

**OVERVIEW OF DEVELOPMENT OF  
ENVIRONMENTAL MANAGEMENT AND  
MONITORING PLANS (EMMP) FOR THE  
HARDROCK PROJECT**

## Introduction

Chapter 23 of the Final Environmental Impact Statement/Environmental Assessment (EIS/EA) (Stantec 2017) for the Hardrock Project provided a preliminary framework and scope for Environmental Management and Monitoring Plans (EMMPs), including environmental assessment follow-up and monitoring programs developed through the federal EA process for all Project phases as per the Environmental Impact Statement (EIS) Guidelines, and approved provincial EA Terms of Reference.

Greenstone Gold Mines GP Inc. (GGM) is committed to minimizing environmental effects through mitigation measures, monitoring and adaptive management for the Project within EMMPs throughout the construction and operational phases of the project. Through the EMMPs, the Project's environmental risks and opportunities will be addressed in a comprehensive, systematic, planned and documented manner to support the following objectives:

- To carry out the Project in compliance with existing legislation, consistent with federal and provincial guidelines, best practices and GGM corporate policies;
- To document measures to mitigate environmental effects;
- To enhance benefits from the Project; and
- To structure reporting to inform adaptive management and continual improvement.

The EMMPs will guide environmental management for the Project and will be progressively developed as the Project moves through the EIS/EA process, permitting, and construction, and will also be updated based on continual improvement during operation through adaptive management practices. The development of specific EMMPs must anticipate project development activities, such that appropriate procedures are in place to support the training of workers and the development of effective oversight processes for the work before the work commences. The EMMP's will be "*living documents*", continually updated as new environmental permits are issued and other commitments come into effect, and as site development progresses into new phases of activity.

EMMP development was initiated during the EIS/EA process with the preparation of Conceptual EMMPs (Appendix M of the Final EIS/EA) to demonstrate GGM's approach and commitment to environmental protection consistent with the EA. Those EMMPs are broad in their level of detail, commitment-based and focused on the construction and operation phases of the Project. They include input received from consultation during the Draft EIS/EA preparation and review stage. The level of detail in each EMMP will expand as Project planning and design advance, when detailed follow-up programs are prescribed in the EIS/EA process, and as detailed engineering progresses and specific permit conditions become known. In some cases, an EMMP will be updated as part of the permit application process, but often it will be more appropriate to do this after the monitoring and compliance requirements are confirmed when the permit is issued.

The Project will be subject to a range of monitoring programs, each with its own scope and objective. These include environmental monitoring carried out under specific permit requirements and prescribed EIS/EA follow-up programs, as well as more general regulatory compliance. The objectives of the various EMMP programs will be complementary to reduce duplication, and will be used collectively to inform Project planning and implement the long-term environmental management requirements of the Project. GGM's adaptive management mechanism will be followed to update plans as required.

The following schematic diagram provides a general schedule for when detailed individual EMMP's are expected to be required. The accompanying table outlines the specific activities, environmental permits and regulations that will influence their timing and content. This is intended as a guide and subject to refinement based on permitting discussions with agencies anticipated in 2018.

Overview of Development of Environmental Management and Monitoring Plans (EMMP) for the Hardrock Project

Reference: Chapter 23 of the Final EIS/EA (Follow-Up and Monitoring Programs and Environmental Management Plans)



Overview of Development of Environmental Management and Monitoring Plans (EMMP) for the Hardrock Project

