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VOLUME 3: ASSESSMENT METHODS

Whale Tail Pit Project
Meadowbank Division

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REPORT

EXECUTIVE SUMMARY – VOLUME 3 ASSESSMENT METHODS

Volume 3 describes the approach that was used for analyzing potential effects, and classifying and determining the environmental significance of impacts from the Project on the biophysical and socio-economic environments.

The approaches and methods for assessing potential effects from the Project on the biophysical and socio-economic environments are broken down into the following key elements:

- Valued Components (VCs);
- Pathway Analysis;
- Spatial and Temporal Boundaries;
- Effects Analysis;
- Residual Impact Classification and Significance;
- Uncertainty; and
- Monitoring and Follow-up.

Valued components represent physical, biological, cultural, social, and economic properties of the environment that are either legally, politically, publically, or professionally recognized as important by society. Valued components selected in 2005 are considered appropriate for this Final Environmental Impact Statement (FEIS) Amendment as they are consistent with the issues raised during 2005 FEIS process and recent public meetings with Agnico Eagle.

Pathway analyses are used to identify and assess the linkages between Project components or activities and potential residual effects (i.e., effects after mitigation) to VCs. Pathways are determined to be primary, secondary, or as having no linkage using scientific and traditional knowledge, logic, and experience with similar developments and environmental design features. Each potential pathway is assessed and described as follows:

- no linkage – pathway is removed by environmental design features (i.e., effect mitigation) so that the Project results in no detectable (measurable) environmental change and residual effects to a VC when compared to baseline or guideline values;
- secondary – pathway could result in a minor environmental change, but would have a negligible residual effect on a VC when compared to baseline or guideline values; or
- primary – pathway is likely to result in a measurable environmental change that could contribute to residual effects on a VC when compared to baseline or guideline values.

Pathways with no linkage or that are considered minor are not predicted to result in environmentally significant effects and are not analyzed further. Alternatively, primary pathways undergo further effects analysis to determine the potential environmental significance of the Project on the key properties of VCs. Key properties are called “assessment endpoints”, and should be protected for their use by future human generations.

Spatial and temporal boundaries are defined for each VC prior to the effects analysis. Spatial and temporal boundaries link component-specific characteristics with the appropriate spatial and temporal scales for effects analyses, and gives broad definitions for the boundaries.

The effects analysis provides the general approach to analyzing potential Project-specific and cumulative (where applicable) effects. Cumulative effects assessment includes other human activities that overlap with the spatial and temporal distribution of a VC, and has the potential to substantially affect the environment, including past, present, and reasonably foreseeable future development.

The residual effects summary presents a numerical and/or qualitative description of magnitude, geographic extent, duration, and frequency of residual effects from each pathway. From the summary of residual effects, each pathway that is linked to an assessment endpoint is classified using categorical scales for each impact criterion (e.g., low magnitude, regional geographic extent, long-term duration, high likelihood). Results from the effects analysis and residual impact classification are then used in the evaluation of the significance of impacts from the Project on VCs.

For each effects analysis, key sources of uncertainty are presented, and how the uncertainty is addressed to increase the level of confidence that potential effects to the VC would not be worse than predicted is discussed. Monitoring programs are proposed to deal with the uncertainties associated with the impact predictions and environmental design features. In general, monitoring is used to test (verify) impact predictions and determine the effectiveness of environmental design features (mitigation). Monitoring is also used to identify unanticipated effects and implement adaptive management, where required.

ᓇᐃᓈᖅᓯᒪᔪᖅ – ᐅᖃᓕᒫᒐᖅ 3 ᖃᐅᔨᓴᐃᓂᕐᒧᑦ ᐊᑐᖅᑕᐅᖃᑦᑕᖅᑐᑦ

ᐅᖃᓕᒫᒐᖅ 3 ᐅᖃᐅᓯᖃᖅᑐᑦ ᐊᑐᖅᑕᐅᔪᒥᒃ ᖃᐅᔨᓴᐃᓂᕐᒧᑦ ᖃᓄᐃᖓᓕᖅᑎᑦᑎᓂᐅᑐᐃᓐᓇᕆᐊᖃᖅᑐᓂᒃ, ᐊᒻᒪᓗ ᐃᓂᓕᐅᖅᓱᑎᑦ ᐊᒻᒪᓗ ᖃᐅᔾᔭᓂᕐᒧᑦ ᐊᕙᑎᒥᑦ ᐊᑦᑐᖅᓯᓂᐅᔪᑦ ᐱᓕᕆᐊᕐᒥᑦ ᐃᓂᐅᔪᒧᑦ ᐊᒻᒪᓗ ᐃᓄᐃᑦ-ᐱᕈᖅᐸᓪᓕᐊᓂᐅᑉ ᐊᕙᑎᖏᓐᓂᑦ.

ᐊᑐᖅᑕᐅᔪᑦ ᖃᐅᔨᓴᐃᓂᕐᒧᑦ ᖃᓄᐃᖓᓕᖅᑎᑦᑎᓂᐅᑐᐃᓐᓇᕆᐊᓕᖕᓂᑦ ᐱᓕᕆᐊᕐᒥᑦ ᐱᔪᓂᒃ ᐃᓂᐅᔪᒥᑦ ᐊᒻᒪᓗ ᐃᓄᐃᑦ-ᐱᕈᖅᐸᓪᓕᐊᓂᕐᒧᑦ ᐊᕙᑎᖏᓐᓂᑦ ᐊᕕᒃᑐᖅᑕᐅᓯᒪᔪᑦ ᐅᑯᓄᖕᖓ:

- ᐃᒃᐱᒋᓂᖃᕐᕕᐅᔪᓄᑦ ᐃᓚᒋᔭᐅᔪᑦ (VC)
- ᐊᑉᖁᑎᒋᔭᐅᔪᒥᒃ ᖃᐅᔨᓴᐃᓂᖅ;
- ᐊᖏᓂᕐᒧᑦ ᐊᒻᒪᓗ ᓄᓇᒧᑦ ᑭᒡᓕᐅᔪᑦ;
- ᖃᓄᐃᖓᓕᖅᑎᑦᑎᓂᕐᒧᑦ ᖃᐅᔨᓴᐃᓂᖅ;
- ᕿᒪᒃᑎᑦᑐᓄᑦ ᐊᒃᑐᖅᓯᓂᖅ ᐃᓂᓕᐅᕆᓂᖅ ᐊᒻᒪᓗ ᖃᓄᑎᒋᐅᓂᖓ;
- ᓇᓗᓇᖅᑐᖅ; ᐊᒻᒪᓗ
- ᖃᐅᔨᒋᐊᖃᑦᑕᕐᓂᖅ.

ᐃᒃᐱᒋᓂᖃᕐᕕᐅᔪᑦ ᐃᓚᒋᔭᐅᔪᑦ ᐱᔾᔪᑎᖃᖅᑐᖅ ᑎᒥᒥᒃ, ᐆᒪᓂᖃᕐᓂᕐᒥᒃ, ᐱᖁᓯᕐᒥᑦ, ᐃᓅᖃᑎᒌᕐᒥᑦ, ᐊᒻᒪᓗ ᐱᕈᖅᐸᓪᓕᐊᓂᕐᒧᑦ ᐱᒋᔭᐅᔪᓂᒃ ᐊᕙᑎᒧᑦ ᒪᓕᒃᑯᖓᔪᓪᓗᓐᓃᑦ, ᒪᓕᒐᓕᐅᕐᕕᒃᑯᑦ, ᐃᓄᓗᒃᑖᒨᖓᔪᑦ, ᐅᕝᕙᓘᓐᓃᑦ ᐃᓕᓐᓂᐊᖅᓯᒪᓂᖃᕐᓂᒃᑯᑦ ᐃᓚᑕᕆᔭᐅᔪᑦ ᐱᒻᒪᕆᐅᓂᖏᓐᓄᑦ ᐃᓄᖕᓄᑦ. ᐃᒃᐱᒋᓂᖃᕐᕕᐅᔪᑦ ᐃᓚᒋᔭᐅᔪᑦ ᓂᕈᐊᖅᑕᐅᔪᑦ 2005-ᒥᑦ ᐃᓱᒪᒋᔭᐅᔪᑦ ᓈᒻᒪᒃᑑᓂᖏᓐᓄᑦ ᑖᑉᓱᒧᖕᖓ ᑭᖑᓪᓕᖅᐹᖅ ᐊᕙᑎᒥᒃ ᐊᒃᑐᖅᓯᓂᕐᒧᑦ ᑎᑎᖅᑲᖅ (FEIS) ᐋᖅᑭᒋᐊᖅᓯᓂᕐᒧᑦ ᐊᔾᔨᒋᙱᒥᑦ ᐱᔾᔪᑕᐅᔪᑦ ᓴᖅᑭᑕᐅᔪᑦ 2005-ᒥᑦ FEIS-ᓕᕆᕙᓪᓕᐊᓂᕐᒥᑦ ᐊᒻᒪᓗ ᒫᓇᓵᖅ ᐃᓄᓗᒃᑖᓂᒃ ᑲᑎᒪᖃᑎᖃᖅᑎᓪᓗᒋᑦ ᐊᓪᓃᑯᒃᑯᑦ.

