10.0 CARIBOU

Caribou is assessed as a valued component (VC) for the Berry Pit Expansion (Project Expansion) because caribou provide ecological, cultural, recreational, aesthetic, and economic value to stakeholders, including the public, Indigenous groups, outfitters, local businesses, and government agencies. Under the federal *Species at Risk Act* (SARA), woodland caribou (*Rangifer tarandus caribou*) on the Island of Newfoundland is recognized as a distinct population (Newfoundland Population) (COSEWIC 2014), and are listed as Special Concern on Schedule 1 of SARA (Government of Canada 2021). At the time of writing, the Newfoundland Population of woodland caribou is not listed on the Newfoundland and Labrador (NL) *Endangered Species Act*; however, in 2008, the province provided funding for research and management initiatives to address declines in the caribou population.

Caribou have the potential to be affected by the construction, operation, and decommissioning, rehabilitation, and closure of the Project Expansion through potential changes in habitat, movement (migration), and mortality risk. Caribou also have potential to be affected by Project Expansion-related changes in the Atmospheric Environment (Chapter 6), Groundwater (Chapter 7), Surface Water (Chapter 8), and Other Terrestrial Components (Chapter 11) VCs through land clearing, noise, and dust. As such, residual effects related to these VCs were used in part to inform the assessment of potential Project Expansion residual effects on the Caribou VC. The Caribou VC is also linked to the Socio-economic Environment (Chapter 12), which considers community services and infrastructure, community health, employment and economy, land and resource use, and Indigenous groups, as potential effects on the Caribou VC have the potential to affect current land and resource use associated with hunting and outfitting, traditional land use by Indigenous groups, and other community members.

10.1 APPROACH TO THE CARIBOU ASSESSMENT

The assessment of the Caribou VC considers the four herds of woodland caribou that were assessed in the Valentine Gold Environmental Impact Statement (EIS) (Valentine Gold EIS; Marathon 2020) for the Valentine Gold Project (the Approved Project);[1] Buchans, Gaff Topsails, Grey River, and LaPoile Herds (collectively referred to as the ‘assessed herds’).

As indicated in Section 1.3, the Project Expansion infrastructure will be almost entirely within the Project Area that was assessed for the Approved Project, with the exception of three sedimentation ponds to the north of the Berry waste rock pile and the relocation of the explosives facility to the existing exploration camp location, which has already been disturbed. For the Approved Project, it was conservatively assumed that all habitat in the Project Area (mine site and access road) would be changed (become unsuitable) because of the Approved Project. The addition of the Project Expansion will therefore result in a change in habitat (loss or alteration) of an additional 3.4 ha of habitat (an additional 0.1% relative to the Project Area used for the Approved Project). The Project Expansion will, however, result in the presence

[1] The Valentine Gold Project was released from the EA process with conditions, provincially on March 17, 2022, and federally on August 24, 2022.

of additional features on the landscape (e.g., the Berry pit and the Berry waste rock pile), some of which will be permanent, and will result in changes in the amount of noise and dust present at specific locations within the Project Area. Both of these changes could further affect caribou movement and mortality risk. The Caribou Alternate Migratory Pathway Analysis that was completed during the technical review for the Approved Project also assumed that caribou would avoid the mine site by various distances and can therefore be considered representative of Project Expansion effects as well as those of the Approved Project. Potential alternate migratory pathways for the Buchans herd were estimated during spring and fall migration assuming a zone of influence (ZOI) around the mine site of 1 km, 5 km, 10 km, and 15 km.

Given the spatial and temporal overlap between the Project Expansion and the Approved Project, and the pathways for interactions with caribou, assessing the effects of the Project Expansion independent of the Approved Project is challenging. This is particularly the case for potential effects related to dust and noise, as noise and air dispersion models have been updated in this Environmental Registration / Environmental Assessment (EA) to reflect the combined Projects (rather than modelling the Project Expansion independent of the Approved Project). The Atmospheric Environment VC (Chapter 6) focusses on the assessment of the combined effects of the Approved Project and Project Expansion and whether the addition of the Project Expansion changes the effects predictions for the Approved Project. A similar approach has been taken with the Caribou VC. This Environmental Registration / EA Update considers whether the effects of the Project Expansion, in combination with effects of the Approved Project, change the residual effects prediction made in the Valentine Gold EIS. This approach is consistent with the federal EA requirements with respect to a Change to a Designated Project as outlined in the federal EA Conditions for the Approved Project. This effects assessment considers new data, available since submission of the Valentine Gold EIS. As well, more caribou have been collared, from which additional information on caribou movement is available. Models (described in Section 10.2.2) have been updated to reflect this additional data and results have been incorporated into this assessment. The assessment also discusses the process of updating mitigation measures and monitoring plans to be implemented during construction and operation of the Project Expansion.

The spatial boundaries for the effects assessment of caribou are the same as that used for the Approved Project. Spatial boundaries are defined in Section 5.1.3, Table 5.2, for the Project Area, Local Assessment Area (LAA), and Regional Assessment Area (RAA) and are illustrated in Figures 10-1 and 10-2 and summarized as follows:

- Project Area: The Project Area encompasses the immediate area in which Project activities and components occur and is the anticipated area of direct physical disturbance associated with the construction, operation, and decommissioning, rehabilitation, and closure of the Project. The Project Area comprises two distinct parts:
  - Mine site: the area within which Project infrastructure will be located; and
  - Access road: the existing road to the mine site, plus a 20 metre (m) wide buffer on either side.
- LAA: includes a 1 km buffer surrounding the mine site and a 500 m buffer surrounding the access road. The LAA was established to reflect the area within which caribou-specific Project effects are most likely to occur, including indirect changes to habitat due to sensory disturbance (i.e., displacement or avoidance) (e.g., Benítez-López et al. 2010).

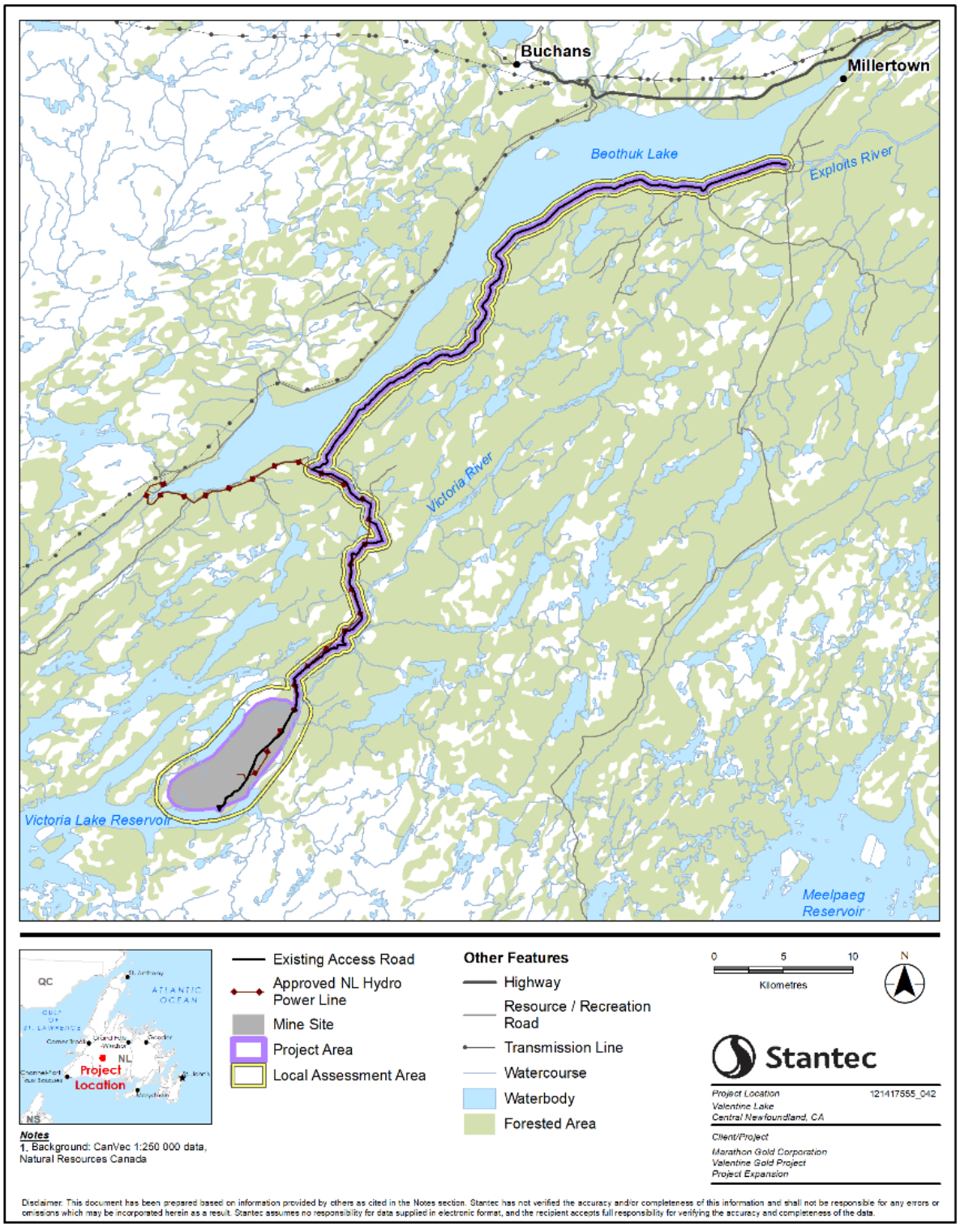

Figure 10-1 Approved Project and Project Expansion Location and Spatial Boundaries (Project Area and Local Assessment Area)

