

BEFORE THE CANTERBURY REGIONAL COUNCIL

IN THE MATTER OF: the Resource Management Act 1991

AND

IN THE MATTER OF: a submission on the Proposed Canterbury
Land and Water Regional Plan

**EVIDENCE OF JEFFREY BRIAN DALLEY
FOR DIRECTOR-GENERAL OF CONSERVATION**

Dated 4 February 2013

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STATEMENT OF EVIDENCE OF JEFF BRIAN DALLEY

INTRODUCTION

- 1 My full name is **Jeffrey Brian Dalley**.
- 2 I am currently employed as a C-Band Ranger in the Visitor Assets programme at Department of Conservation's Waimakariri Area. My qualifications include Doctor of Philosophy in Management and Master of Business Administration. I have a wide range of experience in the tourism and primary sectors, where I have regularly dealt with industrial and domestic effluent management challenges across a diversity of sites, scales and effluent types.
- 3 I am familiar with the nature of greywater discharge and toilets at the Department of Conservation's facilities, to which these proceedings relate.
- 4 I have read the Environment Court's Code of Conduct for Expert Witnesses, and I agree to comply with it. My qualifications as an expert are set out above. I confirm that the issues addressed in this evidence are within my area of expertise. I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed.

SCOPE OF EVIDENCE

- 5 My evidence will deal with the following rules in Canterbury Regional Council's proposed Canterbury Land and Water Regional Plan (pCLWRP) as they pertain to Department of Conservation (DOC) operations:
 - Rules 5.13-5.14 - Greywater Discharge
 - Rules 5.15-5.18 - Pit and Composting Toilets
- 6 My evidence covers:
 - DOC's visitor facilities affected by these rules, and the planning and design philosophy that informs their development;
 - Greywater discharge from DOC facilities, and DOC's policies and procedures for managing greywater;

- Toilets at DOC facilities, and DOC's policies and procedures for managing human waste.
- 7 By way of background to my evidence, I understand that the effect of Rules 5.13 and 5.14 in the pCLWRP relating to discharge of greywater means DOC would require consent to discharge such from its huts and shelters (as it fails to comply with the permitted activity condition requiring it be a dwelling house). The Director-General sought that such discharge be provided for as a permitted activity within Rule 5.13, but that submission has not been accepted in the section 42A report.
- 8 I also understand that the Director-General has submitted in support Rules 5.15 – 5.18 of the pCLWRP that the discharge of human waste via pit and composting toilets be a permitted activity, subject to the specified conditions.

DOC VISITOR FACILITIES

- 9 DOC facilities affected by rules relating to greywater discharge, and pit and composting toilets, are almost entirely associated with servicing the visiting public on conservation lands. Facilities specifically affected are:
- Huts
 - Shelters
 - Campsites
 - Toilets.
- 10 DOC manages a network of more than 980 backcountry huts, 550 shelters and 220 campsites in conservation areas nationwide. These facilities are an important part of the New Zealand (backcountry) outdoor recreation experience, providing visitors with unique places to stay, refuge from bad weather and a place to rest and recover.
- 11 Within the Canterbury region, DOC provides:
- 191 Huts
 - 38 Shelters
 - 21 Campsites
 - 229 Toilets (with 1 or more pans).

Service Standards

- 12 In general, DOC facilities are more basic than their private sector counterparts.
- 13 With respect to huts, all DOC huts are more basic than a backpacker hostel – e.g. they do not have showers, hot water, cooking utensils, laundry facilities or bed linen, and visitors cannot buy food or equipment.
- 14 While each hut is unique, the facilities and services provided in or near huts are categorised into five service standards, ranging from ‘Basic’ with minimal amenities and ‘free-to-use’, to ‘Great Walk’ with comprehensive amenities and hut fees in excess of \$50 per person per night.
- 15 A comparable service standard categorisation and fee structure is also applied to DOC’s campsites, with amenity levels at a ‘Basic’ campsite closely corresponding to those at a ‘Basic’ hut.
- 16 As a rule, the service standard applied to a hut or campsite relates to the level of user demand at that site – the greater the number of users per annum, the higher the service standard that will be applied. For example, ‘Basic’ huts or campsites have been assessed as receiving fewer than 1000 users per annum.