ᐊᑉᖁᑎᒋᔭᐅᔪᓂᒃ ᖃᐅᔨᓴᐃᓃᑦ ᐊᑐᖅᑕᐅᖃᑦᑕᖅᑐᑦ ᐃᓚᑕᖅᓯᓂᕐᒧᑦ ᖃᐅᔨᓴᐃᓗᓂᓗ ᐊᒃᑐᐊᓂᖃᖅᑐᓂᒃ ᐱᓕᕆᐊᑉ ᐃᓚᒋᔭᕆᓇᓄᑦ ᐅᕙᓘᓐᓃᑦ ᖃᓄᐃᓕᐅᕐᓂᐅᔪᓄᑦ ᐊᒻᒪᓗ ᕿᒪᒃᑎᑦᑐᓂᑦ ᖃᓄᐃᖓᓕᖅᑎᑦᑎᓂᐅᔾᔪᓇᖅᑐᓂᒃ (ᓱᕐᓗ ᖃᓄᐃᖓᓕᖅᑎᑦᑎᓃᑦ ᐊᖏᓗᐊᖏᒋᐊᖅᑎᑦᑎᖅᑳᖅᑎᓪᓗᒋᑦ) VC-ᓄᑦ. ᐊᑉᖁᑎᒋᔭᐅᔪᑦ ᖃᐅᔩᔭᐅᖃᑦᑕᖅᑐᑦ ᑖᒃᑯᓗᐊᖑᓂᖏᓐᓄᑦ, ᑐᓪᓕᐅᓂᖏᓐᓄᑦ, ᐅᕙᓘᓐᓃᑦ ᐊᒃᑐᐊᓂᖃᙱᓂᖏᓐᓄᑦ ᐊᑐᖅᓱᑎᒃ ᐃᓕᓐᓂᐊᖅᓯᒪᓂᒃᑯᑦ ᐊᒻᒪᓗ ᐱᖁᓯᒃᑯᑦ ᖃᐅᔨᒪᓂᒃᑯᑦ, ᐱᔭᕆᐊᖃᕐᒪᑦ, ᐊᒻᒪᓗ ᐊᑐᖅᓯᒪᓂᑯᒃᑯᑦ ᐊᔾᔨᑦᓚᖏᓂᒃ ᐱᕙᓪᓕᐊᓯᒪᔪᓂᒃ ᐊᒻᒪᓗ ᐊᕙᑎᒧᑦ ᐋᖅᑭᒃᓯᒪᔪᓄᑦ. ᐊᑐᓂ ᐊᑉᖁᑕᐅᔪᙳᖅᑐᑦ ᖃᐅᔨᓴᖅᑕᐅᖃᑦᑕᖅᑐᖅ ᐊᒻᒪᓗ ᐅᖃᐅᓯᐅᑉᐳᑎᒃ ᐃᒪᓐᓇ:

- ᐊᒃᑐᐊᓂᖃᙱᑦᑐᖅ - ᐊᑉᖁᑎᒋᔭᐅᔪᖅ ᐋᖅᑕᐅᔪᑦ ᐊᕙᑎᓕᕆᓂᕐᒧᑦ ᐋᖅᑭᒃᑕᐅᓯᒪᔪᓄᑦ (ᓱᕐᓗ ᖃᓄᐃᖓᓕᖅᑎᑦᑎᓂᖅ ᐊᖏᓗᐊᖏᒋᐊᖅᑎᑦᑎᓂᕐᒧᑦ) ᐱᓕᕆᐊᒥᑦ ᖃᓄᐃᖓᓂᐅᔪᑦ ᖃᐅᔨᓂᖅᑕᖃᑦᔾᔮᖏᒪᑦ (ᐆᒃᑐᕋᖅᑕᐅᔪᙳᖅᑐᖅ) ᐊᕙᑎᓕᕆᓂᕐᒧᑦ ᐊᓯᐊᙳᕐᓂᐅᔪᒥᒃ ᐊᒻᒪᓗ ᕿᒪᒃᑎᑦᑐᓄᑦ ᖃᓄᐃᖓᓕᖅᑎᑦᑎᓂᐅᔪᑦ VC-ᓄᑦ ᑕᐅᑐᙵᖅᓱᒥᑦ ᑭᒡᓕᒋᔭᐅᔪᑦ ᐅᕙᓘᓐᓃᑦ ᒪᓕᒃᑕᐅᔭᕆᐊᓕᖕᓄᑦ ᓈᓴᐅᑎᓄᑦ;
- ᑐᓪᓕᐅᔪᖅ - ᐊᑉᖁᑎᒋᔭᐅᔪᖅ ᒥᑭᔪᒥᒃ ᐊᓯᐊᙳᖅᓯᓂᖃᕈᓐᓇᖅᑐᖅ ᐊᕙᑎᒧᑦ, ᑭᓯᐊᓂ ᒥᑭᑦᑐᒥᒃ ᕿᒪᒃᑎᑦᑐᓄᑦ ᖃᓄᐃᖓᓕᖅᑎᑦᑎᓂᖃᑦᑐᓂ VC-ᓄᑦ ᑕᐅᑐᙵᖅᓱᒥᑦ ᑭᒡᓕᒋᔭᐅᔪᑦ ᐅᕙᓘᓐᓃᑦ ᒪᓕᒃᑕᐅᔭᕆᐊᓕᖕᓄᑦ ᓈᓴᐅᑎᓄᑦ; ᐅᕙᓘᓐᓃᑦ
- ᑖᒻᒪᓗᐊᖅ - ᐊᑉᖁᑎ ᐆᒃᑐᕋᖅᑕᐅᔪᙳᖅᑐᒥᒃ ᐊᓯᐊᙳᖅᑎᑦᑎᓂᖃᕈᓐᓇᖅᑐᖅ ᐊᕙᑎᒥᒃ ᐃᑲᔪᐃᔪᙳᖅᓱᓂ ᕿᒪᒃᑎᑦᑐᓂᒃ ᖃᓄᐃᖓᓕᖅᑎᑦᑎᓂᖏᓐ VC-ᓄᑦ ᑕᐅᑐᙵᖅᓱᒥᑦ ᑭᒡᓕᒋᔭᐅᔪᑦ ᐅᕙᓘᓐᓃᑦ ᒪᓕᒃᑕᐅᔭᕆᐊᓕᖕᓄᑦ ᓈᓴᐅᑎᓄᑦ.

ᐊᑉᖁᑕᐅᔪᑦ ᐊᒃᑐᐊᓂᖃᙱᑉᓱᑎᒃ ᐃᓱᒪᒋᔭᐅᔪᑦ ᒥᑭᑦᑑᓂᖏᓐᓄᑦ ᐊᒻᒪᓗ ᐊᕙᑎᒥᒃ ᖃᓄᐃᖓᓕᖅᑎᑦᑎᓂᖃᕐᔾᔮᖏᓂᕆᓗᓐᓂᑦ ᐊᒻᒪᓗ ᖃᐅᔨᓴᖅᑕᐅᒃᑲᓐᓂᙳᖏᓕᖅᓱᑎᒃ. ᐊᓯᐊᒍᖕᒐᖅ, ᐊᑉᖁᑕᐅᓗᐊᖅᑐᑦ ᖃᐅᔨᓴᐃᓂᖅᑕᒃᑲᓂᖃᑦᑕᖅᑐᑦ ᖃᐅᔨᓂᕐᒧᑦ ᐊᕙᑎᒃ ᐱᔾᔪᑎᖃᖅᑐᓂᒃ ᐱᓕᕆᐊᕐᒥᑦ ᐱᔪᓂᒃ VC-ᓄᑦ ᐃᓚᒋᔭᐅᔪᓄᑦ. ᐃᓚᒋᔭᐅᔪᑦ ᑕᐃᔭᐅᔪᑦ “ᖃᐅᔨᓴᐃᓂᕐᒧᑦ ᐃᓱᒋᔭᐅᔪᑦ”, ᐊᒻᒪᓗ ᒥᐊᓂᕆᔭᐅᔭᕆᐊᖃᖅᑐᑦ ᑭᖑᕚᓄᑦ ᐊᑐᖅᑕᐅᓂᐊᕐᓂᕐᒧᑦ.

ᐊᖏᓂᕐᒧᑦ ᐊᒻᒪᓗ ᓄᓇᒧᑦ ᑭᒡᓕᐅᔪᑦ ᑐᑭᓕᐅᖅᑕᐅᔪᑦ ᐊᑐᓂ VC-ᓄᑦ ᖃᓄᐃᙱᓕᖅᑎᑦᑎᓂᕐᒧᑦ ᖃᐅᔨᓴᐃᓂᖅᑕᖃᖅᑳᖅᑎᓐᓇᒍ. ᐊᖏᓂᕐᒧᑦ ᐊᒻᒪᓗ ᓄᓇᒧᑦ ᑭᒡᓕᐅᔪᑦ ᐊᑐᐊᓂᖃᖅᑐᑦ ᐃᓚᒋᔭᐅᔪᒨᕐᒐᔪᐃᑦ ᐃᓕᖅᑯᓯᖏᓐᓄᑦ ᓈᒻᒪᒃᑐᒧᑦ ᐊᖏᓂᕐᒧᑦ ᐊᒻᒪᓗ ᓄᓇᒧᑦ ᐊᖏᓂᐅᔪᓄᑦ ᐊᑐᓂ ᖃᓄᐃᙱᓕᖅᑎᑦᑎᓂᕐᒧᑦ ᖃᐅᔨᓴᐃᓂᕐᓄᑦ, ᐊᒻᒪᓗ ᑐᓂᓯᖃᑦᑕᖅᑐᑦ ᐊᖏᔪᒥᒃ ᑐᑭᐅᔪᓂᒃ ᑭᒡᓕᐅᔪᓄᑦ.