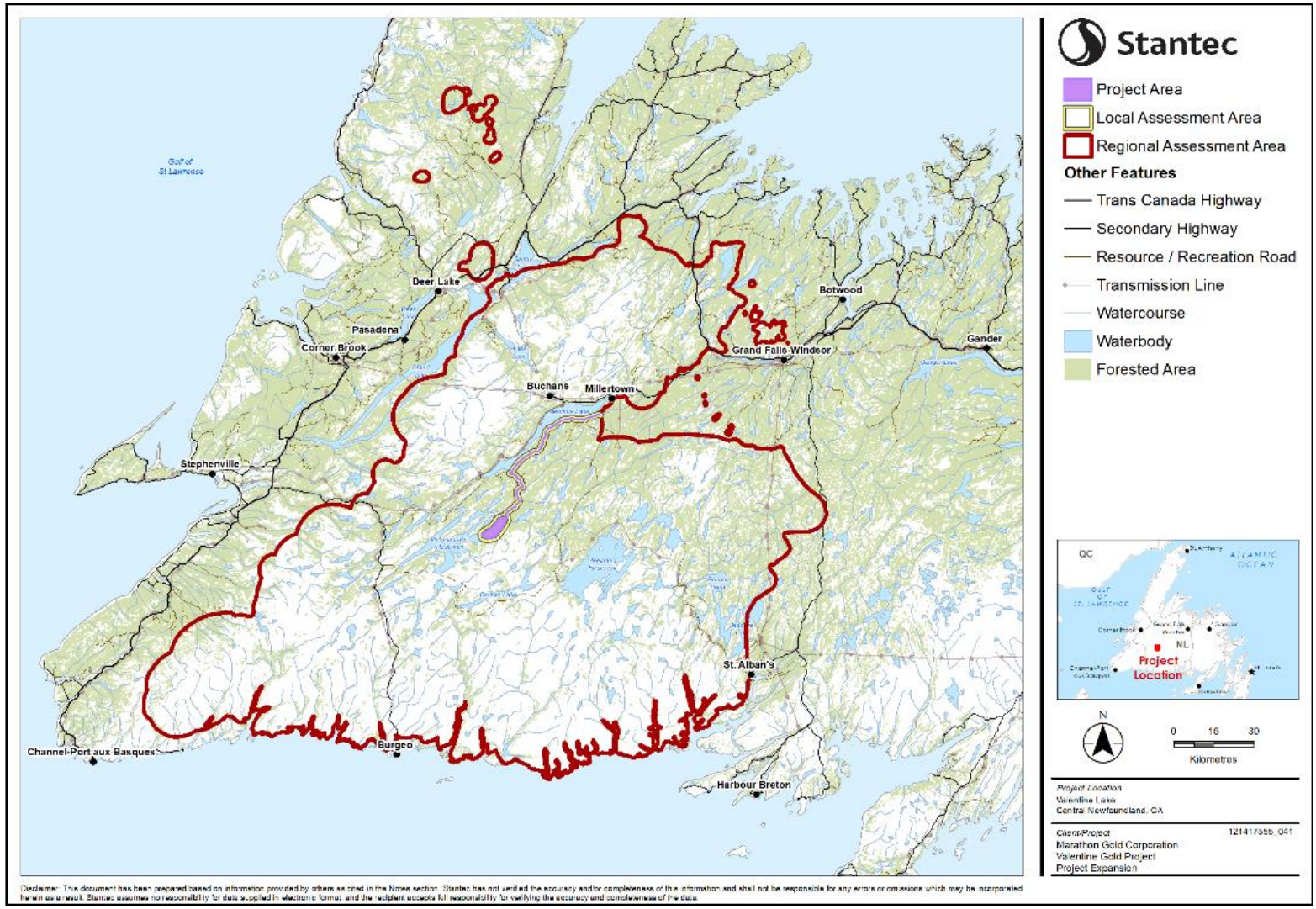

Figure 10-2 Caribou Regional Assessment Area

- RAA: includes the combined population ranges (28,809 km^2) of the Buchans, Gaff Topsails, Grey River, and La Poile Herds (Figure 10-2) as determined by caribou telemetry data obtained from the Newfoundland and Labrador (NL) Department of Fisheries, Forestry and Agriculture – Wildlife Division (NLDFFA – Wildlife Division). The method used to determine the RAA from the telemetry data resulted in several small, spatially discrete areas of use (e.g., base of the Northern Peninsula, north of Grand Falls-Windsor), in addition to the larger 'core' area of use.

10.2 EXISTING ENVIRONMENT

The existing environmental conditions for caribou in the Project Area and LAA are based on established biophysical and socioeconomic baseline studies (i.e., desktop analyses and field programs) completed in support of the Approved Project and supporting documents (e.g., supplemental information provided through the technical review of the Valentine Gold EIS) and caribou surveys completed by Marathon Gold Corporation (Marathon) since the submission of the Valentine Gold EIS. This section summarizes existing conditions presented for the Approved Project, as well as provides updates to existing conditions based on surveys completed since the Valentine Gold EIS was approved and based on newly available public information, where available. Construction activities have begun for the Approved Project (as of October 2022); the existing conditions for caribou refer to pre-construction conditions. This approach has been taken for several reasons:

- Surveys undertaken prior to October 2022 reflect pre-construction conditions
- The conservative assessment approach is to assume that the potential effects of the Project Expansion in combination with the Approved Project, are in consideration of an existing environment undisturbed by construction activities
- Existing conditions within the Project Area and the mine site (Figure 10-1) are changing regularly as construction of the Approved Project advances (and as predicted in the Valentine Gold EIS); therefore, existing conditions reflective of construction activities would be constantly shifting and challenging to characterize in a meaningful way for assessment purposes.

10.2.1 Summary of Existing Environment from the Approved Project

This section summarizes existing conditions for the Approved Project, as presented in the Valentine Gold EIS and in supplemental information during the technical review of the Valentine Gold EIS.

10.2.1.1 Information Sources

An assessment of Approved Project effects on caribou was presented in Chapter 11 of the Valentine Gold EIS, supported by baseline studies appended to the EIS and supplementary information presented in the EIS technical review and approval process, including a Caribou Supplemental Information Report. Information on where to access these documents online is contained in Table 1.8. Information sources referenced as part of the Valentine Gold EIS and the EIS review and approval process include:

- Results from remote camera programs in fall 2019 ([Valentine Gold EIS: Baseline Study Appendix 2: Woodland Caribou (BSA.2), Attachment 2-A], spring 2020 (Valentine Gold EIS: BSA.2, Attachment 2-

B) and fall 2020 (Caribou Supplemental Information Report, Appendix G of the Valentine Gold Project: Amendment to the Environmental Impact Statement).

- 2020 aerial post-calving survey (Valentine Gold EIS: BSA.2, Attachment 2-C).
- Estimates of herd ranges (kernel densities) based on caribou telemetry data obtained from the Newfoundland and Labrador Department of Fisheries, Forestry and Agriculture – Wildlife Division (NLDFFA – Wildlife Division) (Marathon 2020).
- Delineation of heavily used wildlife trails (migration paths) in the mine site using Light Detection and Ranging (LiDAR) data (Valentine Gold EIS: BSA.2, Attachments 2-A and 2-B).
- Dynamic Brownian bridge movement model (dBBMM) outputs to delineate the migration corridor and paths for the Buchans and Gaff Topsails herds (Valentine Gold EIS, Section 11.2.2.1).[2]
- Caribou Alternate Migration Pathway Analysis to predict potential alternate migratory pathways that may be used by the Buchans herd (Caribou Supplemental Information Report, Appendix G of the Valentine Gold Project: Amendment to the Environmental Impact Statement).

[2] 'Migration corridor' refers to the broader area used for migration at the population-level, comprised of a collection of 'migration paths.'

10.2.1.2 Distribution of Assessed Caribou Herds

Seasonal ranges of the four caribou herds (Figure 10-3) that overlap with the Project Area are summarized as follows:

- **Buchans herd:** caribou move between seasonal ranges in central Newfoundland during the fall to wintering areas on the south coast. The calving and post-calving ranges occur primarily north of the Project Area, whereas the other seasons include range near the south coast. Whereas the Project Area overlaps with less than 1% of the Buchans herd seasonal ranges, the overlap includes a primary migration corridor used by Buchans herd caribou to move between seasonal ranges.
- **Grey River herd:** caribou move between calving and summer ranges in south-west Newfoundland and winter range on the south coast. The fall and winter ranges occur southeast of the Project Area towards St. Alban's, while the spring and summer ranges occur further west. The Project Area overlaps with less than 2% of the Grey River herd seasonal range; overlap of the mine site with the spring migration/pre-calving and post-calving rearing ranges is less than 1.5 km^2 and overlap with the calving range is approximately 27 km^2.
- **La Poile herd:** caribou move between calving and summer ranges in south-west Newfoundland and winter range on the south coast. There is no overlap between the La Poile herd range and the Project Area based on available telemetry data and home range estimates (Marathon 2020).
- **Gaff Topsails herd:** the range occurs between Sandy Lake and Twin Lakes in the north and Star Lake in the south. Based on available telemetry data, the Gaff Topsails herd may have smaller seasonal movements within the range but they do not migrate south through the Project Area (Marathon 2020). Only the winter range for the Gaff Topsails overlaps with the Project Area, along a section of the existing access road that is approximately 40 km east of the mine site. The overlap is approximately 0.4 km^2 (or less than 1% of the winter range) (Marathon 2020).

A characterization of the existing conditions for the assessed herds within the spatial boundaries defined in Section 10.1 is provided in the following sections. Due to the overlap of the Project Area with a primary migration corridor of the Buchans herd, the following sections focus on Buchans herd caribou. A more detailed discussion of the Grey River, La Poile, and Gaff Topsails herds is provided in the Valentine Gold EIS (Section 11.2).

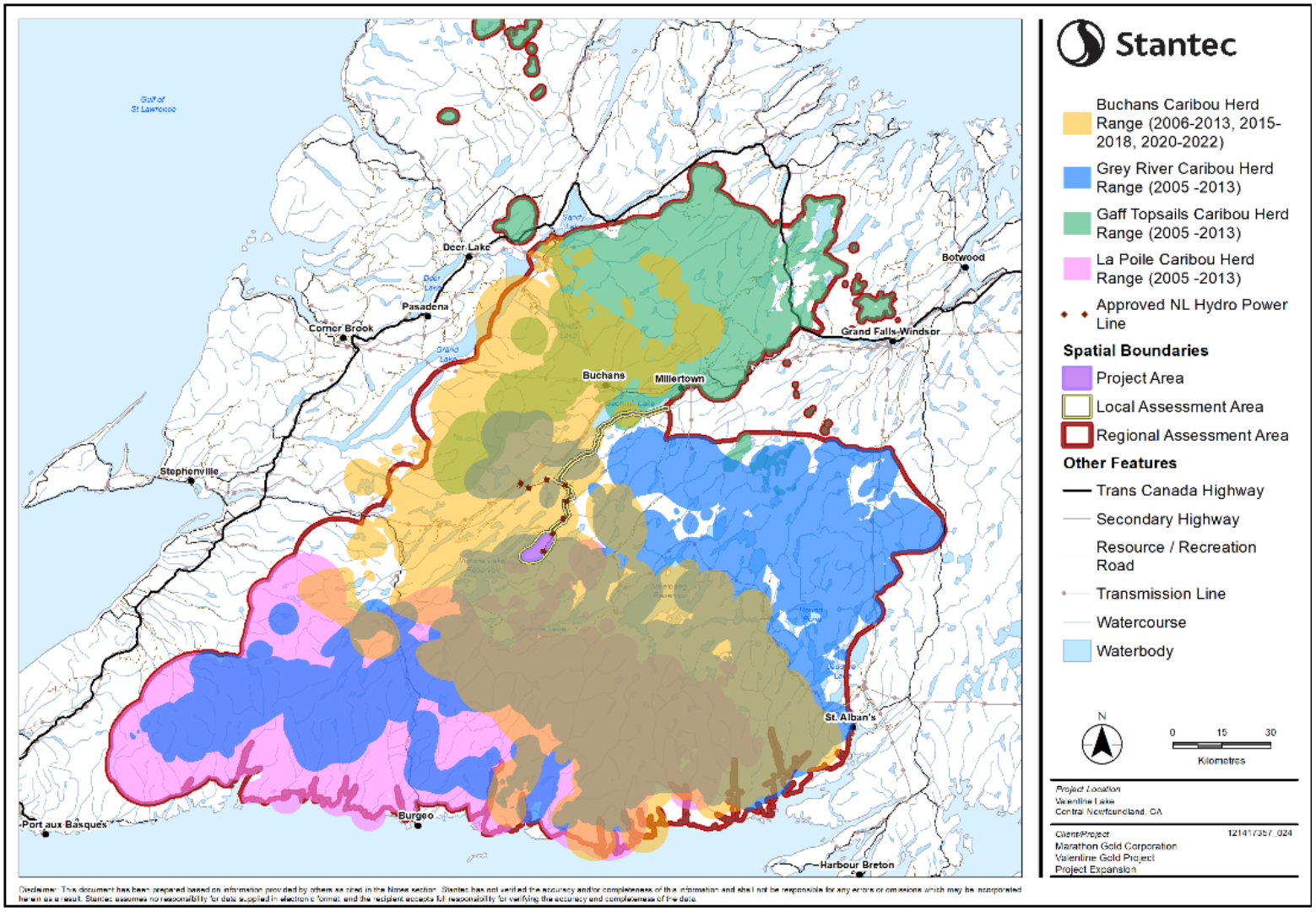

Figure 10-3 Distribution of Assessed Caribou Herds

10.2.1.3 Caribou Habitat Assessment

Habitat types in the LAA were identified using the Ecological Land Classification (ELC) (BSA.7, Attachment 7-D in the Valentine Gold EIS [Marathon 2020]). The ELC Area (ELCA) (Figure 10-4) covers 1,830.6 km^2 and more than 99% of the Project Area and 97% of the LAA. Habitat suitability was assessed for caribou and ranked based on the availability of three critical elements: forage, refuge, and habitat used during migration. ELC habitat types were assigned one of three value ratings: high, moderate, or low. High value habitat types provide an abundance of the three critical elements, moderate habitat types provide an abundance of one or two of the critical elements, and low value habitat types provide marginal forage or refuge or are rarely used during migration. High, moderate, and low-value habitats for caribou in the Project Area, LAA, and ELCA are summarized in Table 10.1. The relative amounts of high, moderate, and low habitat value rankings are similar in the Project Area and ELCA, suggesting that the quantity and quality of caribou habitat in the Project Area are similar to those of the ELCA. Additional information on the caribou habitat assessment is provided in Section 11.2.1.4 of the Valentine Gold EIS.