Environmental Management & Monitoring Plan (EMMP)	Scope / Purpose	Project Activities that will trigger initial plan development	Timing of Plan Development	Links to Regulations, Standards and Regulating Authority																
M1 – Water Management and Monitoring Plan (WMMP)	<p>The purpose of the WMMP is to:</p> <ul style="list-style-type: none"> <li>provide a reliable water supply for Project operation</li> <li>use system capacities to maintain a flexible and robust system that allows for the reduction of peak flows requiring treatment and management</li> <li>where possible, keep contact and non-contact waters separate to reduce the volume of water under management and to reduce the effect of the Project on local waters</li> <li>manage and treat contact water and sanitary effluent streams to meet regulatory effluent requirements and be protective of the receiving environment.</li> </ul>	<p>Preconstruction; (road construction, tree clearing, etc.), potential erosion effects on waterways</p> <p>Construction; (site excavations, aggregate pit dewatering, mine shaft dewatering, camp operation, road crossings of creeks, creek realignment, etc.)</p>	<ul style="list-style-type: none"> <li>Following EA approval prior to site activities involving water</li> <li>Update as site activities and permits evolve</li> </ul>	<p>MOECC DFO MNR ECCC</p> <ul style="list-style-type: none"> <li>Ontario Provincial Water Quality Objectives and Interim Guidelines</li> <li>Canadian MMER Effluent Criteria (DFO 2002)</li> <li>Effluent Monitoring and Effluent Limits - Metal Mining Sector (O. Reg. 560/94)</li> <li>MNR Lakes and Rivers Improvement Act Administrative Guide (MNR 2011)</li> <li>Canadian Dam Association guidelines</li> <li>Mining Association of Canada guidelines for Developing an Operations, Maintenance and Surveillance Manual</li> <li>Ontario <i>Safe Drinking Water Act</i> and Regulations</li> <li>Federal <i>Fisheries Act, 1985</i></li> </ul>																
<p><b>Abbreviations:</b></p> <table> <tr> <td>MOECC</td> <td>Ontario Ministry of the Environment and Climate Change</td> </tr> <tr> <td>MNR</td> <td>Ontario Ministry of Natural Resources and Forestry</td> </tr> <tr> <td>MNDM</td> <td>Ontario Ministry of Northern Development and Mines</td> </tr> <tr> <td>MTCS</td> <td>Ontario Ministry of Tourism, Culture and Sport</td> </tr> <tr> <td>DFO</td> <td>Department of Fisheries and Oceans Canada</td> </tr> <tr> <td>ECCC</td> <td>Environment and Climate Change Canada</td> </tr> <tr> <td>NRCAN</td> <td>Department of Natural Resources Canada</td> </tr> <tr> <td>MMER</td> <td>Metal Mining Effluent Regulations</td> </tr> </table>					MOECC	Ontario Ministry of the Environment and Climate Change	MNR	Ontario Ministry of Natural Resources and Forestry	MNDM	Ontario Ministry of Northern Development and Mines	MTCS	Ontario Ministry of Tourism, Culture and Sport	DFO	Department of Fisheries and Oceans Canada	ECCC	Environment and Climate Change Canada	NRCAN	Department of Natural Resources Canada	MMER	Metal Mining Effluent Regulations
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M2 – Waste Rock Management Plan (WRMP)	<p>The purpose of the WRMP is to provide the geochemical testing and characterization program that will be implemented to guide the use, storage, and management of waste rock for the Project. Specifically, the WRMP identifies:</p> <ul style="list-style-type: none"> <li>• acid rock drainage (ARD) / metal leaching criteria to guide the management of waste rock, including the identification of waste rock appropriate for construction purposes</li> <li>• procedures to be implemented during operation to classify and manage various waste rock lithologies based on ARD potential</li> <li>• methods to manage ARD from WRSAs based on the geochemical properties of the material.</li> </ul>	Construction; (moving old tailings, excavation of foundations, starter pit development, TMF dam construction, etc.)	<ul style="list-style-type: none"> <li>• Following EA approval, prior to site activities involving movement of historic or newly developed waste rock</li> <li>• Update as site activities evolve</li> </ul>	<p>MNDM MOECC</p> <ul style="list-style-type: none"> <li>• Ontario Provincial Water Quality Objectives and Interim Values</li> <li>• Aquatic Protection Values</li> </ul>

