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A.11 – RARE PLANTS AND VEGETATION HEALTH

A.11.1 INTRODUCTION

The Casino Project will interact with vegetation, which includes vascular plants and lichens. Section 11 of the Proposal provided an assessment of potential Project and cumulative effects on rare plants and vegetation health. It also included proposed mitigation to reduce Project effects on vegetation. The assessment focussed on issues related to rare plants and vegetation health within the Project's Potential Disturbance Area (PDA) and larger Local Study Area (LSA). When Project effects cannot be completely mitigated, potential cumulative effects were described.

The Project will interact with rare plants by clearing vegetation, including some rare plant habitat. Potential effects of the Project on rare plants are primarily loss of habitat within the Project footprint. The footprint will disturb vegetation and fugitive dust generated from Project activities will settle on surrounding vegetation, which may affect plant health.

On January 27, 2015, the Executive Committee requested that Casino Mining Corporation (CMC) provide supplementary information to the proposed Casino Project (YESAB Project No. 2014-0002) to enable the Executive Committee to commence Screening. The Executive Committee considered comments from various First Nations, Decision Bodies and regulators on the adequacy of the Project Proposal in the preparation of the Adequacy Review Report (ARR). Casino Mining Corporation is providing this Supplementary Information Report (SIR) to comply with the Executive Committee's ARR; CMC anticipates that the information in the SIR and Proposal, when considered together, is adequate to commence Screening.

The Executive Committee had six requests related to information presented in Section 11 Rare Plants and Vegetation Health of the Project Proposal submitted on January 3, 2014. These requests are outlined in Table A.11.1-1. Some responses require detailed technical information, data, and figures. Where necessary, this additional supporting information is provided as appendices to the SIR, as detailed in Table A.11.1-1.

Table A.11.1-1 Requests for Supplementary Information Related to Rare Plant and Vegetation Health

Request #	Request for Supplementary Information	Response
R308	Discussion of the potential effects of the construction, operation, and possible decommissioning of other project infrastructure on habitat (such as fens and tors) with elevated potential for rare species.	Section A.11.2.1.1 Appendix A.12A Wildlife Monitoring and Mitigation Plan Appendix A.22C Sediment and Erosion Control Plan
R309	Discussion of the potential effects of the construction, operation, and possible decommissioning of the airstrip and airstrip access road on proximate vegetation and wetlands. In particular, this discussion should identify impacts to downslope wetlands.	Section A.11.2.1.2 Appendix A.12A Wildlife Monitoring and Mitigation Plan Appendix A.22C Sediment and Erosion Control Plan
R310	An update to Figure 3.1 with the ecosystem types identified in the large vegetation polygon overlapping with the centre of the airstrip.	Section A.11.2.1.3

Request #	Request for Supplementary Information	Response
R311	Discussion of the use of “Loss of Vegetation Associations” and “Wetlands and Riparian Vegetation Associations” as indicators for vegetation health.	Section A.11.3.1.1 Appendix A.12A Wildlife Monitoring and Mitigation Plan Appendix A.22C Sediment and Erosion Control Plan
R312	A clear mitigation (buffer zone and avoidance) and management plan (where avoidance cannot be achieved) to support the residual effect assessment, for both the construction and operation of the project components.	Section A.11.3.1.2 Appendix A.10A Fish Habitat Offsetting Plan Appendix A.22C Sediment and Erosion Control Plan
R313	Details on a conceptual integrated management plan for project activities affecting vegetation. Details should include: a. proposed buffer zones around wetlands, valuable vegetation associations or sites, and riparian areas which also consider the needs of wildlife for movement corridors; b. species to be used for re-vegetation; c. timeframe for re-vegetation and reclamation activities; d. measures to monitor success and take corrective actions as necessary; and e. control of invasive species.	Section A.11.4.1.1 Appendix A.10A Fish Habitat Offsetting Plan Appendix A.22C Sediment and Erosion Control Plan Appendix A.22D Invasive Species Management Plan

Notes:

1. Request # refers to the assigned identification number in the YESAB Adequacy Review Report January 27, 2015 Prepared by Executive Committee Yukon Environmental and Socio-economic Assessment Board.
2. Response refers to the location of CMC's response to the YESAB request for supplementary information.