Table 10.1 Amount of Habitat by Ranking for Caribou in the Project Area, LAA and ELCA

Habitat Value Ranking	Area in Project Area[1,2]		Area in LAA[1,2,3]		Area in ELCA[1,3]	
	km^2	%	km^2	%	km^2	%
High	18.7	53.9	52.5	41.3	849.1	46.4
Moderate	9.8	28.1	46.5	36.6	718.5	39.2
Low	6.2	18.0	28.0	22.1	263.0	14.4
Total	**34.7**	**100.0**	**127.0**	**100.0**	**1,830.6**	**100.0**

Notes:
[1] Numbers rounded to one decimal place. Areas and percentages may not add up to total amounts due to rounding.
[2] Values pertain to the portion of the Project Area and LAA with ELC data.
[3] LAA = Local Assessment Area; ELCA = Ecological Land Classification Area.

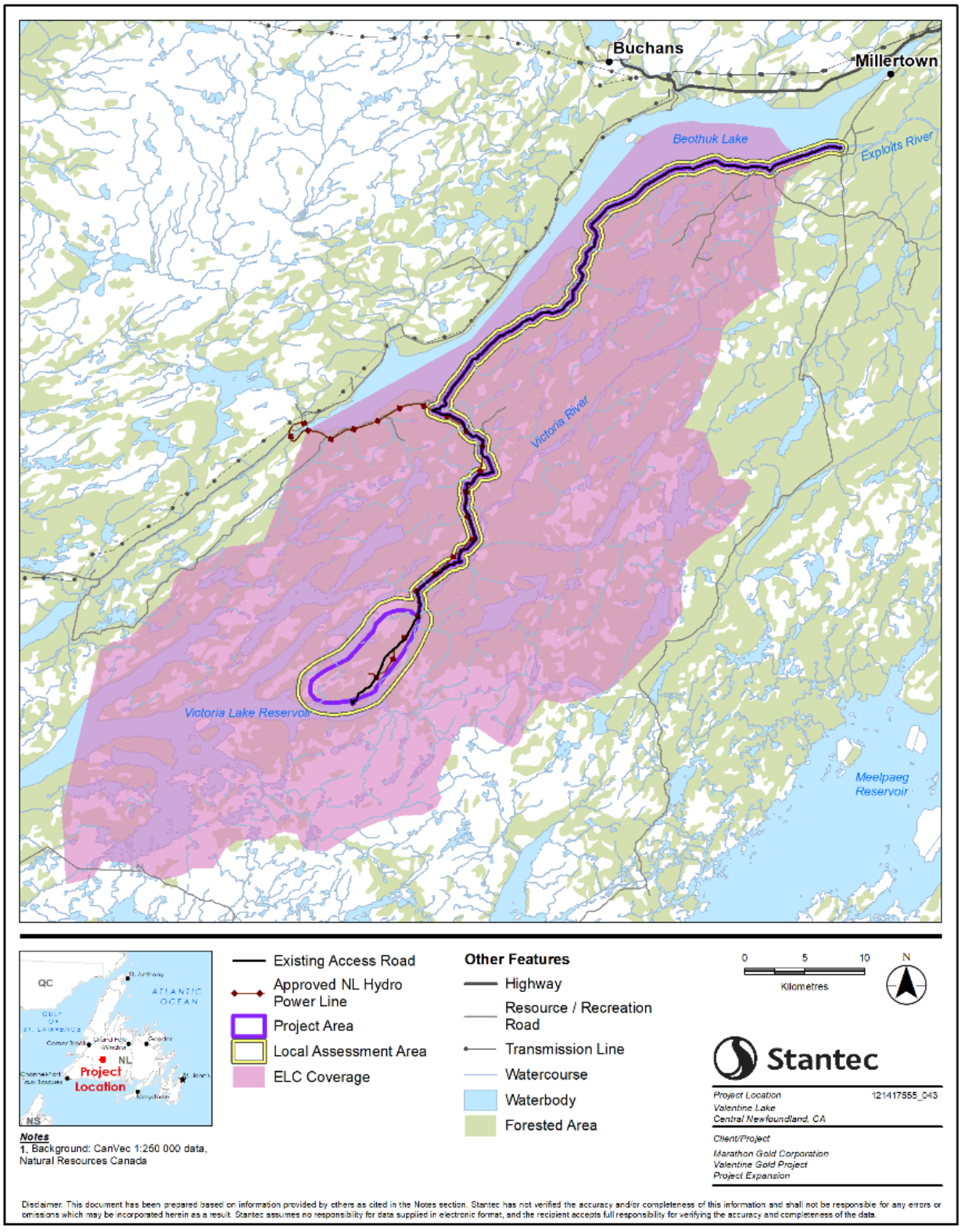

Figure 10-4 Coverage of ELC Data (ELCA) and Overlap with Project Area and LAA

10.2.1.4 Caribou Migration

Migration Timing

General (non-herd specific) migration periods for caribou on the Island of Newfoundland indicate that spring migration occurs from April 1 to May 19 and fall migration occurs from November 1 to December 15 (Emera 2013). An analysis of caribou movements between winter (December 16 to March 31) and summer (May 20 to August 31) ranges, using telemetry data from 2015 to 2017 (Section 11.2.1.3 of the Valentine Gold EIS) indicated interannual variation in the timing of migration of caribou from the Buchans herd, with combined spring migration dates through the mine site occurring from April 18 to May 10, and in fall migration from November 17 to December 12. These dates coincide with general spring and fall migration periods for caribou on the Island of Newfoundland (Emera 2013) but occur over a shorter period for all years investigated. Remote cameras deployed in the Project Area in 2019 and 2020 detected females moving through the mine site earlier than males during spring (peak movement April 25 to May 7, 2020 for females, and May 15 to May 27, 2020 for males) but not during fall migration (peak movement November 9 to 12, 2019).

Buchans Herd Caribou Migration

Information provided by NLDFFA – Wildlife Division (Government of NL 2019) and subsequent LiDAR analyses identified several caribou migration paths through the Project Area. Modelling using caribou collar telemetry (dBBMM) identified a single, distinct population-level migration path through the Project Area used during both spring and fall migration (Section 11.2.2.1 in the Valentine Gold EIS). This migration path was also confirmed via the remote camera program (Marathon 2020). While caribou migration movements were found to be more dispersed in spring than in fall, consistent use of the area by caribou was observed in the locations of the Marathon open pit and waste rock pile. Up to 55.1% of the collared caribou were found to use the dominant migration path during spring, and up to 58.4% during fall (Marathon 2020). While this result was based on collared caribou, the assumption was that the movement patterns are representative of the Buchans herd generally.

Caribou Alternate Migration Pathway Analysis

To assist in understanding potential effects of the Approved Project on movement patterns of Buchans herd caribou, a Caribou Alternate Migration Pathway Analysis (least-cost path [LCP] analysis) was undertaken and submitted during the technical review process for the Valentine Gold EIS, as part of the Caribou Supplemental Information Report (Appendix G of the Valentine Gold Project: Amendment to the Environmental Impact Statement). Information on where to access these documents online is contained in Table 1.8. The LCP analysis included modelling the relative energetic cost for an animal to move between locations, assuming complete avoidance of potential ZOI around the mine site (i.e., 1 km, 5 km, 10 km, and 15 km), and under frozen and unfrozen scenarios. Results of the LCP analysis indicated that if caribou alter their primary migration path because of the Approved Project, caribou will travel between 0 km and 13 km farther than the baseline LCP during frozen conditions, and 6 km to 30 km farther than the estimated baseline LCP during unfrozen conditions (assuming caribou avoidance of large water bodies

including Victoria Lake Reservoir, Beothuk Lake, and Meelpaeg Lake).[3] The associated relative energetic costs of these alternative pathways range from 1.01 to 1.41 times greater than the baseline LCP. The remote camera monitoring program has detected caribou along some of the alternate migration paths (Appendix 10A) suggesting that some caribou are already using these paths for migration.

10.2.2 Existing Environment Update (New Data and Analyses)

This section summarizes updates to existing conditions based on surveys completed since the Valentine Gold EIS was approved and on newly available public information, where available.

10.2.2.1 Information Sources

Caribou surveys and data analyses (Appendix 10A) completed by Marathon since the submission of the Valentine Gold EIS have been compiled into a baseline information update for the Approved Project. This report has also informed the update of existing conditions for the Project Expansion. The report includes:

- Updated estimates of seasonal ranges (kernel densities) of Buchans herd caribou, based on Global Positioning System (GPS) collar data from 2006 to 2013, 2015 to 2018, and 2022 (includes data from up to 40 new GPS collars purchased in 2020).
- Updated dBBMM for Buchans Herd caribou, using available telemetry data from 2006 to 2013, 2015 to 2018, and 2020 to 2022.
- Net squared displacement (NSD) analysis to identify Buchans herd caribou spring and fall migration timing and duration using telemetry locations of collared caribou from 2006 to 2013, 2015 to 2018, and 2020 to 2022.
- Results from remote camera programs in spring and fall of 2021 and 2022.
- Aerial post-calving survey results from 2021 to 2022 of the Buchans herd calving grounds and resident caribou calving grounds within a 17-km ZOI around the mine site and 4-km ZOI on the south side of the access road.

10.2.2.2 Seasonal Ranges (Kernel Estimates) of Buchans Herd Caribou

Kernel or range density estimates were used to update the description of the location, area, and seasonal range use of collared Buchans herd caribou. The dates for spring and fall migration used in the analysis were based on the results of the NSD analysis (Section 10.2.2.3), with remaining seasons informed by the general seasons for caribou on the Island of Newfoundland (Emera 2013). The range of the Buchans herd was estimated at approximately 14,237 km^2 (slightly lower than 15,650 km^2 estimated in the Valentine Gold EIS). As expected, caribou were generally found to move between seasonal ranges, migrating from central Newfoundland during the fall to wintering areas on the south coast, although caribou appear to deviate from this strategy (e.g., some collared caribou did not migrate in some years). Generally, caribou from the Buchans herd are found north of the Project Area during post-calving migration / dispersal (June 11 to June 30), while remaining seasons (Table 10.2 and Figure 10-5) include range near the south coast. The sizes of the seasonal ranges for Buchans herd caribou, based on NSD

[3] Narrow portions of these lakes (i.e., <1 km) were not included as barriers.

migration dates, are provided in Table 10.2. Additional details on the updated kernel range estimates for Buchans herd caribou is provided in Appendix 10A.