ᖃᓄᐃᙱᓕᖅᑎᑦᑎᓂᕐᒧᑦ ᖃᐅᔨᓴᐃᓂᖅ ᑐᓂᓯᖃᑦᑕᖅᑐᖅ ᐊᑐᖅᑕᐅᔪᒥᒃ ᖃᐅᔨᓴᐃᓂᕐᒧᑦ ᐱᓕᕆᐊᕐᒥᑦ ᐱᔪᓐᓇᖅᑐᓂᒃ ᐊᒻᒪᓗ ᑲᑎᑉᐸᓪᓕᐊᔪᓂᒃ (ᐊᑐᖅᐸᑦ) ᖃᓄᐃᙱᓕᖅᑎᑦᑎᓂᐅᔪᓂᒃ. ᑲᑎᑉᐸᓪᓕᐊᔪᓂᒃ ᖃᓄᐃᙱᓕᖅᑎᑦᑎᓂᕐᓄᑦ ᖃᐅᔨᓴᐃᓂᕐᒥᑦ ᐃᓚᐅᔪᑦ ᐊᓯᖏᑦ ᐃᓄᐃᑦ ᖃᓄᐃᓕᐅᕐᓂᖏᑦ ᑲᑎᓐᓂᖃᖅᑐᑦ ᐊᖏᓂᕐᒧᑦ ᐊᒻᒪᓗ ᓄᓇᒧᑦ ᑐᓂᐅᖅᑲᐅᑕᐅᔪᑦ VC-ᒥᑦ, ᐊᒻᒪᓗ ᐊᒃᑐᖅᓯᓂᖃᕐᔪᐊᕈᓐᓇᖅᓱᓂ ᐊᕙᑎᒥᒃ, ᐃᓚᐅᐸᓗᑎᒃ ᐊᓂᒍᖅᑐᒥᑦ, ᐅᐸᓗᒥᐅᔪᒥᑦ, ᐊᒻᒪᓗ ᖃᐅᔨᒪᓐᓇᖅᑐᒥᑦ ᓯᕗᓂᒃᓴᒥᑦ ᐱᕙᓪᓕᐊᓂᕐᒥᑦ.

ᕿᒪᒃᑎᑦᑐᓄᑦ ᖃᓄᐃᙱᓕᖅᑎᑦᑎᓂᕐᓄᑦ ᓇᐃᓈᖅᓯᒪᔪᖅ ᑕᑯᒃᓴᐅᑎᑦᑎᔪᖅ ᓈᓴᐅᑎᓂᒃ ᐊᒻᒪᓗ/ᐅᕙᓘᓃᑦ ᐊᒥᓱᙳᕈᓐᓇᕐᓂᕐᒧᑦ ᓇᓗᓇᐃᔭᖅᓯᒪᔪᓂᒃ ᐊᖏᓂᐅᔪᒥᑦ, ᖃᓄᑎᒋ ᓄᓇᒥᒃ ᑎᑭᐅᑎᓯᒪᓂᖓ, ᖃᓄᑎᒋᐅᓂᖓ, ᐊᒻᒪᓗ ᖃᑉᔾᔮᖅᑕᖃᑦᑕᕐᓂᖓ ᕿᒪᒃᑎᑦᑐᓄᑦ ᖃᓄᐃᙱᓕᖅᑎᑦᑏᑦ ᐊᑐᓂ ᐊᑉᕿᑎᒋᔭᐅᔪᓐ. ᓇᐃᓈᖅᓯᒪᔪᒥᑦ ᕿᒪᒃᑎᑦᑐᓄᑦ ᖃᓄᐃᙱᓕᖅᑎᑦᑎᓂᕐᒥᑦ, ᐊᑐᓂ ᐊᑉᕿᑕᐅᔪᑦ ᐊᒃᑐᐊᔪᑦ ᖃᐅᔨᓴᐃᓂᐅᑉ ᐃᓱᙵᓄᑦ ᐃᓂᓕᐅᖅᑕᐅᖃᑦᑕᖅᑐᖅ ᐊᑐᖅᓱᑎᒃ ᖃᓄᐃᑦᑑᓕᙵᔪᑦ ᐊᖏᓂᖏᑦ ᐊᑐᓂ ᐊᒃᑐᖅᑕᐅᓯᒪᔪᒧᑦ (ᓵᕐᓗ ᒥᑭᔪᖅ ᐊᖏᓂᕆᔭᖓ, ᐊᖏᓂᖅᓴᒥᒃ ᑎᑭᖅᑲᐅᒪᓂᖓ, ᐊᑯᓂᐅᔪᑦ ᑕᑭᑎᒋᓂᖓ, ᐊᖏᔪᒥᒃ ᐱᔪᓐᓇᖅᑐᖅ). ᖃᓄᐃᙱᓂᐅᔪᑦ ᖃᓄᐃᙱᓕᖅᑎᑦᑎᓂᕐᒧᑦ ᖃᐅᔨᓴᐃᓂᕐᒥᑦ ᐊᒻᒪᓗ ᕿᒪᒃᑎᑦᑐᓄᑦ ᐊᒃᑐᖅᓯᓂᐅᔪᖅ ᐃᓂᓕᐊᖅᑕᐅᓂᖓ ᐊᑐᖅᑕᐅᓕᖅᓱᑎᒃ ᕿᒥᕈᓂᕐᒧᑦ ᐊᖏᓂᕆᔭᖓ ᐊᒃᑐᖅᓯᓂᐅᑉ ᐱᓕᕆᐊᕐᒥᑦ ᐱᔪᓂᒃ VC-ᓄᑦ.

ᐊᑐᓂ ᖃᓄᐃᙱᓕᖅᑎᑦᑎᓂᕐᒧᑦ ᖃᐅᔨᓴᐃᓃᑦ, ᐱᐅᓯᐅᔪᑦ ᓇᓗᓇᖅᑐᓂᒃ ᑕᐃᒪᐅᔪᑦ, ᐊᒻᒪᓗ ᖃᓄᖅ ᓇᓗᓇᖅᑎᒋᓂᖓ ᐱᓕᕆᐊᖑᐸᓗᓂ ᐊᖏᒡᓕᒋᐊᖅᑎᓐᓂᕐᒧᑦ ᓇᓃᓐᓂᖓ ᓇᓗᓈᒋᓐᓂᐅᑉ ᖃᓄᐃᙱᓕᖅᑎᑦᑎᓂᐅᔪᓐᓇᖅᑐᑦ VC-ᒧᑦ ᐊᖏᓂᖅᓴᐅᓕᕐᓂᐊᖏᒪᑦ ᓇᓚᐅᑦᑖᖅᑕᐅᔪᒥᑦ ᐅᖃᐅᓯᐅᓕᖅᓱᓂ. ᖃᐅᔨᒋᐊᖃᑦᑕᕐᓂᕐᒧᑦ ᑐᕌᖓᔪᑦ ᓴᖅᑭᑕᐅᖃᑦᑕᖅᑐᑦ ᐱᓕᕆᐊᕆᓂᕐᒧᑦ ᓇᓗᓇᖅᑐᐃᑦ ᐊᒃᑐᐊᔪᑦ ᐊᒃᑐᖅᓯᓂᕐᒧᑦ ᓇᓚᐅᑦᑖᖅᑕᐅᔪᓄᑦ ᐊᒻᒪᓗ ᐊᕙᑎᓕᕆᓂᕐᒧᑦ ᐋᕿᐅᒪᔪᓄᑦ ᐃᓚᒋᔭᐅᔪᓄᑦ. ᖃᐅᔨᒋᐊᖃᑦᑕᕐᓂᖅ ᐊᑐᖅᑕᐅᖃᑦᑕᖅᑐᖅ ᐆᒃᑐᕋᐃᓂᕐᒧᑦ (ᓇᓗᓇᐃᖅᓯᓂᕐᒧᑦ) ᐊᒃᑐᖅᓯᓂᕐᒥᒃ ᓇᓚᐅᑦᑖᖅᑕᐅᔪᑦ ᐊᒻᒪᓗ ᖃᐅᔨᓗᓂ ᐊᑑᑎᖃᕐᓂᖓ ᐊᕙᑎᓕᕆᓂᕐᒧᑦ ᐋᕿᒃᓯᒪᔪᒧᑦ ᐃᓚᒋᔭᐅᔪᑦ (ᐊᖏᓗᐊᖏᑦᑎᐊᖅᑎᑦᑎᓂᖅ). ᖃᐅᔨᒋᐊᖃᑦᑕᕐᓂᖅ ᐊᑐᖅᑕᐅᖃᑦᑕᕐᒥᔪᑦ ᐃᓕᑕᖅᓯᓂᕐᒧᑦ ᓂᕆᐅᓇᙱᑦᑐᓂᒃ ᖃᓄᐃᙱᓕᖅᑎᑦᑎᓂᐅᔪᓂᒃ ᐊᒻᒪᓗ ᐊᑐᓕᖅᐳᒋᑦ ᐊᐅᓚᑦᑎᔾᔪᑏᑦ, ᐱᔭᕇᕐᓇᖅᑐᓂᑦ.

