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October 7, 2019

Angela Love
Regulatory Specialist
Mackenzie Valley Land and Water Board
PO Box 2130
Yellowknife, Northwest Territories
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Subject: SLEMA Comments on De Beers Submissions for the Amendment / Renewal Application of Snap Lake Mine Water Licence

Dear Ms. Love,

The Snap Lake Environmental Monitoring Agency (SLEMA) would like to thank the Mackenzie Valley Land and Water Board for the opportunity to comment on De Beers submissions for the application for the renewal and amendment of the Snap Lake Mine Water Licence.

SLEMA is pleased to submit comments from Elizabeth Keats, consultant and SLEMA Board Member, who reviewed the Snap Lake Mine Final Closure and Reclamation Plan (DeBeers Group, March 2019). The review performed by Ms. Keats was conducted based on the following scope: "*To review the Final Closure and Reclamation Plan and in particular sections 2.1, 2.2, 2.4, 3, 4.2, and 5, and how Traditional Indigenous Knowledge (TK) and the consideration of Aboriginal rights informed the plan creation, zeroing in on sections that have a strong relationship with TK and resource use, and how the themes of TK, engagement and consultation have informed the closure plan*." The review is provided in the attached spread sheet along with a draft of a document prepared for the Yellowknives Dene First Nation titled "TK Integration Framework for the GMRP: Guidance Document" which may be of assistance to De Beers and the Mackenzie Valley Land and Water Board.

We are also submitting another spreadsheet summarizing comments from Zhong Liu, consultant and former Environment Analyst with SLEMA, and Sonia Aredes current Environmental Analyst with SLEMA.

Please note that as an independent monitoring agency created pursuant to the Snap Lake Environmental Agreement, SLEMA will not formally intervene in the hearings scheduled for November 26 and 27, 2019, however, we are submitting

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these comments solely to assist De Beers and the MVLWB in preparing a water licence that will be satisfactory to the Aboriginal Parties of the Agreement and to the Snap Lake Environmental Agency.

Please contact me should you have questions or concerns.

Sincerely,

ORIGINAL SIGNED BY

Johnny Weyallon
Chair

Attachments: SLEMA Comments
SLEMA TK Review
Draft YKDFN TK Integration Discussion Paper

TOPIC	COMMENT	RECOMMENDATION
Be as specific as you think is appropriate; for example a section or page of the	*Comments should contain all the information needed for the proponent and the Board to understand the rationale for the accompanying recommendation.*	*Recommendations can be for the proponent or for the Board. Recommendations should be as specific as possible, relating the issues raised in the "comment" column to an action that you believe is necessary.*
SLEMA #1) North Pile Tailings Management - Tailing Piping	Kimberlite piping is extensively discussed in the literature. *"Piping of tailings through shallow covers has been an issue at several sites. Given the ongoing deposition of a higher water content PK slurry which will likely be subject to separation and slimes pool formation, the potential for piping is enhanced. This is often addressed through application of deeper covers, the use of graded filters or the application of geofabrics to inhibit migration" Randy Knapp, P. Eng. For SLEMA, December 2016, comments made during Technical Review of the July 2013 Snap Lake Interim Closure and Reclamation Plan.* SLEMA notices that although piping is an issue of concern as expressed by Mr. Knapp as well as an issue discussed in the literature, it has not been addressed in the DeBeers' document North Pile Closure Design.	Recommends DeBeers discuss a) how it is going to prevent piping of the pk tailings; b) how the change in cover thickness would affect piping prevention c) the likelihood that piping happens in the NP
SLEMA #2 FCRP Appendix H Part4 North Pile Close Cover Feasibility Design.MEMO NORTH PILE CLOSURE COVER DESIGN – ACID ROCK DRAINAGE REVIEW dated May10,2018	The currently approved ICRP for North Pile includes mention of a 500 mm granite rock cover over the PK material. Aimed to evaluate options for cover designs and to provide field scale performance data, monitoring field trials were run. They includded two trial cover pads that were constructed and instrumented on the Starter Cell during the fall of 2011 and dismantled in 2015. The two trial cover pads were constructed to a thickness of 0.5 m, with one comprised of ¼ inch minus material, and the other with 3 inch minus material. Both material types were sourced from nearby surface granite quarries at site. Now, the Proponent proposal is, according to the referrenced FCRP Memo, "*Based on site inspections, experience at other sites, and the performance of the cover that has been place on the outside embankments of the North Pile, a 300 mm thick granular cover over PK is expected to meet all design objectives. Over the shallow sloping surfaces within the PK deposits, a cover layer 150 mm thick is likely sufficient to provide the needed erosion control*"	Recommends: 1) elaborate further and provide examples on "experience at other sites" 2) How a 300 mm thick cover would meet all design objectives, what have you considered to arrive to such conclusion

SLEMA #3 FCRP Appendix H Part4 North Pile Close Cover Feasibility Design.MEMO NORTH PILE CLOSURE COVER DESIGN – Appendix E - ACID ROCK DRAINAGE REVIEW dated May10,2018		Recommends 3) Discuss further: How the monitoring data of a 500 mm thick cover of granite is extrapolated to a 300 mm thick cover of different materials, specifically in what is concerning to a) runoff coefficient, b) cover capacity to store water and c) cover net percolation
SLEMA #4 FCRP Appendix H Part4 North Pile Close Cover Feasibility Design.MEMO NORTH PILE CLOSURE COVER DESIGN- Appendix E - ACID ROCK DRAINAGE REVIEW dated May10,2018	The Report is incomplete. The information presented is related to the material deposited in the NP. Does not provide information on the cover material chemical stability.	Provide information related to cover materials chemical stability
SLEMA #5 FCRP Appendix H Part4 North Pile Close Cover Feasibility Design.	Table 1 in this appendix presents the North Pile Closure Cover Borrow Area Quantity Estimate. This information is relevant to the cover design and should not be included in an appendix of an appendix. It should be included in the North Pile Closure Cover Detailed Design Report main body	To include the borrow area quantity estimates table in the main body Report.
SLEMA #6 FCRP Appendix H Part4 North Pile Close Cover Feasibility Design. Design Basis and Criteria	Table 3 presents Potential Borrow Sources for Cover Construction. This information is relevant to the cover design; it should not be included in an appendix of an appendix. It should be included in the North Pile Closure Cover Detailed Design Report main body	To include potential borrow sources for cover construction in the main body of the Report
SLEMA #7 FCRP Appendix H Part4 North Pile Close Cover Feasibility Design. Design Basis and Criteria	Table 3 presents Potential Borrow Sources for Cover Construction. Under heading Borrow Sources: Engineered fill pads (5th row) and then under Materials: both non-AG and PAG material. Does it mean that the Proponent is proposing to use AG material as cover for the NP?	To remove the use of AG material. AG material must not be used for cover construction purposes.