Table 10.2 Areas of Seasonal Use by Collared Caribou from the Buchans Herd

Seasonal Dates for Buchans Herd Caribou based on NSD Migrations	No. of GPS Collared Caribou[A]	Area (km^2)[B,C,D]	
		50% Kernel	95% Kernel
Fall Dispersal / Winter	87	3,270	7,659
Spring Migration	83	3,647	10,826
Pre-calving / Calving	84	1,563	6,492
Post-Calving Migration / Dispersal	81	672	2,129
Post-Calving Rearing	85	1,876	5,387
Fall Rut	83	1,074	4,432
Fall Migration	86	2,848	6,883
Total Range[E]	**94**	**14,237**	

Notes:

A. Number of collared caribou used in the analysis, based on GPS telemetry data from the following years: 2006-2013, 2015-2018, 2020-2022.
B. Areas calculated using only collars with more than 50 locations.
C. Areas rounded to the nearest integers.
D. Kernel ranges are shown on Figure 10-5.
E. Total range is based on 95% kernel.**Error! Reference source not found.**

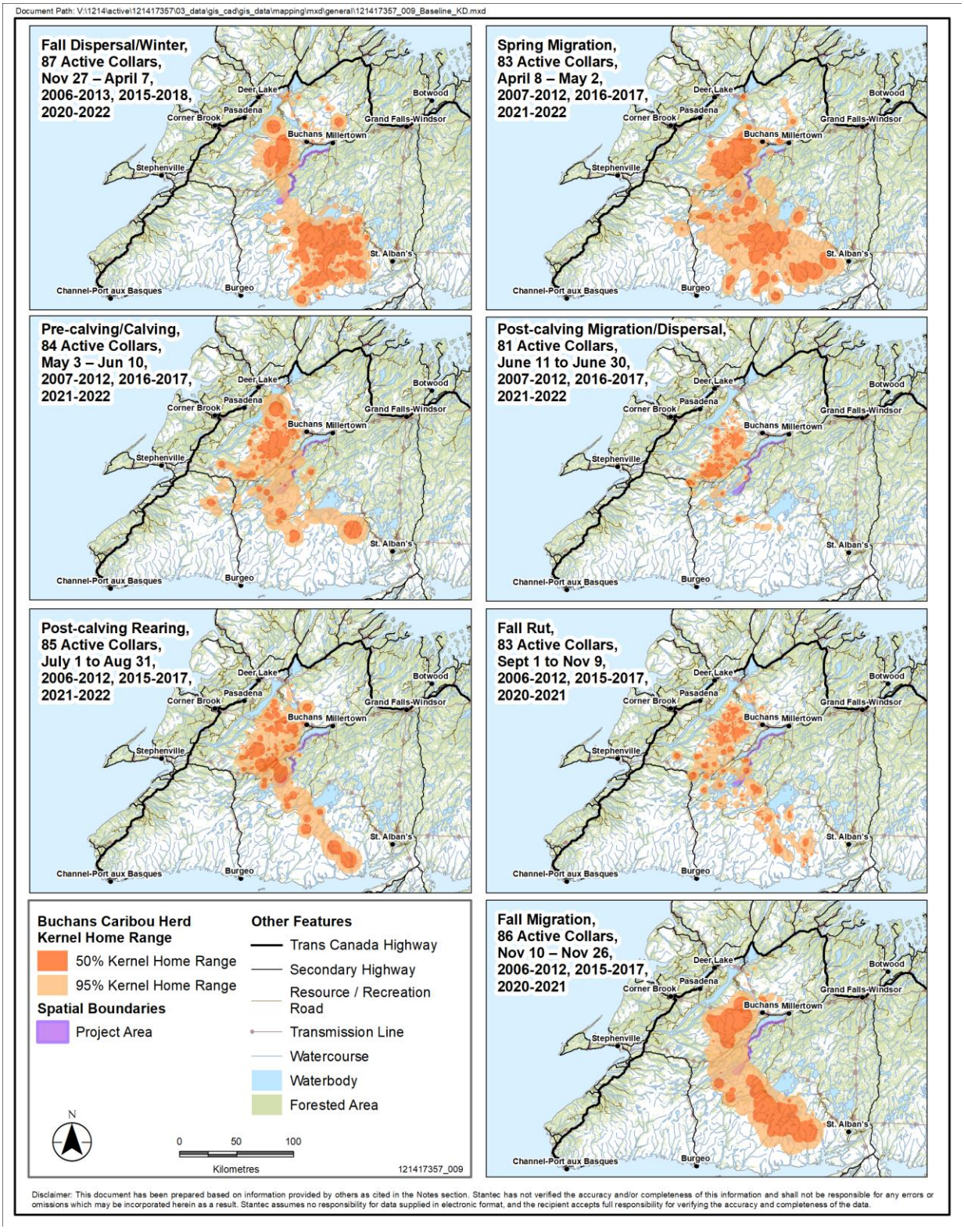

Figure 10-5 Seasonal Ranges for Buchans Herd Caribou

10.2.2.3 Timing of Migration

NSD (Bunnefeld et al. 2011, Singh et al. 2016) was used to classify migratory behaviour and to identify timing and duration of spring and fall migration periods of Buchans herd caribou using GPS collared caribou data from 2006 to 2012, 2015 to 2018, and 2020 to 2022. Results of the NSD analysis are presented in detail in Appendix 10A and summarized in Table 10.3. The mean start and end dates for fall migration were November 10 to November 26 (16 days duration), and for spring migration from April 8 to May 2 (24 days duration) (Table 10.3). The NSD dates for Buchans herd caribou overlap with the general spring and fall migration dates for caribou on the Island (spring migration: April 1 to May 19; fall migration: November 1 to December 15 [Emera 2013]), but occur over a shorter period.

Table 10.3 Seasonal Migration Metrics for Buchans Caribou Herd, 2006-2022

Metric	Spring (n = 117)[A,B]			Fall (n = 140)[B,C]		
	Start Date	**End Date**	**Duration Days**	**Start Date**	**End Date**	**Duration Days**
Mean (95% CI)	Apr 8 (Apr 07-10)	May 2 (Apr 30-May 04)	24 (23-26)	Nov 10 (Nov 04–16)	Nov 26 (Nov 21–Dec 02)	16 (14-18)
Median	Apr 10	May 1	21	Nov 15	Nov 29	14

Notes:
A. Migration metrics were calculated using NSD estimates from 77 GPS collared caribou over 117 spring migrations.
B. All collared caribou are female.
C. Migration metrics were calculated using NSD estimates from 79 GPS collared caribou over 140 spring migrations

Annual remote camera monitoring similarly showed interannual variation in caribou movements, based on detections in the camera study area that captured data for both collared and non-collared animals, and included males, females, and calves (the NSD analysis was based on collared females only). As a result, variation in the timing and duration of caribou movements is larger than the reported NSD dates. Most caribou moved through the camera study area from five days to five weeks in fall, and from four to 10 weeks in the spring, with caribou detected by cameras almost daily during spring migration (Appendix 10A). Caribou were detected by cameras earlier than either the mean NSD or general migration initiation dates during fall migration, but later than these dates during spring migration.

Ongoing monitoring and assessment of migration dates, and therefore, triggers to implement protection levels and mitigations is subsequent management actions is one of the key aspects considered in the follow-up monitoring program in the Caribou Protection and Environmental Effects Monitoring Plan (CPEEMP) (Appendix 10B). Current mitigation measures related to the timing of Project activities and levels of caribou protection are also presented in the CPEEMP.

10.2.2.4 Spring and Fall Migration Routes

The dBBMM analysis used new collar data (2020 to 2022) combined with earlier data (2006 to 2012 and 2015 to 2018) to identify spring and fall caribou migration routes of GPS collared caribou in the Buchans herd. The updated dBBMM used the start and end dates of the spring and fall migration periods identified in the NSD for each collared caribou (Table 10.4), which differed from the previous analysis that used NLDFFA – Wildlife Division migration dates. To generate the updated dBBMM, the same model

parameters were used as the previous analysis completed for the EIS. For each pixel within the migration path, a utilization distribution (UD) was calculated, which represented the probability that an individual GPS collared caribou was located within that grid cell during their spring or fall migration periods relative to other grid cells within the migration path. The UD values for each population-level spring and fall migration corridor was classified into quartiles where the upper 25% quartile of the UD for each seasonal migration period was considered an area of high use and assumed to represent 'migratory stopovers' (e.g., resting, foraging) similar to Sawyer et al. (2009) and Sawyer and Kauffman (2011). The remaining quartiles (25-50% and 50-75%) were considered connecting movement pathways between stopover sites, and the last quartile (75-99%) represented relatively low use areas. This collection of migration paths identified by the dBBMM is referred to as a migration corridor.

Table 10.4 Caribou Seasonal Timing Dates for the Buchans Caribou Herd

General Seasons for Caribou on the Island of Newfoundland[A]		Seasonal Dates for Buchans Herd Caribou based on NSD[B] Migrations	
Winter	December 16 – March 31	Fall Dispersal / Winter	November 27 – April 7
Spring Migration / Pre-calving	April 1 – May 19	Spring Migration	April 8 – May 2
Calving	May 20 – June 10	Pre-calving / Calving	May 3 – June 10
Post-Calving Migration / Dispersal	June 11 – June 30	Post-Calving Migration / Dispersal	June 11 – June 30
Post-Calving Rearing	July 1 – August 31	Post-Calving Rearing	July 1 – August 31
Fall Rut	September 1 – October 31	Fall Rut	September 1 – November 9
Fall Migration / Dispersal	November 1 – December 15	Fall Migration	November 10 – 26

Notes:
A. Source Emera 2013
B. NSD = Net Squared Displacement; NSD dates are mean dates.

The results of the dBBMM identified a network of travel paths (i.e., low, moderate, and high use areas) that are approximately 30 to 80 km wide (east of, west of, and through, the Project Area). Consistent with information presented in the Valentine Gold EIS, there was only one distinct population-level migration pathway used by Buchans herd caribou during both spring (Figure 10-6) and fall (Figure 10-7). Use of the primary path by caribou was confirmed by the remote camera program, which consistently detected higher numbers of caribou and caribou events in cameras that align with the pathway. Other, less-often-used migration paths, have the potential to become dominant paths if caribou change their migration route, as identified in a least-cost path analysis (Adriaensen et al. 2003, Etherington 2016). Depending on how much of a change occurs, alternate paths that may become more dominant are predicted to be within 1 to 15 km from the mine site (Caribou Supplemental Information Report, Appendix G of the Valentine Gold Project: Amendment to the Environmental Impact Statement). Information on where to access this document online is contained in Table 1.8. The approximate area of utilization for high-, moderate- and low-use areas during spring and fall migration, based on the results of the dBBMM, is presented in Table 10.5.

Table 10.5 Approximate Area of Utilization by GPS Collared Caribou from the Buchans Herd during Spring and Fall Migration

Migration Utilization	Approximate Area of Utilization (km^2)[A,B]	
	Spring Migration	Fall Migration
High use: stopover site	11	20
Moderate-high use: movement area	48	73
Moderate-low use: movement area	88	129
Low use (general)	4,097	3,236

Notes:
A. Based on the following GPS telemetry data: 2007-2012 and 2015-2017 (30 collared caribou) and 2020-2022 (49-54 collared caribou)
B. Area rounded to the nearest integer

Both the spring and fall migration corridors include areas of relative high use (stopover sites) connected by moderate use movement areas and a network of surrounding low-use travel paths (Table 10.5, Figure 10-6 and Figure 10-7). The fall migration corridor (Figure 10-7) included a relatively narrow network of low use travel paths compared to spring, when travel paths are more dispersed (e.g., some individuals travelled west of Victoria Lake Reservoir and others across Beothuk Lake) (Figure 10-6). The camera data also supported findings of a wider network of pathways used during spring migration (30 of up to 31 cameras detected caribou) compared to the fall (12 cameras only).

