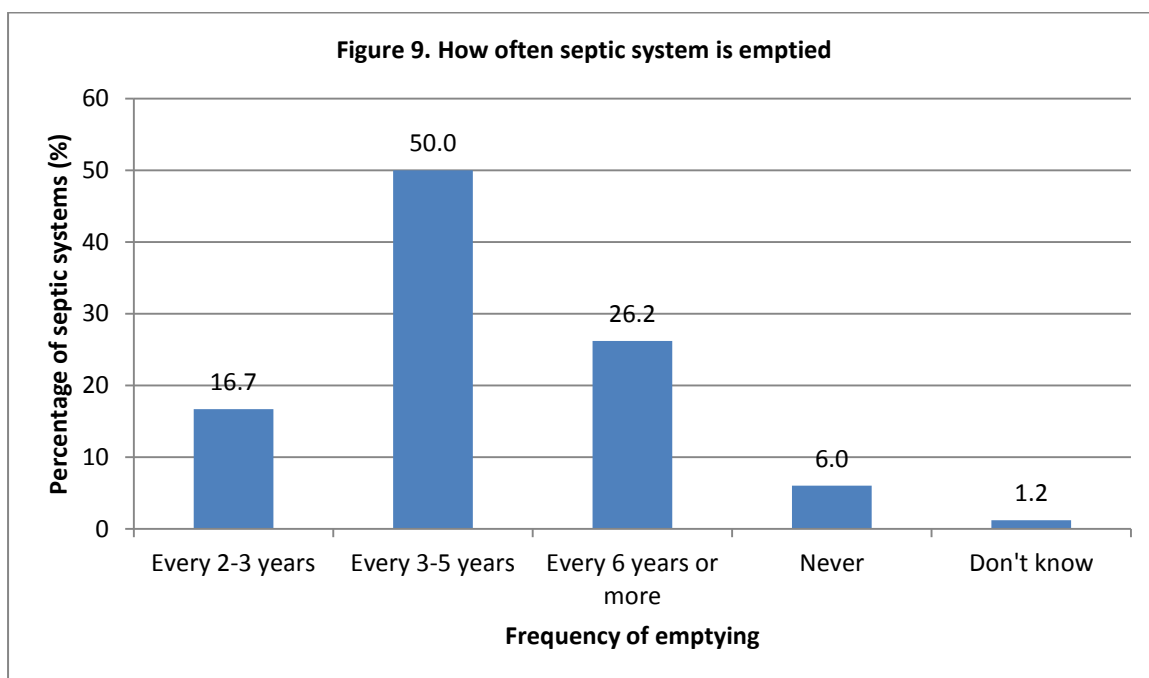
Most residents (87.7%, n=71) did not know who installed the septic system at their property. Seven residents (8.6%) stated that a builder (or the company that built the residence) installed the system, and responses were missing for 24 residents.

Most residents (91.2%, n=72) had had their septic system emptied in the previous 5 years (Figure 8). Twenty eight residents did not provide a specific date when their system was last emptied.



Of the 82 responses, most residents (84.1%, n=69) stated that their septic system was emptied by a single local contractor (Leech Drainage Services Ltd), and one resident stated that their septic system was emptied by Selwyn Waste Disposal. The remaining residents (14.6%, n=12) did not know who emptied the system. Less than half of residents (42.5%, n=42) reported that the contractor provided a certificate to indicate that this work was completed, however responses to this question were missing for 32 residents.

Two thirds of the 84 residents that responded (66.7%, n=56) reported that they had their septic tank emptied every 2-5 years (Figure 9). No residents reported emptying their septic system more frequently. Five residents reported never having their septic system emptied.



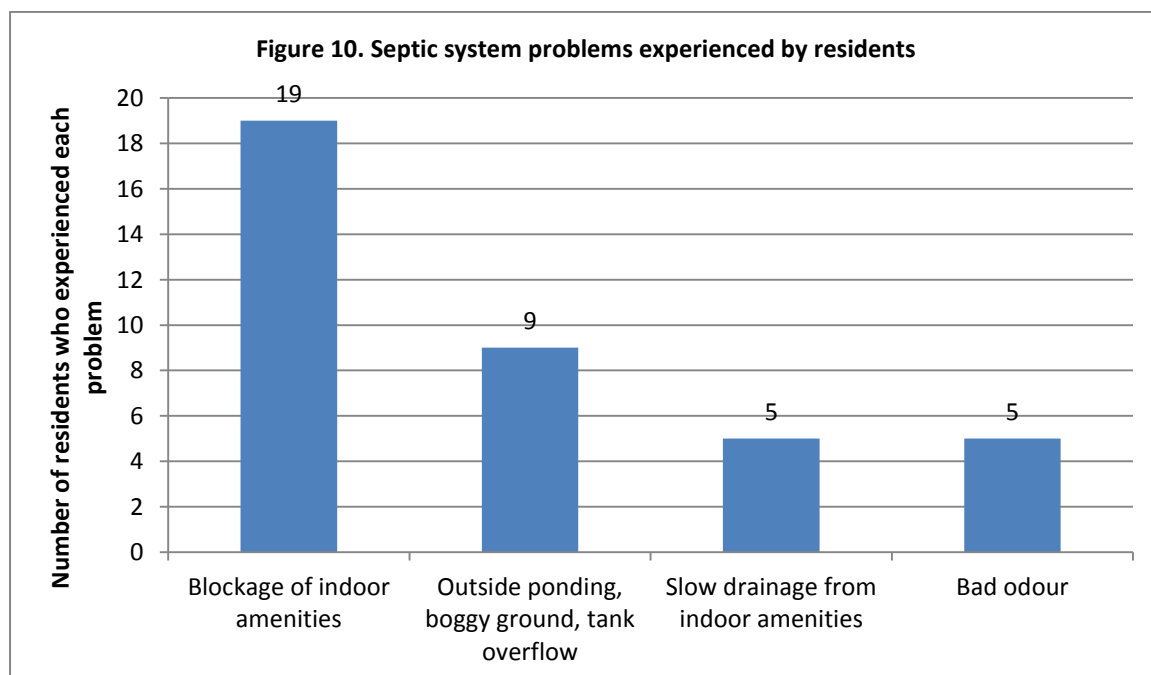
Most residents (92.6%, n=88) reported doing no service or maintenance themselves on their septic system, and five residents (5.3%) reported having done some. This consisted of tasks such as checking the system, adding bacteria to the system, digging drains, and flushing filters. Responses were missing for 10 residents.

