

Otago Regional Council
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Attention: Hilary Lenox

Dear Hilary

Technical Review to Inform Notification Decision: Smooth Hill Landfill - Appendix 9 - Surface Water Assessment

Introduction

- 1 Dunedin City Council (DCC) proposes to establish a new Class 1 landfill, to be located at Smooth Hill to the east of Dunedin Airport. DCC has applied to Otago Regional Council (ORC) for a range of resource consents required for the establishment and operation of the proposed landfill.
- 2 Tonkin & Taylor Limited (T+T) has been engaged by ORC to undertake a technical review of the surface water assessment lodged by DCC in support of its resource consent applications.
- 3 The purpose of this report is to set out the findings of our technical review of DCC's surface water assessment to inform a decision to be made by ORC regarding notification of the resource consent applications.
- 4 The following documents have been considered as part of this technical review:
 - **Dunedin City Council - proposed Smooth Hill Landfill: Section 92 review - requests for further information:** Report prepared for ORC by T+T, September 2020 (referred to as the s92 request).
 - **Appendix 3- Landfill Concept Design Report:** prepared by GHD August 2020, updated May 2021.
 - **Appendix 4: Concept Design Plans:** prepared by GHD August 2020, updated May 2021.
 - **Appendix 8 – Groundwater Report:** prepared by GHD August 2020, updated May 2021 (referred to as the Groundwater Report).
 - **Appendix 9 – Surface Water Assessment Report:** prepared by GHD August 2020, updated May 2021 (referred to as the Surface Water Report).
 - **Appendix 11 Ecological Impact Assessment Report:** prepared by Boffa Miskell August 2021, updated May 2021 (referred to as the Ecology Report).
 - **Appendix 19 Preliminary Site Investigation Report:** Prepared by GHD, May 2021 (the PSI Report).
 - **Smooth Hill Landfill Draft Landfill Management Plan.** Prepared for Dunedin City Council by GHD (Draft LMP).

- **Smooth Hill Landfill Draft Conditions.** *Provided by ORC as part of its further s92 response of 4 August 2021 (referred to as the Draft Conditions).*
- 5 This technical review has been undertaken by Peter Cochrane, a Principal Environmental Scientist at T+T. Peter has reviewed the aspects of the application relating to effects on surface water quality and quantity.
- 6 This report has been prepared in accordance with T+T's letter of engagement with the ORC dated 12 November 2019.

Review Scope

- 7 The scope of this assessment covers:
- Effects of construction, operation and closure of the landfill on:
 - o Wetland and surface water hydrology – including changes to flow conditions and water levels in wetlands.
 - o Surface water quality.
 - Our opinion on the effects of the activity on surface water resources.
 - Mitigation measures proposed to address adverse effects.
 - Monitoring.
 - Proposed conditions.

Description of the proposal

- 8 The Smooth Hill Landfill proposal is described elsewhere, but in summary is intended to replace the existing Green Island landfill located in Dunedin.
- 9 The Smooth Hill Landfill is reduced in scale from an original application made in May 2020 as follows:
- A footprint of 18.6 ha instead of the original 44.5 ha.
 - A gross capacity reduced from 7.9 million m³ to 3.3 million m³.
 - Net waste capacity of 6.2 million m³ to 2.9 million m³.
 - The predicted landfill life reduced from 55 years to years to 40 years.

Receiving Environment

- 10 The proposed landfill will be in the upper catchment of the Ōtokia Creek, which flows into the sea at Brighton.
- 11 The existing land use at the site and surrounding area is plantation forestry with the last harvest of trees occurring in 2017. Based on a range of historic aerial photographs provided in the PSI Report, it appears that there has been only one forest crop rotation, with land use prior to Ca 1980 being pastoral.
- 12 The Applicant states that catchment outside of the landfill footprint will continue to be used for plantation forestry and this activity is likely to exert a strong influence on freshwater resources both within and downstream of the landfill.
- 13 The landfill Designation area contains ephemeral watercourses with no defined channels although there is water at or near the surface as indicated by the presence of wetland vegetation.
- 14 The original application identified the watercourse between the designation site and McLaren Gully Road as being perennial, however, its subsequent description in the Ecological Report described this reach as intermittent (surface water is present for some but not all of the year).

