

BAY OF PLENTY REGIONAL COUNCIL
TOI MOANA

Submission for Kopeopeo Canal Remediation Project

Project Excellence Award - Best Remediation Project (>$1M)

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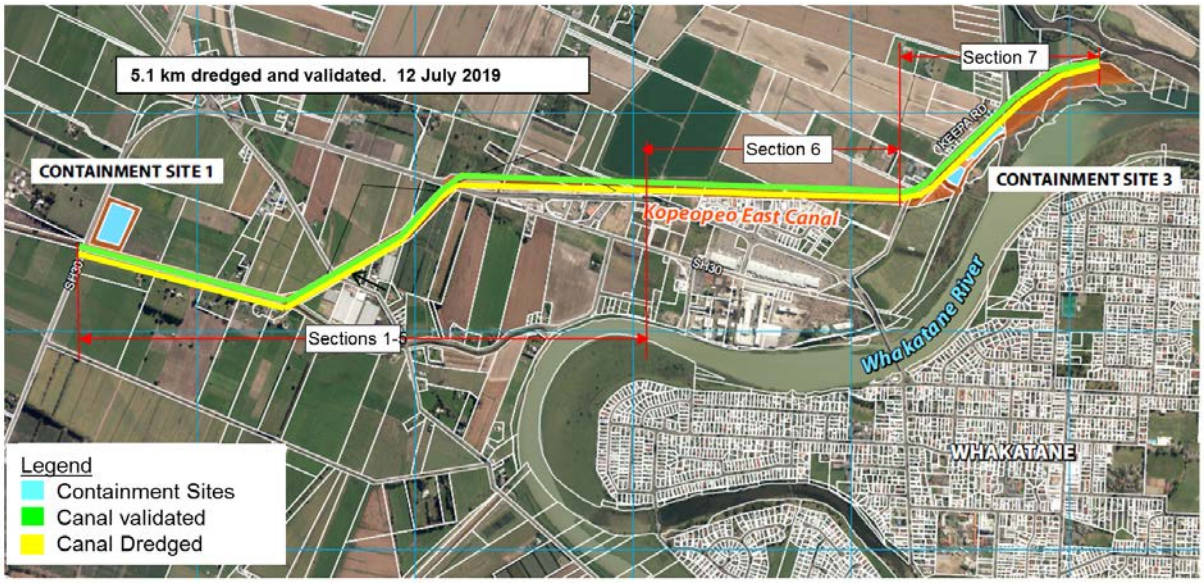
Introduction

The following submission outlines the reasons for submitting this project for a Project Excellence Award for Best Remediation Project (>$1M). The submission structure is based on individual assessment criteria. Given that this project has been a collaborative effort the perspectives of other stakeholder representatives has also been included.

Background

The Kopeopeo Canal is located on the Rangitāiki Plans in the Eastern Bay of Plenty, New Zealand. The purpose of the Kopeopeo Canal Remediation Project was to safely remove elevated levels of dioxin contaminated sediment from the 5.1km of Kopeopeo Canal at its eastern end (Figure 1). The project consisted of physical works to safely remove and securely contain contaminated sediment within two containment sites, followed by bioremediation for up to 15 years. The first phase to remove and safely contain the dredged contaminated sediment has been achieved with the completion of dredging.

While the initial evaluation of remediation options and consultation revealed that the removal and treatment of sediment needed to occur locally, the method for extraction and transportation using excavators and trucks had many members of the community and adjoining landowners concerned over dioxin exposure during and following remediation.



Through further engagement and trials, an alternative method was identified that not only became acceptable to the community but also maintained or enhanced social, cultural and environmental values in the process.

The Kopeopeo Canal Remediation Project cost $21.3 million and has been jointly funded by Bay of Plenty Regional Council and the Ministry for the Environment through their Contaminated Site Remediation Fund.

Response to individual criteria

A remediation project largely finalised within the last 2 calendar years

Project investigations and planning commenced in 2005 and consents were granted in late 2013. These consents were appealed in 2014. From 2014-2016 a second round of consultation and trials were carried out and variations to consents were granted for a revised method of extraction, transfer and containment.

Actual remediation works commenced in early 2017 with construction of the first of two purpose-built containment sites (Figures 1 and 2). Civil construction works were delayed in April 2017 due to Cyclone Debbie and recommenced in October 2017. Dredging commenced in January 2018 (Figure 3) and final dredging and canal validation was completed in July 2019 (Figure 4).