When asked whether service or maintenance of the septic system was conducted by a contractor, 44.2% of residents (n=23) stated that some was, and the remainder (55.8%, n=29) stated that none was. However, no response was recorded for approximately half of residents (n=53).

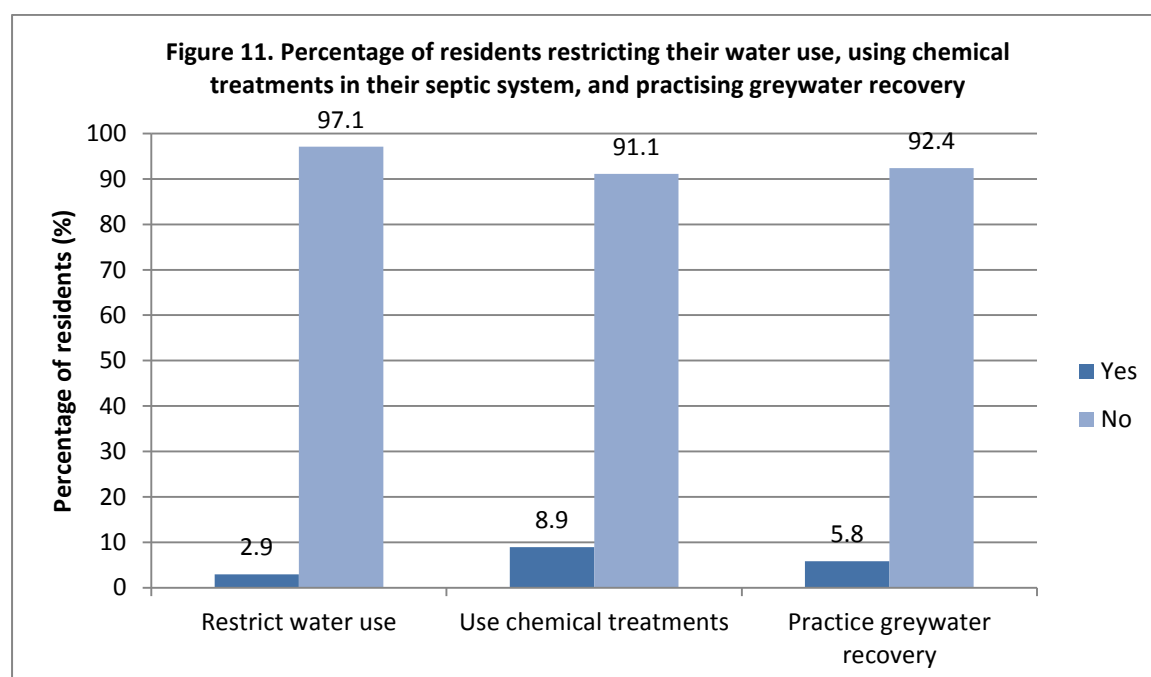
Service or maintenance of the system (by either the resident or a contractor) was conducted every 3-5 years for approximately a third of the 60 residents for whom there was a response (36.7%, n=22), or never for the remainder (63.3%, n=38).

A small number of residents (11.8%, n=11) stated that repairs had been made to their system, and the majority (88.2%) stated that none had been done. Most repairs were related to fixing/moving/upgrading pipes, leakage, and repairing the boulder pit. Three people mentioned that repairs were necessary due to damage caused by earthquakes. Responses were missing for 12 residents.

Over two thirds of residents (70.6%, n=72) had never observed any failure or blockage of their septic system. However, 29.4% of residents (n=30) had experienced some sort of failure, which included blockages (n=19, and in three cases blockages led to the overflow of indoor amenities), ponding of water outside/boggy ground (n=9), slow draining of indoor amenities (n=5), and odour (n=5) (Figure 10). Some residents mentioned more than one problem. In some instances, problems were attributed to greater numbers of people than usual staying at the residence at the time (n=3) and tree roots (n=3). No septic system problems were reported by residents to be ongoing. Responses were missing for three residents.



Few residents reported that they restricted their water use (n=3), used chemical treatments for their septic system (n=9), or practiced greywater recovery (n=6) (Figure 11). Of those who did practice greywater recovery, this usually consisted of using water from the washing machine or bath on the garden (rather than using a specific greywater recovery system). Responses were missing for three residents regarding water restriction, four residents regarding chemical treatments, and two residents regarding greywater recovery.



Most residents (93.3%, n=98) were not aware of any problems with septic systems in their neighbourhood, while the remainder had heard of some issues (6.7%, n=7).

Many residents (41.9%, n=44) had no further comments about communities that use individual on-site septic systems to manage their wastewater. Of the 61 residents that did provide a comment, 31 residents indicated that they were happy with the current septic system, and 14 stated that they would prefer a reticulated system. Some residents expressed concern about population growth and development in the Darfield area, and the impact that this may have on the current wastewater systems. Cost to ratepayers was raised by several residents as an issue in relation to introducing a reticulated system.