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M3 – Emergency Response Plan (ERP)	<p>The purpose of the ERP is to:</p> <ul style="list-style-type: none"> <li>• facilitate prompt, efficient and safe response actions for addressing emergencies or compliance issues</li> <li>• identify the organization, responsibilities and reporting procedures of the emergency response team</li> <li>• define appropriate communications protocols, including procedures to contact relevant regulatory agencies and Aboriginal communities related to an accident or malfunction event and follow-up actions that will be taken</li> <li>• provide site information on the facilities and contingencies in place should an emergency or compliance issue occur</li> <li>• provide support and information on available resources, facilities and trained personnel if an emergency occurs.</li> </ul>	Preconstruction (fuel use, tree clearing, road construction, camp operation, etc.)	<ul style="list-style-type: none"> <li>• Following EA approval, prior to site clearing activities</li> <li>• Update as site activities evolve</li> </ul>	<p>MNDM MOECC ECCC</p> <ul style="list-style-type: none"> <li>• United Nations Environment Programme (UNEP) report titled Awareness and Preparedness for Emergencies on a Local Level for Mining: Guidance for the Mining Industry in Raising Awareness and Preparedness for Emergencies at Local Level (UNEP 2001)</li> <li>• Environmental Code of Practice for Metal Mines (Environment Canada 20)</li> <li>• CAN/CSA-Z731-M91 Emergency Planning for Industry (Canadian Standards Association 2002)</li> <li>• Workplace Hazardous Materials Information System 2015 (WHMIS) (Health Canada 2015)</li> <li>• Implementation Guidelines for Part 8 of the Canadian Environmental Protection Act, 1999 – Environmental Emergency Plans (Environment Canada 2004).</li> <li>• Federal <i>Transportation of Dangerous Goods Act</i>, 1992</li> <li>• Emergency Management Program Standards O.Reg. 380/04</li> <li>• <i>Occupational Health and Safety Act</i> (1990), and associated Ontario Regulation 854: Mines and Mining Plants</li> </ul>

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M4 – Waste Management Plan (WMP)	<p>The purpose of the WMP is to facilitate the effective management of solid non-hazardous wastes generated from the Project including setting performance objectives, ensuring compliance with regulatory requirements and adhering to the waste management principles of Reduce, Reuse, Recycle, Recover. The WMP outlines:</p> <ul style="list-style-type: none"> <li>• compliance obligations and methods for managing compliance with these requirements</li> <li>• performance objectives of the WMP</li> <li>• estimates of the quantity and type of solid non-hazardous waste to be generated</li> <li>• methods for characterizing and segregating hazardous waste from the solid waste management stream</li> <li>• appropriate disposal, recycling, or re-use options for wastes generated</li> <li>• tracking environmental performance and evaluating mitigation measures to enable the implementation of adaptive follow-up programs as needed.</li> </ul>	Construction; (camp operation, demolition of houses / buildings, receipt of building materials, etc.)	<ul style="list-style-type: none"> <li>• Following EA approval, prior to construction activities</li> <li>• Update as site activities evolve</li> </ul>	<p>MOECC ECCC</p> <ul style="list-style-type: none"> <li>• <i>Federal Transportation of Dangerous Goods Act</i>;</li> <li>• <i>Canadian Environmental Protection Act</i> and applicable regulations</li> <li>• <i>Ontario Environmental Protection Act</i>, and several associated regulations</li> <li>• Ontario Regulation 347: General – Waste Management</li> </ul>

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M5 - Erosion and Sediment Control Plan (ESCP)	The purpose of the ESCP is to provide measures and Management Practices to limit site erosion and protect the watercourses from sedimentation for the protection of the environment.	Preconstruction; (road construction, site clearing)  Construction; site preparation	<ul style="list-style-type: none"> <li>• Following EA approval, prior to site activities</li> <li>• Update as site activities evolve</li> </ul>	MNRF MOECC DFO  <ul style="list-style-type: none"> <li>• <i>Fisheries Act</i> and MMER (suspended solids a deleterious substance to fish);</li> <li>• <i>Environmental Protection Act</i> (MOECC)</li> <li>• <i>Lakes and Rivers Improvement Act</i> (MNRF)</li> <li>• <i>Ontario Water Resources Act</i> (MOECC)</li> <li>• <i>Endangered Species Act</i> (MNRF)</li> <li>• Ontario Provincial Standard Specification for Temporary Erosion and Sediment Control Measures (OPSS 805, November 2006).</li> <li>• Ontario Provincial Standard Specification, 2014. Construction Specification for Seed and Cover Measures (OPSS 804). April 2014.</li> </ul>
M6 - Greenhouse Gas Management and Monitoring Plan (GHGMMP)	The purpose of the GHGMMP is to reduce and record the Project GHG emissions to comply with relevant GHG emissions management and reporting legislation.	Construction phase; ordering of key process equipment and vehicles	<ul style="list-style-type: none"> <li>• Following EA approval</li> <li>• Prior to ordering of key process equipment and vehicles</li> </ul>	MOECC ECCC  <ul style="list-style-type: none"> <li>• Passenger Automobile and Light Truck Greenhouse Gas Emission Regulations, SOR/2010–201; 74, aligned with the US, sets progressively stricter GHG emissions standards for 2011-2016 model years</li> <li>• Heavy-duty Vehicle and Engine Greenhouse Gas Emission Regulations, SOR/2013-24, apply to 2014 and later model years</li> <li>• Ontario Greenhouse Gas Emissions Reporting amendment (O. Reg.452/09)</li> <li>• Climate Change Mitigation and Low Carbon Economy Act, 2016 - O.Reg 143/16 and provincial ‘cap and trade’ program (O.Reg 144/16)</li> </ul>