Waste

- 17 All DOC visitor facilities generate and concentrate waste to a greater or lesser degree according to their levels of visitation. Waste types generated at backcountry huts are:
 - Human waste (faeces and urine)
 - Waste water (termed ‘greywater’ or ‘sullage’) from hand washing, body washing, dish washing, cleaning and clothes washing
 - Food waste
 - Solid waste or waste that does not fall into the other categories.

Dwelling Houses

- 18 Huts are designed for over-night stays and as such are always fitted with bunks, and typically equipped with cooking benches, sinks and hand basins. In contrast, shelters are not designed for over-night stays, and consequently are never fitted with bunks and tend to be empty structures with rudimentary bench seating; the exception to this are shelters located within campsites, which may be equipped with cooking benches, tables and seats, sinks, wood stoves, showers, etc.
- 19 While DOC huts provide accommodation, they do not meet the definition of a 'dwelling house' as used in the pLWRP. Unlike similar facilities in the private sector, DOC huts and campsites are neither designed for, nor provided for, long-term occupation. The number of consecutive nights that a visitor may stay at any given DOC hut or campsite is restricted, with restrictions varying from site to site based on factors such as the level of user demand or local body by-laws.
- 20 It is not possible for someone to legally occupy a DOC hut or campsite as their residence – ie live there permanently/long term. Given this, it can be concluded that if a hut cannot be a residence, then it cannot be deemed a 'dwelling house' under the proposed region-wide rules.

GREYWATER DISCHARGE

- 21 Any DOC facility that provides for over-night stay by visitors can be expected to generate greywater (sullage), and this greywater must be discharged via some means or other.
- 22 Greywater contaminant concentrations in back-country huts and campsites differ from typical household greywater because of the variability in the sources of greywater and because, typically, there is no laundry activity. Contaminants of particular concern at DOC facilities are biological oxygen demand related to the breakdown of organic matter which can cause malodours and septic conditions, and chemicals in detergents and soaps such as sodium, which damages soil structure, and phosphorus, which modifies plant ecology.

Discharge Solutions

- 23 It is a requirement of DOC's "Hut Procurement Manual" that any discharge to the environment from a greywater treatment and disposal system must comply with the relevant regional plan. The rules in the relevant regional plan must be checked as part of the hut planning and design process.
- 24 The polluting effects of greywater discharge depend largely on patterns of hut or campsite use. Consequently, DOC designs greywater discharge solutions for its huts and campsites based on annual patterns of use; specifically:
- average daily sullage flows during the peak week of occupancy
 - lower sullage flows of the remainder of the year.
- Through the analysis of various records such as hut book entries and warden's logs, these usage patterns are well understood at each site, and are typically expressed as users per annum.
- 25 At back-country huts and campsites where annual user numbers are low – ie fewer than 1000 per annum - the traditional method for discharging greywater involves the visitor filling a container from the water supply, washing, and then discarding the washing water onto the ground surface well away from the hut, shelter or campsite, and from any water bodies and watercourses. This method of greywater discharge is the norm at 'Basic' standard huts and campsites.
- 26 As part of routine hut and campsite inspections, the immediate environs of all huts and campsites are inspected by DOC field staff for evidence of environmental impact from greywater discharge. Inspections follow the "Hut Inspection SOP" to ensure consistency across time and place. Decades of such inspections across a wide diversity of low use sites has conclusively established that the practice of discarding greywater to the ground surface has barely noticeable effects, and as such is a sustainable solution.
- 27 At sites where user numbers are greater than 1000 per annum, DOC provides engineered solutions ranging progressively from a dedicated outside washing tap, to an outside sink for washing, to ultimately an inside sink, according to the assessed number of users.