A.11.2 PROJECT INFRASTRUCTURE AND SENSITIVE HABITATS

A.11.2.1.1 R308

R308. Discussion of the potential effects of the construction, operation, and possible decommissioning of other project infrastructure on habitat (such as fens and tors) with elevated potential for rare species.

The updated Wildlife Mitigation and Monitoring Plan (WMMP – Appendix A.12A) defines sensitive wildlife areas as site-specific features such as mineral licks, den sites, active migratory bird nest sites, raptor stick nests, cliff nests, and wetlands. Mitigation measures for reducing effects on sensitive wildlife areas are listed in the updated WMMP. Riparian setbacks for mitigating effects are defined in the Sediment and Erosion Control Management Plan (Appendix A.22C) for the protection of fish habitat and water quality, and will benefit riparian vegetation and the wildlife that use riparian habitats.

No sensitive vegetation or wildlife features have been found in the areas identified as fens or tors.

Fens and tors may contain suitable habitat for some sensitive species of plants and animals. The distribution of the rare plant species that are known and expected to occur within the LSA is not restricted to the tor and fen habitats (See Appendix 11A Vegetation Baseline Report). While no baseline studies specifically targeted fens and tors, they were included in a number of the baseline survey areas and locations. Table A.11.2-1 identifies the baseline surveys that overlap with the fen and tor habitats that intersect the Project footprint. Aerial surveys are included in the list because sightings of larger wildlife (i.e., large bird and mammals) would be documented in the incidental sighting database.

The potential disturbance area (PDA) includes roads, borrow pits and mine infrastructure. Borrow pit locations and sizes are estimates and still need to be ground truthed. The footprints of borrow pits displayed in the Project proposal are shown with a 100 m buffer because there is still uncertainty in the exact footprint of each borrow pit, and which borrow pits will ultimately be used. The displayed borrow pits are large over-estimates of the real potential footprint. Including the additional area for borrow sources, and other Project infrastructure, is done to ensure that the assessment of Project effects is conservative (errs on the side of overestimate) and allows some flexibility in the final Project design. Furthermore, the Project does not require all the borrow sources identified in the Project proposal to construct the mine infrastructure, so borrow sources that overlap with sensitive habitats identified during pre-clearing surveys may not need to be developed.

Table A.11.2-1 Summary of baseline studies that overlapped fen and tor habitats that intersect the proposed Freegold Road upgrade alignment

ELC Feature ID	ELC Habitat Description	Overlapping Survey Type
588	Tor	2012 Late Winter Ungulate Survey (aerial)
607	Tor	2011 Fall Ungulate Survey (aerial) 2012 Late Winter Ungulate Survey (aerial)
668	Tor	2008–2012 Bird Observation
687	Tor	2008/2012 Bird Observation 2011 Fall Ungulate Survey (aerial) 2011/2012 Late Winter Ungulate Survey (aerial) 2013 Breeding Bird Point Count Plot 2013 Vegetation and Soil Sampling Site
803	Tor	2011 Late Winter Ungulate Survey (aerial)
2636	Shrubby Fen	2011/2012 Late Winter Ungulate Survey (aerial)
2912	Tor	2012 Late Winter Ungulate Survey (aerial)
3086	Tor	2013 Breeding Bird Point Count Plot 2014 Pika Monitoring Site
3087	Tor	2011 Ungulate Survey Observation (aerial) 2012–2013 Pika Monitoring Site 2013 Vegetation and Soil Sampling Site
3347	Shrubby Fen	2012 Late Winter Ungulate Survey (aerial)
3419	Shrubby Fen	ELC Ground Truthing Plot 2010/2012 Rare Plant Plot 2011 Ungulate Survey Observation (aerial)
3482	Shrubby Fen	2010/2012 Rare Plant Plot

