‘MOVING MOUNTAINS AND GOALPOSTS – HOW DO YOU KNOW WHEN YOU’VE REACHED THE GOAL?”
REGULATORY PERSPECTIVES OF MINE RECLAMATION SUCCESS

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ABSTRACT
The *Mines Act* (1969) and the Health, Safety and Reclamation Code for Mines in BC (Code) governs standards for all types of mine reclamation in BC. The Code specifies a number of reclamation requirements, including; soil salvage, re-contouring of disturbed surfaces, erosion control, re-establishment of land capability and productive capacity, ecological risk assessment, and monitoring programs to document success. Regulators are often questioned about the changes in interpretation of the Code requirements (i.e. “moving goalposts”). As in most natural sciences, there are no hard and fast rules in reclamation. Each mine and reclamation plan is as unique as its geographic location (i.e. playing field). This means that the rules of the game (i.e. intent of the code) must be interpreted by the referees (i.e. inspectors) according to site and mine design specifics. As the game (i.e. knowledge of the reclamation process) evolves, so do the rules.

The Ministry of Energy and Mine’s (MEM) current interpretation of the rules (i.e. reclamation guidelines) is aimed at ecological restoration. Our approach is informed by site conditions and allows proponents to develop their own game-plan, with guidance from MEM. Baseline ecological assessments and objectives for restoring the land to its pre-mining capability (i.e. the rules) enable proponents to place their project on an ecological restoration track for success. Proponents will be tasked with defining monitoring programs and measures for determining revegetation success (i.e. the team decides where the goalposts are placed). The referees oversee the game for fairness and determine when the goal line is crossed. This move toward a team effort in reclamation holds promise of greater certainty for all parties and will hopefully make finding the goal line easier.

Key Words: mine reclamation, ecological restoration, revegetation

DEFINING RECLAMATION

The term reclamation can be as confusing as the term “football”. It has varying rules and methods of play in different parts of the world. As in football, “reclamation” has geographic and interpretative differences in rules and terminology. Reclamation, as defined by the Society for Ecological Restoration, is considered to be the “*....conversion of land perceived as being useless to a productive condition, commonly for agriculture and silviculture. Recovery of productivity is the main goal...* ” (Clewell and Aronson 2007). This definition relates back to the historic terminology for reclaiming land from the sea to create “productive” agricultural land. It pre-dated current day concepts regarding the values and functions of natural habitats. More recently, other terms have been adopted in the scientific/technical realm to address the breadth of concepts related to reclamation.
These include:

- **Revegetation –** "Establishment of plant cover on open land, usually with one or few species, irrespective of their provenance".
- **Rehabilitation** "The recovery of ecosystem processes to regain normal function and ecosystem services without necessarily restoring the biodiversity of the reference or its projected trajectory".
- **Restoration** or **ecological restoration** "The process of assisting the recovery of an impaired ecosystem" (all definitions from Clewell and Aronson 2007).

In practice, BC's Code encompasses elements of all of the above terms. According to Code, reclamation is defined as follows: "*It is the duty of every owner, agent, and manager to institute and during the life of the mine to carry out a program of environmental protection and reclamation, in accordance with the standards described in this section (10.7.1)*."[1] Within the subsequent 30 standards are provisions for: land use, land capability, stability, landforming, impoundments and waste rock dumps, watercourses, water quality metal uptake, revegetation and monitoring, among others. Needless to say, there is room for interpretation and application of the Code that can be both a strength and weakness. BC has the most diverse climate and terrain in Canada, presenting great challenges for reclamation policy, regulation, strategy and implementation within the mining industry. The Code is broad enough to meet the needs of the diverse mines in various regions of BC, but still requires interpretation to fit specific circumstances. Details of how reclamation objectives are to be accomplished are tailored by MEM to the needs of specific types of mines and their locations, refined during permitting, specified in Permits and enforced by MEM inspectors.

The complexity of issues and interpretations often requires clarification regarding MEM's expectations regarding the approach and determination of reclamation success. To assist in clarifying these concerns, we have utilized the analogy of team sports, specifically football, as a model for success in complex, multi-dimensional endeavours. Concepts such as game plan, strategy, good coaching, focus, keeping the goal line in sight, overcoming the inevitable fumble or dropped ball, all have application for reclamation. The following tips are intended to guide proponents on the path to success.