- 28 At the lower end of this band, (1000-2000 users per annum), the greywater from an outside tap irrigates the ground in the locality of the tap, while the greywater from outside or inside sinks requires a discharge system, usually a soak pit.
- 29 A soak pit is used to soak greywater to the surrounding ground. A typical DOC soak pit comprises an excavation approximately 1,200mm deep by 750mm in diameter, filled with large stones and covered with earth. Hut greywater is piped to the pit, where it percolates through the stones to the surrounding soil. Soak pits do not provide any direct treatment of the greywater and are based on the principle that treatment occurs as the greywater passes through the surrounding soil. The correct functioning of soak pits is also assessed as part of the hut inspection SOP.
- 30 At the higher end of this band – ie sites with medium (2000-4000 users per annum) to high numbers (more than 4000 users per annum), more sophisticated solutions include discharging greywater from sinks to a grease trap, with the discharge from the grease trap going to soak pit, or to a septic tank with septic tank effluent discharging to a soak pit or to a soil soakage field. Again, the correct functioning of these greywater systems is assessed as part of the hut inspection SOP.

Permitted Activity status for greywater discharges from DOC huts and shelters

- 31 Decades of routine site inspections have conclusively established that greywater discharge from DOC huts and campsites results in minimal environmental impact.
- 32 While DOC huts and campsites are not 'dwelling houses', the department manages greywater discharge at its facilities to the same standards as dwellings. It can therefore be stated that greywater currently being discharged from DOC facilities within Canterbury would meet the requirements of the proposed Permitted Activity rule.
- 33 The implications for DOC should greywater discharge onto or into land require resource consent are substantial. Given the large number of facilities operated by DOC, and the diverse and remote locations where they are often sited, experience indicates the resource consent process could be expected to cost a minimum of two thousand dollars per facility. As an illustration, the cost of obtaining individual consents for just the 116 'Basic' standard huts and campsites operated by the Department would

amount to several hundred thousand dollars, and likely result in the closure of a number of facilities. Across the region, in excess of 200 facilities would be affected.

- 34 While obtaining a 'global' consent may represent an option for reducing these costs, DOC's experience is that this approach inevitably costs many tens of thousands of dollars. For example, obtaining a Canterbury region-wide consent 'To discharge contaminants (sediment) to water' (CRC110324) cost the Department in excess of \$25,000 in professional fees, staff time, disbursements, and consent fees.

TOILETS

- 35 As a rule, DOC provides toilets at all facilities that provide for over-night stays – ie huts and formally designated campsites. The exceptions to this rule are very remote and very small bivvies' which receive minimal use, where visitors are expected to manage the impact of their human waste according to accepted best practice – ie carried out in secure containers or buried at least 50 meters from water, tracks and campsites.
- 36 Toilets are also provided at some shelters, picnic areas and car parks.
- 37 Within the Canterbury region, DOC provides 229 toilet facilities comprising one or more pans.

Planning

- 38 With respect to the provision of toilets, DOC has Standard Operating Procedures (SOP's) and Guidelines that inform decision making throughout the country and ensure consistency in the standard of service delivery. It is a DOC requirement that all such documents are consistent with the relevant standards.
- 39 All SOPs and guidelines that cover waste water are consistent with AS/NZS 1547:2012 "On-site domestic wastewater management", and AS/NZS 1546.1:2008 & 1546.2:2008 "On-site Domestic Waste Water Treatment Units". Adherence to these standards should ensure that consent is not required for pit and composting toilets.
- 40 Due to the remote nature of most DOC facilities, connecting toilets to reticulated treatment systems is not an option. Consequently, alternative solutions appropriate for a wide diversity of sites have been devised and formalised in two SOPs: "Toilet

Standards for Back Country Huts (New or Replacement)” and “Hut Procurement Manual”. These documents are reviewed and revised on a regular basis to ensure current best-practice is being implemented at DOC facilities. “Toilet Standards for Back Country Huts (New or Replacement)” provides clear procedures for:

- Site Investigations
- Designing toilet solutions
- Selecting a standard solution
- Monitoring human waste loads

41 Site investigations include:

- An assessment of the number of overnight visitors and the number of day visitors to the site to determine the design ‘User Numbers’;
- A review of Departmental plans, regional council plans and iwi plans to Identifying regulatory requirements; and
- A detailed characterisation of the site in terms of topography, soils, ground water, surface water and land cover.