ELC Feature ID	ELC Habitat Description	Overlapping Survey Type
3607	Shrubby Fen	2008–2012 Bird Observation 2010/2012 Rare Plant Plot 2011 Fall Ungulate Survey (aerial) 2011/2012/2014 Late Winter Ungulate Survey (aerial) 2013 Breeding Bird Point Count Plot
3616	Shrubby Fen	2012 Late Winter Ungulate Survey (aerial)
3783	Shrubby Fen	2011 Late Winter Ungulate Survey (aerial)
3977	Shrubby Fen	2012 Late Winter Ungulate Survey (aerial)
3991	Shrubby Fen	2011 Late Winter Ungulate Survey (aerial)
4099	Shrubby Fen	2012 Late Winter Ungulate Survey (aerial)
4115	Shrubby Fen	2011-2013 Late Winter Ungulate Survey (aerial) 2013 Vegetation and Soil Sampling Site
4136	Shrubby Fen	2013 Vegetation and Soil Sampling Site
4150	Shrubby Fen	2012 Late Winter Ungulate Survey (aerial)
4156	Shrubby Fen	2012 Late Winter Ungulate Survey (aerial)
4180	Shrubby Fen	2011/2012 Late Winter Ungulate Survey (aerial)
4222	Shrubby Fen	2011 Late Winter Ungulate Survey (aerial) 2013 Breeding Bird Point Count Plot 2013 Vegetation and Soil Sampling Site
4265	Shrubby Fen	2011 Late Winter Ungulate Survey (aerial) 2013 Breeding Bird Point Count Plot 2013 Vegetation and Soil Sampling Site

A.11.2.1.2 R309

R309. Discussion of the potential effects of the construction, operation, and possible decommissioning of the airstrip and airstrip access road on proximate vegetation and wetlands. In particular, this discussion should identify impacts to downslope wetlands.

Quantifiable effects on vegetation and criteria for significance were identified in the Proposal vegetation effects assessment (Section 11). Key indicators used in the assessment of Project effects on vegetation are rare plant occurrence and vegetation health. Other indicators, such as loss of vegetation associations, were not brought forward during meetings with regulators or other interested governments. Additionally, no valuable vegetation conservation associations of interest were located within the PDA. Some riparian and wetland associated vegetation is within the PDA and will be removed.

Alternatively, while not specifically identified as an indicator, wetlands were assessed specifically in the assessment of potential Project effects on rusty blackbird. As rusty blackbird are typically found within shrubby habitats at the edge of ponds or lakes and shrubby wetlands, the assessment of effects on this species can be acknowledged as an acceptable assessment for wetlands in general. The model, detailed in Appendix 12B, used still water bodies based on available imagery, and a 75 m buffer was applied to the water bodies and any overlapping habitat types located within the buffer were rated as high. Additionally, all other wetland habitat types within the vegetation mapping area were rated as low under the assumption that wetland habitats without open water areas would provide some nesting opportunities but were likely not preferred. The results of the habitat

model indicate that over 99% of the LSA is considered low or nil value habitats for rusty blackbird. The available high value habitat is scattered in small pockets, generally at mid- to low elevations, throughout the Project and these results can be considered comparable for wetlands in general.

Mitigation measures discussed include:

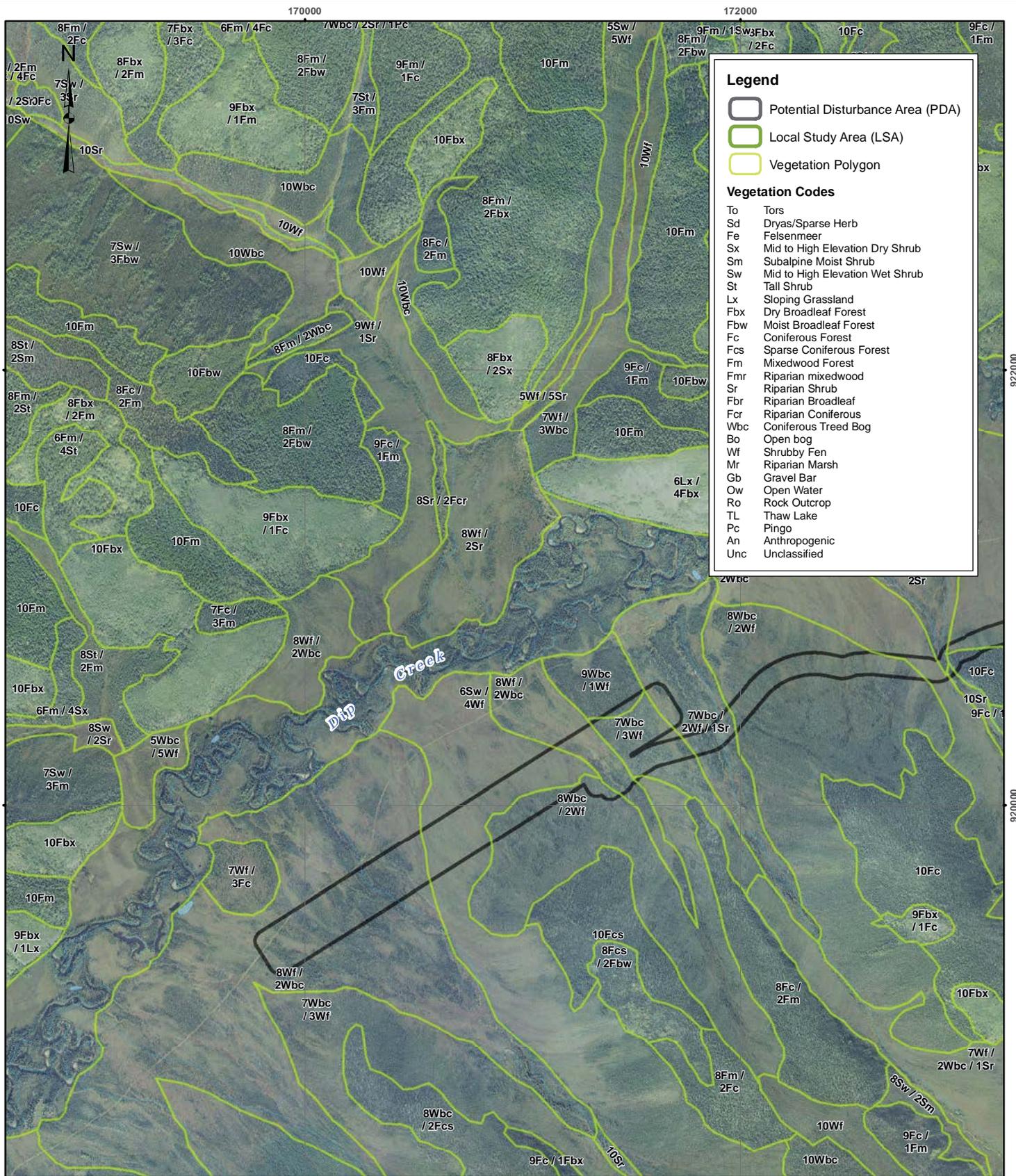
- Generally reducing the Project footprint;
- Where possible given the terrain and other site-specific features, Project design will incorporate a minimum 100 m buffer between Project infrastructure and any ponds or open-water wetlands (e.g. marsh, fen etc.). The 100 m buffer will help maintain riparian shrub and riparian forest communities which were identified as high value habitats for passerine species as a group.
- Dust suppression methods will be employed along roads during dry summer periods to reduce effects on passerine (wetland) habitat (this is a general mitigation action applicable to habitats of many wildlife Key Indicators).

Further mitigation and monitoring measures for reducing effects on wetlands and riparian areas are detailed in the WMMP (Appendix A.12A) and riparian setbacks are defined in the Sediment and Erosion Control Management Plan (Appendix A.22C) for the protection of fish habitat, riparian vegetation, users of riparian habitat and water quality.

A.11.2.1.3 R310

R310. An update to Figure 3.1 with the ecosystem types identified in the large vegetation polygon overlapping with the centre of the airstrip.

A revised Figure 3.1 with the label 6Sw /4Wf is provided in Figure A.11.2-1.

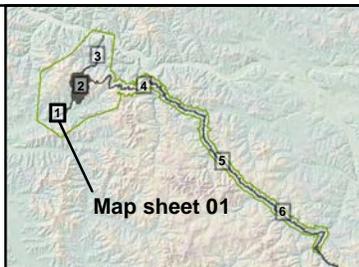


Notes:

PDA provided by Knight Piesold Ltd. 2013.

LSA developed by EDI and is based on boundary ELC vegetation data collected by AECOM and Summit Environmental Consultants and provided by Knight Piesold Ltd. 2013.

Digital Elevation Models (30 m and 90 m) provided by Yukon Government - Geomatics Yukon; online Corporate Spatial Warehouse. www.geomaticsyukon.ca



Airstrip vegetation polygons, map sheet 01

Drawn: MP/LG	Checked: MAS	Date: 26/02/2015	Figure: A.11.2-1
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Map scale 1:24,000 (printed at 8.5x11)
North American Datum 1983 CSRS Yukon Albers



A.11.3 SELECTION OF INDICATORS FOR THE VEGETATION HEALTH VALUED COMPONENT

A.11.3.1.1 R311

R311. Discussion of the use of “Loss of Vegetation Associations” and “Wetlands and Riparian Vegetation Associations” as indicators for vegetation health.