Figure 1: First containment site (Containment Site 1)



Figure 2: Second containment site (Containment Site 3)



Figure 3: Start of dredging with cutter suction and pumped transfer methodology



Figure 4: Completion of dredging at end of 5.1km stretch of dredging

Significant attention to environmental, economic and social components

The Kopeopeo Canal is situated within the Rangitāiki Plains and passes through a combination of rural and residential land before discharging into the Whakatane River. The canal forms a significant component of the regional flood conveyance network with rural farmland reliant on drainage functions to support pastoral grazing, a key contributor to the local economy. Due to dioxin impacts to canal sediment, regular canal maintenance dredging could not be carried out. Flood events have been noted to increase in scale and intensity over the last 15-20 years and posed an ongoing threat of dioxin impacted sediment being discharged onto adjoining pastoral grazing land.

Dioxin impacted sediments resulted in dioxins entering the food web and biota (eel tissue). Eel is a traditional food source that is highly prized by local Maori. The Whakatane township is located in the centre of Ngati Awa's rohe with the township population having one of the largest percentages of Maori within a community in New Zealand. Traditional hunting and food gathering are important to Maori. Eel tissue sampling and analysis in the canal led to health advisory warnings being put in place. This has led to effects on cultural and social values within the community.

Remediation works needed to be carried out in accordance to a detailed flood management plan, with modified flood conveyance methods and flow paths put in place for the duration of the remediation works. Remediation works resulted in the removal of over 35,000 cubic metres of sediment from the canal and resulted in improved flood and drainage conveyance.

Remediation targets for sediment quality were developed to be protective of eel tissue concentrations and recreational contact. Hundreds of validation samples were collected as dredging progressed and validated that residual sediment quality in the canal met remediation targets. Long term eel tissue monitoring is in place. Once several rounds of eel tissue monitoring are completed, the health advisory warnings can be removed and eel fishing and consumption can resume.

Conceptual relationship to SuRF ANZ or international SR framework(s)

During 2006, Sinclair Knight Mertz undertook remediation option analysis using the Best Practise Environmental Outcome (BPEO) approach as defined by the Royal Commission on Environmental Pollution (Ref: RCEP 1988). Based on consultation with stakeholders the BPEO assessment process identified an encapsulation method near the site as the best possible for remediation. This was aligned with cultural views, which preferred an option that used enhanced natural attenuation and containment within the rohe (local area) as the preferred remediation method.

Further investigations led to extraction of the sediment by excavator and road transport to move the contaminated sediment to containment sites being the preferred remediation method. These containment sites were located near the canal where treatment using fungal and phytoremediation would be used to breakdown contaminants.

This method met the key cultural requirements, being;

- The remediation must take place within the rohe, and not be transferred to another district
- The remediation must involve a treatment component so that the contamination is not left for future generations to manage
- That the treatment must use natural processes rather than methods that destroy the contaminant using chemical or thermal treatment

Following further investigations and remediation trials, consent applications were lodged in 2013. However, a lack of broader community consultation during remediation options assessment led to significant opposition during the consent hearings. While consents were granted in late 2013, community opposition to the remediation project grew and the consents were appealed. The primary focus of the appeal was related to the extraction and transfer methods proposed, and the lack of adequate containment at the sites.

Further consultation with concerned community members during 2014 identified that a lack of information sharing and lack of communication of risk, resulted in the spread of misinformation. The project team immediately set out to communicate better through the development of a project website and the

formation of a Community Liaison Group with representatives covering a wide range of stakeholder groups and landowners. Meetings were open to the public and information shared openly. Through further consultation and a review of submission responses, the key concerns associated with the consented method were identified. This led to re-evaluation of alternative extraction techniques and containment techniques that were previously excluded in the original assessment of remediation options.

Further laboratory analysis data and bench scale geobag dewatering tests led to a cutter suction dredge and geobag dewatering trial on a section of the canal in 2015 (Figure 5 & 6). The trial was used to gather a significant amount of environmental data to prove the efficacy of the method for both the Consent Authority and the Community. The trial also provided an opportunity to showcase the extraction and dewatering technique with the community first-hand. Over four days a series of tours allowed small groups to undertake site visits. A short video of the entire process was also used to document the process and convey this information to the wider community through the website. This proved significant in terms of winning support for the remediation process and led to variations to the consents being sought and granted on a non-notified basis by an Independent Commissioner during 2016.