- 15 The point at which the watercourse transitions from ephemeral to intermittent has not been identified in the Ecology Report and would be difficult to define due to the wetlands occupying the valley floors and the fact that this boundary may shift from year to year in response to climate variability.
- 16 At some point downstream of McLaren Gully Road the watercourse becomes perennial (continuously flowing) and that point was also not identified in the Ecology Report. However, in the meeting between T+T & GDH on 28 July 2021 to discuss the Groundwater Report, GHD indicated that the perennial flows of the Ōtokia Creek occur approximately 1 km downstream of the toe of the proposed landfill.

Evaluation of Effects

- 17 Construction of the landfill will remove a very small reach of zero order tributary at the top of the catchment, and construction earthworks will encroach well within 100 m of what the Ecology Report refers to as a 'swamp wetland' (immediately below the landfill toe).
- 18 Landfill construction and operation is likely to lead to an alteration in water supply to the 'swamp wetland' and potentially to a downstream 'valley floor marsh wetland', which occupies most of the valley bottom draining the designation site to Ōtokia Creek (see Figure 2 in the Ecology Report).
- 19 The Ecology Report concludes that there will be very low level of effects with respect to the loss of freshwater habitat. This conclusion was based on a negligible magnitude of effect on moderate ecological values.

Wetland Hydrology

- 20 Section 5.1.4 of the Ecology Report concludes that landfill construction is likely to lead to an alteration in water supply to the 'swamp wetland' (immediately below the landfill toe) and potentially the downstream 'valley floor marsh wetland' (which occupies most of the valley bottom draining the designation site to Ōtokia Creek).
- 21 Potential changes to the hydrology of these wetlands, have been summarised in the Surface Water and Groundwater Reports as:
 - Temporarily increased runoff in areas where the landfill liner is initially exposed.
 - Permanently reduced groundwater recharge from beneath the landfill footprint as a result of landfill lining, capping, and interception of leachate and other runoff.
 - Permanently increased groundwater recharge from areas outside the landfill footprint, due to groundwater infiltration from the stormwater Attenuation Pond.
 - Permanently reduced runoff from the landfill footprint due to increased evapotranspiration (when the cap is ultimately grassed).
- 22 Section 5.4.1 of the Ecological Report concludes that these may have indirect effects on wetlands throughout the landfill lifespan and the hydrological changes will largely persist even following landfill closure.
- 23 The conclusions reached in the Ecological Report provide a full and reasonably accurate assessment of effects on wetland hydrology. Some of these effects (potentially reduced groundwater discharge to the swamp wetland) have been quantified in the Groundwater Report, whereas others (such as the degree of hydrological change in the wetlands themselves) have not been quantified and are described qualitatively.
- 24 The Surface Water and Groundwater Reports acknowledge that there is likely to be reduced groundwater recharge to the wetland immediately downstream of the landfill and point to the

use of soakage from the base of the Attenuation Pond to mitigate this effect¹. The Groundwater Report also recommends monitoring of water levels in the wetland to monitor any long-term changes in water levels associated with landfill development (refer to Table D1 in the Groundwater Report).

- 25 While I agree that there is a potential adverse effect on wetland hydrology, I am unable to conclude if this effect (either by itself or following the implementation of the proposed mitigation measures) would be minor or less than minor for several reasons:
- The magnitude of this effect on the hydrology (surface water levels and changes of water level and hydro-period) of the wetlands has not been quantified or evaluated.
 - The extent to which soakage from the base of the attenuation pond will mitigate this effect is not quantified as there are no details in the Surface Water Report, Concept Design Report or Concept Drawings on how the Attenuation Basin would achieve this and maintain recharge in the long-term.
 - Whether the discharge from the Attenuation Pond's low-level outlet will affect wetland hydrology.
- 26 This uncertainty could be addressed by the Applicant, as a part of its ongoing communication with the Council, or in evidence should the applications be heard.

Surface Water Hydrology

- 27 The Surface Water and Groundwater Reports conclude that surface water bodies in the immediate vicinity of the site are ephemeral and become permanent downstream of the landfill site. Section 3.5 of the Ecology Report concludes that flows become permanent downstream of the landfill's designation boundary.
- 28 Both the Groundwater Report and Surface Water Report acknowledge that construction and operation of the landfill will result in reduced surface water runoff. This has the potential to result in permanent flow conditions in the valley floor to move downslope.
- 29 The Groundwater Report assesses this downslope movement of the perennial stream flows to be in the order of 45 m, which in my view is a reasonable assessment.
- 30 The Surface Water Report concludes that overall, the effects of the landfill on surface water hydrology will be less than minor. However, this assessment is made in the context of the catchment as a whole and in the context of forestry operations having a potentially more significant effect on hydrology (and water quality). In other words, the magnitude of effect is assessed as minor, when compared to forestry as a neighbouring land use and because the landfill comprises only a small part of the catchment overall.
- 31 The Surface Water Report discusses the effects of the landfill on flood flows – and concludes that the change in land use will have a less than minor effect on flood flows at McLaren Gully Road and further downstream. I agree with this conclusion.