SOMMAIRE DE GESTION – VOLUME 3 - LES MÉTHODES D'ÉVALUATION

Le Volume 3 décrit l'approche qui a été utilisée pour l'analyse des effets potentiels, ainsi que la classification et la détermination de l'importance environnementale des impacts du Projet sur les environnements biophysique et socio-économique.

Les approches et méthodes pour l'évaluation des effets potentiels du Projet sur les environnements biophysique et socio-économique sont divisées selon les éléments clés suivants :

- Les composantes valorisées (CV);
- L'analyse des trajectoires;
- Les limites spatiales et temporelles;
- L'analyse des effets;
- La classification et l'importance des impacts résiduels;
- L'incertitude; et
- La surveillance et le suivi.

Les composantes valorisées représentent les propriétés physiques, biologiques, culturelles, sociales et économiques de l'environnement qui sont reconnues légalement, politiquement, publiquement ou professionnellement comme importantes par la société. Les composantes valorisées sélectionnées en 2005 sont considérées comme appropriées pour cet Énoncé des incidences environnementales (EIE) puisqu'elles sont conformes aux questions et inquiétudes soulevées au cours du processus de l'EIE 2005 et lors des récentes rencontres publiques avec Agnico Eagle.

Des analyses de trajectoire sont utilisées pour identifier et évaluer les liens et relations entre les composantes ou activités du Projet et les effets résiduels potentiels (c.-à-d. les effets après atténuation) sur les CV. Les trajectoires sont déterminées comme primaires, secondaires ou n'ayant aucun lien, en utilisant les connaissances scientifiques et traditionnelles, la logique et l'expérience avec des éléments similaires de conception environnementaux et de développement. Chaque trajectoire potentielle est évaluée et décrite comme suit :

- aucun lien – la trajectoire est éliminée par des éléments de conception environnementaux (c.à-d. une atténuation des effets) afin que le Projet n'entraîne aucun effet résiduel sur une VC ni aucune modification environnementale détectable (mesurable) lorsque comparé aux valeurs de base ou préconisées;
- secondaire – la trajectoire pourrait entraîner une modification environnementale mineure, mais aurait un effet résiduel négligeable sur une CV lorsque comparé aux valeurs de base ou préconisées; ou
- primaire – la trajectoire est susceptible d'entraîner une modification environnementale mesurable qui pourrait contribuer à des effets résiduels sur une CV lorsque comparés aux valeurs de base ou préconisées.

Les trajectoires n'ayant aucun lien ou qui sont considérées comme mineures ne devraient pas occasionner d'effets importants sur l'environnement et ne sont pas analysées plus avant. Au contraire, les trajectoires primaires font l'objet d'une analyse additionnelle des effets afin de déterminer l'importance environnementale potentielle du Projet sur les propriétés clés des CV. Les propriétés clés sont appelées des « paramètres de mesure » et leur utilisation devrait être protégée et préservée pour les générations futures.

Les limites spatiales et temporelles sont définies pour chaque CV avant de procéder à l'analyse des effets. Les limites spatiales et temporelles relient les caractéristiques spécifiques des composantes aux échelles spatiale et temporelle appropriées aux fins des analyses des effets et procurent des définitions générales des limites et frontières.

L'analyse des effets procure l'approche générale visant à analyser les effets potentiels spécifiques au Projet et les effets potentiels cumulatifs (lorsqu'applicables). L'évaluation des effets cumulatifs inclut les autres activités humaines qui recoupent la répartition spatiale et temporelle d'une CV et a le potentiel d'affecter substantiellement l'environnement, incluant le développement passé, présent, et raisonnablement prévisible pour le futur.

Le résumé des effets résiduels présente une description quantitative et/ou qualitative de l'ampleur, l'étendue géographique, la durée et la fréquence des effets résiduels de chaque trajectoire. À partir du résumé des effets résiduels, chaque trajectoire qui est liée à un paramètre de mesure est classée en utilisant les échelles nominales pour chaque critère d'impact (ex. : faible ampleur, étendue géographique régionale, durée à long terme, probabilité élevée). Les résultats de l'analyse des effets et de la classification des impacts résiduels sont ensuite utilisés pour l'évaluation de l'importance des impacts du Projet sur les CV.

Pour chaque analyse des effets, des sources clés d'incertitude sont présentées, et une discussion se tient sur la façon dont l'incertitude est traitée afin d'augmenter le niveau de confiance que les effets potentiels sur la CV ne sera pas pire que ceux prévus. Des programmes de surveillance sont proposés pour traiter les incertitudes associées aux prévisions des impacts et aux éléments de conception environnementaux. En général, la surveillance est utilisée pour tester (vérifier) les prévisions des impacts et pour déterminer l'efficacité des éléments de conception environnementaux (atténuation). La surveillance est également utilisée pour identifier les effets imprévus et mettre en œuvre une gestion adaptative, lorsque nécessaire.

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APPENDICES

LIST OF ACRONYMS

EIS	Environmental Impact Statement
FEIS	Final Environmental Impact Statement
FTPCCCEA	Federal/Provincial Territorial Committee on Climate Change & Environmental Assessment
IQ	Inuit Qaujimajatuqangit
NIRB	Nunavut Impact Review Board
the Project	Whale Tail Pit and Haul Road Project
VC	valued component

3.0 ASSESSMENT METHODS

3.1 Introduction

3.1.1 Context

This section describes the approach used for analyzing effects, and classifying and determining the environmental significance of impacts from the Project on the biophysical and socio-economic components in the Final Environmental Impact Statement (FEIS) Amendment to the FEIS (Cumberland 2005a). The approach described below was applied to the analysis and assessment of the potential effects from the construction, operations, and closure of the proposed Whale Tail Pit and Haul Road Project (referred to as the Project) using information from the Project Description (Volume 1, Sections 1.2 to 1.4), the various management and monitoring plans submitted in support of the FEIS Amendment and Type A Water Licence Application, and existing (baseline) conditions. Information from Inuit Qaujimajatuqangit (IQ) and land use is also used in the effects assessment.

3.1.2 Purpose and Scope

The purpose of this section is to provide a general overview of the approach and methods for analyzing, assessing, and determining the significance of potential environmental impacts. Key elements of the FEIS Amendment that are defined and described are as follows:

- **Section 3.2:** Valued Components (VCs) – defines VCs of the biophysical, economic, social, and cultural aspects of the environment potentially affected by the Project, and associated assessment endpoints and measurement indicators.
- **Section 3.3:** Spatial and Temporal Boundaries – links component-specific characteristics with the appropriate spatial and temporal scales for effects analyses, and gives broad definitions for spatial and temporal boundaries.
- **Section 3.4:** Pathway Analysis – provides the definition of pathways, environmental design features and mitigation, and approach and methods for evaluating relevant effects pathways between the Project and the biophysical, socio-economic, cultural, and heritage VCs. Provides the pathway analysis for the VCs.
- **Section 3.5:** Residual Effects Analysis – gives the general approach to analyzing project-specific and cumulative effects for biophysical and socio-economic components, after implementing environmental design features and mitigation.
- **Section 3.6:** Prediction Confidence and Uncertainty – introduces the key sources of uncertainty and discusses how uncertainty is addressed to increase the level of confidence that potential effects will not be worse than predicted.
- **Section 3.7:** Residual Impact Classification and Determination of Significance – introduces and provides definitions for residual impact criteria for the biophysical and socio-economic components, and presents an overview of the approach and method used to classify impacts and determine environmental significance.
- **Section 3.8:** Monitoring and Follow-Up – presents the concepts of adaptive management and different types of monitoring, and explains how monitoring and follow-up programs are used to test impact predictions, reduce uncertainty, and determine the effectiveness of mitigation.

The assessment approach presented herein is based on ecological, cultural, and socio-economic principles, and environmental assessment best practice. There is general consistency in the approach for identifying pathways that link the Project to potential effects on VCs and to determining the spatial and temporal boundaries for the effects analysis across the biophysical and socio-economic environment.

In contrast, the methods for analyzing effects, classifying residual impacts (e.g., direction, magnitude, and duration), and predicting environmental significance can differ between biophysical and socio-economic components. For example, socio-economic effects of a specific project are difficult to isolate from the ongoing processes of interdependent social, cultural, and economic change. Evolving social trends, government policy and programming decisions, and individual choice all have effects that will be concurrent with potential Project effects. While, biophysical components also are influenced simultaneously by natural and human-related forces many disciplines, project-specific effects can be quantified (e.g., incremental changes to air quality, soil, vegetation, and wildlife). Because the socio-economic status of different communities, subpopulations, and individuals may vary, a socio-economic effect may have both positive and negative aspects. An effect to a biophysical component is typically negative or positive.

