20 December 2019

Bruce Crabbe
Project Director
Bay of Plenty Regional Council

Our ref: 2124648
Your ref:

Dear Bruce

Kopeopeo Canal Remediation Project
Independent Monitor comments – Sediment Validation Report

1 Introduction

As part of our Independent Monitor (IM) role, GHD was requested to provide comments on the technical aspects of the following report prepared by Golder:

- *Validation Report for Sediment Dredging and Placement in Containment Sites Kopeopeo Canal Remediation Project* (December 2019 – Rev C) – the SVP

The report was prepared following review by GHD of earlier versions of the SVR. IM review comments have been addressed and included in the final validation report:

- *Validation Report for Sediment Dredging and Placement in Containment Sites Kopeopeo Canal Remediation Project* (December 2019 – 1894562-005-R-Rev0) – the SVP

2 IM review

The SVR provides a summary of the site works and validation sampling completed during the remediation of the canal. The SVR was reviewed taking into account GHD's experience in conducting and monitoring remedial works, potential community concerns expressed during the project and consistency with applicable MfE guidelines, including Contaminated Land Management Guidelines No.1 *Reporting on Contaminated Sites in New Zealand* (Revised 2011 – the MfE guidelines). Commentary on the key aspects as required for validation reports (Section 3.2 of the MfE guidelines) is presented in Table 1.

Table 1 IM comments on the SVR

Section (as per Section 3.2 of the MfE guidelines)	Comment
Executive summary	The SVR included an executive summary which provided a succinct outline of the purpose of the remedial works and the validation program.
Scope of work	The purpose of the validation program, namely to document compliance with relevant Project conditions of consent and to

GHD Pty Ltd ABN 39 008 488 373
Level 15, 133 Castlereagh Street Sydney NSW 2000 Australia
T 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com **W** www.ghd.com

Section (as per Section 3.2 of the MfE guidelines)	Comment
	present validation and monitoring data was presented in Section 1 of the SVR.
Site identification	The SVR identifies the site and its location in relation to neighbouring areas. A figure was referenced showing the canal and the two containment sites into which the sediments in the canal were transferred.
Site history	The background section outlines the history of activities that led to contamination of the canal and a summary of the works that led to the definition of the area that was remediated.
Site condition and environment	A summary is only required by the MfE guidelines. Section 2 of the SVR presents a description of the area of the canal that was the subject of the remediation as well as the commentary on the surrounding land uses and potential receptors.
Geology and hydrogeology	A summary is only required by the MfE guidelines. Although no information was presented in the SVR on geology and hydrogeology, the IM was aware that these aspects of the environment were taken into account in the planning of the remedial works and logs of the material that comprised all samples collected as part of the validation program were recorded.
Sampling and analysis plan and sampling methodology	Following completion of dredging within a section of the canal, validation samples of the dredged surface were collected. Intially, three samples were collected at segments of 100 metres. Where a sample exceeded the criterion of 60 pg/g ITEQ, a protocol was used to collect additional samples to characterise the sediments in that particular area (second and where necessary a third phase). The samples were collected with the aid of an auger and sampling tube which was driven into the bed of the canal. Samples were logged and processed for laboratory analysis. Laboratory analysis was conducted by AsureQuality, a laboratory accredited by IANZ for dioxin analysis. Where initial validation results failed the criterion of 60 pg/g, the area was redredged and another phase of sampling conducted. Up to three phases of

Section (as per Section 3.2 of the MfE guidelines)	Comment
	sampling were conducted. Two hundred and four primary samples were collected as part of the validation program.
Field quality assurance and quality control	The field quality control program included: • Evidence that the sampling was conducted in a consistent manner using methods that are considered representative of industry standards. • Trip blank analysis. • Duplicate samples to evaluate the precision of the field sampling methods. • Information about the decontamination procedures. Golder collected rinsate blanks to demonstrate the effectiveness of the methods used, Samples were placed in laboratory supplied containers following their collection and submitted to AsureQuality Laboratories under under chain of custody (COC) procedures. The level of field quality assurance and quality control program was implemented in a manner consistent with MfE guidance.
Laboratory QA/QC	The laboratory program included analysis of: • Ongoing Precision and Recovery samples (similar to laboratory control spikes and duplicates). Matrix spike and matrix spike duplicates were not tested owing to the testing of OPR samples. • Inter duplicate samples (submitted to a second laboratory) to evaluate the precision of the primary analytical laboratory method. • Method blanks. Golder evaluated the laboratory representativeness, accuracy, comparability and precision.
QA/QC data evaluation	Golder applied appropriate, recognised means to evaluate the data collected through comparison of relative percent differences (for duplicate pairs), documentation of field procedures and checking recoveries of quality control samples such as OPR samples. The amount and type (and resultant evaluation) of quality control data demonstrated that the data was collected in a