TIPS FOR SUCCESS

Tip #1 - Know the rules of the game

Just as sports organizations periodically review and modify rules, so do regulators. Our aim is to achieve a level playing field by maintaining consistent goals, objectives and expectations. Mine reclamation has historically involved regrading disturbed surfaces and spoil piles, and planting them with cultivated species to re-establish a highly productive but not necessarily self-sustaining vegetation cover. The current approach has evolved from lessons learned and focuses on re-establishing land capability using an ecological restoration approach to reclamation (i.e. by salvaging soils, adopting landforming techniques and utilizing native species in an effort to re-establish ecosystem functions wherever possible). Other measures, such as soil or water amendments or planting cultivated species (nurse crops) may be necessary to assist the site return to an appropriate, self-regulating complement of native species. This aligns with the Mining Association of Canada's commitment to sustainable development and ongoing efforts to

protect the natural environment. This commitment seeks to minimize the impact of mining operations on the environment and biodiversity, through all stages of development, from exploration to closure; and draws on the 1987 Bruntland Commission definition of Sustainable Development: as one "…that meets the needs of the present without compromising the ability of future generations to meet their own needs."

Tip #2 – Huddle

Develop a strategy. Get the whole team together and talking so everyone knows the game plan. This includes everyone involved; managers, engineers, consultants, players. Mine plans should be developed in consultation with environmental personnel so everyone is aware of limitations, requirements and objectives (e.g. waste rock slopes no greater than 2:1). Plan on scheduling pre-authorization meetings with relevant agencies to discuss options and requirements as early as possible. It will save time, effort and money if you know what the regulators expect instead of guessing or relying on what may be outdated third party advice.

Get the fans (i.e. the public) behind you. Win the public trust. Plan to reduce emissions, re-slope the land, keep the site clean and green, maintain transparency, be a good neighbour (i.e. don't have noisy parties, or bring in bad elements to the neighbourhood). Invite the neighbours over for a visit, get to know them and show them you care about the neighbourhood. The concept of "social licence" has become a critical part of gaining environmental approvals. Plan to do things right and do the right thing.

Tip #3 – Develop a good game plan

The game plan has to be right and appropriate. This is spelled out in guidance documents available on the MEM website. The game plan should start with the baseline inventory of the site, which will enable development of end land use/capability objectives for reclamation. The general reclamation approaches to be used should be well-established in the early stages of mine design in order to pro-actively anticipate opportunities for incorporation of reclamation requirements into the mine plan.

A variety of Mine Plans and Environmental Management Plans are required for Permitting, including the reclamation plan that addresses:

- Soil salvage, management and erosion control;
- Reestablishment of natural landforms and drainages;
- Surface preparation and revegetation to-site specific conditions (i.e. slope, aspect, elevation, moisture conditions);
- Revegetation with natural, local plant species; and,
- Utilization of appropriate literature or site appropriate research as foundation for reclamation and/or research programs.

To achieve these ends, the onus is on the Proponent to propose:

- End land use and capability objectives;
- Measures of success;
- Monitoring programs appropriate for the documentation of success; and,
- Research programs to address topics requiring further information.

This means that the Proponents and their consultants must utilize all of the information available to design site-specific reclamation programs suited to the mine and its location. This includes identifying adaptive management and research programs to provide additional information and certainty for successful restoration efforts. Reclamation/restoration takes time; therefore monitoring and scientifically valid documentation of research and reclamation implementation is essential. This serves both as a documentation of success and as a learning tool for future reclamation endeavours in the province.

Tip #4- Kick off

Issuance of Permit and authorization to start construction. If you have gone through all the steps above, this should be quick and easy**.**

Tip #5 – Establish a good playing field

You can't have a great game in a desert or on a rock pile. The pre-mining assessment of existing substrate conditions provides data for soil salvage volumes and suitability as a growth medium, salvage locations, potential for erosion and baseline soil metal and nutrient concentrations. Soil salvage and proper stockpiling will provide the necessary foundation materials for the reclamation program.

Tip #6 - Good coaching and teamwork

Good coaching and teamwork are critical to make sure that everyone does their job and follows the same game plan. Everyone must play their position to the best of their ability to get the job done. Everyone needs the appropriate training to work to the best of their ability. Environmental superintendents are the coaches, know the rules and have eyes on the ground. They report to, and require the support of the management. Good communication is vital! All team members should know their roles and responsibilities and be aware of the rules.

Tip #7 - Carry the ball

The Permit is a commitment to be followed. Reclamation is progressive and ongoing. Various action items need to be followed throughout the life of mine. Don't wait until the last minute of the 4th quarter to leap into action.