SLEMA #8 FCRP Appendix H Part4 North Pile Close Cover Feasibility Design. Design Basis and Criteria	Table 3 presents Potential Borrow Sources for Cover Construction. East cell rib berm is presented as potential source of borrow material. The material coarse and grits PK.	If PK is going to be used as cover material, 1) how is DB going to address the NP Closure Objective #1 that states "Prevent PK from entering the surrounding terrestrial and aquatic environment" 2) Eventually PK as cover would suffer erosion by wind and water and enter to the environment. SLEMA does not recommed PK as cover material
SLEMA #9 FCRP Appendix H Part4 North Pile Close Cover Feasibility Design	*The chemistry of cover material must also be considered during the design of cover system. Cover material with elevated levels of metals and or salts may produce unacceptable water quality in the receiving environment* (AANDC, 2012, Cold Region Cover System, p.42)	Proposed material for cover be tested for metals, salts and ARD.
SLEMA #10 EQC - Cryoconcentration effect on the NP drainage water quality	The current ICRP version 3.2, as well as the Project Environmental Assessment (EA) and North Pile Management Plan (De Beers, 2012), have identified cryoconcentration as a potential source of concern and topic of research regarding its effect on the seepage water quantity and quality of the North Pile. A better understanding of cryoconcentration processes within the pile will also help to mitigate uncertainties over predicted post closure water quality highlighted in the North Pile Closure Considerations. SLEMA notices that despite the recommendations cryoconcentration effects on NP water quality have not been discussed.	The Proponent discuss the effects of cryoconcentration on NP water quality and how they were taken in account in the proposed EQC
SLEMA #11 EQC - The relationship between water hardness and nitrate toxicity	The Ekati Diamond Mine Site Specific WQO for nitrate (April 2012) proposes a SSWQO for nitrate as a function of water hardness. The CCME Canadian Water Quality Guidelines for the Protection of Aquatic Life Nitrate Ion (2012) states that nitrate toxicity data tested for four species vs the water hardness when plotted in a log-log graph could not be combined to generate a pooled slope. The slopes were significantly different from one to another. Therefore a hardness adjusting equation for nitrate toxicity in water was not proposed.	The Proponent to demonstrate that the pooled slope proposed to calculate the nitrate toxicity in function of water hardness is valid from a statistical point of view. Otherwise the calculation of nitrate toxicity as a function of water hardness is not valid
SLEMA #12 Water Quality Model Report Site	NP drainage assumptions, runoff coefficient assumes increasing from 0.5 to 0.99. How those values have been selected? What cover was considered in this case?	Recommends 1) to discuss further assumptions made for the WQM, specifically the ones related to the cover.
SLEMA #13 Proposed EQC	There's some uncertainty surrounding the definiton of the proposed EQC for closure and post closure . Some of the issues have not been discussed including 1) the relationship between nitrate toxicity and water hardness 2) cover material chemical stability 3) cover material properties (i.e. runoff coefficient, cover capacity to store water and cover net percolation) 4) the cryoconcentration effect and its effect on the NP water quality	Recommends not to approve the proposed EQC and renew the WL with the current EQC until the Proponent provides the required information

SLEMA #14 Water Management at Site Influent Storage Pond	East and West Influent Storage Ponds, the following information is important. - Elevation, size (area and depth) - Outlet design (vs. deep diffuser discharge during mining operation) - Surface flow channels to Snap Lake	Recommends to include that information on the ISP design
SLEMA#15 Monitoring - Incorporation Of TK In the SL Monitoring Program	A comment/recommendation of SLEMA consultant, Beth Keats states: "*Community Based Monitoring is a widely accepted and growing practice that incorporates TK and science-based managemen* t".	SLEMA recommends the inclusion of members of the community during the closure and post closure monitoring programs. With an annual frequency (once a year) members of the community would visit the site during active reclamation, closure and post closure monitoring. Members of the community, especially those who had been at the site before the mine was developed are very well qualified to judge whether the reclamation activities restore the site to the closest to the natural status of the land and whether the site is successfully returned to useful purposes. A questionnaire or a check list after the visit may help the visitor to express his/her view of the site status and provide a useful track record to be evaluated by the Board when time comes.
SLEMA#16 Final Closure Report	The water licence, if approved, would include two phases clearly differentiated, a first phase of closure and remediation activities at site, and a second phase of post closure monitoring. The end of the closure and reclamation activities would mean that no more activities are required, that the site has been successfully restored. The restoration of the site in what concern to adequacy, safety and environmental risk requires to be evaluated and discussed by the stakeholders. The post closure monitoring will be carried out in order to gather data that will allow to prove that the closure objectives have been met. At this time evaluation of the post closure monitoring program seems too early, more information is required, information that is not yet available and will be gathered with time.	SLEMA recommends that after the period of closure and remediation, once activities at site, except monitoring, have ended, the submission of a Final Reclamation Report aimed to: a)to provide an assessment of the site conditions that shows that the site has remained largely stable and no more active reclamation is required to limit the environmental risks. b)To assess the monitoring data and based on that assessment to evaluate the proposed post closure monitoring program; c)To answer the question, is the post closure monitoring program as proposed adequate to demonstrate with time that the Snap Like mine site has been fully reclaimed?

	#8 BK for SLEMA	"The closure and reclamation planning process for the Mine began during the environmental assessment and mine design stages. Early closure considerations evaluated possible residual effects from the site and incorporated mitigation measures within the design of the site"	There were several TK studies developed during the environmental assessment process which identified community requests and ideas for mitigation. Moreover, SLEMA has held several TK field projects over the years. The authors should consider linking these TK and engagement projects up with the pertinent sections where they have been incorporated in the closure plan document.
	#9 BK for SLEMA	"This FCRP is aligned with the objectives of the previous ICRP, but includes additional information to advance the CRP from a conceptual plan to a detailed plan. The FCRP refines the closure criteria that will be used to confirm the achievement of closure objectives and incorporates these into the planning and design of closure measures."	Although there are references to workshopping the closure criteria with Indigenous communities later in the document, it is worth stating here whether the additional information, closure criteria, closure objectives, and plan / design for closure measure have been shaped by TK or TU concerns.
2.2 Goal of the Closure and Reclamation Plan	**#10 BK for SLEMA**	2.2 "The overarching goal for the Mine is to return the site, and affected areas around the Mine, to technically viable and, wherever practicable, self-sustaining ecosystems that are compatible with a healthy environment and with human activities.... The closure goal is supported by four closure principles: physical stability, chemical stability, no long-term active care requirements, and future use (including aesthetics and values)"	
2.2.3 Post-Closure Active Care Requirements	**#11 BK for SLEMA**	2.2.3 "As a primary goal, closure designs seek to achieve no active long term care and maintenance, ensuring that any project component that remains after Closure will not require long-term active care and maintenance. Post-Closure monitoring will be conducted for a defined period only. Physical and chemical stability will help ensure that this principle is achieved."	If this primary goal re. long-term care and maintenance has been informed by community engagement, we would encourage explicit recognition of this in the interests of clearly stating where TK and TU concerns have been influential on reclamation.

2.2.4 Future Land Use	**#12 BK for SLEMA**	2.2.4 "The site should be compatible with the surrounding land and water bodies, wherever practical, once closure activities have been completed. Closure objectives have been developed to ensure that the Mine is returned to such a condition that: * Naturally occurring bio-physical conditions, including any physical hazards in the area, are minimized; * The Mine site is compatible, where possible, with the surrounding landscape at Closure; * The closure condition of the Mine meets the intended level of land and aquatic function for Post-Closure; * Local community values and culturally significant or unique attributes of the land are preserved in Post-Closure; * The level and scale of environmental impacts are minimized to acceptable levels; * The land use of surrounding areas prior to site development are protected; and * The Mine supports the safe future use of the area by humans and wildlife."	The closure objectives are not as definitive on resource use and its practices as they are on ecology; for the latter, there are clearly stated intentions regarding the regional integrity of the site and surrounding area. Given the importance of this section, we suggest that the role that community engagement and TU and TK played in forming these goals is either described, however briefly, in the engagement section, or here.
Figure 2.4 Closure and Reclamation Planning Team	**#13 BK for SLEMA**	2.3	Within the organziational schema, the parties responsible for engagement and inclusion of TK should be identified.
2.4.1 Overview	**#14 BK for SLEMA**	2.4.1	The phrases consultation and engagement are both used within this section but each has a difference nuance in meaning, especially given that it is noted that MVLWB does consultation.

	#15 BK for SLEMA		The engagement principals are laudable. The question of how TK is gathered and blended within a project such as this, however, cannot be answered by engagement principals as it requires some separate framework, plan, or approach. MVLWB (2013) describes the two separately (28). The engagement principals do not address the difficulties of blending science and TK. The inclusion of the TK work in the description of engagement suggests that this work is a type of community engagement, and not a component of the technical knowledge gathering in support of the development of closure plans. We suggest that De Beers & SLEMA would benefit from developing a separate TK framework to guide the inclusion of TK. This would work in tandem with the engagement, obvioulsy, but would give more structure to what to do with the outcomes of the engagement and TK research. IF, however, it is realistically too late for such an approach, we recommend that 1. the Closure Plan include some more robust discussion of the outcomes of a the TK work over the years and 2. Clear description where and how TK informed the plan.