Section (as per Section 3.2 of the MfE guidelines)	Comment
	consistent, technically robust manner and could be relied upon for the purposes of validating the success of the remedial works.
Basis for guidance values	A guidance value of 60 pg/g ITEQ dioxin was selected as the validation criterion. The remediation area was to be considered validated when the 95 percent upper confidence level of the arithmetic mean was less than the nominated criterion and no individual sample result had a concentration greater than 120 pg/g ITEQ. The validation criterion was used to estimate the volume of material to be remediated. The criterion was selected on the basis of a human health risk assessment which calculated that a sediment dioxin concentration of 60 pg/g ITEQ would be protective of human health with respect to the dermal contact and eel ingestion pathways.
Results	Section 5.5 of the SVR presented a discussion on the analytical results generated as part of the validation program. The final validation set comprised 213 sediment sample results which were used to calculate a 95% UCL of 39 pg/g ITEQ.
Site characterisation	Information used to demonstrate the effectiveness of the remediation included the hydrographic surveys, visual inspections of sediments following dredging and validation sampling and analysis. The 95% UCL of the arithmetic mean of the average dioxin concentration was used to characterise the remnant material following sediment dredging. This approach was robust and was consistent with MfE guidelines.
Remedial actions	Section 3 of the SVR presents a summary of the remedial works that were conducted, namely the dredging of sediments along a 5.1 km stretch of the canal where sediments with concentrations greater than 60 pg/g ITEQ had been identified. The dredging was conducted along seven sections along the canal. A volume of 34 465 m^3 of sediments was removed during the remediation. This was estimated using hydrographic surveys. The dredged material was transferred via an HDPE pipeline to Geobags ™ that were located in one of two engineered containment cells. Prior to discharge to the Geobags ™ the sediment was screened for the presence of taonga and kōiwi and oversize material. The sediment was then dosed with a flocculent

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	and mixed with wood pellets and lime before final transfer to the Geobags ™. Filtrate released from the Geobags ™ was collected in sumps within the containment cells prior to discharge as per the conditions of consent to the canal. All sediment dredged from the canal was discharged to the containment cells. All oversize material was collected in one cubic metre bulker bags which following cessation of dredging activities, were placed into the containment cells. Water released as part of the draining of the Geobags ™ was released to the canal as per the conditions of consent.
Validation	The range of dioxin results recorded in the final validation data set was 20 (the limit of reporting) to 160 pg/g ITEQ. The 95% UCL of the average concentration for the final validation set was 39 pg/g ITEQ. This was less than the consented validation target of 60 pg/g ITEQ. Only one sample exceeded the maximum consented value of 120 pg/g ITEQ (a concentration of 160 pg/g). The area in which this sample was collected was deemed to have been remediated to the extent practicable as there was no visible evidence that the targeted sediment was present, the dredge operator noted that dredging had advance to a hard base and verification sampling by the independent monitor did not identify any visible evidence of the targeted material.
Site management plan	The remedial works were conducted in accordance with a Construction and Environmental Management Plan (Waiotahi 2017) that was prepared to conform to the consent conditions. Apart from some minor incidents (which were swiftly dealt with), there were no incidents that could have resulted in environmental harm. A monitoring program of dioxins in eel tissue will be undertaken for a period of up to five years to verify that uptake of dioxins in eels does not occur to a degree that could constitute an unacceptable risk of exposure.
Conclusions and recommendations	The SVR concluded that the validation program demonstrated that the remediation had been effective in removing dioxin contaminated sediments to levels below the target criterion fo 60 pg/g ITEQ within the 5.1 km of the Kopeopeo Canal. The

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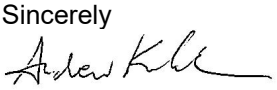
	conceptual site model identified that there was a low risk of exposure for humans to dioxins that may be present in the stop banks along the canal and to eels the come into contact with the residual sediments. Ongoing monitoring of both these exposure pathways was recommended.

3 Concluding remarks

The SVR presented a comprehensive summary of the data that was collected for the validation of the canal dredging program. The data collected as part of the validation protocols established that the dioxin contaminated sediments were remediated to levels less than the nominated criterion of 60 pg/g ITEQ. The SVR contained sufficient information to demonstrate it had been prepared in a manner consistent with the MfE (2011) *Reporting on Contaminated Sites in New Zealand*. The ongoing monitoring of dioxin concentrations in the eels that will be reintroduced into the canal will be an important step in the validation and healing process so that the cultural use of the canal to the community can recommence.

Sincerely



Andrew Kohlrusch

Independent Monitor – Kopeopeo Canal Remediation Project