The FEIS Amendment application has been completed consistent with the requirements of the Guidelines (NIRB 2004). The submission includes a Project Description (Volume 1), a core FEIS Amendment document, as well as a series of complementary documents to provide a full understanding of the technical and scientific aspects of the Project (Volumes 4 through 8). The scope of the FEIS Amendment is the development of the Whale Tail deposit and supporting infrastructure on the Amaruq property, including a haul road to the Meadowbank Mine for milling. The temporal extension of Meadowbank Mine infrastructure including, milling, tailing deposition in existing infrastructure, and use of camp infrastructure at the Meadowbank Mine and use of the existing All-Weather Access Road from Baker Lake to Meadowbank Mine, are also part of the assessment.

3.2 Valued Components, Assessment Endpoints, and Measurement Indicators

3.2.1 Identification of Valued Components

The VCs concept is defined in Section 4.19.1 of the FEIS (Cumberland 2005a) using the terminology Valued Ecosystem Component. Herein valued ecosystem components and valued socio-ecosystem components are referred to as VCs. Valued components represent physical, biological, cultural, social, and economic properties of the environment that are considered to be important by society. Rationale for VC selection is provided in the following documents:

- Cumberland FEIS, Section 4.19.2 and 4.21.4.1 (Cumberland 2005a);
- Terrestrial Ecosystem Impact Assessment, Section 2.3 (Cumberland 2005b);
- Cumulative Effects Assessment, Section 4.1.2 (Cumberland 2005c);
- Aquatic/Ecosystem/Fish Habitat Impact Assessment, Section 3. 1 (Cumberland 2005d);
- Socio-Economic and Archaeology Impact Assessment, Section 2.2. (Cumberland 2005e); and
- Volumes 4 through 7 of the FEIS Amendment.

For the most part, the VCs selected in 2005 are considered appropriate for the FEIS Amendment as they are consistent with the issues raised during 2005 FEIS process and recent public meetings with Agnico Eagle (NIRB 2014, 2015), including December 2014 and February 2016 public consultation workshops. The VCs were also accepted as meeting the Project Guidelines (2004) by the Nunavut Impact Review Board (NIRB) for the Meadowbank Mine and recent FEIS Amendment documents in support of the Vault Pit Expansion into Phaser Lake (Phaser Pit and BB Phaser Pit). Summary tables are provided in each Volume of the FEIS Amendment that provides the rationale for VC selection and exclusion. Biophysical and socio-economic VCs selected for the environmental assessment of the Project is provided in Table 3.2-1, with assessment endpoints and measurement indicators as described in Section 3.2.2.

While not defined as VCs, Project interactions with the following components will also be included in the FEIS Amendment:

- climate;
- vibration;
- groundwater quality and quantity;
- soil and terrain;
- species at risk;
- sediment quality;
- non-traditional land use;
- marine environment (Volume 3, Appendix 3-A);
- human and ecosystem health (Volume 3, Appendix 3-B);
- population demographics;
- economics;
- governance and leadership; and
- worker and public health.

These components are included to meet the Environmental Impact Statement (EIS) Guidelines for the Meadowbank Project (NIRB 2004), requirements of regulatory authorities, and to address additional issues that have been brought to Agnico Eagle through public meetings, other forms of consultation and are consistent with recent NIRB Guidelines at other projects in Nunavut.

3.2.2 Assessment Endpoints and Measurement Indicators

Assessment endpoints represent the key properties of the VC that should be protected for their use by future human generations (i.e., incorporates sustainability). Assessment endpoints are general statements about what is being protected. For example, protection of water quality, maintenance of self-sustaining and ecologically effective wildlife and fish populations, and continued opportunities for traditional use of these ecological resources may be assessment endpoints for surface water, wildlife, fish, and traditional land use.

Assessment endpoints are typically not quantifiable and require the identification of one or more measurement indicators that can be directly linked to the assessment endpoint. Measurement indicators represent properties or attributes of the environment and VCs that, when changed, could result in, or contribute to, an effect on assessment endpoints. Measurement indicators may be quantitative (e.g., concentrations of metals in surface water) or qualitative (e.g., movement and behaviour of wildlife from disturbance to habitat and travel corridors). Measurement indicators also provide the primary factors for discussing the uncertainty of effects on VCs and, subsequently, are key variables for study in follow-up and monitoring programs.

The significance of effects from the Project on a VC is evaluated by linking changes in measurement indicators to effects on the assessment endpoint (Section 3.7). All VCs have measurement indicators, but not every VC has an explicit assessment endpoint. For example, VCs such as permafrost, are considered as measurement indicators for other VCs, and do not have assessment endpoints. The results of the analysis of changes in measurement indicators for VCs such as permafrost are provided to other VCs with assessment endpoints (e.g., vegetation and wildlife populations) for inclusion in the analysis and evaluation of significance of residual effects. Project interactions with components that are not VCs, such as soil and groundwater, are included in the analysis and evaluation of significance of residual effects of VCs with assessment endpoints.

Valued components with no explicit assessment endpoint are still analyzed for project-specific and cumulative changes in measurement indicators. The changes are characterized in terms of magnitude, duration, and geographic extent, but are not classified using typical definitions of impact criteria (e.g., low magnitude and long-term duration). These VCs may also be included in follow-up and monitoring programs. The pathway assessment approach and effects analysis is applied to VCs with and without assessment endpoints, except that effects on VCs without explicit assessment endpoints are not classified using impact criteria or evaluated for significance. Valued components, assessment endpoints, and measurement indicators used in this FEIS Amendment are presented in Table 3.2-1.

Table 3.2-1: Assessment Endpoints and Measurement Indicators Associated with Valued Components

<table>
<tr><th>Valued Component</th><th>Assessment Endpoints</th><th>Measurement Indicators</th></tr>
<tr><td>Climate</td><td>■ There is no assessment endpoint for climate because "…the contribution of an individual project to climate change cannot be measured" (FTPCCCEA 2003)</td><td>■ Greenhouse gas emissions</td></tr>
<tr><td>Air Quality</td><td rowspan="2">■ No assessment endpoint - VC represents measurement indicators and pathways for other VCs with assessment endpoints</td><td>Compliance with regulatory ambient air quality standards or guidelines for the following criteria air contaminants:
■ Carbon monoxide;
■ Sulphur dioxide;
■ Oxides of nitrogen; and
■ Particulate matter (e.g., dust)</td></tr>
<tr><td>Noise</td><td>Compliance with regulatory noise and blasting standards and guidelines:
■ A-weighted energy equivalent sound levels (L_{eq} in dBA) for steady-state noise – Alberta environmental noise limits</td></tr>
</table>

Table 3.2-1: Assessment Endpoints and Measurement Indicators Associated with Valued Components (continued)

Valued Component	Assessment Endpoints	Measurement Indicators
		■ Unweighted peak sound levels (L_{peak} in dBL) for blasting noise – Ontario blasting limits
Permafrost		■ Permafrost distribution
Vegetation	■ Self-sustaining and ecologically effective plant populations and communities	■ Habitat loss and degradation ■ Quantity, arrangement, and connectivity (fragmentation) of plant communities ■ Plant community diversity and health ■ Relative abundance and distribution of habitat for listed and traditional plant species
Terrestrial Wildlife and Birds: ■ Ungulates (caribou and muskox) ■ Predatory mammals (grizzly bear, wolverine, and wolves) ■ Raptors ■ Waterbirds (waterfowl, loons and shorebirds) ■ Upland birds (songbirds and ptarmigan)	■ Self-sustaining and ecologically effective wildlife populations	■ Changes to wildlife habitat quantity ■ Changes to wildlife habitat quality ■ Changes to wildlife survival and reproduction
Surface water quality	■ Protection of surface water quality for aquatic and terrestrial ecosystems, and human use	■ Physicochemical water quality parameters (e.g., pH, conductivity, turbidity, suspended solids) ■ Major ions and nutrients ■ Total and dissolved metals
Surface water quantity	■ Availability of the spatial and temporal distribution of water quantity for aquatic and terrestrial ecosystems	■ Flow rate and the spatial and temporal distribution of water ■ Surface topography, drainage boundaries, waterbodies, and water pathways
Fish and Fish Habitat: ■ Fish populations (lake trout, Arctic char, round whitefish, and Arctic grayling) ■ Fish habitat is not a VC; rather, fish habitat is a measurement indicator	■ On-going fisheries productivity	■ Habitat quantity and quality (includes surface water quality and quantity indicators) ■ Habitat arrangement and connectivity (fragmentation) ■ Survival and reproduction ■ Abundance and distribution of VCs and forage fish that support VCs ■ Lower trophic status (includes plankton and benthic invertebrate species composition, abundance, and biomass)

Table 3.2-1: Assessment Endpoints and Measurement Indicators Associated with Valued Components (continued)

Valued Component	Assessment Endpoints	Measurement Indicators
Archaeology	■ Protection of archaeological resources	■ Archaeological and sacred sites
Traditional Land Use	■ Continued opportunities for traditional land use	■ Access to traditional land use areas and resources ■ Availability of traditionally used resources (caribou, other wildlife, fish, and plants) ■ Availability of culturally important sites or areas
Socio-Economic VCs		
Employment	■ Maximizing local participation in the Project ■ Improving the capacity of the labour force	■ Local and regional employment ■ Employment rate ■ Unemployment rate ■ Participation rate ■ Incomes
Training	■ Encouraging further education in the interest of capacity building ■ Supporting educational service delivery	■ Labour force training initiatives ■ Educational attainment ■ Capacity of education services
Business Opportunities	■ Maximizing local business participation in the Project	■ Portion of Project procurement of goods and services spent locally
Community Wellness	■ Minimizing negative community health and wellbeing impacts	■ Physical and mental health ■ Family structure and welfare ■ Social and economic disparity ■ Public health and safety ■ Crime
Infrastructure and social services	■ Supporting and minimizing negative impacts on infrastructure capacity and service delivery	■ Housing stock and condition ■ Capacity and condition of transportation infrastructure ■ Airports ■ Roads ■ Capacity and condition of physical infrastructure ■ Solid waste disposal ■ Water and sanitation ■ Utilities ■ Capacity of social services ■ Capacity of healthcare services ■ Capacity of emergency response services ■ Capacity of protective services

dBA = A-weighted decibels; L_{eq} = equivalent energy noise level; L_{peak} = peak sound level; VC = valued component; FTPCCCEA = Federal/Provincial Territorial Committee on Climate Change & Environmental Assessment.