Drinking water and gastrointestinal health

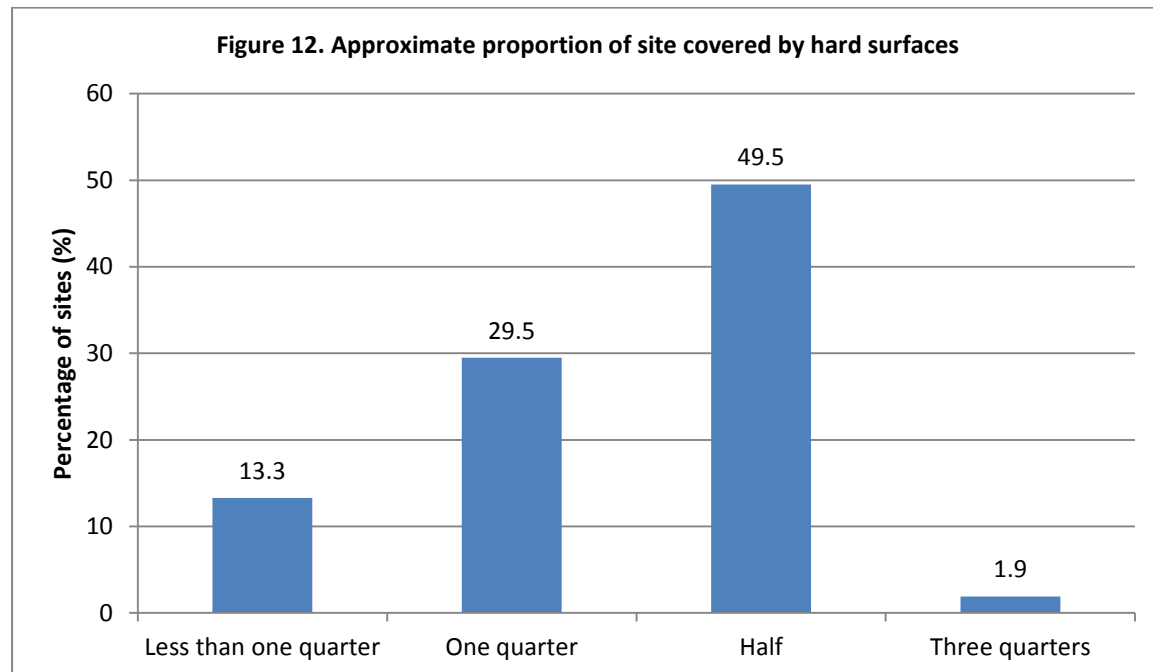
The source of all residents' drinking water was the Darfield reticulated supply.

Eight residents (7.5%) reported that a member of their household had experienced a gastrointestinal-type illness in the preceding 30 days. Four of those residents mentioned (unprompted) that this was around the time a boil water notice had been issued for the area due to *Escherichia coli* above recommended levels in the Darfield water supply. Three people had sought medical attention for their illness, and a cause had been found for two people (*Campylobacter* and *Escherichia coli*, respectively).

Site inspection

All residents except one allowed an interviewer to undertake a site inspection of their property.

Hard surfaces (including the main residence, other buildings, paths and paving) covered one quarter to half of most sites (Figure 12).



Three types of septic system features were observed on the sites. There were many missing responses in this part of the questionnaire; therefore, the number of observed features (rather than the percentage) is shown in Figure 13. On most sites ($n=102$), the septic tank vent could clearly be seen (Figure 14). On at least eight sites the interviewer noted that it was not possible to see any of the system features apart from the vent.

Disposal fields ($n=24$) and boulder pits ($n=9$) were also observed on some sites. The mean age of septic systems that had observable disposable fields was 38 years ($SD=18$ years, range=4-71 years, $n=16$). The disposal field (including the boulder hole and drainage field) was (or was presumed to be) usually under a lawn or garden. Only two sites had a reserve disposal field. Two thirds of sites (66.7%) had room for a reserve disposal field, while 29.5% did not.

No unused systems, outhouses/cesspools, long-drop toilets, old disposal fields or old boulder pits were observed on any of the sites.

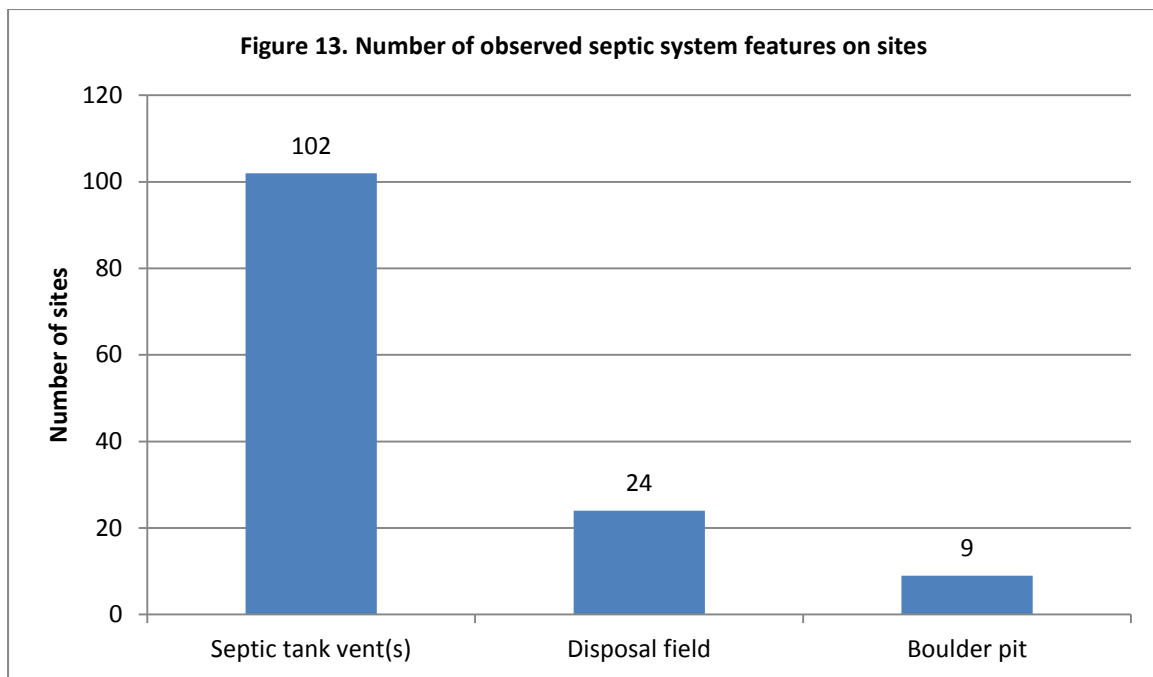


Figure 14. Septic tank vent and inspection hatch(es) visible in the lawn of a residential property

From a brief visual inspection, a small number of minor problems/system failures were observed. These included slightly sunk/uneven ground near the system (9 sites), odour (5 sites), slow plumbing drainage (2 sites), boggy ground (1 site), many trees growing over the septic system area (1 site), greener grass over the tank area (1 site), and a loosely-fitting hatch (1 site). No liquid/discharge on the ground surface or discharges to a ditch/creek or low point were observed on any of the sites. One septic system was currently being serviced due to collapse of the tank (Figure 15).



Figure 15: Repair of boulder pit in a residential property

On most sites, the septic tank area (80.0%, n=84) and the drainage/disposal area (71.4%, n=75) were protected from vehicle traffic/parking.