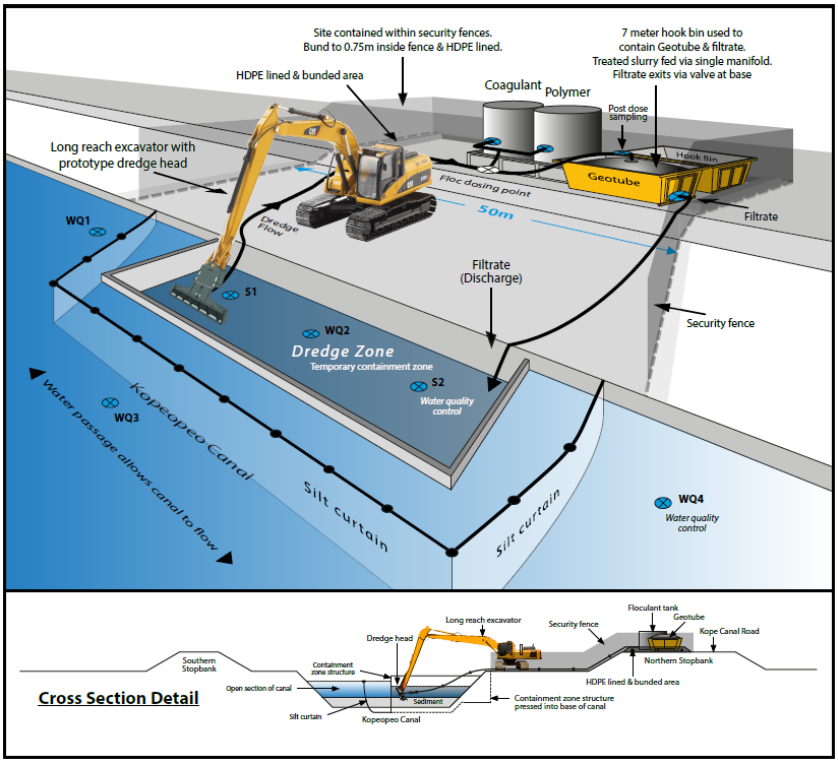


Figure 5: Conceptual diagram of dredging trial for community communication



Figure 6: Dredging trial

Following the approval of the consent, variations works were tendered and commenced in early 2017. While the initial evaluation process carried out in 2006 may have been considered best practice the evaluation was not supported by a detailed analysis of stakeholder or community member views.

What this project has highlighted is the need to undertake significant consultation on larger remediation projects to ensure that social, cultural and environment sustainable solutions can be identified and delivered on remediation projects. Although sustainability standards were not available at the time, the final remediation selection process has considered and addressed the bulk of the holistic remediation indicator sets outlined in Table 2 of International Standard ISO 18504.

Evidence of significant sustainability outcomes

There are several sustainability factors that were improved significantly through the adoption of the new sediment extraction, transfer and containment methods. These were:

Social sustainability

The new method eliminated the need for the use of large trucks and excavators for the duration of the project. This reduced impacts on local roads, which are funded through the landowner rates scheme. The reduction in traffic also reduced the potential for accidents, nuisance dust generation and the risk of dioxin

contaminated sediment/dust being released into the environment and affecting public health, and noise and vibration associated with heavy traffic movements. There was also a reduction in stress related harm through better risk communication and seeking community feedback on their concerns. This has previously been evaluated and shown to have an impact on communities during remediation projects (Ref: Couch, Coles 2011). An article titled, Community Stress, Psychosocial Hazards, and EPA Decision-Making in Communities Impacted by Chronic Technological Disasters was published in the American Journal of Public Health and concluded that, 'stress has adverse impacts on health and may interact with environmental hazards to increase health risk'.

Even with the revised method which effectively eliminated potential dust and groundwater effects the consent holder retained air quality monitoring and groundwater monitoring conditions which provided extra peace of mind to local community members. While difficult to measure the elimination of opposition to the consent variation is telling. Project Manager, Brendon Love sums up the situation; "We started out in early 2014 with a situation where we had over 50 submissions against the project, appeals against the consent, and petitions to the local government select committee to stop the project going ahead. There was lots of tension in the community that that starting to become nasty with threats to Council staff, trespass orders, and calls and visits to the police station. Just over a year later we applied to alter the consent and had written approvals from previous submitters and no public opposition to the variation". On this basis, the Independent Commissioner granted the variation on a non-notified basis.