The fall migration corridor had five stopover areas (Figure 10-7), covering a combined area of 19.95 km^2. There was one relatively larger stopover area at the east end of Victoria Lake Reservoir that overlapped the Project Area (4.56 km^2 overlap), and four small stopover sites (<0.03 km^2 overlap): three small areas to the south of Star Lake near the west end of Beothuk Lake, and a fourth stopover site near the south arm of Granite Lake.

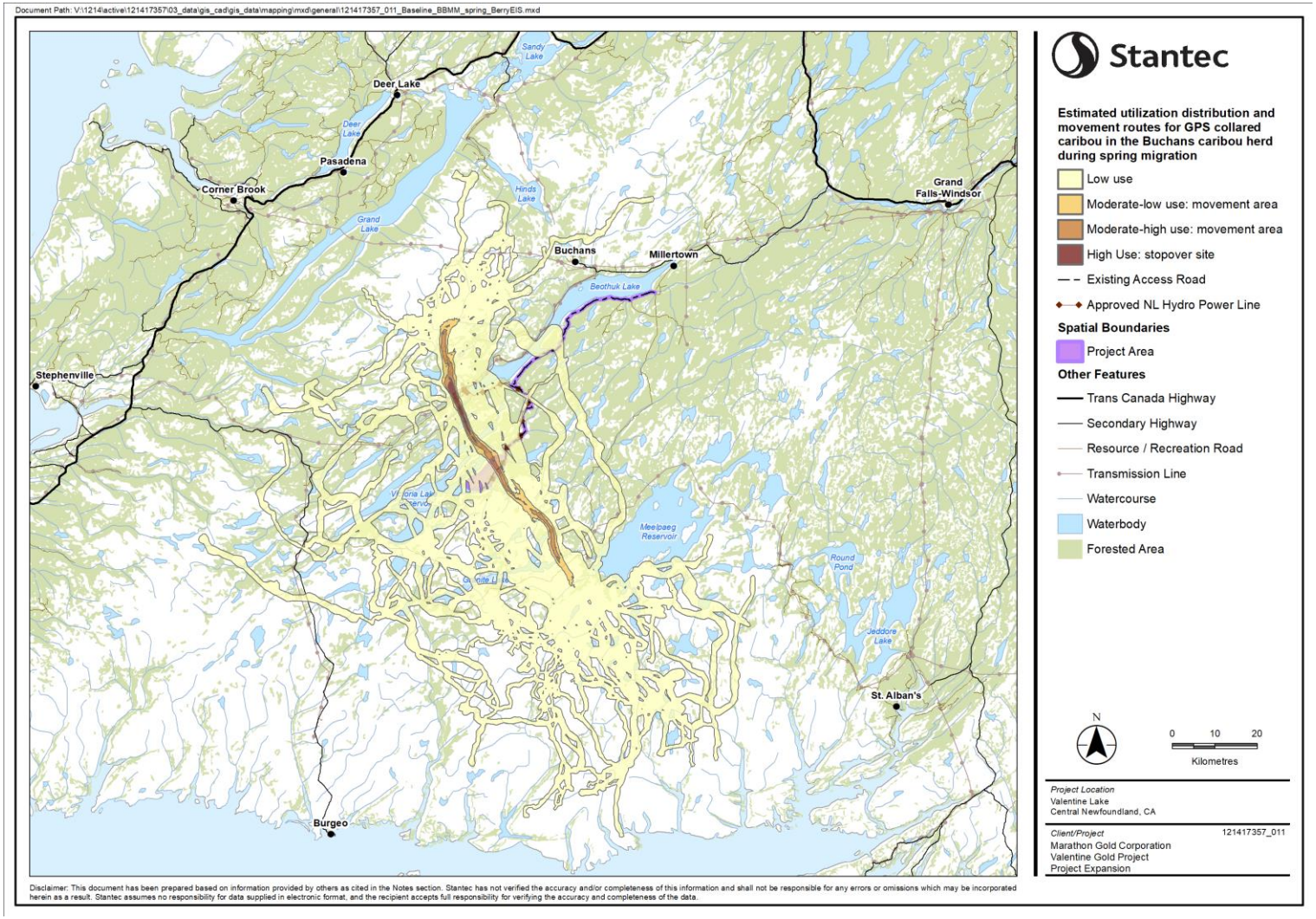

Figure 10-6 Estimated Utilization Distribution and Migration Routes of GPS Collared Caribou in Buchans Herd: Spring Migration

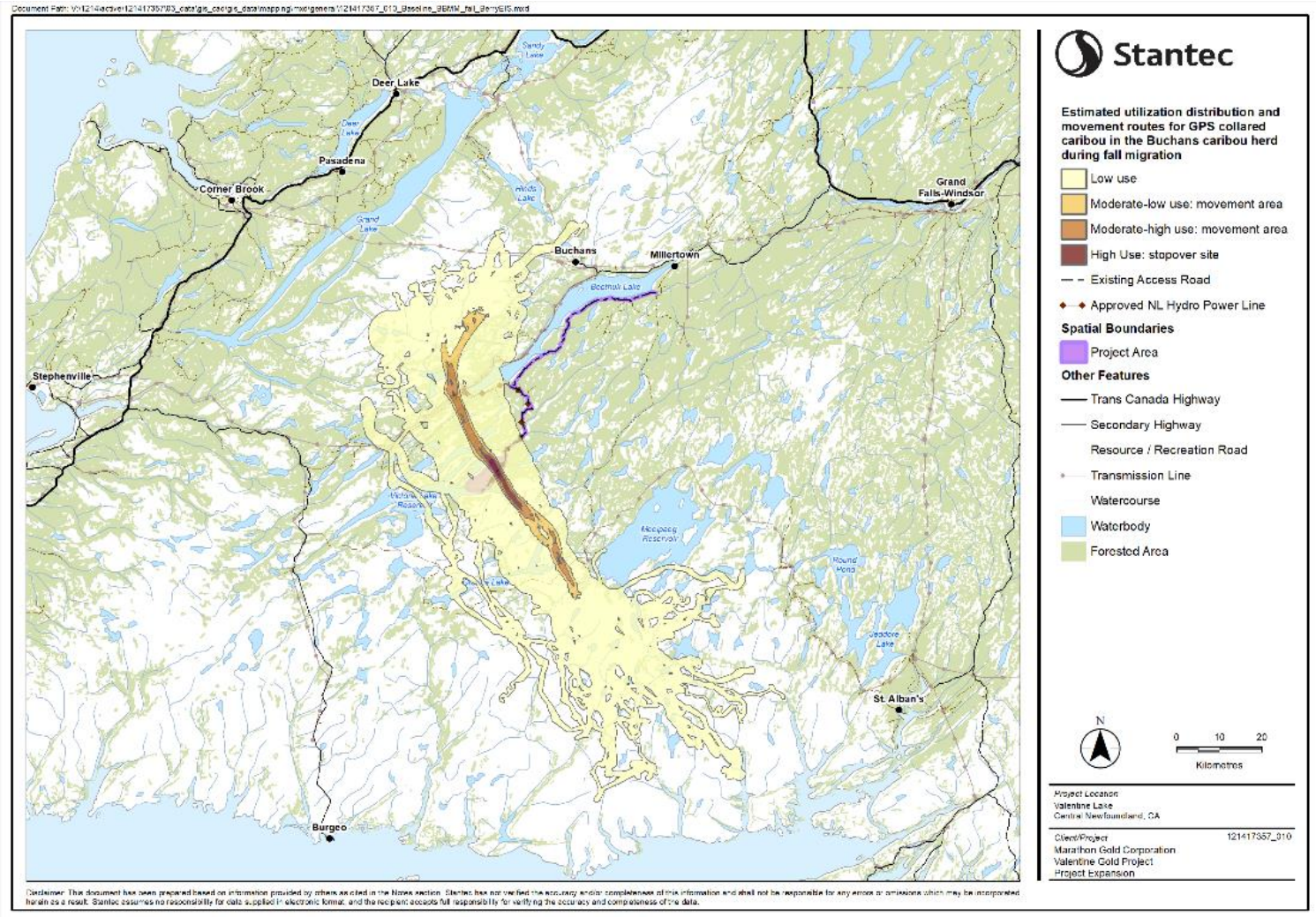

Figure 10-7 Estimated Utilization Distribution and Migration Routes of GPS Collared Caribou in Buchans Herd: Fall Migration

The spring migration corridor had one larger and three smaller stopover areas (Figure 10-6), covering a combined area of 11.4 km^2. The large stopover area was south of Star Lake near the west end of Beothuk Lake and overlapped the high use areas used during fall migration. The three smaller stopover sites were located east of Victoria Lake Reservoir, two of which overlapped with the Project Area (<0.03 km^2 overlap).

10.2.2.5 Buchans Herd Caribou Calving Grounds Population Survey

Aerial surveys were undertaken in 2021 and 2022 to estimate the population of caribou in the Buchans herd calving grounds survey area. Surveys were completed in accordance with methods and conditions outlined in Scientific Research Permits issued by NLDFFA – Wildlife Division, and following direction (timing and extent of survey area) from NLDFFA – Wildlife Division who also had a representative participate on the surveys. Details on the survey methods and boundaries are provided in Appendix 10A.

The population estimate for the Buchans herd on the calving grounds in 2021 was 1,278 caribou (95% CI: 812 to 2,011) and in 2022 was 1,724 caribou (95% CI: 1,090 to 2,726). The population estimate from 2021 is within the 95% confidence interval for 2022, and the 2022 estimate is within the 95% confidence interval for 2021, meaning the two population estimates are not statistically different from each other between those two years. The best fit model estimated a mean group size of approximately 4.30 caribou in 2021 and 3.65 caribou in 2022. These estimates represent baseline information on the population of Buchans herd caribou on the calving grounds for the Approved Project (pre-construction), based on surveys during the early post-calving period within the 5,229.6 km^2 area delineated as the Buchans herd calving ground survey area.

As summarized in Table 11.5 of the Valentine Gold EIS, historical population estimates completed by NLDFFA – Wildlife Division for the Buchans herd were completed during other seasons (e.g., fall-winter or spring) and over different survey areas. The differences in seasonal distribution and group size composition likely contribute to differences in those population estimates (e.g., 4,112 and 4,474 caribou in 2007 and 2019, respectively) and those completed in 2021 and 2022. In addition, different survey methods and population models were used in previous studies compared to the current investigation, thus making it difficult to compare population estimates and trend over time. Ultimately, the historical surveys (2014 and 2019) are not directly comparable to 2021 and 2022 due to differences in survey methods, area, and season.

The proportion of caribou calves (i.e., percent calves out of total animals classified) on the Buchans herd calving grounds was 23% in 2021 and 29% in 2022 (Appendix B of Appendix 10A).

As these surveys were undertaken immediately following calving, a relatively high proportion of calves would be expected compared other seasons such as migration (e.g., only <1% to 11% of caribou detected by the spring and fall remote camera programs were calves). Historic surveys completed during the fall and winter of 2007, 2011, 2016, and 2019 found 8–16% calves in the Buchans herd and 6–15% calves in the Grey River herd (Government of NL 2020a). In 2014, Weir et al. (2014) reported an average, stabilized calf recruitment of ~11% beginning in the 2000s for the Newfoundland caribou population (based on fall surveys), however, indicated that this number was insufficient for population increase.