Effects on vegetation are quantified in the vegetation effects assessment of the proposal (Section 11). Criteria for significance were identified in the same volume. Key indicators used in the assessment of Project effects on vegetation are rare plant occurrence and vegetation health. Other indicators, such as loss of vegetation associations, were not brought forward during meetings with regulators or other interested governments. Assessing the “ecosystem value” of the vegetation association was not considered a measurable parameter of the selected indicators.

The Project effects on vegetation associations that have value as habitat for wildlife are assessed throughout Section 12. Vegetation associations are mapped within a 1 km buffer of the Freegold Road extension, and within Britannia Creek and its tributary Canadian Creek, as well as upper Dip Creek and its tributary Casino Creek. Wide ranging animals use habitats at coarser scales so the vegetation mapping only informs the assessment of Project effects on breeding birds and sedentary mammals.

Conversely, wetlands and riparian vegetation associations were assessed specifically through wetlands assessment through potential Project effects on rusty blackbird. The proposal’s Bird Baseline Report (Appendix 12B) identified water bodies buffered by 75 m and all other wetland habitat types as potential habitat for rusty blackbirds. The potential loss and disturbance to that habitat were assessed in Section 12.3.7 Passerine and Bird Species at Risk Effects Assessment in the Proposal, and measures to mitigate Project effects are identified in the WMMP (Appendix A.12A). Further, the Sediment and Erosion Control Management Plan (Appendix A.22C) defines setbacks around riparian areas for mitigating Project effects on water quality and fish that will also benefit wildlife.

A.11.3.1.2 R312

R312. A clear mitigation (buffer zone and avoidance) and management plan (where avoidance cannot be achieved) to support the residual effect assessment, for both the construction and operation of the project components.

A preliminary Sediment and Erosion Control Plan (Appendix A.22C) was written for the Project, and includes details of vegetative buffers and erosion and sedimentation control systems that may be implemented for the Project. This Plan is preliminary, and will be updated as the Project design progresses, and as construction details become apparent. The primary method of preventing erosion and preventing sediment laden water from entering watercourses is to limit the footprint near waterbodies and to maintain a vegetated buffer between construction activities and the watercourse. This method also protects riparian vegetation and aquatic habitat. Wherever possible, vegetated buffers will be maintained between construction activities and waterbodies. Buffers may range from 10 m to 30 m, depending on the size of the waterbody. The Project footprint near waterbodies will also be limited to the extent possible.

Additionally, construction within riparian areas will adhere to DFO operational statements to minimize loss. Where riparian loss cannot be avoided, riparian areas will be compensated for through the Fish Habitat Offsetting Plan (Appendix A.10A).

A.11.4 SOIL EROSION, RE-VEGETATION AND INVASIVE SPECIES

A.11.4.1.1 R313

R313. Details on a conceptual integrated management plan for project activities affecting vegetation.

Details should include:

- a. proposed buffer zones around wetlands, valuable vegetation associations or sites, and riparian areas which also consider the needs of wildlife for movement corridors;**
- b. species to be used for re-vegetation;**
- c. timeframe for re-vegetation and reclamation activities;**
- d. measures to monitor success and take corrective actions as necessary; and**
- e. control of invasive species.**

As discussed above in response to R312, a preliminary Sediment and Erosion Control Plan (Appendix A.22C) was written for the Project, and includes details of vegetative buffers and erosion and sedimentation control systems that may be implemented for the Project. This Plan is preliminary, and will be updated as the Project design progresses, and as more details of the proposed construction activities are provided. The primary method of preventing erosion and preventing sediment laden water from entering watercourses is to limit the footprint near waterbodies and to maintain a vegetated buffer between construction activities and the watercourse. This method also protects riparian vegetation and aquatic habitat. Wherever possible, vegetated buffers will be maintained between construction activities and waterbodies. Buffers may range from 10 m to 30 m, depending on the size of the waterbody.

Additionally, construction within riparian areas will adhere to DFO operational statements to minimize loss. Where riparian loss cannot be avoided, riparian areas will be compensated for through the Fish Habitat Offsetting Plan (Appendix A.10A).