42 The SOP identifies four generic toilet solutions as suitable for use at DOC sites:

- Pit Toilets
- Containment Toilets
- Septic Tank Systems
- Composting Toilets

43 Pit, containment and septic systems are designated ‘Standard’ solutions, and are used routinely throughout the country; in contrast, composting toilets are rarely used. I will address the reason for this later in my evidence. As a general rule, pit toilets are used at sites with low-medium usage, and containment toilets and septic systems at sites with low-high usage.

44 With respect to selecting the exact spot on which to build a toilet, the “Hut Procurement Manual” provides clear guidance on:

- Location and orientation of toilets with respect to huts, vegetation and prevailing wind
- Distance from both surface and ground water.

- 45 The SOP stipulates that where not specified otherwise in Departmental or regional plans, a pit toilet or land application area for septic tank effluent or other effluent shall:
- Be sited greater than 20 metres horizontally from any surface water or wetland
 - Be sited greater than 20 metres horizontally from any ground water well supply
 - Have a separation distance of at least 600mm between the waste application surface – ie the bottom of the pit or soakage trench - and the maximum ground water level.

Pit Toilets

- 46 The definition of ‘pit toilet’ under the pCLWRP rules is one “...constructed over a hole dug in the ground surface, which human excrement is disposed directly into...”. Under this definition and the proposed rules, a pit toilet can be expected to discharge untreated human excrement onto or into land.
- 47 As noted above, pit toilets are a standard solution at DOC huts and campsites with low to medium levels of usage. For higher levels of usage, containment toilets are the recommended solution.
- 48 Both pit toilets and containment toilets involve excavating a pit, and erecting a toilet superstructure over the pit comprising a shelter, pedestal, and usually an enhanced ventilation system. Pit and containment toilets are simple, practical and cost-effective solutions to human waste management at remote facilities, and require no supporting systems such as electricity or reticulated water.
- 49 While pit toilets result in discharge of untreated excrement, containment toilets are specifically engineered to prevent any discharge to the environment, and thus do not appear to be affected by the proposed rule. Containment toilets, in addition to the superstructure, comprise a watertight container - also known as a vault – that is placed inside the pit. The vaults are designed to receive and store all human waste, and like septic systems, must be emptied from time to time.
- 50 Where vehicle access is not possible, the contents of the vault are pumped into a receptacle, which is then flown to a hazardous waste tanker at the nearest road end. Depending on the site, usually at high-altitude alpine huts, the vaults are mounted

above ground in a supporting frame, and when full are either pumped out on site or the vault itself is disconnected from the superstructure and flown out to the nearest road end for pumping to a tanker. DOC currently operates 81 containment toilets in the Canterbury region.

- 51 In respect of pit toilets as addressed under the proposed rules, DOC currently operates 112 of these toilets within the Canterbury region. The dimensions of the pits - and therefore their capacity and service life - are specified within the DOC standard according to the levels of usage at the site. When the pit has reached capacity, the superstructure of the toilet is removed and the pit sealed and covered over. At the same time, a new pit is excavated, the superstructure is placed over it, and the cycle is repeated.
- 52 Routine inspections have established over several decades that pit toilets, when carefully designed and located according to the conditions existing at each site, result in minimal environmental impact. It can be stated with a high degree of confidence that all DOC pit toilets would comply with the proposed rules as currently written.

Composting Toilets

- 53 The term composting toilet is used to describe a variety of waterless toilet systems in which biological decomposition of organic matter by bacteria and fungi is encouraged in order to breakdown faeces. Composting toilets typically comprise one or two containment chambers in which the composting takes place, and produce a nutrient rich, odour and pathogen-free humus which can be disposed of safely on site.
- 54 Composting describes the range of biological processes by which organic matter is broken down into simple organic compounds by micro-organisms such as bacteria, fungi and insects. Composting can be either aerobic or anaerobic. Different organisms are responsible in each case, resulting in different chemical changes and operating temperatures.
- 55 Anaerobic composting is also known as digestion and occurs in the absence of oxygen. The active bacteria break down organic matter into gases which are responsible for the unpleasant smell associated with this type of composting. While a small amount of heat

is produced, anaerobic composting results in temperatures not much higher than ambient temperatures.