On some sites (14.3%, n=15) it was not possible to determine how stormwater (rainwater) drainage occurred. On all other sites (85.7%), stormwater drainage was separate from the septic system.

Non-residential (commercial, industrial and school) property assessment

A total of eight non-residential properties were surveyed between 30 January and 20 February 2014. These included a variety of properties such as food outlets, a school, an office, accommodation providers, a hospital and a veterinary surgery.

As the number of non-residential properties surveyed was small, and the use of these properties highly variable, survey findings can only be described in general terms.

Property and building characteristics

Five of the eight properties had the original building. There was a wide range in age of the buildings, from the oldest - built in 1926, to the newest - built in 2013.

Half of the properties surveyed were mid-sized (650-2,000m²), and two properties each were <650m² and 2,000-5,000m², respectively. No building had an in-sink kitchen waste disposal unit.

The number of property users varied widely (up to 850 people), with some properties being used only during the day. Most had no permanent residents living at the property.

On-site wastewater treatment (septic) systems

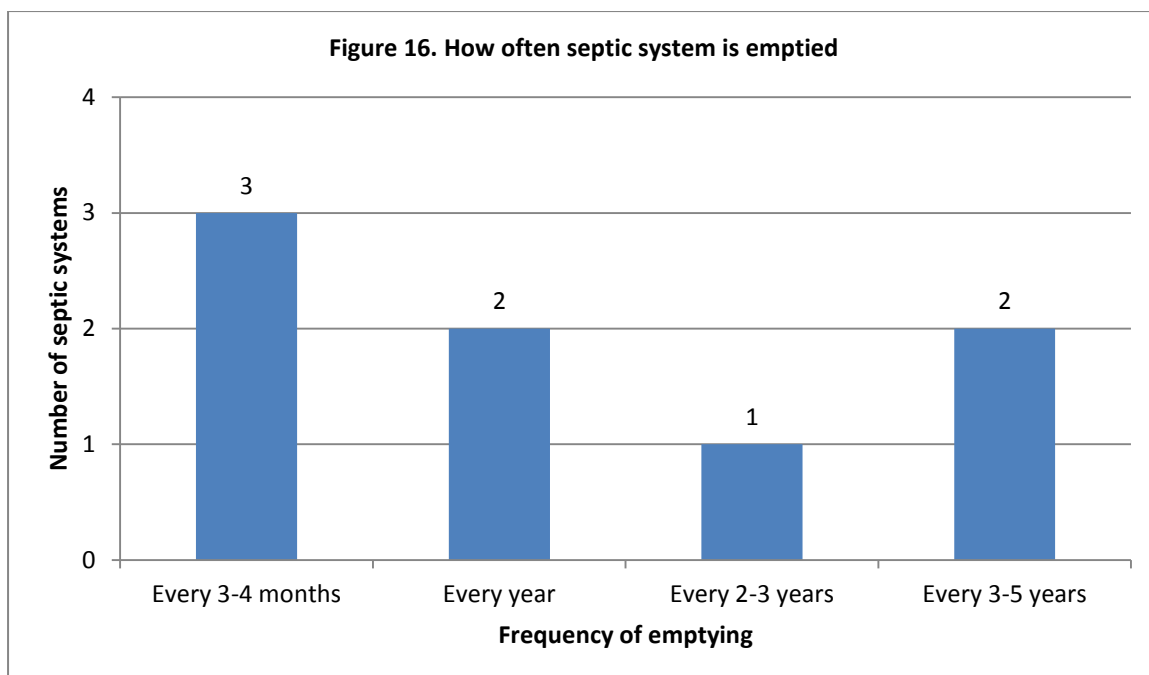
All properties had an on-site wastewater (septic) system. Six properties had one septic system, one property had two systems, and another property had six systems. The properties with two and six systems were used by a larger number of people.

Five interviewees estimated the age of the septic system on the property – four systems were less than 30 years old, and one was 88 years old.

Four interviewees reported that the system was covered by resource consent and two did not know under what rules the septic system on their property was installed. The remaining two interviewees did not answer this question.

Seven interviewees reported that the septic system tanks were made of concrete, while one interviewee did not know what material the tank was made of. Four interviewees did not know the brand of the septic system, while one stated that the brand was Hynds and one stated that the brand was Oasis Clearwater.

All interviewees that answered the question (n=6) stated that the septic system had been emptied in the previous 2 years – two in 2014, three in 2013, and one in 2012. One local contractor (Leech Drainage Services Ltd) emptied six of the systems, Allen's Ashburton Ltd Liquid Waste Disposal emptied another, and one interviewee did not answer this question. Most interviewees (n=5) reported that the contractor provided a certificate to indicate that this work was completed. Five of the interviewees reported that the septic system was emptied at least once per year (Figure 16).



Most interviewees (n=7) reported doing no service or maintenance themselves on the septic system, and four interviewees reported that a contractor undertook service or maintenance on the septic system. Service or maintenance of the system (by either the interviewee or a contractor) was conducted annually for two properties, every 3-5 years for two properties, or never for one property. Three interviewees did not respond to this question.

Three interviewees stated that repairs had been made to their system, and these repairs were related to an overloaded system and new rodding eye installation. Only one interviewee reported a failure of the system, which was related to blockages due to tree roots, which was an ongoing problem. The remaining seven interviewees reported no system failures or blockages.

No interviewees reported that they restricted their water use or practiced greywater recovery. Only one interviewee used chemical treatments for the septic system, which they did twice a year.

Interviewees were not aware of any problems with septic systems in their neighbourhood.

When asked if they had any further comments about communities which use individual on-site septic systems to manage their wastewater, one interviewee stated that they would prefer a reticulated system due to potential problems with septic systems in the future. Another mentioned the expense of moving to a reticulated system, and another felt that there should be a warrant of fitness approach for septic systems.

Drinking water

The source of drinking water for all of the non-residential properties was the Darfield reticulated supply.

Site inspection

A site inspection was undertaken on all sites except one (n=7). Hard surfaces (including the main residence, other buildings, paths and paving) covered approximately half (n=2) or three quarters (n=5) of all sites.

Septic tank vents were visible on six sites, a disposal field on four sites, and a boulder pit on two sites. These were in grassed (Figure 17), gravel (Figure 18) or garden (Figure 19) areas. No unused systems, outhouses/cesspools, long-drop toilets, old disposal fields or old boulder pits were observed on any of the sites.