3.3 Spatial and Temporal Boundaries

3.3.1 Spatial Boundaries

Individuals, populations, and communities function within the environment at different spatial (and temporal) scales (Wiens 1989). In addition, the response of physical, chemical, and biological processes to changes in the environment can occur across several spatial scales at the same time (Hollings 1992; Levin 1992). Because the responses of physical, biological, cultural, and economic properties to natural and human-induced disturbance will be unique and occur across different scales, a multi-scale approach for describing baseline conditions (existing environment) and predicting effects from the Project on VCs has been adopted.

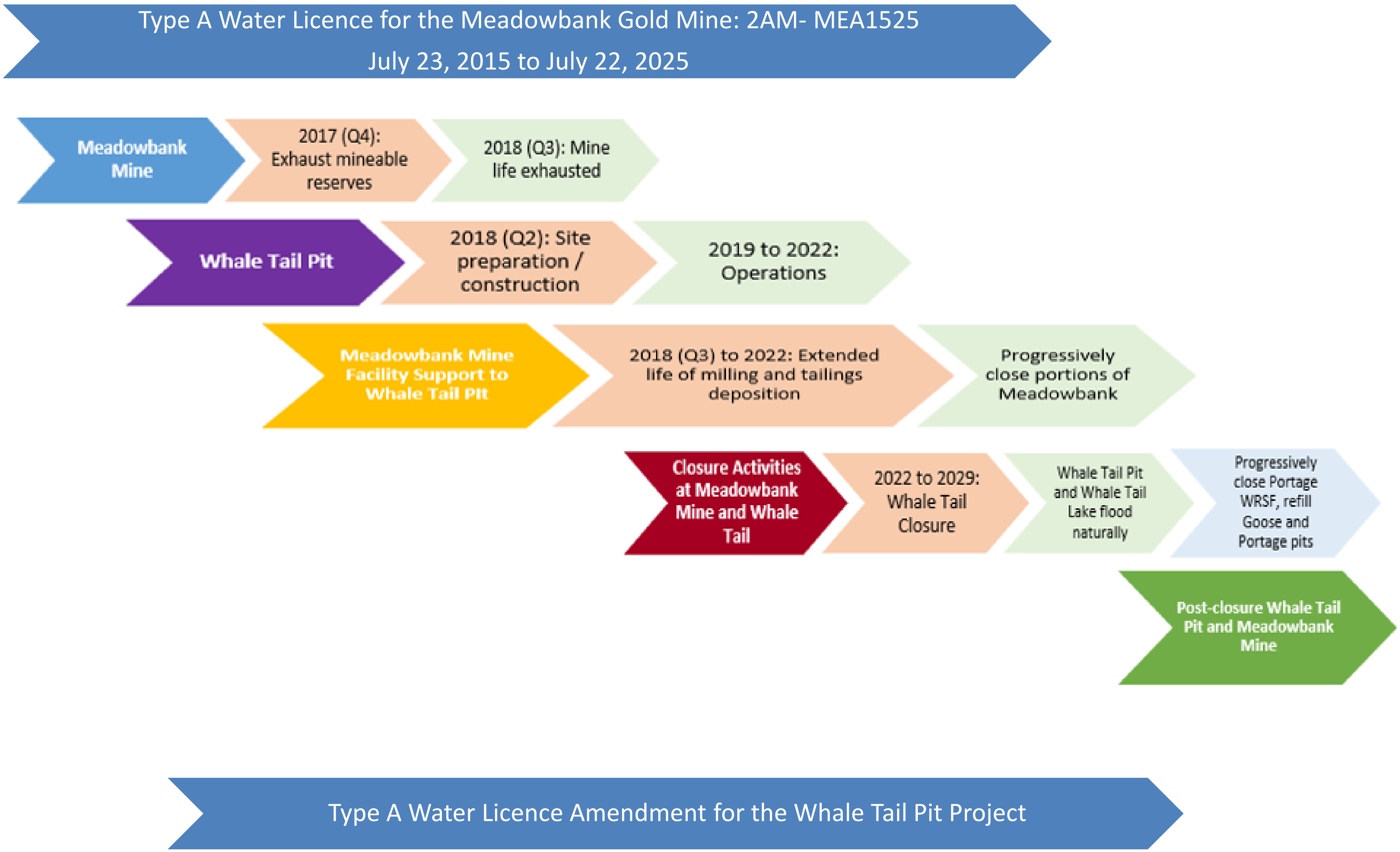
Selection of the boundary for effects study areas was based on the physical and biological properties of VCs. In addition, effects assessment areas were designed to capture the maximum spatial extent of potential effects from the Project and other previous, existing, and reasonably foreseeable future developments. The spatial scales selected are described in each discipline section (Volumes 4 through 7).

3.3.2 Temporal Boundaries

In the original FEIS, the Meadowbank Mine was assessed for two years of construction, up to 10 years of operations, and two years of closure activities for a total 14 year assessment period (or from 2008 to 2022). The Meadowbank Mine was licensed in 2008, began operations 2009 and is expected to cease production in Q3 of 2018 for a nine year operational life. The addition of the Whale Tail Pit will add an additional three to four years to the life of mine for Meadowbank Mine (including two years of active closure) as construction will occur starting in Q2 of 2018 at Whale Tail. The temporal boundary for construction, operations, and closure of the Project is about seven years (i.e., one year construction, three to four years operations, and two years closure). Operations at Whale Tail Pit will begin in 2019; as a result the Meadowbank Mill and Tailings Storage Facility will be operationally reduced as the focus shifts to mill refurbishment and repair for approximately one year. Equipment operators will continue to assist in construction activities at Whale Tail Pit and the closure of Meadowbank Mine facilities. This includes the encapsulation of Portage Waste Rock Storage facilities, reflooding of Vault Pit, encapsulation of Vault Waste Rock Storage Facility and decommissioning of various roads. Full scale operations at Whale Tail Pit is proposed to begin in 2019 and will continue for three to four years (i.e., 2019 to 2021/2022). Although there is an overlap with Whale Tail Pit construction and operations with the closure of the Meadowbank Mine, the closure period of the Meadowbank Mine was previously assessed. Key phases of the Meadowbank Mine and Whale Tail Deposit are presented in Figure 3.3-1. While milling and tailings deposition will extended at the Meadowbank Mine, progressive closure will occur, including filling of existing open pits.

Active closure is defined as the two year period when the majority of the mine infrastructure will be actively remediated, excluding water control structures, and active pumping of open pits will be initiated. For Whale Tail Pit closure is expected to begin in 2021/2022. A passive closure period will follow that is defined as the breaching of remaining water retention infrastructure. Details of closure are provided in the Interim Whale Tail Closure and Reclamation Plan (Volume 8, Appendix 8-F.1). Both active and passive closure are considered in the assessment.

Figure 3.3-1: Key Phases for the Whale Tail Deposit and Meadowbank Mine



For all VCs, residual effects are assessed for all phases of the Project. For some VCs and effects pathways, potential effects are analyzed and predicted from construction through closure, which generates the maximum extent of effects (e.g., removal and alteration of habitat is initiated in construction and continues to a period of time during closure). Alternately, for other VCs, the assessment was completed for those phases of the Project where predicted effects would be expected to peak or at several key snapshot points in time.

Similarly, the temporal boundaries identified for cumulative effects assessments are specific to the VCs being assessed. Temporal boundaries include the duration of residual effects from previous and existing developments that overlap with potential residual effects of the Project, and the period of time over which the residual effects from reasonably foreseeable developments will overlap with residual effects from the Project (if applicable). The temporal boundaries considered for each VC are defined in the associated discipline sections.

3.4 Pathway Analysis

Pathway analysis identifies and assesses the linkages between the Project components or activities, and the correspondent potential residual effects to VCs (e.g., surface water quality, soil, wildlife, and socio-economics). The first step in the pathway analysis is to identify all potential effects pathways through which the Project could affect VCs. Each pathway is initially considered to have a linkage to potential effects on VCs.