2.4.2 Scope	**#16 BK for SLEMA**	2.4.2 This summary focuses on engagement and consultation as related to closure and reclamation planning for the Snap Lake Mine, which builds on De Beers' engagement over earlier phases. Records of past engagement are available in other documentation, including the Environmental Assessment Report (De Beers, 2002; for engagement activities undertaken in relation to the design and assessment of environmental and social impacts); water licence applications and renewals (including engagement updates); and annual closure and reclamation plan progress reports (including annual reports from 2012 to 2017, each of which contains a description of engagement and consultation related to closure plans, objectives, criteria, progressive reclamation, and related topics).	The report would be greatly improved by direct integration of at least some of the results of TK research and projects, and clear identificaiton of where it has influenced the closure plan.
2.4.4 Forums for Engagement	**#17 BK for SLEMA**	2.4.4 " A goal of the SLEMA Board is to incorporate Indigenous knowledge and western science in its activities and recommendations, and this is supported by a Science Panel (including nominated experts with relevant subject matter expertise) and a Traditional Knowledge (TK) Panel (including Elders nominated by each Indigenous organization). Workshops are led by the SLEMA and supported by De Beers. SLEMA hosted TK Panel workshops focused on closure planning—and the integration of TK into closure planning and criteria—in November and December 2017 and in November 2018."	The report would be improved by greater clarity re. how the Science Panel and TK Panel function, their relation to the working group, and how they go about blending science and TK in De Beers operations; as noted earlier, the report would also be improved by clarifying where TK has informed the outcomes.

	#18BK for SLEMA	2.4.4 "As part of annual engagement with Indigenous groups and communities, De Beers holds regular meetings in communities to provide information and updates about the project, and to seek feedback and answer questions from community members for each of the four IBA Indigenous groups. Community meetings in 2013, 2015, 2016, 2017, and 2018 included discussions about closure planning and closure criteria."	Same as above; community meetings are an important source of incidental TK, concerns, mitigations, etc… but we recommend more clarity as to what came out of these engagements and how the closure plan represents a response to that would improve the process and the closure plan.
Traditional Knowledge Working Group	**#19 BK for SLEMA**	2.4.4 "With support from De Beers, the SLEMA organizes TK workshops with Elders and other knowledge holders of the IBA Indigenous groups. The workshops are designed to engage participants in discussions about the Mine and specific topics of interest. Closure planning, objectives, and closure criteria have been topics of discussion in June 2015 and in November and December 2017. In 2018, TK workshops focussed on closure planning were held by the NSMA and the Tlicho Government (November 8, 2018; December 17-18, 2018). Through these workshops, TK has directly informed plans and designs for closure of the Mine site and the specification of closure criteria through discussions of what the site will look like after closure, ability of Indigenous people to access and use the land and traditional pursuits, and the importance of ecosystem services for environmental and cultural sustainability (Appendix C). De Beers considers these requirements to be an important part of the overall environmental, social and safety context for closure. In addition to TK workshops, the annual fish tasting event at the mine site brings together Elders and other community representatives to fillet, taste, and evaluate freshly caught lake trout. The 2016 fish tasting event was the first event following the decision to put the Mine into a state of care and maintenance, and included discussion about ongoing environmental management and planning for closure. Fish tasting events were also held in 2017 and 2018 at the Mine."	We did not have Appendix C Engagement to review. As noted above, we recommend that the plan would benefit by showing more and telling less. As it is, a number of potentially important sources and processes for TK inclusion exist within SLEMA and are described in the report; but it is hard to tell what they do. We recommend that an Appendix on TK / TU-based input drawing directly from the workshops, site visits, and closure visits be included. This appendix could be a simple spreadsheet identifying observations. In addition, as noted above, sections of the closure plan should identify where TK / TU has informed the plan. Without this information, it is difficult to meet the guidance within MVLWB (2013) that "Key considerations when designing for closure include integrating both Traditional Knowledge and other scientific information, making use of the best available information and technology, promoting environmental protection, and applying the precautionary principle in the absence of conclusive information." (44)
	#20 BK for SLEMA	2.4.4 Site Visits, Closure Visits,	See comment above. Lots of TK work was done but its influence is not apparent.

2.4.5 Record of Engagement	**#21 BK for SLEMA**	2.4.5 /2.2Table 2.2 Selected Engagement on Closure and Reclamation	The list of events in Table 2.2 is extensive. Many are TK or land use focused and must have resulted in material that influenced the closure plan; but as noted above, it isn't apparent how. As noted above, we recommend that some attempt be made to distill from the products of these sessions TK-related material, and, following this, that some attempt could be made to demonstrate how and where that input influenced outcomes within the closure plan. It is worth pointing out that the inclusion of the TK sessions within the Engagement description underlines a potential problem in the way De Beers approaches TK inclusion in mine closure planning. Many of the descriptions of the engagement session sound, in their brief descriptions, as though they were transactional communications and not participatory engagement, in which there is an expectation that the meanings and outcomes are negotiated between the parties and the results will somehow inform outcomes. Moreover, although TK and TU Study work can exist and complement engagement or consultaiton work, it is not merely engagement and does not belong in an engagement section any more than does a study on water quality. The purpose of TK work is to create new knowledge to inform decision-making. We would recommend that De Beers consider breaking out a discussion within the final report on its TK work.
3.4.3 Terrestrial and	**#22 BK for SLEMA**	3. Project Environment (ALL)	
4.5 Project Alternatives	**#23 BK for SLEMA**	4. Project Description (All)	

5. PERMANENT CLOSURE AND RECLAMATION	**#24 BK for SLEMA**	5. Permanent Closure and Reclamation (All)	We recommend that the Proponent describe how TK has informed the closure plan decisions and evaluation of closure planning, obectives, design, and monitoring scenarios within this section. We also recommend that the Proponent describe how TK has been integrated in ongoing monitoring plans. By identifying and demonstrating where TK has been considered and informed the closure plan, it will become clearer where any inconsistencies or disagreement between community knowledge and science arose, and how they were dealt with. As was often noted throughout this review, the major issue with this section is the lack of apparent integration of the tremendous amount of TK and TU research and community engagement that has been done prior to and over the life of the mine. MVLWB (2013) states that this is important in reference to identifying uncertainties in closure planning (37): "Proponents should identify important uncertainties that arise during closure planning including uncertainties associated with the risks of various closure options and how to select the best closure activity, how to best implement a selected closure activity, how to define closure criteria, how Traditional Knowledge will inform closure planning, and more. Indicate how each uncertainty will be addressed—whether through specific reclamation research (including Traditional Knowledge research), an engineering study plan, or other means."
5.1 Definition of Permanent Closure and			
5.2 Permanent Closure and Reclamation Requirements			
Figure 5.1 Objectives-based Approach to			

5.2.2 Pre-Disturbance, Existing and Final Site			
Table 5.1 Summary of Pre-disturbance, Existing, and			
5.2.3 Closure Objectives and Criteria			
5.3 Closure Activities			
Table 5.2 Closure Objectives, Criteria, and Method of Measurement to Evaluate			
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Figure 5.3 Integrated Summary of Closure			
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5.3.2.2 Engineering Work Associated			
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5.3.4.2 Engineering Work Associated			
Buildings and Equipment			
5.3.5 Summary of Climate Change			
5.4 Predicted Residual			
5.4.5 Resource			
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Non-Traditional			
Traditional Use			
Aesthetic			
Tibbitt-Contwoyto			
5.5 Post-Closure Monitoring, Maintenance			
Table 5.6 Snap Lake Monitoring			
5.6 Contingency			

Figure 5.9 Overview of Monitoring Response			
Table 5.7 Potential			
6. PROGRESSIVE			
6.1 Definition of Progressive Reclamation			
6.2 Opportunities for Progressive			
6.3 Completed Progressive Reclamation			
Figure 6.1 Snap Lake Progressive Reclamation			
8. INTEGRATED SCHEDULE OF ACTIVITIES FOR			
8.1 Closure			
8.2 Post-			
Figure 8.1 Integrated Schedule of			
9. POST-CLOSURE SITE			

9.1 Assessment Approach	**9**		The plan would benefit from identifying any pre-existing or future planned monitoring scenarios involving community-based or Indigenous-led monitoring, as well as any reporting scenarios that have developed through engagement or TK work. Community Based Monitoring is a widely accepted and growing practice that incorporates TK and science-based management.
9.2 Completion Reporting			
Table 9.1 Post-Closure Success			

RECOMMENDATION

DRAFT YKDFN TK Integration Framework for the GMRP: Guidance Document

July 2018

Prepared for:
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INTRODUCTION

Mining activities impact local communities—socially, culturally, and environmentally—through adverse effects to the environment and changes to regional and household economies. This can create social tensions, economic inequalities, and disruption to quality of life and well being (Sosa and Keenan, 2001; Findlay and Wuttunee, 2007). Even after mine closure, efforts to remediate and/or address abandoned mines and toxic sites can trigger historical conflicts and injustices associated with original development and impacts (Keeling and Sandlos, 2009; Keeling and Sandlos, 2013). The Giant Mine has had extreme social, cultural, and environmental effects, according to the oral history traditions of Yellowknives Dene whose lives concur with the mine's operating history, and those looking cautiously toward the future.