Figure 17. Septic tank vent and disposal field on a non-residential property



Figure 18. Septic tank vent, tank area, and tank access point on a non-residential property



Figure 19. Septic tank vent and tank area on a non-residential property

From a brief visual site inspection, no signs of septic system failure were observed.

On all sites, the septic tank area was protected from vehicle traffic/parking (Figure 19). The drainage/disposal area was protected from vehicle traffic/parking on five sites, but not on two sites.



Figure 20. Septic tank area protected from vehicle traffic/parking on a non-residential property

No sites had a reserve disposal field, but all had room for one.

Stormwater/rainwater drainage was separate to the septic tank on six sites, and not able to be determined for the one remaining site.

Conclusions

Residential property assessment

The properties included in this survey covered a wide range of mostly mid-sized residences built in the last 60 years. Most households included a small number of residents, with 57% of residents over the age of 40. This survey may represent a slightly older sample of residents, as in the Selwyn District, 48% of the population are 40 years of age or older (Statistics New Zealand, 2014b).

All residences (except one) had one on-site wastewater treatment (septic) system on their property, and most were less than 60 years old. Knowledge of the septic system on their property was low for many residents. Most systems had been emptied in the last 5 years, however, regular service or maintenance of the system was not undertaken by a large proportion of residents. Some residents had previously experienced some sort of failure of their septic system, which most commonly included blockages and system overflows, as well as boggy ground outside, slow draining of indoor amenities, and odour. Residents did not experience ongoing problems with their septic systems. Low level of knowledge combined with irregular system servicing may have contributed to some of the septic system problems experienced. This could indicate the need for more education about septic systems for residents combined with requirements for regular servicing and/or maintenance. The Ministry of Health (2013) states that “Smaller settlements that still use septic tanks should adopt guidelines (and inspections) related to their design, construction, operation, maintenance and cleaning”.

Only one residence had an in-sink kitchen waste disposal unit. This low number is positive, as the use of these systems can significantly increase both the amount of water and also the organic load on the septic tank, compromising the treatment of wastewater. This finding may indicate good general awareness of those who install these systems and/or the property owners.

All residents sourced their household drinking water from the reticulated Darfield supply. Eight residents reported that a member of their household had had a gastrointestinal-type illness in the 30 days preceding the survey. Four of those residents mentioned that this was around the time a boil water notice had been issued for the area (28-31 December 2013) (Selwyn District Council, 2013a, 2013b), however it is not possible to determine whether these illnesses were a result of drinking water contamination or due to other factors.

While some residents were happy with the current septic system on their property, others expressed a desire to see a reticulated system in Darfield. In some cases this was driven by a concern about population growth and the impact that this rapid development may have on the current wastewater systems. However, the subsequent perceived high cost for ratepayers of a new reticulated system was an issue that several people raised.

On visual inspection of the properties, there were few obvious signs of current septic system failures/problems. Sunk/uneven ground around the tank area and odour were the two most commonly observed signs. On sites where it was possible to determine, fortunately, no situations

were identified where stormwater drained into the septic system. On some properties, the area was not protected from vehicle traffic, and/or lacked the space for a reserve disposal field, which represent potential future problems.

Non-residential (commercial, industrial and school) property assessment

There was a wide variation in the function of the non-residential properties surveyed, and properties that catered to larger numbers of users had more septic systems. Interviewees tended to be relatively knowledgeable about the septic system on the properties and reported having them emptied regularly. High-load businesses (such as food outlets and accommodation providers) were particularly vigilant at having the septic system emptied regularly, probably to avoid any problems which may negatively impact on their business. However, very frequent emptying may compromise the treatment processes within the septic system. Few septic system problems were reported by the interviewees, or observed during the site inspection.

Due to the small number of non-residential properties surveyed, and the unique use of each property, it is not possible to make general conclusions about the on-site wastewater systems of non-residential properties.