Potential pathways through which the Project could affect VCs were identified from a number of sources including the following:

- a review of Project description, and scoping of potential effects by the environmental, socio-economic, and engineering teams;
- a review of Project Guidelines;
- a review of relevant legislation (*Migratory Bird Convention Act*, *Fisheries Act*, *Nunavut Wildlife Act*, *Species at Risk Act*, etc.).
- results of Agnico Eagle’s public consultation;
- IQ;
- scientific knowledge and experience with other northern mines; and
- consideration of potential effects identified for the Project.

A matrix table of all Project activities or components was completed for each of the environmental and socio-economic components (Volume 3, Appendix 3-C). Within this matrix, all potential interactions between project activities (from construction through closure) and environmental components were identified. From these interactions, a list was made of all potential effects pathways for the Project. Each pathway was initially considered to have a linkage to potential effects on VCs. The pathway analysis for each VC is also provided in Volume 3, Appendix 3-C.

This step is followed by the development of environmental design features and mitigation that can be incorporated into Project designs to remove a pathway or limit (mitigate) the effects to VCs. Project designs and mitigation can utilize IQ, such as avoiding important esker habitat. Environmental design features are developed through an iterative process between Agnico Eagle’s engineering and environmental teams and include Project design elements, environmental best practices, management policies and procedures, spill response and emergency contingency plans, and social programs.

Knowledge of the environmental design features is then applied to each of the pathways to determine the expected amount of Project-related changes to the environment and the associated residual effects (i.e., effects after mitigation) on VCs. Changes to the environment can alter physical measurement indicators (e.g., water chemistry) and biological measurement indicators (e.g., animal behaviour) (Table 3.2-1). For an effect to occur there has to be a source (Project activity) that results in a measurable environmental change (pathway) and a correspondent effect on a VC.

Project activity → change in environment → effect on VC

Pathway analysis is a screening step that is used to determine the existence and magnitude of linkages from the initial list of potential effects pathways for the Project. This screening step is largely a qualitative assessment, and is intended to focus the effects analysis on pathways that require a more comprehensive assessment of effects on VCs.

Pathways are determined to be primary, secondary, or as having no linkage. Each potential pathway is assessed and described as follows:

- No linkage – Analysis of the potential pathway reveals that there is no effect to the measurement indicator, or the pathway is removed by environmental design features or mitigation such that the Project would not be expected to result in a measurable change to the measurement indicator. Therefore, the pathway would have no residual effect on a VC relative to the Baseline Case (Section 3.5.2.2) or guideline values (e.g., air, soil, or water quality guideline).
- Secondary – Pathway could result in a measurable minor change to measurement indicators, but would have a negligible residual effect on a VC relative to the Baseline Case or guideline. Therefore, the pathway is not expected to contribute to effects of other existing, approved, or reasonably foreseeable projects to cause a significant effect.
- Primary – Pathway is likely to result in a measurable change to measurement indicators that could contribute to residual effects on a VC relative to the Baseline Case or guideline values.

Pathways that are assessed as no linkage or secondary are not assessed further because environmental design features or mitigation will remove or limit the pathway to a negligible residual effect.

3.5 Effects Analysis

3.5.1 Project-Specific Effects

The effects analysis considers all primary pathways that are likely to result in measurable environmental changes and residual effects on VC measurement indicators (Section 3.4). Residual effects on measurement indicators may have more than one primary pathway that link a Project activity to an interaction with the environment and a subsequent effect on a VC. For example, the pathways for effects on the ability of fish populations and fish habitat to remain self-sustaining and ecologically effective could include alteration of local flows, water levels, and water quality.

A description of the methods used to analyze residual effects from the Project on VCs is provided in each discipline section (Volumes 4 through 7). Where possible and appropriate, the analyses are quantitative, and include data from field studies, modelling results, scientific literature, government publications, effects monitoring reports, and personal communications. Available IQ and community information is incorporated into the analysis and results, where information is available. Due to the amount and type of data available, some analyses are qualitative and include professional judgement or experienced opinion.

Results from the effects analyses are used to describe the direction, magnitude (intensity), duration and geographic (spatial) extent of the predicted residual changes to VCs. Where possible and appropriate, expected changes are expressed quantitatively. For example, the magnitude of the effect may be expressed in absolute or percentage values above baseline (existing) conditions or a guideline value. Duration of the change is estimated relative to Project phases, and the geographic extent of effects is expressed in area (ha) or distance (m, km) from the Project. In addition, the likelihood and frequency of effects is also described, where applicable.

Expressions such as “short-term” duration or “moderate” magnitude are not used in the summary of residual effects. These expressions are reserved for the classification of impacts, where definitions of these expressions are provided (Section 3.7.1).

3.5.2 Approach to Cumulative Effects

3.5.2.1 Definition and Application

Cumulative effects represent the sum of all natural and human-induced influences on the physical, biological, cultural, and economic components of the environment through time and across space. Some changes may be human-related, such as increasing mining and other industrial development, and some changes may be associated with natural phenomenon, such as an extreme rainfall event. Where information is available, the cumulative effects assessment estimates or predicts the contribution of effects from the Project and other developments on VCs, in the context of natural changes in the system.

Not every VC requires an analysis of cumulative effects. The key is to determine if the effects from the Project and one or more additional developments/activities overlap (or interact) with the temporal or spatial distribution of the VC (Section 3.3).

Cumulative effects are identified, analyzed, and assessed in each discipline section, where applicable. The approach is the same as that used for the Project-specific effects analysis (Section 3.5.1), and residual impact classification and determination of significance (Section 3.7).

3.5.2.2 Assessment Cases

For VCs that require cumulative effects analysis, the concept of assessment cases is applied to the associated spatial boundary (effects study area) to estimate the incremental and cumulative effects from the Project and other developments (Table 3.5-1). The approach incorporates the temporal boundary for analyzing the effects from previous, existing, and reasonably foreseeable developments before, during, and after the anticipated life of the Project.

Table 3.5-1: Contents of Each Assessment Case

Baseline Case	Application Case	Future Case
Range of conditions from little or no development to existing and approved developments prior to the Project.	Baseline Case plus the Project.	Application Case plus reasonably foreseeable developments.

The Baseline Case represents a range of conditions over time within the effects assessment (study) area before application of the Project. Environmental conditions on the landscape prior to human development (e.g., mining, mineral exploration, outfitting, and transportation), which represent reference conditions, were considered independently within the Baseline Case, where possible. Observations collected during baseline studies represent part of the range of variation in the ecological and socio-economic systems produced by historical and current environmental selection pressures (both human and natural). Thus, the Baseline Case includes the cumulative effects from all previous and existing developments within the effects study area of a VC.

The temporal boundary of the Application Case begins with the anticipated start of construction of the Project, and continues until the predicted effects are reversed (Section 3.3.2). For several VCs, the temporal extent of some effects likely will be greater than the lifespan of the Project because the effects will not be reversible until beyond closure.

The Future Case includes the predicted duration of residual effects from the Project, and other previous, existing, and reasonably foreseeable developments. Thus, the minimum temporal boundary for the Application and Future case is the expected operational lifespan of the Project, which in the case of the Project is three to four years.

Analyses of the effects for the Baseline and Application cases are largely quantitative; effects analyses for the Future Case are qualitative due to the large degree and number of uncertainties. For example, there are uncertainties associated with the timing, rate, type, and location of developments in the study areas for each VC. There are also uncertainties in the direction, magnitude, and spatial extent of future fluctuations in ecological, cultural, and socio-economic variables, independent of the Project effects.

The cumulative effects study area and the reasonably foreseeable future developments used in the assessment are provided in Volume 3, Appendix 3-D.

3.6 Prediction Confidence and Uncertainty

Most assessments of impacts embody some degree of uncertainty. The purpose of the uncertainty section is to identify the key sources of uncertainty and discuss how uncertainty is addressed to increase the level of confidence that effects will not be worse than predicted.

Confidence in effects analyses can be related to many elements, including the following:

- adequacy of baseline data for understanding existing conditions and future changes unrelated to the Project (e.g., extent of future developments, climate change, catastrophic events);
- model inputs (e.g., estimates of the spatial distribution of dust deposition);

- understanding of Project-related impacts on complex ecosystems that contain interactions across different scales of time and space (e.g., how and why the Project will influence wildlife); and
- knowledge of the effectiveness of the environmental design features for reducing or removing impacts (e.g., environmental performance of the Project).

Uncertainty in these elements can decrease confidence in the prediction of environmental significance. Where possible, a strong attempt is made to reduce uncertainty in the EIS to increase the level of confidence in impact predictions through the following:

- using the results from several models (where feasible) and analyses to help reduce bias and increase precision in predictions;
- using data from effects monitoring programs at existing mines and the literature as inputs for models rather than strictly hypothetical or theoretical values; and
- implementing a conservative approach when information is limited so that impacts are typically overestimated.

Where appropriate, uncertainty may also be addressed by additional mitigation and in follow-up and monitoring programs. Each discipline includes a discussion of sources of uncertainty and how uncertainty is addressed.

3.7 Residual Impact Classification and Determination of Significance

3.7.1 Residual Impact Classification

The purpose of the residual impact classification is to describe the residual incremental and cumulative adverse effects from the previous and existing developments, the Project (i.e., the Application Case), and future developments (i.e., the Future Case, if applicable) on VC measurement indicators using a scale of common words rather than numbers and units. The use of common words or criteria is accepted practice in environmental assessment. It is difficult (and not appropriate) to provide definitions for all residual adverse effects criteria and significance that are universally applicable to all of the VCs. Consequently, specific definitions are provided for each VC in Volume 3, Appendix 3-E.