Effects on Surface Water Quality

Investigations

- 32 The Applicant has undertaken a very limited programme of investigations to document groundwater and surface quality². The results of this are reported in the Groundwater Report (Table A5).

¹ The Surface Water Report (page 12) acknowledges that discharges from the Attenuation Pond will be further attenuated in the wetland immediately downstream.

² Having an understanding groundwater quality is important because surface water quality will be influenced by groundwater quality.

- 33 The Groundwater Report proposes further data collection over a period of 18 months to establish baseline water quality conditions, and in Table D1, the Groundwater Report proposes quarterly monitoring of groundwater and monthly monitoring of surface water (when flows occur). The Surface Water Report (page 26) recommends a longer period of 36 months of monitoring to establish baseline conditions.
- 34 Quarterly monitoring of groundwater for 18 months is likely to be inadequate. It will result in a dataset containing six data points and would augment an already very limited data set of only two sampling rounds.
- 35 The frequency of groundwater monitoring proposed in the Groundwater Report is insufficient to understand groundwater quality and variability. For instance, the Groundwater Report comments on high concentrations of nitrate in groundwater for some bores and attributes those to activities related to the catchment's forestry activities (fertiliser application, clearing of gorse). Presuming that these are in fact the cause, these activities will no longer occur in the catchment, and groundwater quality may change as a result. This underpins the need for the establishment of a good baseline of water quality from which to monitor and assess any changes.
- 36 Table D1 of the Groundwater Report indicates monthly monitoring of three surface water sites, which if undertaken over a period of 36 months prior to construction would provide a sufficient dataset from which to monitor and assess any changes because of the landfill's discharges to surface water.
- 37 The surface water report recommends the establishment of trigger levels, to respond to changes in water quality and take action if necessary and suggests some metrics (95th percentile) as trigger levels. While I agree with the approach to gather data and develop a suite of trigger levels, I think it is premature to establish those levels in the absence of a suitable baseline dataset.
- 38 I consider that this can be managed through consent conditions requiring pre-construction monitoring for the minimum periods of time recommended in the Groundwater and Surface Water Reports (monthly monitoring for 18 and 36 months for groundwater and surface water respectively) and the subsequent provision of a report that assesses the dataset and proposes trigger levels for key parameters that are protective of surface water quality.

Construction Effects

- 39 Earthworks associated with the construction of the landfill (and development of subsequent stages) has the potential to generate sediment, entrain it in stormwater and have this discharged from the site.
- 40 The Applicant is proposing the adoption of standard erosion and sediment control measures, with specific measures to be adopted through the design and construction phases.
- 41 The Surface Water Report and Drawings identify four key sediment retention devices (Sediment Retention Ponds) but makes it clear that other measures will need to be put in place to adequately manage sediment.
- 42 I agree with this approach and consider that this effect can be managed through consent conditions requiring the development and implementation and regular updating of an erosion and sediment control plan and monitoring, as proposed by the Applicant.

Operation and Closure

- 43 The Applicant has clearly set out its objectives for the operation of the site in regarding stormwater management, including separation of clean stormwater, and the diversion of potentially contaminated stormwater to the leachate collection system.

- 44 From the completion of Stage One, stormwater from upstream of the landfill will be diverted to a proposed Attenuation Pond located to the south of the landfill. The purpose of the Attenuation Pond is to provide soakage to groundwater, and to attenuate flows from the site before it discharges to the valley floor upstream of the swamp wetland identified in Figure 2 of the Ecological report.
- 45 The Attenuation Pond is proposed to have a low-level outlet to control flows and a spillway to enable the 1% AEP flood event to discharge from the site safely.
- 46 Although the pond will not provide water quality treatment, the Surface Water Report states that water quality in the pond will be continuously monitored, and the low-level outlet will be fitted with a shut-off valve to enable the consent holder to contain and manage situations where stormwater becomes contaminated.
- 47 This is a reasonable approach and although continuous monitoring of electrical conductivity, pH and ammonia is supported, the Surface Water Report and draft consent conditions are silent as to how this would be implemented.
- 48 Monitoring of this nature should consider setting-up of automatic alarms to warn the landfill operator of situations of potential contamination and include response processes to act to immediately stop any discharge and to take the necessary remedial steps. These are important procedures that require a lot of detail to be worked through and are appropriately specified through a detailed monitoring plan and contingency plan.
- 49 During the operation of the site the Applicant is proposing the establishment of four Sediment Retention Ponds (SRPs) to treat runoff from areas of the site where earthworks are likely to occur on an ongoing basis (soil stockpiles for instance).
- 50 SRP 4 drains an area of the site where the landfill gas plant and refuelling areas are located. I was unable to find out whether this area will become paved or remain unsealed. I suspect that because this would be an area of relatively high traffic volume that it would in time need to be paved. If this is the case the construction of a sediment retention pond draining this area would be inappropriate and another device (that could manage higher flows from paved surfaces, and potentially hydrocarbon contamination) would be a more appropriate solution. This is an area of uncertainty in the application documentation that would benefit from clarification from the Applicant. This could be provided as a part of an ongoing communication with the Applicant or addressed in evidence should the applications be heard.