Cultural Sustainability

The genesis of building cultural sustainability into this project is related to the efforts of a local kaumatua; Joe Harawira. Joe campaigned for years to get acknowledgement of the effects to human health that sawmill workers suffered from. His engagement with others during this process led to his further involvement on associated environmental impacts such as the canal sediments and woodwaste disposal sites in the district. Joe went on to ensure that cultural values were at the forefront of decision making on remediation options. These values were then woven into the final remediation method. To meet these requirements the project included developing and trialling a treatment method that enhanced natural attenuation, including koiwi and taonga screening processes, including Cultural Monitors and iwi and hapū representatives on the Community Liaison Group and Project Steering Group, opening works with and meetings with karakia. This collaboration has resulted in the two-way transfer of knowledge between stakeholder groups and into the broader community through iwi and hapū representatives. Overall, the feedback received from local Iwi and hapū representatives has been positive and the project is considered to have maintained and improved cultural values.



Figure 7: Cultural Monitor observes sediment flow across shaker screens for Koiwi and Taonga

Environmental sustainability

In order to maintain cultural values for the project it was necessary to contain and treat the sediment at a site/s in the district. Three sites were selected as containment sites where sediment would be transported to for treatment. The original method involved dividing the canal into 500m long sections with sheet pile, partial dewatering of the canal sediments and then excavating the sediment and transporting it using trucks to the containment sites. Due to the potential for the wet slurry to spill out onto public roads, consent conditions limited truck filling and resulted in over 8000 forecast truck movements.

The revised method used a single cutter suction dredge (Figure 3) and transfer pump to pump the dredge slurry from the canal through a pipeline to the containment sites where it was treated and dewatered (Figure 8). In addition to this transfer process reducing the potential for spillage, it eliminated the need for heavy equipment to be operated on the roads and the edges of the canal. While the exact reduction in energy use to complete the project was not calculated there can be not doubt that a significant reduction of energy use and emissions was achieved through this change in method.



Figure 8: Water treatment plant with outflow to geobags in Containment Site 1

Evidence of significant attention to Workplace Health and Safety

Health and Safety has been embedded into the Kopeopeo Canal remediation project during both the planning and implementation phases of the project. Project management staff have built health and safety requirements into investigation, remediation procurement and actual remediation works. This has included the development of health and safety plans and use of Job Safety Analysis and toolbox meetings throughout the project. H&S systems have also been regularly audited and updated prior to the commencement of new phases of the project. Incident reporting and investigations have been very thorough and involved staff from various levels of the organisations involved in the project.

One key change that reduced health and safety risks on the project was the shift from using a large number or excavators and trucks to dredging the sediment and pumping it via pipeline to the treatment facility at the containment site. This resulted in the elimination of over 8000 truck movements through public roads. Project Manager, Brendon Love from HAIL Environmental sums this benefit up. “When we complete remediation projects we are often trying to eliminate or contain a source of contaminants that might generate an increase in risk to 1 out of 100,000 individuals exposed to the contaminants over a long term. When we are mindful of managing that level of risk, we should be doing everything possible to select a remediation method that reduces the risk to remediation contractors and the public when completing remediation projects”.

New Zealand Transport Authority (NZTA) research indicates that that the risk of a serious injury or death (75% of the time to the occupant of a different vehicle) was 1-in-100,000 per 120 km travelled by truck on major roads. In 2016 alone 75 people died, and a further 850 people were injured in road crashes involving trucks.

The Remediation Contractor, EnviroNZ was very focused on managing workplace health and safety. This started prior to the commencement of the project with baseline blood testing and medicals for all full-time

staff members. The start of every day included a toolbox meeting, which was recorded, and JSAs were required to be completed and signed off before every new task was commenced. Over the 3-year duration of the works over 300 hundred people carried out site inductions. This included sub-contractors and visitors to the project site. H&S elements were built into every aspect of the project and documented in JSAs, Take 5 records, Hazard registers, and Contract Site Meeting minutes. During the project there were no loss time medical injuries (LTIs). There were three incidents involving heavy equipment operating on rough unstable ground close to the canal didn't result in injuries. This simply reinforces the benefits of reducing or eliminating heavy traffic movements.