10.3 PROJECT EXPANSION INTERACTIONS AND PATHWAYS

Table 10.6 lists the potential Project Expansion effects on caribou and provides a summary of the Project Expansion effect pathways, measurable parameters and units of measurement to assess potential effects. These are consistent with those used for the Approved Project in the Valentine Gold EIS. Potential environmental effects and measurable parameters were selected based on review of recent environmental assessments for mining projects in Newfoundland and Labrador (NL) and other parts of Canada, comments provided pre- and post EIS submission during public engagement sessions, during engagement with NLDFFA – Wildlife Division officials, Indigenous groups and specific stakeholder groups, and on professional judgment.

Although potential environmental effects and effects pathways of the Project Expansion are identified for change in habitat, movement, and mortality risk in Table 10.6, these effects are not assessed and characterized independently for the Project Expansion. Instead, as the activities of the Project Expansion and the Approved Project are highly interrelated functionally, spatially, and temporally, they are assessed in combination. That is, as described in Section 10.1, the assessment of potential effects on the Caribou VC considers the effects of the Approved Project in combination with the effects of the Project Expansion (Section 10.7). The potential change in residual effects predictions from those provided in the Valentine Gold EIS are described.

Table 10.6 Potential Effects, Effects Pathways and Measurable Parameters for Caribou

Potential Environmental Effect	Effect Pathway	Measurable Parameters and Units of Measurement
Change in habitat	• Direct and/or indirect loss or alteration of habitat arising from vegetation clearing and mine construction, and/or sensory disturbance (e.g., avoidance)	• Amount of high and moderate-ranked caribou habitat (km2) directly or indirectly lost or altered relative to its availability in the ELCA
Change in movement	• Change in movement paths or patterns arising from a change in habitat and/or sensory disturbance (e.g., avoidance)	• Amount of high and moderate-high use existing caribou paths (km2) directly lost or altered relative to availability in the migration corridorA • Proportion of relative amount of use of the preferred migration pathA within the Project Area
Change in mortality risk	• Direct change in mortality risk due to vegetation clearing and site preparation activities, vehicular collisions, and indirect change in mortality risk (e.g., increased predation)	• Changes in traffic volumes during the life of the Project Expansion • Likelihood of interactions with Project Expansion infrastructure, vehicles and equipment

Note:
A. "migration corridor" is defined as the corridor used for migration at the population level, composed of various smaller "migration paths" which are used by a single individual or several caribou

Direct change in caribou habitat (i.e., loss of physical habitat) was calculated as the incremental loss of suitable habitat from clearing and development of the Project Expansion (approximately 3.4 ha), in addition to the habitat assessed as lost in the Valentine Gold EIS. Habitat types were ranked as low, moderate, or high quality, and those ranked as high or moderate were categorized as suitable habitat.

As was done for the Approved Project, indirect change in habitat was determined based on the estimated area of potential sensory disturbance (e.g., noise, visual, vibration, dust, human activities). Sensory disturbance was anticipated to be more substantial within a 500 m ZOI than outside a 500 m ZOI, based on proximity, propagation, and attenuation of sensory disturbance associated with Project Expansion activities. Therefore, habitat within the 500 m ZOI is expected to have reduced value for, and hence reduced use by, caribou through all phases of the Project Expansion.[4] Predicted effects on caribou habitat are expected to extend beyond the 500 m buffer and therefore caribou habitat within a range of potential ZOIs, extending up to 15 km from the mine site, were considered. As indirect change in habitat was assessed as a buffer on the Project Area for the Valentine Gold EIS, the addition of the Project Expansion (which is located almost entirely within the Project Area) results in very little additional indirect change in habitat from that assessed for the Approved Project.

Change in movement was assessed using the estimated area of direct overlap of the Project Expansion with a population-level migration corridor and considered physical barriers from Project Expansion infrastructure that may affect the permeability of the Project Area for caribou. Indirect changes to caribou movement due to sensory disturbance are discussed qualitatively. As indicated in Section 10.1, the Project Expansion will result in new infrastructure, some of which will be permanent (i.e., the Berry pit and waste rock pile).

Change in caribou mortality risk was assessed qualitatively (direct and indirect sources of mortality), based on existing literature and professional judgement, and using estimates of predictions of increases in construction activity and equipment and vehicular traffic related to the Project Expansion. The Project Expansion will result in a small increase (5-8%) of traffic along the access road and will extend the life of the Approved Project by 1.4 years.

Table 10.7 identifies the physical activities associated with the Project Expansion that might interact with the Caribou VC and result in the identified environmental effect. These interactions are indicated by checkmark and are discussed in detail in Section 10.4 in the context of effects pathways, standard and project-specific mitigation / enhancement, and residual effects. Following the table, justification is provided where no interaction (and therefore no resulting effect) is predicted.

[4] The use of a 500 m ZOI for caribou is aligned with the federal Scientific Assessment to inform the Identification of Critical Habitat for Woodland Caribou in Canada (Environment Canada 2011), which uses a 500 m buffer on anthropogenic disturbances to define disturbed habitat as a correlate of population decline.

Table 10.7 Project Expansion-Environment Interactions with Caribou

Physical Activities	Environmental Effects to Be Assessed		
	Change in Habitat	Change in Movement	Change in Mortality Risk
CONSTRUCTION			
Mine Site Preparation and Earthworks: Clearing and cutting of vegetation and removal of organic materials, development of roads, and excavation and preparation stockpile areas within the Project Expansion footprint. For the open pit, earthworks include stripping, stockpiling of organic and overburden materials, and development of in-pit quarries to supply site development rock for infrastructure such as structural fill and road gravels. Also includes temporary surface water and groundwater management, and the presence of people and equipment on site.	✓	✓	✓
Construction / Installation of Infrastructure and Equipment: Construction of infrastructure as required for the Project Expansion. Also includes: • Installation of water control structures (including earthworks) • Presence of people and equipment on-site.	✓	✓	✓
Emissions, Discharges and Wastes:[A] Noise, air emissions / GHGs, light, water discharge, and hazardous and non-hazardous wastes.	✓	✓	–
OPERATION			
Open Pit Mining: Blasting, excavation, and haulage of rock from the open pits using conventional mining equipment.	–	✓	✓
Topsoil, Overburden and Rock Management: Four types of piles: • Topsoil • Overburden • Waste rock • Low-grade ore Rock excavated from the open pit that will not be processed for gold will be used as engineered fill for site development, maintenance, and rehabilitation, assuming it is non-acid generating, deposited in mined out basins of Berry pit, or deposited in a waste rock pile.	–	✓	–
Tailings Management: Following treating tailings via cyanide destruction, tailings will be thickened and pumped to an engineered tailings impoundment in years 1 to 9, then pumped to the exhausted Berry open pit in year 10 to the end of operation. Marathon plans to upgrade the water treatment process by replacing the proposed polishing pond with a smaller SAGR unit that provides improved treatment of nitrogen species.	–	✓	–
Water Management (Collection, Treatment, and Release): Site contact water and process effluent will be managed on site and treated prior to discharge to the environment. Where possible, non-contact water will be diverted away from mine features and infrastructure, and site contact and process water will be recycled to the extent possible for use on site	–	✓	–

Table 10.7 Project Expansion-Environment Interactions with Caribou

Physical Activities	Environmental Effects to Be Assessed		
	Change in Habitat	Change in Movement	Change in Mortality Risk
Utilities, Infrastructure and Other Facilities: Most utilities, infrastructure, and facilities remain unchanged and are as described in the Valentine Gold EIS (Marathon 2020) and assessed as part of the Approved Project. Relocation of the explosives facility, maintenance of Berry haul road, and site snow clearing will be required for the Project Expansion. Note that while the location of the explosives facility has changed, the design and activities associated with the facility have not.	–	✓	✓
Emissions, Discharges, and Wastes[A]: Noise, air emissions / GHGs, light, water discharge, and hazardous and non-hazardous wastes.	✓	✓	–
Employment and Expenditure[B] Operation of the combined Approved Project and Project Expansion is estimated to require a peak workforce of approximately 524 full time equivalents (FTEs) (44 FTEs above the Valentine Gold EIS estimate) and an average of 366 FTEs.	–	–	–
DECOMMISSIONING, REHABILITATION AND CLOSURE			
Decommissioning of Mine Features and Infrastructure	✓	✓	✓
Progressive Rehabilitation: Erosion stabilization and re-vegetation of completed overburden and/or waste rock piles; infilling or flooding of exhausted mining areas; and completing revegetation studies and trials.	✓	✓	✓
Closure Rehabilitation: Active rehabilitation based on successes of progressive rehabilitation activities. Includes: grading and revegetating cleared areas, where practicable; breaching and regrading ponds to reestablish drainage patterns; erosion stabilization and revegetation of completed overburden and/or waste rock piles; and infilling or flooding of open pit.	✓	✓	✓
Post-Closure: Long-term monitoring	–	–	–
Emissions, Discharges, and Wastes[A]	✓	✓	✓

Notes:
✓ = Potential interaction
– = No interaction
[A] Emissions, Discharges, and Wastes (e.g., air, waste, noise, light, liquid and solid effluents) are generated by many Project Expansion activities. Rather than acknowledging this by placing a checkmark against each of these activities, “Wastes and Emissions” is an additional component under each Project Expansion phase.

During each phase of the Project Expansion (i.e., construction, operation, and decommissioning, rehabilitation, and closure), no interaction was identified between caribou mortality risk and Emissions, Discharges and Wastes. There is no apparent pathway as discharges will be treated to meet regulatory thresholds, which are designed to prevent adverse health effects to fauna, including caribou, prior to their release to the environment. No interaction was identified between Employment and Expenditures as there is no apparent pathway for potential effects. NLDFFA – Wildlife Division determines the number of caribou licenses based on the size and health of the herd, and while Project Expansion-related employment and expenditures could result in an increase in the number of people requesting a license, the Project would not change the amount of legal hunting. Additionally, employees will not be permitted to hunt while on site or to bring firearms to site.

During operation, sensory disturbances (e.g., acoustic, light, dust emissions) associated with various activities are accounted for under Emissions, Discharges and Wastes; therefore, no further pathway exists between a change in habitat and the following activities:

- Open Pit Mining
- Topsoil, Overburden, and Rock Management
- Tailings Management
- Water Management
- Utilities, Infrastructure, and Other Facilities

Except for Open Pit Mining and Utilities, Infrastructure, and Other Facilities, the above activities are also not anticipated to interact with a change in mortality risk as there is no apparent pathway between these activities and risk to caribou (e.g., potential for caribou to be trapped or for collisions/injuries).

During decommissioning, rehabilitation, and closure no interactions are anticipated between post-closure long-term monitoring and caribou habitat, movement, or mortality risk as there is no apparent pathway. Monitoring activities will be undertaken in accordance with permit conditions and approvals, including measures to reduce disturbance to caribou.

Pathways between physical activities associated with the Project Expansion and potential interactions with caribou (i.e., environmental effects identified by a checkmark) are similar to those for the Approved Project (Marathon 2020) and are discussed below in Section 10.5.