- 56 In aerobic composting, oxygen-using micro-organisms break down the organic matter, with the production of odourless gases and water as well as a considerable amount of heat. Heat production is almost 20 times that achieved during anaerobic composting. As a result, a well-aerated compost can reach temperatures of over 65° C in ideal conditions.
- 57 The main advantage of aerobic over anaerobic composting is the higher temperature achieved which speeds up decomposition and death of disease-causing organisms (pathogens). Once material is deposited, aerobic composting predominates but almost immediately the level of oxygen begins to decline.
- 58 Composting toilets attempt to maintain the period of aerobic composting as long as possible by promoting air entry through vents, air channels and under floor venting. As material becomes more deeply buried and oxygen is used up then anaerobic decomposition begins to take over. In almost all composting toilets, a combination of the two processes will be occurring at different locations within the compost mass. Due to several factors, the temperature in traditional composting toilets rises no more than 5-10 °C above ambient air temperatures – similar to that of anaerobic composting. As a consequence, the composting process and disease organism die-off is slow and a function of months rather than days.
- 59 In principle, composting toilets represent a useful and compelling alternative to the three standard back-country toilet solutions, and consideration of their use is provided for in the DOC SOP “Toilet Standards for Back Country Huts (New or Replacement)”. In practice, due to their design and operating requirements, and the associated higher costs of construction and operation, composting toilets do not represent a viable solution for the majority of DOC sites, and there are currently no examples in use in the Canterbury region.

- 60 While composting toilet systems have proven themselves in a number of controlled situations, systems which operate reliably across the majority of environments have yet to be developed. This is because composting toilets are essentially a dynamic biological process, and a wide range of factors can influence the rate, nature and effectiveness of the composting achieved.
- 61 Consequently, successful design and operation of composting systems depends on addressing four key parameters in their initial design, and their on-going operation and maintenance. The parameters are:
- Availability of oxygen in the compost mass
 - Carbon: nitrogen ratio of the compost mass
 - Moisture content of the compost mass
 - Heat loss from the compost mass.
- 62 Composting toilets can only be successful in decomposing and stabilising human waste if these parameters are actively managed within specific tolerances.
- 63 Actively managing these factors requires installation and maintenance of ancillary systems, and implementation and performance of additional maintenance procedures. The demands of these systems and procedures present significant challenges for the majority of DOC facilities given the remoteness and climatic conditions of their locations, and the absence of staff permanently on site to undertake the continuous maintenance tasks.
- 64 Consequently, given the above, and the current and limited data on composting toilet performance in New Zealand, the DOC standard recommends that they be considered only in the following situations:
- Where an interested and motivated person can attend daily to support operation and maintenance of the system
 - Minimum average daily use is at least 5 uses/day in the low season
 - Minimum mean daily temperature does not fall below 4° C Cost effective to supply bulking agents (to control the carbon: nitrogen ratio), and dispose of the finished compost (either in-situ or off-site).

65 The above notwithstanding, in specific locations composting toilets represent a viable solution for the management of human waste, a solution that in some important respects is superior to other toilet systems in terms of environmental impacts. As such, their use should be a Permitted Activity

CONCLUSIONS

66 Greywater contaminant concentrations in back-country huts and campsites differ from typical household greywater because of the variability in the sources of greywater and because, typically, there is virtually nil laundry activity.

67 While DOC huts and campsites are not 'dwelling houses', DOC manages greywater discharge at its facilities to the same standards as dwellings – ie AS/NZS 1547:2012 "On-site domestic wastewater management". It can therefore be stated that greywater currently being discharged from DOC facilities within Canterbury would meet the requirements of the proposed Permitted Activity rule.

68 The implications for DOC should greywater discharge onto or into land require resource consent are substantial given the large number of facilities operated by DOC, and the diverse and remote locations where they are often sited..

69 The proposed permitted activity rule for the use of pit and composting toilets is supported.



Jeffrey Brian Dalley
4 February 2013