Other outcomes

Capacity building

The selected remediation technique was overlooked in 2010 during the initial remediation option assessment. This was primarily due to a lack of local and national contractor expertise in dredging and geotube dewatering. Further evaluation of the method and local marketplace in 2015 showed that expertise and equipment were available to complete the project. Dredging and geotube dewatering systems have been used internationally for decades and shown to minimise the potential effects of contaminated sediment remediation projects. Containment measures included geobags and HDPE lined cells (Figure 9). Through the implementation of this project, capacity building with both contractors and consultants has been realised which may prove beneficial to future sediment remediation projects in New Zealand.

There has also been capacity building and knowledge sharing a local and international level. This included:

- Cultural monitoring and Iwi and Rohe roles were developed for the project that involved local community members
- Community members have also been active in CLG and PSG meetings
- Community members were provided with technical talks at CLG meetings
- Community members have been involved in bioremediation trials and monitoring
- Waikato University research and research grants for bioremediation work to support students. This treatment phase of the project using fungi and bacteria to enhance natural degradation rates is currently in the full scale implementation phase.
- Project knowledge has also been shared at National and International conferences including:
    - Healing the Rift – Beneficial outcomes through open community engagement (Brendon Love, HAIL Environmental, Andrew Kohlrusch GHD). Battelle International Sediment Remediation Conference 2017.
    - Healing the Rift – Beneficial outcomes through open community engagement (Brendon Love, HAIL Environmental, Andrew Kohlrusch GHD). Australasian Land and Groundwater Association Conference, Auckland 2017.
    - Development and implementation of a dioxin/turbidity proxy for the Kopeopeo Canal remediation project (Brendon Love, HAIL Environmental, 2018). Australasian Land and Groundwater Association Conference, Christchurch 2018.
    - Rare On-Site Tour of New Zealand's Largest Contaminated Land Remediation Project – Kopeopeo Canal. Brendon Love, HAIL Environmental, ALGA BOP, 2018.
    - Is the tuna safe to eat? Brendon Love, HAIL Environmental. Ecoforum 2019. Australasian Land and Groundwater Association Conference, Auckland 2019.



Figure 9: Geobags being inspected at Containment Site 1

Evidence of beneficial brownfields development attributes

Given the canal does not support habitation in any form it is difficult to identify any benefits in terms of land value. The remediation has reduced the threat of contaminants migrating onto adjoining land during floods. The remediation is also likely to have had a positive effect on adjoining land values as the stigma associated with living next to a contaminated site can often have a negative impact.

In terms of social benefits, the canal remediation has opened recreational access and use to the canal system which joins the broader network of waterways including the Whakatane River. This area is commonly used as an access point for walkers, cyclists, and recreational fishers. Once the long-term eel tissue monitoring results show that eel tissue levels are safe restrictions on eel fishing will be lifted.

Evidence of engagement of the project with regulatory practice requirements or a local jurisdictional regulator

This project was unique in that the Consent Holder and Consent Authority were within the same organisation, the Bay of Plenty Regional Council. Due to this, there was a need to maintain a degree of separation between these two sections of the organisation while still maintaining statutory roles and ensuring that compliance was maintained throughout the project. This was largely achieved through the use of independent external planning consultants and commissioners during the consent processing phases of the project.

Another vital link between the Consent Authority and the Consent Holder was the Independent Monitor. During late 2014 Andrew Kohlrusch from GHD Pty Ltd was appointed as the Independent Monitor (IM). Andrew's role was to provide independent oversight on the project for both the community and the consent authority. Andrew was supported by a field observer; Matt James, who observed the entire remediation and validation process. Along with regular meetings and email updates the monthly reports prepared by the IM were a key method of engagement between the project and the regulatory agency.

Regulatory monitoring was by way of real time monitoring of canal levels and turbidity to meet consent requirements. A dioxin-turbidity proxy was developed using bench scale testing and laboratory analysis to enable real-time monitoring of potential effects generated by the activity. In addition to reporting on compliance to the Consent Authority, the project team made the real time monitoring (through a mobile phone app and via the web) available to the Independent Monitor and Consent Authority so compliance could be checked independently at any point in time. Information on this aspect of the project has been presented at the NZ ALGA conference in 2018.