The general objective for re-vegetation is to initiate the process for the return of the mine site to a condition which is similar to the existing natural vegetation. Existing vegetation in the area of the Casino Mine consists of black and white spruce in valleys and on lower slopes, with black spruce prevailing on wetter sites and white spruce on drier areas. In valley bottoms, sedge tussock fields are common. Alpine vegetation consists of scrub birch and stunted black spruce. In general, the vegetation at the Project is typical of what is present throughout the Dawson Range.

As detailed in the Conceptual Closure and Reclamation Plan (CCRP – Appendix 4A) the objective of the re-vegetation plan for the Casino mine is to control erosion of reclaimed areas and to initiate the transition to long-term or climax vegetation. Vegetation type will be adjusted for soil moisture, altitude and aspect to the sun.

Re-vegetation measures are expected to consist of:

- Placement of topsoil (taken from stockpiles developed during mine construction). In nutrient poor areas, vegetation establishment will be assisted by the use of early succession nitrogen fixers;
- Non-invasive species will be used, and use of native species will be promoted;
- Initial seeding of areas susceptible to erosion (slopes, etc.) with a native grass mix and a nurse crop to encourage rapid establishment;
- In areas less susceptible to erosion, a more natural approach to establish native species will be used, including woody species planting and local herb species establishment;

- The final phase of re-vegetation will be planting of spruce in patches or plugs to initiate the vegetation transition to climax vegetation; and
- Techniques currently being tested by the Yukon Research Centre, and those used successfully at other mines in the Yukon, will also be incorporated where appropriate.

Re-vegetation and cover trials will be carried out during operations to evaluate the performance of various cover designs and will include the composition and nutrient level of materials used for a vegetation substrate as well as consideration of erosion control to meet the objective of long-term physical stability of all final landforms. Details of the re-vegetation plan will be developed and updated throughout the mine life using the results from pilot plots and other testing at the Project, and in the larger research community.

CMC's Environmental Monitoring, Surveillance and Reporting Plan and a Vegetation Monitoring Plan will be developed to ensure successful re-vegetation of disturbed areas of the Casino Mine Project and will consider the following:

- Vegetation surveying and sampling has been completed as part of the baseline assessment (Appendix 11A). The vegetation monitoring plan will focus on rare plant species monitoring, invasive plant species monitoring and vegetative health monitoring.
- Monitoring of progressive reclamation activities will include re-vegetation monitoring.
- CMC is currently collaborating with the Yukon College to research wetland treatment. To further refine the treatment wetland design the initiation of field trials will identify optimal plants to be established in the North and South wetlands for maximum metal removal, minimal plant metal uptake (see Section A.4.11.3 for more details).
- Re-vegetation will also be guided by native species, and First Nations traditional knowledge and future land use objectives.

As shown in Table A.11.4-1, successful re-vegetation of the mine site will require field trials during operations to evaluate appropriate plant species and potential soil amendments to ensure re-vegetative success. To ensure that the re-vegetation activities meet the requirements for successful re-vegetation, research programs will be required, and may include:

- Assessing the availability of natural seed or the availability of productive seed material from local surroundings;
- Undertaking vegetation trials using native plant species;
- Assessing nutrient level deficiencies in available soils to determine necessary amendments;
- Determining appropriate seed mixes, fertilization and growth media through experimental test plots; and
- Establishing performance standards to measure re-vegetation success.

Table A.11.4-1 Adaptive Management for Re-vegetation Planning

Test Case	Implementation of Test Case	Monitoring of Test Case	Measurement of Success
Natural seed availability	Assessment of natural seed in the Project area.	Assess natural seed collection success.	Ability to collect enough natural seed to meet re-vegetation requirements.
Vegetation trials for re-vegetation	Establishment of trial plots.	Evaluation of re-vegetative success.	Achievement of 100% cover using native species.
Nutrient level deficiencies in available soils	Examination of various methods of nutrient supplementation (e.g., fertilizer, nitrogen fixing plant species, biochar, etc.)	Analysis of subsequent nutrient concentrations and successful growth of native plant species.	Maximum growth of native plant species.

The above studies will be undertaken during the early operations phase, in conjunction with a First Nations working group, as identification of preferred plant species to be available in the ultimate closure landscape will be imperative.

Control of invasive species is detailed in the preliminary Invasive Species Management Plan provided in Appendix A.22D. The Invasive Species Management Plan summarizes the management and monitoring proposed to prevent the introduction and propagation of invasive plant species at the Casino Project.