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M7 – Air Quality Management and Monitoring Plan (AQMMP)	<p>The purpose of the AQMMP is to:</p> <ul style="list-style-type: none"> <li>describe requirements for the routine management of sources of airborne dust during construction and operation</li> <li>describe requirements for monitoring ambient air quality and meteorological conditions in and near the PDA as the basis for assessing potential air quality effects that may be attributable to the Project on surrounding areas</li> <li>track air quality performance and provide feedback to the Environment Manager which may be used to refine the dust suppression program and other potentially significant air quality sources</li> <li>describe requirements for provincial and federal air quality and emissions reporting.</li> </ul>	<p>Construction; haul road traffic, camp operation, burning of brush (if any), etc.</p> <p>Operation; mine operations, process plant operation</p>	<ul style="list-style-type: none"> <li>Following EA approval, prior to major construction works;</li> <li>Update as site activities evolve;</li> </ul>	<p>MOECC</p> <ul style="list-style-type: none"> <li>MOECC Operations Manual for Air Quality Monitoring in Ontario (MOE 2008) (Operations Manual);</li> <li>Control of fugitive dust emissions per Appendix B of MOECC Guideline A-10</li> <li>National Ambient Air Quality Objectives (NAAQOs) (Canada Gazette 1989), Canada Wide Standards (CWS) and the Canadian Ambient Air Quality Standards (CAAQS) PM2.5, ozone, CO, TSP, SO2 and NO2</li> <li>Ontario Regulation 419/05 Ambient Air Quality Criteria (AAQC) Schedule 3 standards</li> <li><i>Toxics Reduction Act (TRA)</i> - O. Reg. 455/09 Ontario Toxics Reduction Program</li> <li>Canadian NPRI regulations</li> </ul>

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M8 – Spill Prevention and Response Plan (SPRP)	<p>The purpose of the SPRP is to provide the Hardrock Project with guidance in the development of spill prevention, contingency planning and reporting practices for the timely and effective response to spills of pollutants during the Project construction and operation phases for the safety of the environment and Project infrastructure.</p>	Preconstruction; (road construction, site clearing)	<ul style="list-style-type: none"> <li>• Following EA approval, prior to site activities</li> <li>• Update as site activities evolve</li> </ul>	<p>MOECC DFO ECCC</p> <ul style="list-style-type: none"> <li>• <i>Fisheries Act</i> (DFO);</li> <li>• MMER (Environment and Climate Change Canada)</li> <li>• <i>Transportation of Dangerous Goods Act, 1992</i></li> <li>• CAN/CSA-Z731-M91 Emergency Planning for Industry (Canadian Standards Association 2002)</li> <li>• Environmental Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products (CCME 2003)</li> <li>• Workplace Hazardous Materials Information System 2015 (WHMIS) (Health Canada 2015);</li> <li>• Implementation Guidelines for Part 8 of the Canadian <i>Environmental Protection Act, 1999</i> – Environmental Emergency Plans (Environment Canada 2004)</li> <li>• <i>Environmental Protection Act</i> – O. Reg 224/07 Spill Prevention and Contingency Plans</li> </ul>
M9 – Soil Management Plan (SMP)	<p>The purpose of the SMP is to:</p> <ul style="list-style-type: none"> <li>• retain and preserve suitable soil for use in Project rehabilitation</li> <li>• identify and manage soil impacted by existing or historical anthropogenic activities that require excavation to allow development of the Project.</li> </ul>	Construction; (road construction, soil stripping of quarries or other work sites, excavating historic tailings, etc.)	<ul style="list-style-type: none"> <li>• Following EA approval, prior major construction works</li> <li>• Update as site activities evolve</li> </ul>	<p>MNDM</p> <ul style="list-style-type: none"> <li>• <i>Environmental Protection Act, R.S.O. 1990, c. E.19</i>;</li> <li>• O. Regulation 347: General - Waste Management</li> <li>• MOECC - Management of Excess Soil, A Guide for Best Management Practices (2014)</li> <li>• MOECC Site Condition Standards; Tables 1 - 9 of Ontario Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the <i>Environmental Protection Act</i> (2011)</li> </ul>