Remediation costs are estimated at almost one billion $CAD (AANDC 2012), and the federal government has been tasked to address 237,000 tonnes of arsenic released during operation (Bromstad et al., 2017), some of which has been frozen in underground chambers and stopes (SRK Consulting and SENES Consultants, 2007). In addition, the mine has impacted important lands and waters—in particular, the Yellowknife Bay on Great Slave Lake—used for hunting, gathering, fishing, and travel by Yellowknives Dene First Nation (YKDFN) communities. Contamination has also been detected in local fish species (de Rosemond et al., 2008), soils (Bromad et al., 2017), and water (Clark and Raven, 2004) which has made closure and planning a challenge.

Contamination and remediation are often framed as technical or scientific issues, which might explain the general lack of local community knowledge and citizen participation in remediation policy and practice (AFN 2001, McBeath and Shepro 2007, NOAMI 2003, Sistili et al., 2006). Not surprisingly, throughout the six years of its review and environmental assessment process of remediation, YKDFN have struggled to have their historical experiences and knowledge of the cumulative impacts of the project acknowledged as relevant input (Sandlos and Keeling, 2016). However, remediation is distinctly and directly relevant to local traditional knowledge (TK)—which includes historical experience and memory associated with land use—because it addresses environmental impacts of extractive activities that occured in the past to make inferences on potential future outcomes (Sandlos and Keeling, 2016). TK also includes political experiences of socio-economic impacts of development projects on local communities (Sandlos and Keeling, 2016). In this manner, TK can embody cultural elements that have implications for sustainability and local support for remediation projects.

Butler et al (2012) describe the incorporation of TK into "post mine" land use planning as a way of ensuring the appropriateness and acceptability of remediation efforts by affected communities.

The incorporation of the traditional knowledge of landholders in the planning process connected communities with the development of the rehabilitation strategy and implementation plan and ensured the development of culturally appropriate completion criteria to validate the outcome. (p. 613)

This document provides guiding principles and recommendations for integrating TK into the process of remediation meaningfully and effectively. We highlight key components that a framework integrating science and TK should contain, and tools that may be used to support it, as well as a suggested path for creating the framework.

GUIDING PRINCIPLES

The value of linking TK with environmental assessment and project planning processes has been underlined by the Canadian Environmental Assessment Agency's (CEAA) recent expert panel review, which called for an integrated approach that weaves science and TK together (CEAA, 2017). This approach hinges on developing a framework for integrating these two knowledge systems at the outset of every project: "the best way to integrate different sources of knowledge should be determined on a project-by-project basis in discussion with Indigenous and community knowledge-holders and scientists" (p. 45). Accordingly, a framework should be co-developed during the project planning phase and will require—as well as cultivate—strong relationships among scientists, policy-makers, and knowledge-holders that are based on trust, respect, and transparency. Establishing these relationships early on, and maintaining them throughout the project, is critical to avoid challenges and conflicts during implementation, or worse, the creation of a poorly integrated project that leads to ill-informed decisions and dissatisfying outcomes.

Garnett et al. (2009), proposes a set of principles intended to guide participatory or integrative research programs, which—particularly in light of Canada's current focus on reconciliation with Indigenous people—might also be read as a list of reasons for undertaking TK integration in decision-making processes that have direct impacts on Indigenous communities. They are:

1. Promoting active collaboration and participation at every stage of research;
2. Fostering co-learning;
3. Ensuring projects are defined and driven by the community;
4. Disseminating results in useful terms; and
5. Ensuring research and intervention strategies are culturally appropriate. (Garnett et al., 2009, p. 571)

Developing a framework that successfully integrates TK not only fosters a more inclusive process but leads to mutual benefits, including more locally relevant and applicable decisions and recommendations, and increased awareness and endorsement by local community members. Given historic and ongoing impacts of the Giant Mine on Indigenous people whose traditional lifestyles and territory have been most affected by the mine, developing such a framework for its remediation will be pivotal.

Simply recognizing that certain groups of people have been negatively affected and ensuring their participation in the process of remediation is not enough, as colonial power

structures can continue throughout these projects… As Tsosie notes, problems of cumulative impacts and intergenerational injustices also need to be acknowledged through an ethics of remediation. (Beckett 2017, p. 45)

Remediation is inherently linked to moral objectives of reparative justice, and an intercultural approach is a necessary and legal obligation to redress the tangible harms of mining activities (Tsosie, 2015). For YKDFN, restoration means accommodating traditional use and recognition of past injustices suffered by the YKDFN community at large, including displacement, arsenic contamination, poisoning of the local environment, and infringements on their Aboriginal and Treaty rights. Remediation is often fraught with policy debates, due to advocacy by Indigenous groups to have their fundamental human rights respected and reverse historical trajectories of unsustainable development that is based on land, resource, knowledge, and cultural expropriation (Carino, 2010). Hence, ethics of remediation is "as much about redressing inequities of power, capacity, and agency, as it is about 'cleaning up the environment'" (Tsosie 2015, p. 210).

As a starting point, every project that aims to consider, include and/or integrate TK will require engagement with YKDFN through a process based on trust, respect, and transparency. These principles are critical to the success of any collaboration, as with any working relationship.

Trust

Even before any knowledge sharing can begin, and questions of how to bring together science and local TK can be raised, relationships based on trust and shared experience must be developed. (Thornton & Scheer 2012, n.p.)

Simply put, building trust is the essential preliminary step to any successful effort to integrate TK into any process that includes scientific knowledge and/or decision-making. In the case of the Giant Mine and the Indigenous people whose traditional territory and ways of life have been most impacted (e.g., YKDFN)—first by its existence and then by the initial approach taken to its closure—this will be a critical and potentially demanding task.

As a first step, it is important to recognize how YKDFN and other Indigenous peoples perceive and/or relate to the federal government. For example, "you are speaking to a group of people that the federal government put into residential schools, and you think they're just going to believe you?" (Beckett, 2017, p. 174-5). Or, in the more relevant words of one YKDFN member:

> Since the 1930s the Yellowknives Dene had no trust with the federal government. First with the treaties—the violation of the treaties. They basically lied. And there's residential school. And then there's racism. And now they have this mining clean up... there's never been trust. (Beckett, 2017, p. 174-5)

Beckett's (2017) analysis of interviews with Indigenous people and other community stakeholders surrounding the Giant Mine reveals the centrality of trust and transparency to their impressions and recollections of the remediation process to date, and the necessity of these two principles to any successful remediation effort.

When interviewees reflected on the benefits, challenges and process of the Giant Mine Remediation Project and the Environmental Assessment, they spoke little about technical details. Rather, issues of trust and communication were mentioned in almost every interview. (p. 172)

The process of building trust will likely have to allow for the airing and acknowledgement of real and perceived grievances. People affected by the Giant Mine's legacy may need to, as Tallbear (2001) suggests, "spend some time lamenting, engaging in memory, and setting themselves apart from a history that many [Indigenous] people find objectionable and oppressive" (p. 2). The intention to integrate TK meaningfully in mine remediation efforts may demonstrate a degree of reconciliation and respect for affected Indigenous communities that was lacking in previous remediation planning—not to mention the establishment, operation and closure of the mine. Establishing trust towards an effective TK integration process will require the same respect to be paid to the Indigenous experience of the Giant Mine from its establishment and operation through to its closure and subsequent approaches to remediation.