10.4 MITIGATION AND MANAGEMENT MEASURES

A series of environmental management plans have been developed by Marathon to mitigate the effects of the Approved Project on the environment. The CPEEMP defines the mitigation measures aimed at reducing the risk of adverse effects on caribou and describes the follow-up and monitoring activities that will be undertaken to verify effects predictions and mitigation effectiveness (Appendix 10B). The CPEEMP is considered a ‘live’ document to be updated regularly, based on conditions of authorizations (EA release and permitting); information from follow-up and monitoring activities; and ongoing review with regulators, scientific experts, Indigenous groups, and stakeholders.

Prior to construction of the Project Expansion, and in addition to ongoing and future reviews and updates of the CPEEMP associated with the Approved Project, it is anticipated that the CPEEMP will be reviewed in consultation with NLDFFA – Wildlife Division to identify the need for revisions to reflect Project Expansion activities. Mitigation and management measures previously committed to in relation to the Approved Project can be found in Appendix 2E. These measures are considered appropriate for the Project Expansion and will be applied to Project Expansion activities as applicable. In addition to the suspension of mining activities at the Marathon pit and Tailings Management Facility (TMF) during caribou migration, activities at the Berry pit may also need to be reduced to reduce sound pressure levels near high and moderate-high use migration pathways for spring and fall migration of the Buchans caribou herd (discussed in Section 10.6.2). Sound pressure levels evaluated in Section 10.7.2.2 present a worst-case scenario of full-scale mining operations at the Berry pit during spring and fall migration. In consultation with NLDFFA – Wildlife Division, Marathon will further evaluate sound pressure levels associated with various reduced activity scenarios at Berry pit with the objective of meeting acceptable thresholds identified in the CPEEMP and providing increased flexibility/duration for suspended activities at the Marathon pit.

10.5 SUMMARY OF APPROVED PROJECT RESIDUAL EFFECTS

An evaluation of residual effects of the Approved Project on caribou was presented in the Valentine Gold EIS (Section 11.5; Marathon 2020), within the Caribou Supplemental Information Report (Marathon 2021), and through various IR processes.

A significant adverse residual effect on caribou and their habitat is defined in the Valentine Gold EIS as one that threatens the long-term persistence or viability of one or more of the four assessed caribou herds within the RAA, including effects that are contrary to or inconsistent with the goals, objectives and activities of recovery strategies, action plans and management plans.

10.5.1 Change in Habitat

In the Valentine Gold EIS, the amount of high- and moderate-ranked caribou habitat that was predicted to be directly lost through site preparation (e.g., vegetation clearing and mine construction) for the Approved Project was 28.5 km^2. This was determined based on the conservative assumption that all habitat within the Project Area would be directly lost. Analysis of the assessed caribou herds showed that the winter, calving, and spring migration / pre-calving ranges of the Grey River herd overlapped the Project Area. However, the percentage of overlap was less than 2% of the Grey River herd seasonal ranges. There was also some overlap between the seasonal ranges of Buchans herd and the Project Area (1% of the Buchans herd seasonal range). This overlapping range, while small in areal extent, is a key part of the migratory pathway connecting these two herds. The La Poile herd had no seasonal range overlap with the Project Area, and the Gaff Topsails herd had a small amount of overlap with the existing access road during the winter.

It was also predicted that caribou habitat would be indirectly affected by sensory disturbance (e.g., noise, light) arising from activities associated with the Approved Project. Indirect change in habitat attributed to sensory disturbance within a 500 m buffer around the Project Area was estimated to be up to 57.3 km^2 of

high- and moderate-ranked habitat. When combined with direct habitat change in the Project Area, a change in habitat of up to 85.8 km^2 was estimated. Given proposed mitigation measures and the amount of predicted change in habitat, adverse effects on caribou habitat were predicted to be low in magnitude for the Approved Project.

10.5.2 Change in Movement

In the Valentine Gold EIS, the effects of the Approved Project on the migration of the Grey River, Gaff Topsails, and La Poile herds were predicted to be low, as these herds have little overlap with the Project Area and do not migrate through the site. However, effects were anticipated to be high in magnitude and adverse for the Buchans herd because of the overlap of the Project Area with a well-defined and well-used migration corridor, with permanent Project infrastructure being developed directly within this corridor. While changes in caribou movement because of development have been studied in various jurisdictions, there is uncertainty in how the residual effects of the Approved Project would affect the movement of the Buchans herd following mitigation, and what the long-term effects could be (e.g., reduced calving rates, increased predation). A change in movement because of the Approved Project could result in changes to timing of movement or movement rate, which could cause a change in recruitment or survival.

10.5.3 Change in Mortality Risk

The Valentine Gold EIS predicted that caribou were expected to avoid construction activities due to sensory disturbance. Caribou were therefore anticipated to be at low risk of direct mortality from equipment and construction activities. The amount of overlap between the assessed herds and the Project Area is less than 2% for the Grey River herd and less than 1% for the Buchans herd. The seasonal ranges of the Gaff Topsails and La Poile herds have little to no overlap with the Project Area. The risk of direct mortality resulting from vegetation clearing and site preparation was considered negligible to low. Direct mortality caused by wildlife-vehicle collisions was expected to occur infrequently, as Approved Project-related traffic volumes on the access road were estimated to be incremental to existing traffic volumes. Traffic on the haul roads within the mine site was predicted to be substantial. However, given the limited overlap and proposed mitigations during the migratory periods for the Buchans herd, Approved Project-related risk of direct mortality resulting from vehicular collision on the access road and the site roads was considered negligible to low.

In addition to a change in direct mortality risk (e.g., vehicle collision), it was predicted that a change in caribou mortality risk could be affected by the Approved Project via an increase in predation risk (i.e., habitat fragmentation) or increase in energy expenditure. While direct habitat change would be limited to the Project Area, an increase in predator abundance because of the Approved Project could extend to the caribou RAA. The Buchans and Grey River herds would be most affected by a potential increase in predation risk, as they have the greatest degree of overlap with the Approved Project. However, given the low densities of predators reported for the Island, a potential increase in predator density from the Approved Project, and a subsequent increase in predation rate, mortality risk due to increased predation was predicted to be low in magnitude. With the implementation of mitigation measures, a change in mortality risk for caribou resulting from the Approved Project was still expected to be greatest for the Buchans and Grey River herds as their ranges overlap the Project Area. However, the magnitude was

anticipated to be low in the construction and operation phases, and negligible to low during decommissioning, rehabilitation, and closure phase for all assessed caribou herds.

10.5.4 Summary

Conclusions in the Valentine Gold EIS were that with mitigation and management measures, residual environmental effects from the Approved Project would not threaten the long-term persistence or viability of the Grey River, La Poile, and Gaff Topsails herds, and would not be contrary or inconsistent with the goals, objectives, and activities of recovery strategies, action plans, and management plans. Approved Project-related effects that may affect change in movement of Buchans herd were predicted to be high in magnitude. Whereas caribou may be able to circumnavigate the Approved Project (via alternate migration paths), there was uncertainty in the effects that a deviation from the current migration corridor would be on the Buchans herd, some of which may not be realized for several years. Given these uncertainties, and those related to the effectiveness of planned mitigation, the residual adverse effect of change in movement for the Buchans herd was conservatively predicted to be significant, and therefore, the residual adverse effects of the Approved Project on caribou were predicted to be significant.

The prediction confidence for change in caribou movement was moderate to low. There was a high likelihood that effects of the Approved Project would alter caribou movement compared to existing conditions. However, there was uncertainty in how the movement of the Buchans herd would be affected by the Approved Project and what the effect would be on the herd. This uncertainty contributed to the conservative prediction of a significant residual effect on caribou as a result of the Approved Project.

These adverse effects were predicted to be interconnected and to persist through the operations and decommissioning, rehabilitation, and closure phases and to have the potential to reduce caribou survival and negatively affect caribou populations. Predicted residual environmental effects from the Approved Project are summarized in Table 10.8.

Table 10.8 Approved Project Residual Effects on Caribou

Residual Effect	Residual Effects Characterization							
	Project Phase	Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Ecological and Socio-economic Context
Change in Habitat	C	A	L	RAA	LT	C	I	D
	O	A	L	RAA	LT	C	I	D
	D	A/N	L	RAA	LT	C	I	D
Change in Movement	C	A	H	RAA	LT	C	I	D
	O	A	H	RAA	LT	C	I	D
	D	A	H	RAA	LT	C	I	D
Change in Mortality Risk	C	A	L	RAA	MT	IR	R	D
	O	A	L	RAA	MT	IR	R	D
	D	A	L	RAA	ST	IR	R	D

KEY:
See Table 10.9 for detailed definitions

Project Phase
C: Construction
O: Operation
D: Decommissioning

Direction:
P: Positive
A: Adverse
N: Neutral

Magnitude:
N: Negligible
L: Low
M: Moderate
H: High

Geographic Extent:
PA: Project Area
LAA: Local Assessment Area
RAA: Regional Assessment Area

Duration:
ST: Short term
MT: Medium term
LT: Long term
P: Permanent

Frequency:
S: Single event
IR: Irregular event
R: Regular event
C: Continuous

Reversibility:
R: Reversible
I: Irreversible

Ecological/Socio-Economic Context:
D: Disturbed
U: Undisturbed
N/A: Not applicable

10.6 ASSESSMENT OF RESIDUAL EFFECTS FOR PROJECT EXPANSION

10.6.1 Assessment Criteria and Methods

This section describes the criteria and methods used to assess environmental effects of the Project Expansion on caribou. Residual environmental effects (Section 10.5.2) are assessed and characterized using criteria defined in Section 10.6.1.1, including direction, magnitude, geographic extent, timing, frequency, duration, reversibility, and ecological or socio-economic context. The methods of determining residual effects for the Project Expansion are the same as for the Approved Project. The assessment also evaluates the significance of residual effects using threshold criteria or standards beyond which a residual environmental effect is considered significant. The definition of a significant effect for the Caribou VC is provided in Section 10.6.1.2. As noted in Section 10.1, although Project Expansion interactions and

pathways are identified, a change in habitat, movement, and mortality risk for caribou are not characterized and assessed separately for the Project Expansion, but rather in combination with Approved Project because the activities of both are closely interrelated functionally, spatially, and temporally.

10.6.1.1 Residual Effects Characterization

Table 10.9 presents definitions for the characterization of residual environmental effects on caribou. The criteria describe the potential residual effects that remain after mitigation measures have been implemented. Quantitative measures were developed, where possible, to characterize residual effects. Qualitative considerations were used where quantitative measurement was not possible.