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M10 – Noise and Vibration Management and Monitoring Plan (NVMMP)	<p>The purpose of the NVMMP is to:</p> <ul style="list-style-type: none"> <li>describe requirements for the routine management/ maintenance of sources of noise and vibration during construction and operation</li> <li>describe requirements for monitoring noise and vibration during various phases of the Project, as the basis of asserting compliance of Project construction and operation against the predictions described in the Final EIS/EA</li> <li>describe acoustic assessment and reporting requirements for provincial (and federal) approval/compliance</li> <li>develop a monitoring program to verify the effectiveness of the mitigation measures implemented for the Project and compliance with the requirements and guidance identified in the “Technical Data Report: Hardrock Project – Noise and Vibration Assessment” (Appendix F2)</li> <li>Identify: minimum equipment performance requirements, monitoring locations, duration and timing of the monitoring, analysis and reporting requirements and training of field personnel</li> <li>provide guidance for abatement if exceedances are found during compliance verification.</li> </ul>	Construction; (site excavations, aggregate pit operation, blasting in starter pit, etc.)	<ul style="list-style-type: none"> <li>Following EA approval, prior to site activities involving blasting or trucking of large volumes of waste rock</li> <li>Update as site activities evolve</li> </ul>	<p>MOECC</p> <ul style="list-style-type: none"> <li>For construction and operation noise, in accordance with the NPC-300, sound level and construction vibration limits at points of reception (PoR)</li> <li>For operation vibration: ISO 2631-2 provides guidance pertaining to upset limits of vibration exposure</li> <li>For blasting noise and vibration: NPC-119 provides limits to noise and vibration at receptor locations</li> </ul>

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M11 - Explosives and Blasting Management Plan (EBMP)	The purpose of the EBMP is to provide direction for the safe storage, handling and use of explosives and explosive components at the Project, for the safety of the public and Project personnel, and protect both the environment and Project components.	Construction; (blasting in starter pit and foundation excavations)	<ul style="list-style-type: none"> <li>• Prior to use of explosives for excavating the starter pit, building foundations etc.</li> <li>• Update as site activities evolve</li> </ul>	<p>NRCAN ECCC DFO MNRF</p> <ul style="list-style-type: none"> <li>• Canadian Explosives Regulations, 2013 (SOR/2013-211) outline the requirements for an application for a license;</li> <li>• Ammonium Nitrate Storage Facilities Regulations (CRC, c 1145);</li> <li>• Transportation of Dangerous Goods Regulations (SOR/2001-286);</li> <li>• Environmental Emergency Regulations (SOR/2003-307 as amended by SOR/2011-294); and</li> <li>• Natural Resources Canada (2014) Guidelines for Bulk Explosives Facilities</li> <li>• DFO's Measures to Avoid Causing Harm to Fish and Fish Habitat Including Aquatic Species at Risk (DFO 2016)</li> </ul>