> Discussions of responsibility for the waste legacy will be unavoidable and integral to the success of social and cultural approaches… They will certainly preface all movements by tribes towards assuming any responsibility whatsoever for long-term stewardship activities… Solely future and information oriented approaches to stewardship cannot deal with responsibility for the past. (Tallbear, 2001, p. 2)

This statement suggests past experience and information are not exclusive, and catharsis is potentially needed in order to establish trust in TK integration. TK is rooted in (often shared) experience and, if it is to be recalled from the past to the present, related memories and knowledge are likely to be brought forward with it (Tallbear, 2001). This effect was observed by Sandlos and Keeling (2015) in their analysis of environmental assessment hearings for the Giant Mine remediation plan.

Traditional knowledge of the land and the historical experience of mine development (along with its attendant social, economic and environmental injustices) cannot be neatly separated from one another.

Indeed, accommodation for hearing, acknowledging and responding transparently to what Beckett (2017) describes as "cumulative impacts and intergenerational injustices" (p. 45) are likely a prerequisite to establishing and maintaining trust in effectively integrating TK into the Giant Mine remediation plans.

Trust has, and continues to play, a pivotal role in the development and implementation of the Giant Mine Remediation Plan. The recognition of the circumstances that have led to this lack of trust, and the resulting actions to rectify this situation, will hopefully lead to a resolution of this issue that is more acceptable to everyone involved. (Jardine et al. 2013, p. 6)

Respect

Because closure and remediation planning is often rooted in scientific principles, attempts to integrate TK into this process will require respect—an acknowledgement and appreciation of different paradigms that distinguish TK and scientific knowledge. Any attempt to integrate science and TK must begin with an appreciation of differing research paradigms. A paradigm is the basic belief system that guides an investigator, not only in choosing methods, but in more fundamental ways of considering what is real (ontology), how reality can be known (epistemology), and how it can be studied (axiology). A paradigm is often so embedded in an investigator's way of being and/or seeing that it is not easily discerned, yet it influences all aspects of research, analysis, and decision-making. For example, a scientist might insist on using a scientific approach to collect data in a community-based monitoring program without realizing that Indigenous community members—through their frequent and unique interactions with the environment—are already actively collecting information through their own traditional practices, according to their own formal and informal monitoring and/or management priorities.

Research within the natural sciences resides almost solely within the positivist or post-positivist (quantitative) research paradigm that has dominated both the physical and social sciences for approximately 400 years (Table 1). Community-based and participatory research, as well as other types of inquiry that seek to gather local knowledge and experiences (e.g., TK), typically reside within one of the qualitative paradigms (e.g., interpretivist or constructivist). Table 1 summarizes some of the underlying assumptions that are typical of dominant paradigms within land and resource management research (quantitative), contrasted with paradigms associated with related social sciences (qualitative) that are often used in research involving TK. It offers considerations for potential barriers, challenges, and incompatibilities, and attempting to integrate TK and science.

Unfortunately, many researchers and policymakers consider science as "given" and consider TK to be valid to the extent that it overlaps with—or is verifiable by—science. These groups may only consider TK alone where there are gaps in scientific information, until scientific information becomes available to verify it. This approach forces TK to conform to a scientific paradigm, disregarding the unique and alternative paradigm that TK follows, and undermines any effort to incorporate the Indigenous perspective that TK reflects. This is counterproductive to any project that is meant to be integrative, as well as foster knowledge co-production.

Integrating science and TK (quantitative and qualitative research) requires respect for the paradigmatic assumptions underlying both types of information. Adaptiveness and respect for unique paradigms are necessary to facilitate collaborations. It may be necessary for program organizers to create education and information-sharing opportunities that allow for social learning among all participants, decision-makers and stakeholders. Planning and scoping sessions, such as those in Quantitative Risk Assessment, can identify shared goals and issues and the sources of common challenges, toward strong research questions that are mutually agreed upon, followed by effective methodologies.

Transparency

Ensuring participants understand precisely how their input will affect decision-making is central to maintaining trust and respect in any engagement process (International Association of Public Participation [IAP2], 2014, p.28). A TK integration framework needs to be co-developed in such a way that it involves knowledge-holders, stakeholders and other relevant groups (e.g., federal representatives) in the process of establishing decision-making criteria. This process should clearly articulate these criteria and their rationale and/or justification to all groups who are involved and/or affected by outcomes.

Environmental projects that lack transparency persist and are a concern across Canada (CEAA, 2017). Transparency—especially of discussions that occur between developers and regulators—is necessary to establish public and Indigenous community trust. Transparency is also the first step for inclusivity as well as informed and meaningful relationships; any process that involves local and/or TK requires strong relationships with the communities that share and/or hold this knowledge.

The following list of recommendations for overcoming barriers to building trust and community involvement from the National Orphaned/Abandoned Mines Initiative (NOAMI, 2003) could be read as a set of starter tools for implementing transparency.

- It is important to get a community involved and all parties communicating early on. Setting the priorities at the beginning, and having a common goal helps maintain focus...
- It should be made clear in what capacity the government and other members so expectations are not unrealistically raised. If jurisdiction is unclear, this should be discussed at the onset. If expectations get raised but no action ends up being taken, frustration levels and burn-out heighten, leaving community/committee members disheartened and jaded with the process.
- An iterative process is time-consuming but is necessary to build trust, otherwise the public remains skeptical and data doesn't change minds.
- Involving the community from the beginning, including in the setting of priorities, may involve a considerable time commitment, but the process engenders a level of trust in the process and the agency responsible. (NOAMI, 2003, p. 45)

It is evident that trust, respect, and transparency are not mutually exclusive and are inherently linked and required in any TK integration process. Each principle is necessary to effectively engage and/or collaborate with local Indigenous communities in proposed project and remediation planning. Successful TK integration efforts hinge on programs that foster and maintain credibility balanced by trust, respect and transparency.

PROCESS: ENGAGEMENT

A TK integration framework—the structure that determines how TK is incorporated—should provide, and is fundamentally defined by, opportunities for meaningful collaborations with knowledge holders (e.g., YKDFN and other Indigenous communities).

Collaborative efforts should produce tangible results and visibly inform decision-making. Knowledge holders should be included at the start of the integration process and treated as equal participants in project implementation (Charnley et al., 2017). This means that knowledge-holders should also be involved in developing the TK framework itself, which will enable gathering and/or documenting TK through appropriate methods and forms, rather than trying to fit TK into a framework developed in the absence of TK and TK holders.

The Spectrum of Public Participation, produced by IAP2 (IAP2, 2014) is an internationally recognized tool for organizing engagement of any type of public community (including Indigenous peoples but is not to be confused with the non-Indigenous "public" typically targeted in public consultation processes) to create and facilitate inclusive decision-making processes and understanding, as well as to prevent and manage conflict.

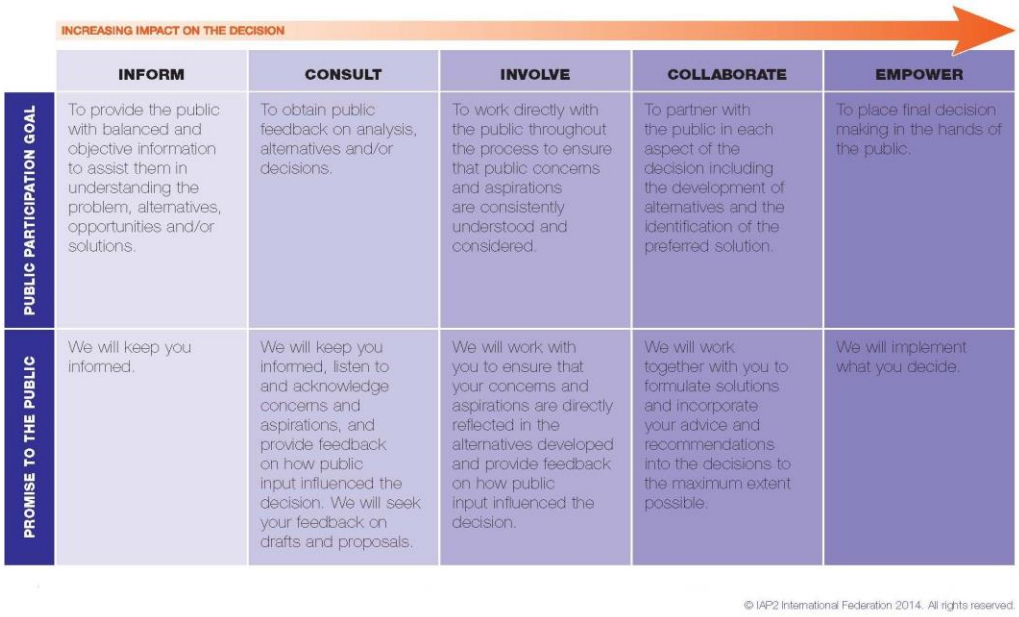
IAP2 teaches us that public participation:

- is based on the belief that those who are affected by a decision have a right to be involved in the decision-making process;
- includes the promise that peoples' contribution will influence the decision;
- seeks out and facilitates the involvement of those potentially affected by or interested in a decision;
- seeks input from participants in designing how they participate;
- provides participants with the information they need to participate in a meaningful way;
- communicates to participants how their input affected the decision (IAP2, 2014, p.28).

These points relate directly to the task of the GMRP. According to IAP2 (2014), different levels of engagement are possible, each involving corresponding commitments to the public relating to roles and outcomes. Conflict, lack of participation, and rejection of decisions likely result from a failure to foster and maintain trust in the process (IAP2, 2014). Trust can be lost, or never gained to begin with, when people are engaged at a level that is higher or lower on the spectrum than is required by the project or process, and/or when commitments implied at a given level of engagement are not met.

The IAP2 spectrum of participation–according to which levels of engagement can range from simply informing to empowering public communities–is summarized in the table below.

Figure 1: IAP2's Public Participation Spectrum (2014, p. 38)



INCREASING IMPACT ON THE DECISION

	INFORM	CONSULT	INVOLVE	COLLABORATE	EMPOWER
PUBLIC PARTICIPATION GOAL	To provide the public with balanced and objective information to assist them in understanding the problem, alternatives, opportunities and/or solutions.	To obtain public feedback on analysis, alternatives and/or decisions.	To work directly with the public throughout the process to ensure that public concerns and aspirations are consistently understood and considered.	To partner with the public in each aspect of the decision including the development of alternatives and the identification of the preferred solution.	To place final decision making in the hands of the public.
PROMISE TO THE PUBLIC	We will keep you informed.	We will keep you informed, listen to and acknowledge concerns and aspirations, and provide feedback on how public input influenced the decision. We will seek your feedback on drafts and proposals.	We will work with you to ensure that your concerns and aspirations are directly reflected in the alternatives developed and provide feedback on how public input influenced the decision.	We will work together with you to formulate solutions and incorporate your advice and recommendations into the decisions to the maximum extent possible.	We will implement what you decide.

Movement from Inform and Empower levels of participation involves shifting the amount of power held by the public and, hence, ability to impact decision-making. For GMRP, engagement must move beyond Inform and Consult levels, and even beyond the conventional researcher-subject relationship towards one that approaches a balance of power in order to support collaborations produce new knowledge, by combining information drawn from divergent paradigms, perspectives, and experiences.

Tengo et al. (2014) differentiate dialogue from discussion, stressing that any effort to integrate contrasting knowledge systems will require ongoing dialogue throughout all stages of a project, and defining it according to three requisite components: equality and absence of coercive influence, empathetic listening, and making assumptions transparent. Rather than thinking of engagement as one stage in a project, it is better conceived as an ongoing element in an integrative project, a process that repeats, expands and deepens at intervals.

If disagreements between science- and TK-based information occur, open dialogue among all project participants can facilitate an understanding of the underlying reasons for the disagreement and help achieve a resolution. Differences might be better viewed as stemming from differing areas of expertise, and can be resolved by focusing on ways that science and TK complement rather than contradict each other (Moller et al., 2014). Disagreement may also point to the need for further research.

TK FRAMEWORK COMPONENTS

Although the protocols and tools specified by a TK integration framework are not standardized and should be determined by the participants, a framework must contain the following components in order to function effectively.

Definition of TK

A working definition of Indigenous and local knowledge should be established at the outset of a given project. It should be, in the first place, locally defined—because all cultures have an important guiding notion of what constitutes their traditional knosledge—but recursive, locally defined and co-developed concept. We recommend a cautious examination of a wide range of definitions spanning broad sectors, and a critical assessment of the effectiveness of each definition in achieving specific purposes. Understanding TK discussions in scholarship, policy, regulation, common law, and international law will also assist participants in co-developing a functional TK framework. However, the definition selected should be revisited as much as possible throughout a project lifespan, and may change from case to case according to discussions and consensus among TK holders and/or stewards.

The key to defining TK for the GMRP effectively is mutual participation through strong engagement and transparency. The way a definition, like all other decisions in the remediation process, is reached is as important and critical to effective TK integration as the definition itself. When it comes to developing or selecting an appropriate definition of TK for an integration framework and/or its tools and components for GMRP it will be essential to reflect the Indigenous (i.e. YKDFN) perspective on what does and does not constitute TK, how it is to be used and represented, and whether it plays a role in the project (Paci & Villebrun 2005, p. 84).

Decision-Making Criteria

In order for decision-making criteria–and by extension decisions–to be perceived as valid they must be developed collaboratively and will complete transparency. Harmonizing TK and science may require certain trade-offs, and in order for the implementation of any such compromises to be accepted and respected the rationale supporting them must be the product of consensus, and both understood and agreed to in advance. To ensure clarity and credibility in the process, both internally (amongst participants) and externally (throughout the community and broader stakeholders), all decision-making criteria and the reasoning for them must be thoroughly explicit and transparent from the outset (CEAA, 2017, p. 47).

Verification Protocols

Huntington (2000) stresses the need to scrutinize TK as thoroughly as science, but not by using science. TK should be considered and verified following the methods and paradigm it emerged from. Community reviews and other methods of local verification can be used to test the validity of knowledge shared, and should be described in the framework developed during the planning phase, to avoid any conflicts that arise during integration.

Green (2014) suggests the immediate challenges of integrating TK and science have less to do with the problems of bridging two knowledge systems, and more to do with

conflicting ideas about the job of the bridge. The Final Report of CEAA's Expert Panel for the Review of

Environmental Assessment Processes in Canada (2017), suggests that when science and TK-based information disagree the inclination has been to try to weigh the two against each other; however, as Tengo et al. (2014) observes:

In research that crosses disciplinary divides, using the validation methods of one certain system (e.g., quantitative natural science) to validate knowledge from other systems (e.g., quantitative and/or qualitative social science or Indigenous knowledge systems), may lead to compromising the quality or integrity of the latter knowledge, and the potential rejection of valid knowledge. (p. 583)

Information Management

Confidentiality, control of information and data, and Intellectual Property (IP) issues are critically important in Indigenous-Crown-industry relations. If these issues are not dealt with appropriately, they can derail processes, scuttle attempts to work together, and ultimately undo efforts toward cultural remediation that integrating TK is, at least partly, intended to accomplish. All information produced and shared as part of the GMRP should respect and enhance the data sovereignty of YKDFN, deepening its ability benefit from data management in the future.

POTENTIAL TOOLS

Community-based Research

Community-based and participatory research strategies rely on a variety of tools that can function simultaneously as methods for developing and sustaining trust and credibility, and for gathering, documenting and sharing TK in order to for it to be integrated. These include semi-directed interviews, participatory mapping, community surveys, ground-truthing, Traditional Knowledge/Use Studies, and workshops, to name a few.

Below we provide some examples and discussion of potential tools for consideration in relation to the development and implementation of a TK integration framework. Tools for a given integration effort can only be determined by the participants in that process, and should be determined by them through transparent and ongoing dialogue.

