

# Remediation and Reclamation Policy Issues and Knowledge Gaps

Policy Issue	Knowledge Gaps
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<p style="text-align: center;"><b>Regulatory, Guidelines, Directives, Policies, &amp; Criteria</b></p> <p>The degree of conservatism current in some regulatory guidelines can be linked to some unnecessary remedial efforts throughout the petroleum industry. The development of accepted risk and science-based studies to protect the environment and reduce remediation costs.</p>	<ol style="list-style-type: none"> <li>1. <b>Organics (PHC) Remediation</b> <ul style="list-style-type: none"> <li>• Fate and transport mechanisms (e.g., GW based soil guidelines)</li> <li>• Understand appropriate protection of various exposure pathways</li> <li>• Clarity on AB Guideline assumptions (e.g., continuous source)</li> </ul> </li> <li>2. <b>Inorganics (salinity, metals) Remediation</b> <ul style="list-style-type: none"> <li>• Fate and transport mechanisms (e.g., GW-based soil guidelines) <ul style="list-style-type: none"> <li>• Understanding background concentrations (including regional variations) of metals and salts</li> </ul> </li> <li>• Understand appropriate protection of various exposure pathways <ul style="list-style-type: none"> <li>• Clarity on Soil Contamination Assessment and Remediation Guidelines (SCARG) criteria (e.g., EC, SAR)</li> </ul> </li> <li>• Outcome-based soil quality guidelines for inorganics (surface/subsoil)</li> </ul> </li> <li>3. <b>Research to support future updates to forested wellsite reclamation criteria:</b> <ul style="list-style-type: none"> <li>• Review of sites reclaimed post 2007. Examples of research questions: <ul style="list-style-type: none"> <li>• Are sites on a trajectory to achieve the offsite ecosite or ecosite phase? <ul style="list-style-type: none"> <li>- Growth curves for woody species on reclaimed sites to support earlier certification of non oil and gas activities.</li> <li>- Woody species plant community trajectory/survival rates on clay pads reclaimed to after 2007.</li> </ul> </li> <li>• Addition of species diversity parameters and thresholds to the forested criteria. Examples of research ideas: <ul style="list-style-type: none"> <li>- Methods for assessing components of habitat for various species (e.g., caribou, mountain sheep, goats).</li> <li>- Methods for determining plant communities indicative of specific ecosites/ecosite phases.</li> <li>- Undesirable species threshold for forested criteria.</li> <li>- How much grass is too much to ensure reasonable growth over time in sensitive areas (e.g. caribou).</li> <li>- Retrospective study on forested trajectories for reclaimed eco-sites with First Nations, Indigenous community representation to measure the success of forested BMP/treatments on wellsites post certification.</li> </ul> </li> </ul> </li> </ul> </li> <li>4. <b>Support the development and update of wetland reclamation closure policy</b> <ul style="list-style-type: none"> <li>• Site selection criteria and tools for selection when reclaiming to wetlands (sites that were not previously wetlands). <ul style="list-style-type: none"> <li>• Review of species richness of reclaimed wetlands on large borrow pits within the combined zones of shallow open water, emergent, wet meadow zones and swamps (when present) across the boreal/parkland for the purpose of reclamation certification.</li> <li>• Minimum species richness and cover required to verify a desired wetland plant community.</li> </ul> </li> <li>• Peatland shifts (e.g.) moderately rich fens to rich fens and construction techniques for preventing loss of trees in caribou zones during minimal disturbance construction.</li> <li>• Peatland partial pad construction, options for establishing trees/shrubs to meet potential woody species requirements in caribou zones.