Appendix A: Selwyn District

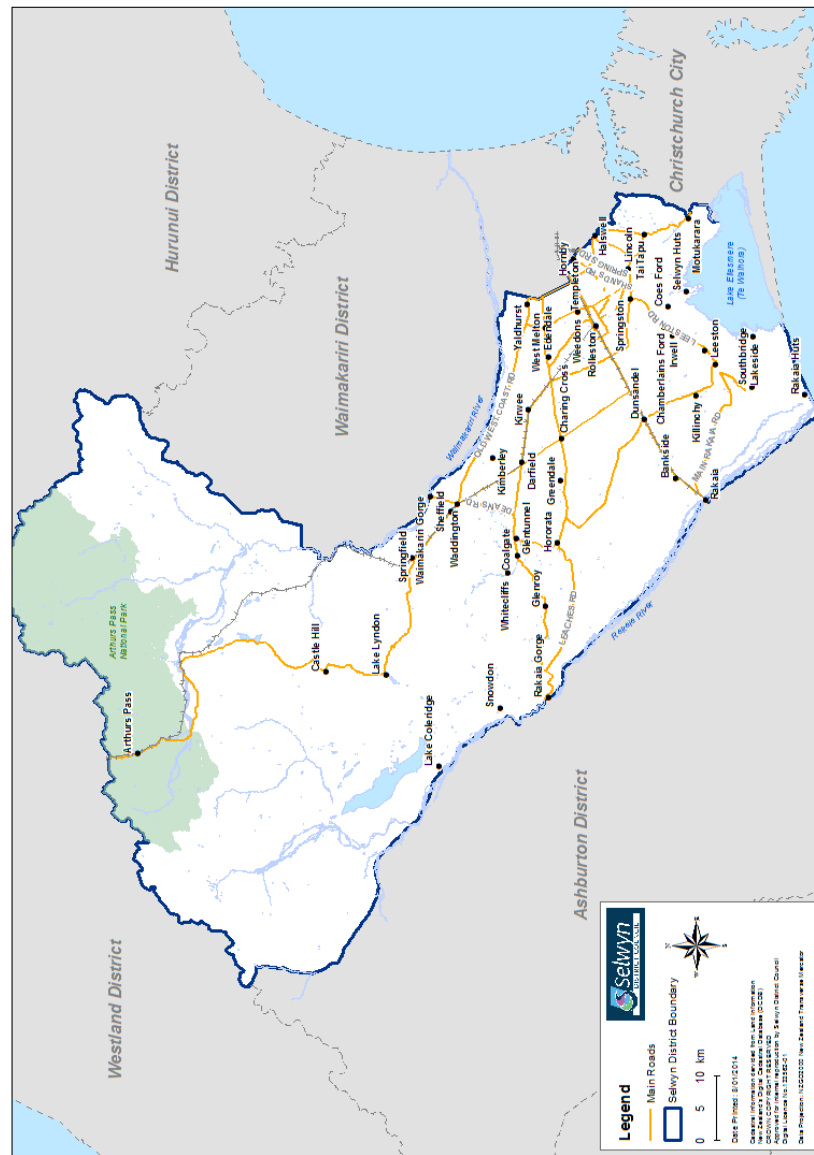


Figure 21. Map of Selwyn District

Appendix B: Existing on-site wastewater treatment system assessment

SANITARY SURVEY

EXISTING ON-SITE WASTEWATER SYSTEMS ASSESSMENT

The following information is being requested to complete a 2013 survey of on-site wastewater management in the Canterbury communities of Darfield in Selwyn District. This information will help to better represent the needs of small unsewered communities.

Public Health District: Community and Public Health, Canterbury District Health Board

Public Health Unit Address: Christchurch office: 310 Manchester Street, Christchurch

Postal address: PO Box 1475, Christchurch

Fax: +64 3 379 6125 Phone: +64 3 364 1777

Interviewer Instructions

Please show your identification to the householder/business.

Please leave the householder/business with the pamphlet on managing their on-site septic system and a business card so they can contact you for further information.

Interviewer's name:

Interview date and time:

1. This interview and inspection for a:

Residential property: Yes/No

Commercial/industrial property: Yes/No type: _____

School/institution: Yes/No type: _____

2. Address of property surveyed: _____

3. Permission to take photos? **Yes/No** Signature of HPO _____

Sanitary Survey – Interview

4. Number of residents usually at property: _____

Number

5. Age range of usual residents:
- <18years
 - 18 – 40yrs
 - 41 - 60
 - >61 yrs

6. Is the house the original on the property? **Yes /No**

7. What is the size of the property?
- <650m²
 - 650m²- 2000m²
 - 2000m² – 5000m²

8. Age/year built of current house: _____

Number of bedrooms: _____ Number of toilets: _____

Number of baths: _____ Number of showers: _____

9. Is there an in-sink kitchen waste disposal unit? _____

10. If the house is not the original, are there any comments relevant for this survey (e.g., current house uses pre-existing septic system, is there an old/unused septic system on the property)?

11. Does the property have a septic system/on-site wastewater system? **Yes/No**

If **NO**, how is wastewater/sewage managed?² _____

If **YES**, is the system covered by resource consent **Yes/No**
 permitted activity **Yes/No**
 or Don't know **Yes/No**

12. How old do you think the septic system is? _____

13. How many separate septic systems do you have? _____

14. Description of septic system type on property	System-1	System-2
For each system is it (the main system, out-house, ...)		
For each system the tank is (concrete, plastic, metal, ...)		
Single chamber with boulder pit		
Single chamber with drainage field		
Single chamber with disinfection(UV)		
Two chamber with boulder pit		
Two chamber with drainage field		
Two chamber with aeration		
Two chamber with disinfection		
Other (add detail)		

15. What brand is the septic system? _____ or **Don't know**

16. Who installed the septic system? _____ or **Don't know**

17. When was the septic system last emptied (date)? _____ or **Don't know**

18. Who emptied it (name)? _____

19. Did the contractor give you a certificate to show work completed? **Yes/No**

20. How frequently is it emptied? Annually **2-3yrs** **3-5yrs** **>5yrs** **Never**

² The "no" option for Darfield/Kirwee is to identify those people who don't know they have a septic system or those who use chemical toilets or those who consider everything is "greywater".

21. What service or maintenance do you do on your septic system? **None or detail**_____

22. Or is this done by a contractor? **Yes/No**_____

23. How frequently do you/contractor service or maintain the system? **Monthly checks**

6 monthly

Annually

3-5 years

Never

24. Have repairs been made to the system? **Yes/No**

If **yes**, what type of repairs and when/by whom: _____

25. Have you ever observed failure of your on-site wastewater system (e.g., slow drainage from toilet, inside overflows, outside ponding, smells, boggy ground, soil collapse)? **Yes/No**

If **Yes** then give details: _____

26. Does water from sinks, drains, shower, toilet etc block up at times? **Yes/No**

If **Yes** give details (when/frequency etc): _____

27. Do you need to restrict your water use? **Yes/No**

If **Yes** give details(why/when/frequency)_____

28. Do you use chemicals or chemical treatments for your septic system? **Yes/No**

If **Yes** give details_____

29. Do you practice **greywater** recovery or reuse **Yes/No**

(e.g., of bath, shower, basin, laundry water)?³

³ ESR's research shows many instances, especially in rural communities, where ad-hoc greywater recovery/reuse is practiced, whether it is a permitted activity or not.

If **YES**, how do you do this? _____

What brand is the greywater system? _____

Who installed the greywater system? _____

30. Are you aware of problems with septic systems in the neighbourhood? Yes/No

Detail - _____

31. What is your drinking-water source (e.g., reticulated [Council supply], roof water, individual bore etc)?

**32. Have you or members of your household had any gastro-type illness in the last 30 days?
Yes/No**

If **Yes** detail: _____

Did you seek medical attention for this? **Yes/No** _____

Was a cause found? **Yes/No** _____

33. Do you have any further comments about communities which use individual on-site septic systems to manage their wastewater?

Sanitary Survey – Site Inspection – HPO to complete

34. Circle what proportion of the section is covered by “hard surfaces” (house/buildings/paths/paving)?

Three quarters

Half

Quarter

Less than a quarter

35. Describe what you can see outside (include outbuildings, general yard maintenance, animals, section uses, vegetable gardens, flushes of bright green grass at variance with area, etc. Take photos).

List the types of septic system features observed.

_____ Septic tank vents

_____ Outhouses/cesspools

_____ Disposal field

_____ Old disposal fields

_____ Boulder pit

_____ Old boulder pits

_____ Unused systems

_____ Long-drop

Other _____

Comment on the condition/general observations of the septic system. (Take photos).