Evidence of meaningful engagement with the community

The importance of meaningful engagement with the community can be highlighted by this project. During the initial planning phase engagement was limited and information related to the project was not shared openly with the community. This led to community members forming their own views often based on information that could be obtained and shared online. The lack of project specific information led to concerns that information was being withheld purposely, which increased the level of fear for the project and mistrust for the project leaders.

In 2014-15 a concerted effort was made by the project team to ensure that the community were provided with up to date accurate information. To ensure that mistakes were not repeated an experienced risk communicator and community engagement professional; Barbara Campany from GHD was brought in to assist the project. Barbara helped facilitate the first Community Liaison Group meeting and produced a Communication and Engagement Plan (CEP) (GHD 2015) that provided a road map for stakeholder engagement and ongoing communication during the different phases of the project. The CEP was structured around the International Association for Public Participation (IAP2) core values and aligned these with project specific inputs.

Other ways that engagement with the community was facilitated included:

- The project website www.boprc.govt.nz/kopeopeo with interactive sample location maps, technical reports, videos, CLG minutes and presentations and newsletters
- Regular newsletters and email updates shared with the community and interested parties email lists
- Press releases to local newspaper
- Regional news updates via 1XX Radio
- Community opens days during the remediation trial and main remediation works
- Publicly open Community Liaison Group Meetings with technical talk hosts discussing specific issues related to aspects of the project.

Perspectives of others

Engineers Representative – Ken Tarboton

Perspective of Ken Tarboton (Engineers Representative on Site and former General Manager at Bay of Plenty Regional Council). I have been involved with the Kopeopeo Canal Remediation Project since its early days when the project was initiated around 2009. This followed delineation of the contaminant around 2005 and remedial option analysis in 2006. Some critical features and turning points in the project were:

- The close collaboration between the project and local iwi (Māori) especially around bioremediation trials and the desire of the local community to solve and remediate the contamination locally, rather than shipping contaminated material elsewhere. i.e. the decision to solve and remediate the problem locally rather than passing it on.

- Appointment of a full-time project manager with extensive contaminated site clean-up and remediation experience in 2015 (previously the project had been managed by a staff member with competing priorities).

- Undertaking the dredging trial and subsequent change of methodology from excavation and trucking to dredging and pumping to the containment sites.

- The decision to use geobags within the containment sites, further ensuring the safe containment of contaminated material.

- Use of a Community Liaison Group, Independent Monitor, Cultural Monitor and Iwi representative for effective two-way communication between the project and the community

- Bringing in a dredging expert when challenges were encountered during the dredging process. A lesson learned was the need to engage such an expert much earlier in the project.

The highlight of the project was removing the contaminated sediment to the desired environmental requirements and safely dredging, pumping, transferring and storing all of the contaminated sediment from the canal to the containment site. There was minimal exposure of the public and staff working on the project to contamination.

Several major challenges were addressed and overcome by the project team and contractors during the works. These included adjusting to use the non-preferred containment site, responding to flooding, addressing various dredging issues. Through all of this the community and various monitors were kept well informed, and as a result were supporting of the project.

Independent Monitor – Andrew Kohlrusch

Perspective of Andrew Kohlrusch (Independent Monitor – GHD Pty Ltd). I have been involved with the Kopeopeo Canal Remediation Project since 2012 when I was asked to review the initial remedial action plan (RAP) prepared in 2012. Following my engagement as the Independent Monitor in 2015, I have been involved in many of the aspects of the project planning, community engagement and technical advisory.

I came in as an outsider with no connection to the community who had lived with the stigma of the contamination of the canal for many years. While this was in some ways beneficial in terms of providing objective technical advice, it was important to establish a degree of trust that their concerns would be listened to and I could provide them with assurance that these concerns would or could be resolved. This was achieved through my attendance at the CLG meetings, presentations on technical matters and open engagement with the community members. The independent monitor role was further enhanced by my trusted colleague Matt James who acted as the independent field observer and became one of the Whakatane community for the duration of the remedial works.

The community was the key factor in shaping this project. The driving force of the community involvement was the late Joe Harawira who's energy and drive led to the initial awareness of the contamination risks in the community, the blending of science, cultural awareness and belief into seeking a solution for the

remediation of the sediments and no doubt was instrumental in obtaining funding for the remediation. The community supported by BOPRC and WDC have maintained Joe's legacy.