</li> </ul> </li> <li>5. <b>Research to support restoration requirements outlined in subregional planning for Caribou region</b></li> <li>6. <b>Effectiveness of restoration/reclamation treatments:</b> <ul style="list-style-type: none"> <li>• When is a disturbance (e.g., seismic line) no longer a disturbance? <ul style="list-style-type: none"> <li>• Ecological value of reclamation (function, habitat, and hydrology) of different reclamation treatments (e.g., natural recovery, progressive reclamation, mounding, full/partial pad removal) compared to pre-/un-disturbed habitats.</li> </ul> </li> <li>• Determining how to measure or assess if a reclaimed site (e.g., p/l, transmission lines, new seismic, OSE) or plant community is on a trajectory to achieve one indicative of a pre-disturbance eco-site phase for</li> </ul> </li> <li>7. <b>Other</b> <ul style="list-style-type: none"> <li>• Understand Phase I ESA calculations for Drilling Waste (link to soil/GW guidelines)</li> <li>• Understand the appropriateness of using of regional/multi-site assessments and develop a set of expectations/requirements for use</li> <li>• Develop expectations/requirement for the use of software tools/numerical modelling</li> </ul> </li> </ol>
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<p><b>Risk Assessment</b> Identify areas for broad application of risk assessment strategies that protect the environment and reduce the required management/remediation efforts.</p>	<ul style="list-style-type: none"> <li>• Understanding risk assessment of receptors <ul style="list-style-type: none"> <li>• Standardized approach of risk assessment based on residual mass vs numerical endpoints (i.e., Tier 2C)</li> <li>• Software tools to aid in the standardized application of Tier 2 guidelines using appropriate site-specific data.</li> </ul> </li> </ul>
<p><b>Reclamation and remediation technology advancement</b> Technology improvements and finding new applications of existing and new technologies to reduce reclamation and remediation costs and timelines.</p>	<ol style="list-style-type: none"> <li>1. <b>Petroleum hydrocarbon in fractured bedrock – effective remedial methods, associated risks, assessment effectiveness and relevance to environmental risk.</b></li> <li>2. <b>Practical remedial options for petroleum hydrocarbons, salinity, and metals impacts in wetland environments.</b></li> <li>3. <b>Effective in-situ/ex-situ groundwater treatment system(s) for petroleum hydrocarbon and salinity impacted sites.</b></li> <li>4. <b>Technologies that address specific issues: small volumes, longer remediation timeframes (e.g., 10+ years), modified endpoints.</b></li> <li>5. <b>Native Grassland Reclamation BMP development:</b> <ul style="list-style-type: none"> <li>• Techniques for meeting infill requirements on problem sites.</li> <li>• Managing Type 3 and 4 species on historical grassland sites constructed/reclaimed pre-2010).</li> <li>• Techniques for management of crested wheatgrass</li> <li>• Preventing problem native grassland reclamation sites – education tools.</li> </ul> </li> <li>6. <b>Forested reclamation BMP Development</b> <ul style="list-style-type: none"> <li>• Success of different reclamation treatments (e.g., natural recovery, progressive reclamation, mounding, planting) in establishing pre-disturbance ecosites.</li> <li>• Weed trajectories in woody plant communities, influences of boreal community variables on longevity of common noxious weeds (shade, woody species diversity/abundance, peat/mineral mixes, soil type). How long and what conditions will individual noxious weeds become outcompeted by forested plant communities?</li> </ul> </li> <li>7. <b>Use of remote sensing (e.g., ARUs, drones/UAVs, imagery), in reclamation</b> <ul style="list-style-type: none"> <li>• Where/when can remote sensing data used for reducing sampling intensity for field level data collection?</li> <li>• Use of remote sensing to verify plant communities are indicative of the ecosite/ecosite phase.</li> <li>• Use of remote sensing to confirm or verify disturbances: <ul style="list-style-type: none"> <li>• Borrows: e.g., snapshots of site following construction, informing wetland indicators/success;</li> </ul> </li> <li>• Assess site variability: progressive reclamation, soil replacement, vegetation monitoring.</li> <li>• Monitoring vegetation: weeds, native grasses, woody species</li> </ul> </li> </ol>