36. Is the septic tank area protected from vehicle traffic/vehicle parking? **Yes/No**

37. Describe the disposal field (include 'boulder hole' and drainage field)

Is there a reserve/additional disposal field? **Yes/No** _____

Is there room for a reserve disposal field? **Yes/No** _____

Is the drainage/disposal area protected from vehicle traffic/vehicle parking? **Yes/No** _____

38. Is there sign of system failure around the septic tank or disposal area/boulder pit? **Yes/No**

If **YES**, what evidence:

Odour _____

Liquid/discharge on surface _____

Boggy ground _____

Collapsing ground _____

Slow plumbing drainage or backup (flush toilet a few times, run some taps)

Discharges to ditch/creek or low point _____

Other comments: _____

Describe what you consider the failure may be due to (e.g., improper use or operation, problems with the installation, under-specified system for the number of occupants, section too small, etc)

39. What happens to the stormwater (rainwater) drainage? Is there a separate soakhole for stormwater? Describe its location including distance from the wastewater disposal area.

40. Other overall comments

Sketch Location of Septic tank/Disposal field/stormwater disposal in relation to House/boundary etc.

Appendix C: Frequently asked questions

How frequently should my tank be pumped out?

BRANZ (Building Research Association of New Zealand) recommends approximately every 3-5 years, or when:

- the top of the floating scum is 75mm or less from the bottom of the outlet, or
- sludge has built up to within 250mm of the bottom of the outlet.

What sort of maintenance should I do or get done on my septic tank?

- Inspect tank annually for scum and sludge levels.
- Check and clean outlet filters regularly (6 monthly) (BRANZ)

For aerated/advanced systems you would expect the following to occur during contracted maintenance:

- clean or replace filters as required,
- monitor effluent quality, including pH of first chamber,
- check submersible pump and float switch operation,
- record all inspection maintenance and monitoring, and
- replace submersible pump every 7-10 years.

What sort of maintenance should I undertake on my disposal field?

- Alternate areas (if available) 6 monthly.
- Keep area clear of deep rooting trees and shrubs.
- Clean and service pumps, siphons and filters according to manufacturers instructions.
- Flush drip lines regularly to remove accumulated sediment.
- Mow grass and maintain plants in evapotranspiration areas.
- Ensure surface drains around land application areas are kept clear to reduce rainwater run-off (BRANZ).
- Ensure that heavy vehicles don't park or drive over the field.

Can I use the effluent on crops?

Septic tank effluent should not be used on crops for human consumption.

What is the problem with having an in-sink kitchen waste disposal unit?

The use of these can significantly increase both the amount of water and also the organic load on the septic tank, compromising the treatment of wastewater.

What to do if...

- *Tank is too full?*
 - Have it pumped out
- *Tank contains too much sludge and scum?*
 - Have it pumped out/desludged
- *Too much water is going into the tank?*
 - Use less water and check for stormwater infiltration

What are the most likely septic tank systems we will see in Darfield?

Historically there were a lot of soakpits installed in Darfield for sewage discharges. However that changed as the NRRP came in (starting in 2004 when the proposed rules came into effect), further reinforced when the Land and Water Plan was proposed in 2012. Soakhole discharges are no longer permitted under either of these plans. It is understood that the odd consent still goes through for discharge via soakhole (with very short consent durations) but mostly for consented discharges we require treatment via either:

- A septic tank system discharging to a sand trench. Sand trenches can be loaded up at higher rates (up to 50mm/day) so they require a much smaller disposal field than dripline irrigation systems. Therefore you tend to see them on smaller, urban properties.
- An aerated wastewater treatment system discharging to land via dripline irrigation – these discharge at a much lower rate than sand trenches (generally between about 2-5mm/day), so require a bigger land area (for example, a 3 bedroom house producing 1000L/day would need at least 200m² of dedicated land area to discharge via dripline irrigation). So you tend to see these on bigger urban properties, or rural properties.

What are the signs of a failing septic tank?

- Bad odours around the drainfield especially after heavy water use or rainfall.
- Soggy soil, wet spots with lush green grass growth over drainfield or septic tank.
- Standing water in drainfield.
- Slow draining fixtures.
- Plumbing back-ups.
- High levels of coliform bacteria or nitrate in nearby well.

What are the signs of a failing disposal field?

- Foul smell around tank or land application area.
- Tank overflows.
- Ground around tank is soggy.
- Sinks/basins/toilets empty slowly.
- Fixtures make gurgling noise when emptying.
- Grass is unusually green.
- Black liquid oozing from trenches.
- Gully trap or tank mushroom is overflowing.

What should I be doing to keep my septic tank working well?

- Reduce volume entering system:
 - Use less water – consider low flow toilets, shower heads, etc.
 - Do laundry a little at a time.
- Don't use products like water softeners.
- Perform system inspection regularly and pump septic tank when needed or on regular interval.
- Don't use an in-sink kitchen waste (garbage) disposal unit.
- Avoid harsh cleaners; use all cleaners sparingly.
- Don't dispose of paints, oils, chemicals into the system.
- Maintain good grass cover over drainfield.
- Protect drainfield from excess runoff.

If there is an old unused septic tank on the property, is there something I need to do to decommission it?

Potentially these could present a hazard, especially if they collapse inward, we would recommend that it is inspected by an engineer.

On the list of septic tanks, there is two chambers with disinfection. What sort of disinfection would we expect to see?

It is possible that some advanced systems may use UV disinfection – but probably unlikely.

Appendix D: Media release

Darfield septic tank survey

December 6, 2013

Starting next week Canterbury District Health Board is to survey septic systems in Darfield to see if they are meeting health and environmental needs.

The survey will allow health officials to assess the volume of sewage and wastewater being processed, and will identify any health or environmental issues resulting from the operation of the septic systems.

Dr Alistair Humphrey, Canterbury Medical Officer of Health, says the survey will help establish how septic tanks are being used and maintained.

“Darfield is the largest New Zealand town not fully reticulated and we’re interested to see whether the septic tank system is still meeting the town’s needs,” Dr Humphrey says.

Dr Humphrey says recent population growth has seen an influx of people into the Selwyn District, and people new to the area may not be used to septic systems or appreciate the on-going care and maintenance required.