One of the challenges that the project team faced was to demonstrate progress on the project delivery timeline. The success of any large remedial project (in particular with so many stakeholders and working in full view of the public) depends on the degree of planning and evaluation of risks and associated mitigation strategies. There were times when the community challenged the project team on the time it was taking to start the remedial works and I recall mentioning at one of the CLG meetings that this project was akin to a marathon and that racing off without careful consideration of different remedial options, design and management requirements and community and worker health and safety could lead to delays in healing the land through generation of greater technical, financial and stakeholder engagement challenges.

This project has been one of the highlights of my career and I am grateful for the trust that the community and the project team has placed in the advice and technical support that Matt James and I have provided over the past four years. I am also proud to have been a part of delivering a complex project that has benefited from careful planning and input from all stakeholders. Finally, the project gave me an insight into Maori culture and the importance of being connected to the land and water and has led me to learn more about Australia's indigenous cultures.

Consent Authority – Emma Joss

Perspective of Emma Joss (Consent Authority representative and Senior Regulatory Project Officer – Contaminated Land at Bay of Plenty Regional Council). I have been involved with the Kopeopeo Canal Remediation Project since 2015 and have come into the project as a newbie having not been involved in the history of the project on behalf of the Consent Authority, Bay of Plenty Regional Council.

Throughout my involvement, the complexity with the consenting process and stakeholder engagement plus the use of bioremediation as the preferred remedial method has ensured this project is unique within New Zealand. It has been a pleasure to be involved with this project where different stakeholders have come together after many years to have a common remedial end goal.

The highlight of this project for me is that it is not another 'dig and dump' contamination project and a lot of work has gone into alternative remedial strategies. The use of long-term bioremediation has been driven by all stakeholders as a method to ensure that the contamination created within the community can be hopefully remediated within the community.

Major challenge has been that Bay of Plenty Regional Council is the Consent Authority and the Consent Holder (the Kopeopeo Canal is a BOPRC asset) and the challenge to be seen as independent to the Consent Holder for compliance purposes. However, with the establishment of an independent project team, I feel that undertaking compliance for the project has been no different to any other complex consent. Any compliance issues have been resolved to a satisfactory level and the project has been a success from the perspective of the Consent Authority.

CLG Meetings and Community feedback

Over 20 community meetings were held over a three-year period. These meetings provided CLG members and members of the public the opportunity to learn more about the project and facilitated two-way communication between the project and the community. At the last CLG meeting in August 2019 the meeting concluded with acknowledgements to individuals who had contributed significantly to the project over the years. Along with various members of the public CLG Chairman John Pullar praised the collaboration between everyone involved.

Closure

The Kopeopeo Canal Remediation Project has been a significant undertaking and one of the largest remediation projects ever completed in New Zealand. Many lessons have been learnt during the completion of the project, particularly around the importance of stakeholder engagement at the outset of remediation to ensure that social, cultural and environment values can be maintained and enhanced as part of the remediation process.

The Kopeopeo Canal Remediation Project had stalled in 2014 due to community opposition and would have been deemed a failure by many if it had proceeded against community wishes. By opening up dialogue with the community again and sharing project information and ideas a method that addressed the concerns of the community was identified and implemented resulting in an outcome that sustained or improved social, cultural, and environmental values in the process.

Many individuals and organisations contributed to the success of this project. Their views have been influential in achieving the project vision.

References

Best Practise Environmental Outcome, 1988, the Twelfth Report Best Practicable Environmental Option, (ISBN 010 1031025).

Couch, Coles 2011. Community Stress, Psychosocial Hazards, and EPA Decision-Making in Communities Impacted by Chronic Technological Disasters, American Journal of Public Health

GHD 2015. Kopeopeo Canal Contamination Remediation Project, Communication and Engagement Plan. GHD Pty Ltd, 2015.

ISO 18504:2017(E), Technical Committee ISO/TC 190, Soil quality, Subcommittee SC 7, Soil and Site Assessment.

SKM 2006. Kopeopeo Canal Remediation Options Study. Sinclair Knight Mertz, August 2006

Trucks 2017, New Zealand Transport Authority (NZTA)
https://www.transport.govt.nz/assets/Uploads/Research/Documents/8764070595/Trucks-2017.pdf