Tip #8 - Minimize the penalties

The objective for the team is to minimize the penalties, especially the major ones. Good coaching and careful execution by all team members keeps the penalties down and expedites the journey to the goal. Follow site rules and regulations. Call the appropriate agencies and inform them if you are having problems. Don't wait for the referees (i.e. inspectors) to come to the site to discover issues.

Tip #9 – Opponents

Schedule/cost/quality are the biggest opponents. Experience helps. That includes your own experience and that of your team. You are looking for both the veteran players and the rookies with the skills and the right attitude; both may be required to build a winning team.

Tip #10 Set the right pace and check your progress

This is especially true when your project is a marathon (i.e. extends over a number of years). A minor problem can turn into a big one if it is not taken care of early. Good plans and processes can help.

Tip #11 Setbacks

If anyone drops the ball, it is a setback but it can be recoverable. Sometimes you have to drop back and punt when things don't go right (i.e. start over with a revised game plan). In a tough situation it is helpful to take the advice of your team members and the referees (i.e. regulators). Potential temporary or short-term closure may be required for geotechnical, ML/ARD, revegetation, sedimentation or other requirements depending on the site and closure scenario. Plan for the unexpected, learn from it and be prepared to make changes.

Tip #12 Results

If you aren't getting the results you want, you have to change the systems that are producing those results! Modify the play, change the equipment, players or training. Knowledge comes from exploring the causes of variation from the expected. There may be too much fog on the field or some of the lights on your scoreboard may be burnt out.

Tip #13 Monitoring

Sports teams are consistently tracking the physical and mental potential of their employees, and using this information to make daily decisions. Why? -they get results from their efforts. A lot of time is spent studying data and building theories about why certain sports systems behave as they do. They don't expect to see performance exceeding what is possible. For reclamation, there is a tendency to expect levels of performance (ecosystem recovery) which are not realistic. Ongoing and long-term monitoring may be required for reclamation depending on the site, its performance and the long-term closure plan.

Tip #14 Keep the goal line in sight

If all conditions of the act, code and permit have been fulfilled to the satisfaction of the Chief Inspector and there are no on-going inspection, monitoring, mitigation or maintenance requirements, the owner, agent or manager will be released from all further obligations under the Mines Act. (Code, Section 10.7.31).

The goal is to end-up with a clean site and stable, self-sustaining vegetation appropriate for local climate and site characteristics, with the potential to achieve structural (i.e. diversity) and functional (i.e. capability) values in the landscape. It is up to the Proponent to plan on how to achieve this goal. As with the mine plan, it is up to the regulators to comment on and approve the plan, if appropriate.

SUMMARY

The most challenging part of reclamation may be the goal of re-establishing or restoring the natural function of the site. *"Land restoration is an acid test of our ecological understanding*" (Bradshaw 1987). The greater the ecological values of the pre-mining site (e.g. critical wildlife habitat), the greater the need and challenge to strive for ecological restoration. For appropriate restoration to occur there is a need to

understand what has changed with the site from pre to post mine. The baseline inventory should serve as a "reference model" for the actual ecosystem(s) upon which restoration planning is based, and as a basis for evaluating the completed restoration project.

Reclamation is often identified with activities occurring at the end of mine life, but despite the majority of "clean-up" or housekeeping commitments at that time, reclamation must be incorporated into the mine plan at the start and throughout the life of mine to ensure its success. Definition of the goal line (i.e. reclamation end-point) should occur at the beginning of the mine development process. A good mine plan that incorporates environmental design elements such as soil salvage, landforming, research and monitoring programs will facilitate site recovery and success. Success is achieved when the objective established at the start of mine life has been met and approved by the regulators. Reclamation research and monitoring of early approaches to reclamation is essential to ensure that results are following the expected trend (Tip 12). If not, the approach may need to be modified. However, determining this early (Tip 11) will allow corrective action to be taken in a timely manner

Good coaching, the right game plan, keeping the goal line in sight selecting the right play at the right time, avoiding penalties, and overcoming the inevitable fumble or dropped ball will leave you dancing in the end zone.

REFERENCES

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For Guidance Documents and further information see the BC Ministry of Energy and Mines Permitting Websites:
http://www.empr.gov.bc.ca/Mining/Permitting-Reclamation/Pages/default.aspx
http://www.empr.gov.bc.ca/Mining/PermittingReclamation/Guidance/PermitAppReqs/Pages/default.aspx