“Septic systems can work well in rural areas but tank owners need to be careful with what they put down their sink and use in their home”.

Dr Humphrey says poorly operated and maintained septic tanks can overflow and send contaminants into nearby surface and ground water.

“This can create a number of health risks through its effect on groundwater and recreational water can also be affected.”

More than 100 households and at least 10 commercial premises will be included in the sanitary survey. Each visit will last about 30 minutes and will involve a discussion with the household about how they manage their septic system, as well as a visual assessment of the septic system.

Survey results are anonymous and confidential. Information gained from individual inspections will not be made available to any other party.

The survey’s overall findings will be compiled into a report for the Selwyn District Council, ESR and the Ministry of Health.

“The final report will contribute to the evidence decision makers need to decide about future wastewater management for the area,” Dr Humphrey says.

Appendix E: Tabulated data from the residential property assessment

Table 1. Residential household characteristics (n=106)

Characteristic	Percentage of residents % (n)
Number of usual residents per household	
1	27.4 (29)
2	38.7 (41)
3	14.2 (15)
4	10.4 (11)
5	6.6 (7)
6	1.9 (2)
7	0.9 (1)
Age of usual household residents	
<18 years	26.0 (66)
18-40 years	17.3 (44)
41-60 years	21.7 (55)
≥61 years	35.0 (89)

Table 2. Residence characteristics (n=106)

Characteristic	Percentage of residences % (n)	
Residence is the original on the property	Yes	95.3 (101)
	No	4.7 (5)
Size of property	<650m ²	11.3 (12)
	650-2,000m ²	84.9 (90)
	2,000-5,000m ²	3.8 (4)
Decade residence built ^a	1910	0.9 (1)
	1920	1.9 (2)
	1930	1.9 (2)
	1940	3.8 (4)
	1950	7.5 (8)
	1960	18.9 (20)
	1970	17.9 (19)
	1980	5.7 (6)
	1990	8.5 (9)
	2000	20.8 (22)
	2010	7.5 (8)
	Missing response	4.7 (5)
Number of bedrooms per residence	1	1.9 (2)
	2	18.9 (20)
	3	53.8 (57)
	4	20.8 (22)
	5	1.9 (2)
	6	2.8 (3)
Number of toilets per residence	1	66.0 (70)
	2	30.2 (32)
	3	3.8 (4)
Number of showers per residence	0	0.9 (1)
	1	70.8 (75)
	2	24.5 (26)
	3	3.8 (4)
Number of baths per residence	0	10.4 (11)
	1	84.9 (90)
	2	4.7 (5)

^a If the interviewee did not state the year or decade in which the residence was built, but did estimate the age of the residence, the age was used to estimate the decade in which the residence was built.

Table 3. Residential septic system characteristics (n=105)^a

Characteristic (n ^b)	Percentage of systems % (n)
Rules governing system installation (97)	
Resource consent	24.7 (24)
Permitted activity	18.6 (18)
Don't know	56.7 (55)
Tank material (89)	
Concrete	79.8 (71)
Plastic	4.5 (4)
Don't know	15.7 (14)
System brand (81)	
Oasis	4.9 (4)
Hynds	1.2 (1)
Don't know	93.8 (76)
Who installed system (81)	
Builder, or building company	8.6 (7)
Other	3.7 (3)
Don't know	87.7 (71)
Who last emptied the system (82)	
Leech Drainage Services Ltd	84.1 (69)
Selwyn Waste Disposal	1.2 (1)
Don't know	14.6 (12)
Resident received a certificate to show work completion after system last emptied (73)	
No	57.5 (42)
Yes	42.5 (31)
Frequency of emptying (84)	
Every 2-3 years	16.7 (14)
Every 3-5 years	50.0 (42)
Every 6 years or more	26.2 (22)
Never	7.1 (6)
Service/maintenance on the system has been completed by resident (95)	
No	92.6 (88)
Yes	5.3 (5)
Don't know	2.1 (2)
Service/maintenance on the system has been completed by a contractor (52)	
No	55.8 (29)
Yes	44.2 (23)
Frequency of service/maintenance (60)	
Every 3-5 years	36.7 (22)
Never	63.3 (38)
Repairs made to the system (93)	
No	88.2 (82)
Yes	11.8 (11)

Characteristic (n ^b)	Percentage of systems % (n)
System has experienced failure or blockage (102)	
No	70.6 (72)
Yes	29.4 (30)
Resident needs to restrict water use (102)	
No	97.1 (99)
Yes	2.9 (3)
Resident uses chemical treatments for the system (101)	
No	91.1 (92)
Yes	8.9 (9)
Resident practices greywater recovery or reuse (103)	
No	94.2 (97)
Yes	5.8 (6)
Resident aware of problems with systems in the neighbourhood (105)	
No	93.3 (98)
Yes	6.7 (7)

^a One residence shared its septic system with a neighbouring property, and was therefore not included in these analyses. The total number of respondents for this part of the survey was 105.

^b The number in brackets represents the total number of responses recorded for that question. For many questions in this part of the survey, the total number of responses did not add up to 105 due to missing data.

Table 4. Residential drinking water and gastrointestinal health (n=106)

Characteristic	Percentage of residences % (n)
Source of drinking water	
Reticulated	100 (106)
Rain water	0 (0)
Bore	0 (0)
Residences with household members experiencing gastrointestinal-type illness in the preceding 30 days	
No	88.7 (94)
Yes	7.5 (8)
Missing response	3.8 (4)

Table 5. Site inspection (n=105)^a

Characteristic	Percentage of sites % (n)
Proportion of the site covered by hard surfaces	
Three quarters	6.7 (7)
Half	49.5 (52)
One quarter	29.5 (31)
Less than one quarter	13.3 (14)
Missing response	1.0 (1)
Septic tank area protected from vehicles	
Yes	80.0 (84)
No	19.0 (20)
Missing response	1.0 (1)
Drainage/disposal area protected from vehicles	
Yes	71.4 (75)
No	23.8 (25)
Missing response	4.8 (5)
Reserve disposal field on site	
Yes	1.9 (2)
No	91.4 (96)
Missing response	6.7 (7)
Room on site for a reserve disposal field	
Yes	66.7 (70)
No	29.5 (31)
Missing response	3.8 (4)

^a One resident did not allow an inspection of their property

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