Interviews

Interviews can be a highly effective way of producing records of knowledge and environmental information in a wide variety of formats including audio/video, transcription/text, map/spatial, etc. When gathering TK-based information through interviews it is recommended to focus on drawing out and recording the knowledge associated with a specific data point, as opposed to just recording the data point. In other

words, the objective of a TK interview should not simply be to map relevant locations, or list relevant species, for example, but to document the knowledge related to each that may be contained in stories, memories, observations, and so on. This is best accomplished by using open-ended questions and departing from prepared question lines to ask follow-up questions when appropriate. What, where, when, why and how questions will always elicit much richer and more useful information than questions with yes/no answers. Even when the goal of the interview is to produce a map or list, these questions will provide the information that supports and explains the data presented in the map or list.

Collins (2015) describes a process of administering and analyzing questionnaires designed to probe the cultural, spiritual, medicinal and nutritional significance of plant life, wildlife, water, and overall land use in order to determine priority species to focus on for closure planning. The questionnaires were administered in approximately 40-minute long interviews with knowledge-holders put forward by the community, during which participants were invited to elaborate on their responses and to discuss other relevant topics and themes. Some participants also requested field visits with the interviewer, in addition to the interviews, in order to share knowledge of their land and territory. Photographs taken during these field visits were also analyzed.

Interviews were recorded digitally, transcribed verbatim, and then the transcripts were subjected to textual analysis. This involved a process called “open coding”, according to which researchers derive and modify codes based on themes and patterns discerned in the transcripts. These codes were then analyzed in turn for “points of intersection, or grouped into clusters” (Collins 2015, p. 59). The result was the identification of categories of highest importance for closure planning, such as hunting, fishing and medicinal plants, as well as species of greatest importance within these categories, including moose, deer, geese, etc. Findings and analysis were presented to both the knowledge-holders and their communities for review and verification.

Surveys

Butler et al. (2012) describe one example of a survey tool designed to integrate Indigenous knowledge into remediation efforts by identifying priority species for a reforestation initiative based on cultural values and ecological or silvicultural attributes, for the specific objective of improving land use outcomes following mine closure. The survey was administered in participants’ homes, as well as in the field in areas where vegetation remained undisturbed; the key objective in both cases being to record as much knowledge and information as possible about the plants considered important by community members, as opposed to creating an exhaustive inventory. The plants listed were then scored according to a “cultural significance index” created to weigh factors including the level of preference for a plant, the frequency with which it is used, the number of different uses for it, the significance of each of those uses, and how actively it is managed by community members, among other factors. Each plant’s ease of propagation was scored “based on professional experience or literature sources, or inferred from knowledge/behaviour of closely related species,” and assigned a site tolerance score based on known habitat preferences and other data derived from professional reports and

observations. The resulting score was intended to enable the identification and selection of “high cultural value species with a high certainty of successful propagation and survival” (Bulter et al. 2012, p. 615).

Community Verification

All information provided by local and Indigenous communities, whether formally or informally, needs to be verified by communities. Information representing individual community members should be validated by knowledge holders and/or providers, while local information can be validated by community representatives that are elected or vetted by knowledge holders and/or providers. In instances where there are language barriers, the interpreters (who are also elected or vetted for) that have an understanding of mutual objectives should be present throughout this process. This process is especially important to ensure interpretations are correct and integrity of TK is maintained.

The work of Gaydos et al. (2015) represents an attempt to quantify community-perceived impacts amongst the Coast Salish of southern coastal British Columbia and northwest Washington State in relation to half a dozen fossil-fuel related development projects proposed for the Salish Sea—a marine waterway shared by the Coast Salish governments, Canada and the United States, and already home to major international ports and shipping lanes. In response to concerns that existing risk assessment methods "fail to account for the fundamental worldviews and relationships that connect Native peoples with the physical, ecological and spiritual worlds, which form the foundation of health and wellbeing," Gaydos et al. (2015) attempted to gauge the likelihood of potential impacts of the proposed projects to Indigenous communities. This was undertaken by compiling a list of 50 culturally important species, and then using available data to assess the likelihood of a project component interacting negatively with these species. Researchers acknowledged that "Coast Salish traditions identify all species as important and connected, making prioritization challenging," and so worked with First Nations members and subject matter experts to identify species of greatest concern and importance according to the following criteria:

- The species is heavily depended upon for harvest revenue
- The species is heavily depended upon as a staple food source
- The species is especially culturally or spiritually significant
- Historically (even if not currently) the species has been part of Coast Salish lifeways (Gaydos et al., 2015).

Once compiled, the list was also verified and endorsed by First Nations members. Charnley et al. (2017) find this type of verification critical to establishing the credibility of TK in order to ensure the use of best available social science, which—unlike natural science—emphasizes “credibility in the eyes of research participants to ensure that their experience is accurately represented” (p. 86). The list was then compared to a list of eight potential impacts associated with each of the proposed projects and assessed according to whether impacts to each culturally important species were likely, possible or unlikely

based on available data. In the authors' estimation the results, which showed that all six projects involved both likely and possible negative impacts to species that are culturally important to the Coast Salish, provided direction on which species/impact scenarios should be prioritized for analysis through cumulative effects assessment, Coast Salish health and well-being studies, and/or further scientific research, etc.

Mutually Acceptable Closure Criteria

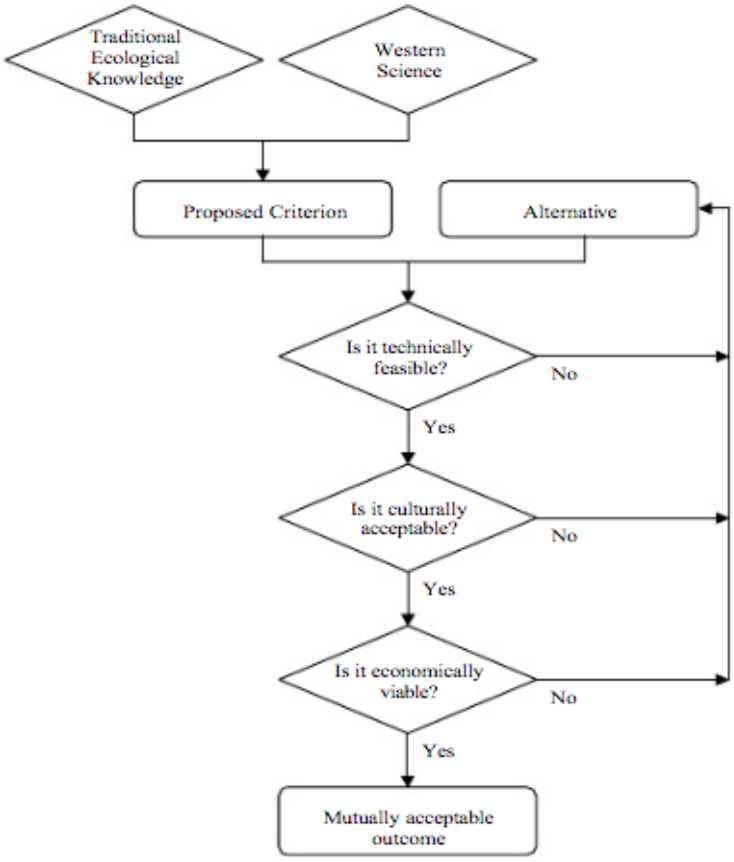
Smith (2008) proposes a method for incorporating both science and TK in rehabilitation efforts, which, although it focuses more on establishing "common ground" between these two ways of knowing than on integrating them to produce new types of information, may meet many of the objectives for integrating TK into the Giant Mine remediation efforts. Smith (2008) describes this approach as a "simple system that can be used to design rehabilitation plans and develop closure criteria that meet the expectations of indigenous landowners, fused with the rigor of western science" (p. 48).

Essentially, conventional scientific methods are used to establish broad-based environmental closure requirements. Knowledge-holders are then engaged in participatory dialogue intended to elicit TK related to these requirements that may be useful for developing, describing and/or communicating more detailed closure criteria.