The classification of residual impacts from associated primary pathways and the determination of environmental significance are only completed for those VCs that have assessment endpoints. This is because assessment endpoints represent the key properties of the VC that should be protected for their use by future human generations (Section 3.2.2). Results from the residual impact classification are then used to determine the environmental significance of the Project (and other developments) on assessment endpoints.

To provide clarity and consistency across VCs with assessment endpoints, effects are described using the following criteria:

Direction: Direction indicates whether the effect on the measurement indicator is negative (i.e., less favourable), positive (i.e., an improvement), or neutral (i.e., no change). The main focus of an environmental assessment is to predict if the Project is likely to cause a significant adverse effect on the environment or cause public concern. Neutral and positive effects are not assessed for significance.

Magnitude: Magnitude is a measure of the intensity of an effect to the measurement indicator, or the degree of change caused by the Project relative to baseline conditions or a guideline value. Magnitude is often classified as negligible, low, moderate, or high. The number and definitions of scales of magnitude are specific to VCs. Where possible, magnitude is reported in absolute and relative terms.

Geographic Extent: Geographic (spatial) extent refers to the area (or distance covered or range) of the effect to the measurement indicator, and is different from the spatial boundary (i.e., effects study area) for the effects analysis. The study area for the effects analysis represents the maximum area used for the assessment and is related to the spatial distribution and movement of VCs (Section 3.3.1). Geographic extent is categorized as site (where applicable), local, regional, and beyond regional. The beyond regional scale includes cumulative residual effects from the Project and other developments that extend beyond the effects study area.

Duration: Duration is VC-specific and is defined as the amount of time from the beginning of an effect to when the effect on a VC is reversed, and is typically expressed relative to the Project development phases (usually in years). Duration has two components: the amount of time between the start and end of a Project activity or stressor (which is related to Project development phases: construction, operations, and closure), plus the time required for the effect to be reversed.

Some residual effects may be reversible soon after the stressor has ceased (e.g., change in distribution of some wildlife species following the decrease in noise and activity levels after closure), while other residual effects may take longer to be reversed (e.g., change in abundance of some species on Project-altered habitat after reclamation and revegetation). By definition, residual effects that are short-term, medium-term, or long-term in duration are reversible.

Reversibility: After removal of the Project activity or stressor, reversibility is the likelihood that the Project will no longer influence a VC at a future predicted time (e.g. reversible or irreversible). The time frame is provided for reversibility (i.e., duration) if an impact is reversible. Permanent impacts are considered irreversible. Available scientific information and experienced opinion may predict that the residual effect is irreversible or the duration of the residual effect may not be known, except that it is expected to be extremely long and well beyond the temporal boundary of the Project. In this case, the residual effect is classified as irreversible.

In terms of the socio-economic environment, the manageability of impacts is considered rather than their reversibility. Where appropriate, the evaluation identifies the resources that may be diverted to facilitate recovery (Volume 3, Appendix 3-E).

Frequency: Frequency refers to how often an effect will occur and is expressed as isolated (confined to a discrete period), periodic (occurs intermittently, but repeatedly over the assessment period), or continuous (occurs continuously over the assessment period). Frequency is explained more fully by identifying when the effect occurs (e.g., once at the beginning of the Project).

Likelihood: Likelihood is the probability of an effect occurring and is described in parallel with uncertainty. Definitions are provided in Volume 3, Appendix 3-E.

For criteria such as frequency and likelihood, the scales can be applied consistently across all biophysical VCs. Socio-economic criteria do not include frequency and likelihood as it is assumed that the impacts have a high likelihood to occur continuously during the assessment period. The scale of classifications for direction, magnitude, geographic extent, and duration are dependent on each biophysical and socio-economic VC. The definitions for these scales are ecologically, socially, or logically based on the VC. The scales for these criteria are specifically defined for each VC (Volume 3, Appendix 3-B).

3.7.2 Determination of Significance

The classification of primary pathways and the associated predicted changes in measurement indicators provide the foundation for determining the significance of potential incremental and cumulative effects from the Project and other existing, approved, and possible future developments on VC assessment endpoints. The significance of the contribution of incremental effects from the Project on VC measurement indicators is provided, but the evaluation is focused on determining the significance of cumulative effects on assessment endpoints of the biophysical and socio-economic environments.

The key factors considered in the determination of environmental significance on VCs of the biophysical and socio-economic assessment endpoints include the following:

- results from the residual impact classification of primary pathways and associated predicted changes in measurement indicators;
- magnitude is the primary criterion used to determine significance, with geographic extent and duration providing important context for assigning magnitude; frequency and likelihood act as modifiers, where applicable; and
- the level of confidence in predicted effects, scientific and socio-economic principles (e.g., resilience and stability), and scientific interpretation and uncertainty is high and the cumulative effect might be either significant or not significant, the assessment conservatively identified the effect as significant and provided additional follow-up actions to reduce uncertainty.

Duration is a function of resilience, which is the ability of the population to recover or bounce back from a disturbance (e.g., rate and degree of fluctuation in population abundance and distribution after a disturbance). Resilience is largely a function of demographic and behavioural life history traits such as size and number of litters or number of eggs and survival of fry, age at reproduction, lifespan of individuals, habitat selection, and effective dispersal. The capacity or ability of individuals in a population to change and accommodate disturbance is also related to resilience.

Resilience can vary with population size, stability, and the likelihood of demographic rescue from neighbouring populations. During periods of low abundance, animal and plant populations can become less resilient to natural environmental and human-related disturbances, which may reduce stability (i.e., trajectory of the population). Stable populations exhibit no long-term increasing or declining trend in abundance outside of natural fluctuations and cycles (e.g., predator-prey cycles). Resilience and stability are properties of a population that influence the amount of risk to VCs from development (Weaver et al. 1996).

As much as possible, effects are classified and significance determined using established guidelines, thresholds or screening values, and scientific principles. For some VCs, such as water quality, guideline or threshold values are known, which provides confidence in effects predictions and determining environmental significance. For other VCs, social and ecological benchmarks or effects thresholds are not known and are challenging to define, which creates uncertainty in determining the significance of predicted effects. Subsequently, magnitude classification was applied conservatively to increase the level of confidence that effects will not be worse than predicted (Section 3.6). Furthermore, the determination of significance considers the key sources of uncertainty in the effects analysis, the management of uncertainties, and the correspondent level of confidence in effects predictions.

The evaluation of significance for biophysical VCs considers the entire set of primary pathways that influence a particular assessment endpoint rather than explicitly assigned to each pathway. The relative contribution of each primary pathway and measurement indicator is used to determine the significance of the Project (and other developments) on an assessment endpoint. The relative effect from each primary pathway is discussed; however, primary pathways that are predicted to have the greatest influence on changes to assessment endpoints are assumed to contribute the most to the determination of environmental significance. This method is used to identify predicted residual adverse effects that have sufficient magnitude, duration, and geographic extent to cause fundamental changes to a VC, and therefore, result in significant effects.

Classification of residual effects and determination of significance for the socio-economic environment generally follow the methods used for biophysical VCs; however, there are some differences in the selection and definition of effects criteria (Volume 3, Appendix 3-D). For socio-economic VCs, direction, magnitude, geographic extent, and duration are the criteria used to classify effects and evaluate the significance of changes to assessment endpoints. The assessment of significance considers the scale of these criteria and professional opinion, which is based on the context of the communities involved, and the informed value and judgement of interested and affected organizations and specialists. The level of significance also assesses the efficacy of the proposed mitigation (i.e., policies, practices, and investments) and benefit enhancement programs to limit negative effects and foster positive effects on the continued persistence of long-term sustainable social, cultural, and economic features of the environment.

3.8 Monitoring and Follow-Up

Monitoring programs are proposed to deal with the uncertainties associated with the impact predictions and environmental design features. In general, monitoring is used to test (verify) impact predictions and determine the effectiveness of environmental design features (mitigation). Monitoring is also used to identify unanticipated effects and implement adaptive management where required. Typically, monitoring includes one or more of the following categories, which may be applied during the development of the Project:

Compliance monitoring and inspection: monitoring activities, procedures, and programs undertaken to confirm the implementation of approved design standards, mitigation, and conditions of approval, and of Company commitments (e.g., inspecting the installation of a silt fence; monitoring mine water discharge quality and volumes).

Follow-up: programs designed to test the accuracy of impact predictions, reduce uncertainty, determine the effectiveness of environmental design features, and provide appropriate feedback to operations for modifying or adopting new mitigation designs, policies, and practices. Results from follow-up programs can be used to increase the certainty of impact predictions in future environmental assessments. Where applicable, the results from follow-up programs completed at the Meadowbank Mine were considered in the assessment of the Project.

These programs form part of the environmental management system for the Project. If monitoring or follow-up detects effects that are different from predicted effects, or the need for improved or modified design features, then adaptive management will be implemented by Agnico Eagle. This may include increased monitoring, changes in monitoring plans, or additional mitigation. Proposed monitoring programs are provided for the various disciplines in Volumes 4 through 7.

3.9 References

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