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M12 – Aquatic Management and Monitoring Plan (AMMP)	<p>The Purpose of the AMMP is to:</p> <ul style="list-style-type: none"> <li>describe proposed mitigation to protect fish and fish habitat</li> <li>describe proposed methods for monitoring potential effects on the aquatic environment to verify the predictions made within the Final EIS/EA</li> <li>convey the intended management and monitoring plans to stakeholders for consideration in the development of individual, regulatory monitoring requirements (e.g. Fisheries Act Authorization, environmental effects monitoring, Environmental Compliance Approval, Follow-up Program Agreement).</li> </ul>	<p>Preconstruction; (only if road construction involves new or upgraded creek crossings)</p> <p>Construction; (construction of creek crossings, creek diversion, discharge of water from excavations near fish habitat, etc.)</p>	<ul style="list-style-type: none"> <li>Following EA approval, prior to site activities involving fish habitat</li> <li>Update as site activities evolve</li> </ul>	<p>MOECC DFO MNRF ECCC</p> <ul style="list-style-type: none"> <li>Canadian <i>Fisheries Act</i> prohibits serious harm to fish, which is defined as the death of fish or a permanent alteration to fish habitat of a spatial scale, duration or intensity that limits or diminishes the ability of fish to use such habitats ... to carry out their life processes;</li> <li><i>Fisheries Act</i> Authorizations for the loss or permanent alteration of fish habitat</li> <li>MMER, under Section 36 of the Fisheries Act, regulate deposit of mine waste into natural waters frequented by fish</li> <li><i>Ontario Lakes and Rivers Improvement Act</i></li> <li><i>Ontario Fish and Wildlife Conservation Act</i></li> </ul>

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M13 – Biodiversity Management and Management Plan (BMMP)	<p>The purpose of the BMMP is to:</p> <ul style="list-style-type: none"> <li>• Outline mitigation approaches for reducing effects on vegetation and wildlife</li> <li>• Outline vegetation and wildlife monitoring program for construction and operation phases to confirm effectiveness of mitigation measures and verify Final EIS/EA conclusions.</li> </ul>	Preconstruction; (site clearing)	<ul style="list-style-type: none"> <li>• Following EA approval, prior to site activities involving wildlife or plant habitat e.g. tree clearing that might impact Species-at-Risk, raptor nests, active bird nesting sites, etc.</li> <li>• Update as site activities evolve</li> </ul>	<p>MNRF DFO ECCC</p> <ul style="list-style-type: none"> <li>• <i>Canada Species at Risk Act (SARA)</i></li> <li>• Federal Recovery Strategies for boreal caribou (2012), Canada warbler (2016), common nighthawk (2016), and one proposed recovery strategy (little brown myotis and northern myotis (2015))</li> <li>• <i>Migratory Birds Convention Act</i> - prohibits the harming, killing, disturbance or destruction of migratory birds, nests and eggs and prohibits depositing oil ... or other substances harmful to migratory birds in areas they may inhabit</li> <li>• <i>Ontario Endangered Species Act, 2007 (ESA)</i> Ontario Regulation 242/08 provides specific exemptions from the provisions of the ESA under certain conditions;</li> <li>• Ontario Woodland Caribou Conservation Plan (MNR 2009);</li> <li>• <i>Ontario Fish and Wildlife Conservation Act</i></li> <li>• Ontario Policy Statement (MMAH 2014) informs land use planning decisions under the Planning Act; Natural Heritage Reference Manual (MNR, 2010); Significant Wildlife Habitat Technical Guide (MNR 2000); and Eco-Region Criteria Schedules (MNRF 2015) for significant wildlife habitat.</li> </ul>

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M14 - Archaeology and Heritage Resource Management Plan (AHRMP)	The purpose of the AHRMP is to ensure the protection of archaeological and cultural heritage resources that could potentially be affected by the Project and where necessary, to identify new resources that may warrant appropriate documentation, salvage and commemoration.	Preconstruction; (road construction, site clearing)	<ul style="list-style-type: none"> <li>• Following EA approval, prior to any site activities involving disturbance of soil or vegetation</li> <li>• Update as site activities evolve</li> </ul>	<p>MNDM MTCS</p> <ul style="list-style-type: none"> <li>• MTCS Ontario Heritage Act and Standards and Guidelines for Consultant Archaeologists (2011) apply to management of archaeological resources;</li> <li>• Ontario Cemeteries Act provides for measures associated with a burial site or artifacts associated with human remains</li> <li>• Mitigation strategies are developed using the MTCS Ontario Heritage Tool Kit (2006)</li> </ul>