Monitoring

- 51 Proposed monitoring sites for groundwater and surface water are set out in Drawing 12506381-C309. For surface water, it provides reasonable coverage downstream of key discharge points and off-site. The range of parameters is set out in Table 5 of the Groundwater Report, with the Surface Water Report including the analysis of suspended solids, turbidity and flow. These parameters are all included in the Attachment 1 to the Proposed Consent Conditions.
- 52 The range of parameters proposed for monitoring were selected based on those most likely to be derived from landfill leachate from municipal solid waste facilities in New Zealand, along with suspended sediment and turbidity.
- 53 There appears to be little thought to considering how these parameters are to be measured, and how they would inform the consent holder and others about the effects of the landfill on groundwater and surface water quality. For instance, the parameters do not specify whether they refer to the total fraction or dissolved, some parameters such as hardness that affect toxicity in aquatic environments are missing from those requiring monitoring, and some (such as volatile and semi-volatile organic compounds) appear to commit the Applicant to an

ongoing programme of monitoring across groundwater and surface water with possibly very little benefit.

- 54 This is an element of the assessment that will require further consideration by the Applicant and is discussed further under proposed conditions.

Proposed conditions

- 55 Condition 17: is supported in principle but with the amendment to monthly monitoring as proposed in the Surface Water Quality Report.
- 56 Condition 18: The intent of this condition to develop trigger levels at each monitoring location is supported. However, the stated purpose of the trigger levels “to detect any leachate in advance of waste being accepted” is not supported as the trigger levels are predicated on detecting leachate, rather than avoiding potential adverse effects on surface water quality.
- 57 Condition 19: This condition in its current form, along with the parameters set out in Attachment 1 is insufficient to provide certainty that monitoring data will be collected in a consistent manner, is sufficiently comprehensive to enable assessment on effects on surface water quality to be confidently undertaken and will be undertaken to appropriate quality assurance standards. Additional information on this matter should be provided by the Applicant as part of the ongoing communication, in an amended condition, or in evidence should the application be heard.

Conclusions

- 58 The proposal is likely to result in changes to the hydrology of surface waters and wetlands at and immediately downstream of the landfill. These effects are likely to include changes to inflows into the swamp wetland immediately downstream of the site.
- 59 While the applicant has been able to estimate likely changes to groundwater inflows into bottom of the valley that contains the wetlands, it has not quantified other changes, such as likely discharges from the toe bund or from the Attenuation Pond.
- 60 As a result, I am unable to conclude whether potential adverse effects on wetland hydrology would be minor or less than minor.
- 61 The implications of this need to be considered in the context of both the Regional Plan, and particularly NES-FM, which sets out a policy to protect wetland values (Policy 6), and its accompanying Regulations.
- 62 While there are similar uncertainties regarding effects on surface water hydrology, these effects are, from a hydrological perspective, likely to be minor affecting only a small reach downstream of the landfill site.
- 63 Data on groundwater and surface water quality to assess the potential effects of contaminant discharges is limited and the Applicant proposes to collect baseline data on surface water and groundwater over periods of 36 months and 18 months respectively.
- 64 This is supported as it will enable the development of a robust picture of groundwater and surface water quality and enable the development of trigger levels that are protective of surface water quality. However, the draft consent conditions are not (at this point) sufficiently developed to ensure the effects on surface water quality would be less than minor.

Applicability

65 This Report been prepared for the exclusive use of our client Otago Regional Council , with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose, or by any person other than our client, without our prior written agreement.

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7-Sep-21

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