Detail that provided a holistic view of the environment was first sought, followed by specific information relevant to each environmental requirement. This allowed identification of a list of [knowledge-holder] expectations that form the basis for future land use agreements, but which also included lists of specific flora and fauna species and estimates of appropriate populations within the final vegetation patterns… Finally, spiritual and cultural values were ascribed to the biophysical parts of the landscape and correlated against general scientific parameters. From these, generalized but key closure criteria that met Indigenous landowner and scientific requirements were determined. (Smith 2008, p. 49)

Smith (2008) does imply that where scientific closure criteria has not yet been established, these and criteria drawn from TK can be generated concurrently, as the flowchart below indicates. The process described by this flowchart may be of greater value to science-TK integration efforts than the applications of it described by Smith (2008). An effectively integrated team following the guiding principles and process components described in this document, may be able to use the process laid out in this flowchart to generate mutually acceptable remediation requirements that successfully integrate science and TK-based information. In this approach to integration, Smith (2008) views the knowledge-holders' role as describing "the reconstruction of vegetation patterns that blend with the surrounding, unaffected areas and indicating the species that are most appropriate, culturally and economically, for future generations," and the scientists' as "ensuring that the post-mining landform design can properly support those vegetation patterns (especially with respect to local ecotypes and plants tolerant to the post-mining landscape), and minimizing the release of unwanted chemical species that will contaminate the food and water supplies" (p. 52-53).

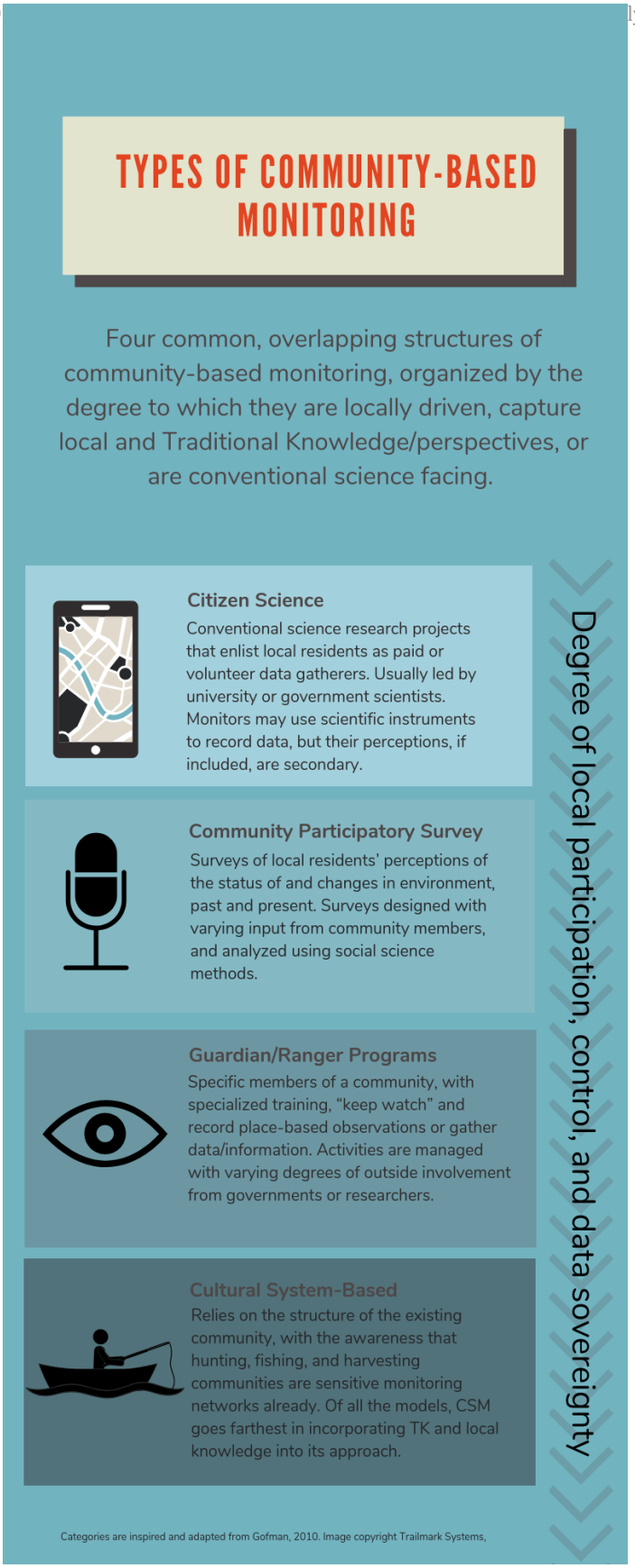
Image 2: Smith's (2008) process flowchart for developing mutually acceptable closure criteria (p. 49)



Community-based Monitoring

Community-based monitoring (CBM) is increasingly recognized as a research method that is ideally suited to documenting ongoing local and/or Indigenous observations of social and environmental phenomena at the local level. Monitoring is an existing part of all other traditional land use practices, including those that are widely understood to be protected Aboriginal rights; all harvesting communities monitor and exchange information about environmental and other conditions relating to the health and availability of the resources they use. Establishing a CBM network then can provide a direct pathway for acknowledging, respecting and including traditional knowledge and traditional land use practices within research and decision-making processes–with the added benefit of supporting the maintenance of those practices. In this way, CBM can simultaneously improve local data and information gathering, and demonstrate appreciation for the authority of Indigenous community members as holders and producers of knowledge. For these reasons, Yellowknives Dene have consistently called for the inclusion of YKDFN-led community-based monitoring to be included as a core component of the oversight and perpetual care of the Giant Mine (Alternative North and YKDFN 2011).

CBM programs must be fundamentally enacted by local (in this case, Indigenous) community members, and should be rooted in the sustained partnerships amongst members engaged in an ongoing project to track and record local environmental trends. These programs typically derive their structure and priorities from the information needs identified by the community, and rely on the participation of community members for data collection and often analysis. Constantino et al., (2008) and Johnson et al. (2015) suggest that community involvement is necessary throughout all stages of the program, from identifying research needs (decision-making applications), through analysis, to recommending how CBM results can impact and inform decision-making. Robust community engagement also helps to ensure sufficient capacity to keep programs operating effectively.



For external parties involved in CBM, community engagement will require considerable time and effort to establish meaningful relationships, consensus and mutual understanding of research and monitoring needs, and to ensure approaches to CBM align with and address external party needs as well as community priorities. Open and adaptable research plans and methodologies are recommended over rigid, prescriptive research structures typical of conventional scientific approaches. Decision-makers need to assess the different types of CBM models that exist and how information is generated by each; CBM can engage local people with science-based systems, or be based primarily on local knowledge, or a combination of the two. Collaboration amongst CBM participants and stakeholders–especially decision-makers–at any point(s) throughout the CBM process can facilitate better understanding of how different types of information are gathered, analyzed, and interpreted, thereby improving and strengthening integration efforts. Developing strategic

points of access and cooperation (e.g. advisory committees) throughout the process can help participants and stakeholders to visualize and maximize the potential applications for CBM data.

CONCLUSION

A TK integration framework for the GMRP cannot be prescribed. In order to be effective such a framework must be developed collaboratively as part of a process that must also successfully establish and/or restore and then be guided by the principles of trust, respect and transparency amongst the parties involved. The best way to integrate TK and science within the GMRP will have to be determined through dialogue between YKDFN knowledge-holders and community members, and the scientists, subject matter experts, and other interested parties. This dialogue can and should lay the groundwork for successful working relationships between these parties as the work of integrating TK and science in the project proceeds. The IAP2 spectrum of public participation provides useful direction on the appropriate styles and levels of engagement in order to ensure that collaboration and true co-development is possible and successful.

In order for integration efforts to achieve the twin goals of incorporating useable, valid and representative TK-based information into decision-making processes, and meaningfully including YKDFN in remediation planning and implementation, it will be necessary for all parties to reach respectful consensus on the tools, protocols and decision-making criteria that will facilitate and govern integration. The TK integration framework should clearly present the results of these discussions, as well as the co-developed rationale for all choices and decisions within the framework and its implementation.

It is understood that the process of developing and finalizing the TK integration framework is as central to achieving the objectives of TK integration as the framework itself–an effective framework that governs successful TK integration will stem from a successful process for developing that framework. It should also be noted that while effectively integrating TK into the GMRP represents an essential step forward in remediating some of the impacts of the mine on the YKDFN, this act alone is unlikely to satisfactorily remedy all of the effects experienced and observed by community members.