Table 10.9 Characterization of Residual Effects on Caribou

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Direction	The long-term trend of the residual effect	**Neutral –** no net change in measurable parameters for caribou relative to baseline **Positive –** a residual effect that moves measurable parameters in a direction beneficial to caribou relative to baseline **Adverse –** a residual effect that moves measurable parameters in a direction detrimental to caribou relative to baseline
Magnitude	Change in caribou habitat	**Negligible –** no measurable change in caribou habitat in the ELCA **Low –** Project changes less than 10% of caribou habitat in the ELCA **Moderate –** Project changes 10-20% of caribou habitat in the ELCA **High –** Project changes more than 20% of other caribou in the ELCA
	Change in caribou movement	**Negligible –** no measurable change to the proportion of caribou use in the migration corridor **Low –** Project changes less than 25% of the proportion of caribou use in the migration corridor **Moderate –** Project changes 25-50% of the proportion of caribou use in the migration corridor **High –** Project changes more than 50% of the proportion of caribou use in the migration corridor
	Change in caribou mortality risk	**Negligible –** no measurable change in caribou mortality risk in the LAA **Low –** a measurable change in caribou mortality risk in the LAA is not anticipated, although individuals may be affected **Moderate –** a measurable change in caribou mortality risk in the LAA might occur; however, a measurable change in the caribou mortality risk in the RAA is not anticipated **High –** a measurable change in the caribou mortality risk in the RAA may occur

Table 10.9 Characterization of Residual Effects on Caribou

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Geographic Extent	The geographic area in which a residual effect occurs	**Project Area –** residual effects are restricted to the Project Area **LAA –** residual effects extend into the LAA **RAA –** residual effects extend into the RAA
Frequency	Identifies how often the residual effect occurs and how often during the Project or in a specific phase	**Single event** **Multiple irregular event –** occurs at no set schedule **Multiple regular event –** occurs at regular intervals **Continuous –** occurs continuously
Duration	The period required until the measurable parameter or the VC returns to its existing (baseline) condition, or the residual effect can no longer be measured or otherwise perceived	**Short term** – residual effect restricted to construction or decommissioning, rehabilitation, and closure phases **Medium term** – residual effect extends through the operation phase (12 years) **Long term** – residual effect extends beyond the operation phase (>12 years) **Permanent** – recovery to baseline conditions unlikely
Reversibility	Describes whether a measurable parameter or the VC can return to its existing condition after the project activity ceases	**Reversible –** the residual effect is likely to be reversed after activity completion and rehabilitation **Irreversible –** the residual effect is unlikely to be reversed
Ecological and Socio-economic Context	Existing condition and trends in the area where residual effects occur	**Undisturbed –** area is relatively undisturbed or not adversely affected by human activity **Disturbed –** area has been substantially previously disturbed by human development or human development is still present

10.6.1.2 Significance Definition

A significant adverse residual effect on caribou and their habitat from the Project Expansion is defined as one that threatens the long-term persistence or viability of one or more of the four assessed caribou herds (Buchans, Gaff Topsails, Grey River, La Poile herds) within the RAA, including effects that are contrary to or inconsistent with the goals, objectives, and activities of recovery strategies, action plans, and management plans.

10.6.2 Assessment of Residual Effects

The potential pathways for a change in habitat, change in movement, and change in mortality risk for caribou that may occur during the construction, operation, and decommissioning, rehabilitation, and closure phases of the Project Expansion are similar to those of the Approved Project.

The primary pathways for change in habitat for the Project Expansion are:

- Site preparation activities will result in the direct loss of trees, shrubs, and understory vegetation, including lichens. Earthworks, such as removal of soils and excavation activities (e.g., open pit preparation) will remove vegetation and will likely alter the remaining soil layers, affecting habitat quality for plants that may later regenerate within the area.
- Sensory disturbance (e.g., noise and light emissions, vibrations) associated with construction and operation, including transportation activities, has the potential to indirectly affect caribou habitat by causing avoidance of the site. Sensory disturbance will vary in duration, magnitude, and location, depending on the activity. The effect of sensory disturbance on caribou may be greater during key life cycle periods (e.g., calving). As indirect change in habitat was calculated for the Approved Project based on a 500 m buffer on the Project Area, these calculated areas would also capture sensory disturbance from Project Expansion activities.
- Dust generated during construction and operation activities may reduce caribou habitat suitability by altering vegetation communities and functionally reducing caribou forage (i.e., potential avoidance of consuming dust-covered plants).
- Sensory disturbance can result in short-term behavioral and physiological responses by caribou. Increased physiological stress on caribou has the potential to affect caribou health and, ultimately, population demographics through reduced reproductive and survival rates.
- Direct (e.g., vegetation clearing) and indirect (e.g., sensory disturbance) changes in caribou habitat may displace caribou to habitats that are less secure or have lower forage value or require higher energetic costs for movement. Use of less ideal habitat could lead to reduced survival and reproductive success. As such, a change in habitat, either directly or indirectly, may also affect movement and mortality risk for caribou.
- Effects pathways that affect caribou habitat will change over time as operation transitions toward habitat restoration (e.g., revegetation of disturbed areas) during the decommissioning, rehabilitation, and closure phase. These activities may reverse some of the adverse effects on caribou habitat.

The primary pathways for change in movement for the Project Expansion include direct effects through the physical placement of mine components that have the potential to act as a barrier to caribou movements, and indirect effects from sensory disturbance that may cause avoidance of the Project Expansion or of previously used migration paths. The main effect pathways for the Project Expansion are:

- The physical placement of mine structures (e.g., Berry pit and Berry waste rock pile) will overlap lower-use migration paths identified by the dBBMM (Section 10.2.2.4) and act as a potential barrier, thereby potentially affecting baseline movement patterns.
- In the absence of mitigation, other features such as ditches and haul roads have the potential to alter caribou movements as caribou may be reluctant to cross if these features present obstacles that are too high or wide.

- Sensory disturbance, primarily from sound, light, and human presence during construction and operation, has the potential to affect caribou movement indirectly by causing avoidance of the mine site or avoidance of nearby migration paths. As indicated in Section 10.1, the Caribou Alternate Migratory Pathway Analysis that was completed during the technical review of the Valentine Gold EIS was also based on the mine site (i.e., assumed caribou would avoid the mine site as a whole) and therefore can be considered representative of Project Expansion effects as well as those of the Approved Project. Potential alternate migratory pathways for the Buchans herd were estimated during spring and fall migration assuming a ZOI around the mine site of 1 km, 5 km, 10 km, and 15 km.
- Effect pathways for change in movement include increased stress, increased energetic costs, decreased forage availability, or increased mortality risk (e.g., if predators select habitat types that caribou would typically avoid). Increased stress and energetic costs have the potential to affect caribou health and, ultimately, population demographics through reduced reproductive and survival rates. Reduced forage availability can lead to smaller calves and subsequent increased vulnerability to predation, and an increase in energy consumption can have potential long-term effects such as a decrease in body condition, pregnancy rates, calving rate, and caribou recruitment, and an increase in adult and calf mortality risk.
- Pathways that directly affect caribou movement will change over time as mine activities transition from operation to closure activities. However, physical interruptions will persist at the Berry pit (for basins that are partially filled) and the Berry waste rock pile.
- During the decommissioning, rehabilitation, and closure phase the level of sensory disturbance will be reduced in comparison to the operation phase. Indirect effects will abate when the mine closes, with reduced traffic levels and the cessation of Project Expansion activities.

The primary pathways for change in mortality risk (adults and calves) include direct (e.g., vehicle collisions) and indirect effects (e.g., increased predation risk). The main effect pathways for the Project Expansion are:

- Caribou mortality risk may be directly affected by collisions with vehicles and heavy equipment. The Project Expansion will only result in a five to eight percent increase in traffic along the access road during operation and an extension of traffic by 1.4 years.
- Caribou interactions with the open pit could result in direct caribou injury or mortality (e.g., caribou becoming trapped in pit).
- Indirect sources of mortality include increased predation risk through changes in habitat and sensory disturbance effects that cause a change in movement.
- A change in preferred migration habitat or avoidance of the site due to sensory disturbance has the potential to increase mortality risk.
- Adult and calf mortality could increase if caribou continue to migrate through the mine site, as they could be subject to reduced body condition resulting from increased stress and increased energetic cost (e.g., increased rate of movement through the site; less time spent foraging while moving through site).
- Use of alternate migration paths or failure to migrate could increase caribou mortality risk for adults or calves if avoidance of the mine site causes caribou to use areas with higher predation risk or prolongs the amount of time that caribou spend in areas where predation risk is greater.

- Sensory disturbance can result in short-term behavioral and physiological responses by caribou, including a startle response, elevated heart rate, and increased hormone production. Prolonged exposure to stress could potentially lead to poor body condition and potentially lower survival and reproductive rates.
- During decommissioning, rehabilitation, and closure activities there will continue to be a risk of vehicle collisions. However, that risk will be reduced as there will be reduced traffic volumes and equipment activity during this phase compared to construction and operation. Project Expansion linear features on the mine site (e.g., roads) not required for long-term monitoring will be decommissioned and rehabilitated to limit future hunting pressures on wildlife and restore habitat to pre-mine conditions where practicable.

As outlined in Section 10.1, Project Expansion activities and the activities associated with the Approved Project are closely interrelated with respect to residual effects on change in habitat, movement and mortality risk. Therefore, this document does not assess and characterize the residual effects of the Project Expansion on its own. Rather, it focuses on the combined effects of the Approved Project and Project Expansion and specifically whether the addition of the Project Expansion changes the effect predictions provided in the Valentine Gold EIS. This assessment is found in Section 10.7.

10.7 COMBINED RESIDUAL EFFECTS OF THE PROJECT EXPANSION AND APPROVED PROJECT

The following sections present the combined residual effects of the Approved Project and Project Expansion on a change in habitat, change in movement and change in mortality risk to caribou.

10.7.1 Change in Habitat

Residual effects on a change in caribou habitat are described with respect to direct effects (i.e., habitat loss) and indirect effects (e.g., sensory disturbance and avoidance behaviours).

10.7.1.1 Direct Habitat Change

Direct change in caribou habitat was quantified in the Valentine Gold EIS in the context of the availability of suitable caribou habitat (i.e., high and moderate-ranked habitat) within the ELCA. Using a conservative assumption that all habitat within the Project Area would become unsuitable, the amount of high and moderate-ranked caribou habitat that would be directly changed through site preparation (e.g., vegetation clearing and mine construction) is approximately 28.5 km^2 (Table 10.1). Some small Project Expansion features will be constructed outside of the assessed Project Area (Figure 10-8). Three sedimentation ponds and associated ditching/drainage channels are located partially or fully outside of the mine site, on the northern perimeter of the waste rock pile for the Berry pit. In addition, to maintain required safety buffers, the explosives facility location, previously assessed as part of the Approved Project, will need to be relocated outside of the Project Area and away from the Berry pit and other Approved Project infrastructure. The new site is located at the former exploration camp location, a previously disturbed site with existing access. The footprint of additional ground disturbance required for Project Expansion infrastructure that is outside of the assessed Project Area is 3.4 ha (0.034 km^2) (Table 10.10). This area

represents an additional 0.1% relative to the habitat area conservatively assumed to be changed (i.e., all habitat within the Project Area was assumed to be cleared), as reported in the Valentine Gold EIS for the Approved Project.

The amount of high and moderate-ranked caribou habitat that will be directly lost from the Approved Project and Project Expansion is 28.5 km^2 (Table 10.10), which is less than 0.01% of high and moderate-ranked caribou habitat (1,567.6 km^2) in the ELCA (Table 10.1). Within these habitats is the vital habitat associated with the migratory corridor. The impact to the corridor is addressed under change in movement (Section 10.7.2).

Table 10.10 Ecosystem Units and Caribou Habitat Value Rankings in the Project Expansion and Project Area

Habitat Value Ranking for Caribou[A]	Ecosystem Unit[B]	Direct Habitat Loss (km^2)			
		Area in Project Area[C]	Additional Area with Project Expansion[C]	Project Expansion + Project Area	
				Total Area	%
High	Balsam Fir Forest	6.2	0.004	6.204	18
	Black Spruce Forest	4.3	0.008	4.308	12
	Open Wetlands[D]	4.6	0.002	4.602	13
	Kalmia-Black Spruce Woodland[E]	3.6	0.003	3.603	10
	Total High	**18.7**	**0.017**	**18.717**	**54**
Moderate	Mixedwood Forest	6.0	0.004	6.004	17
	Open Water	1.3	-0	1.300	4
	Wet Coniferous Forest	2.5	0.009	2.509	7
	Total Moderate	**9.8**	**0.013**	**9.813**	**28**
Low	Regenerating Forest	2.0	0.005	2.005	6
	Alder Thicket	2.2	0.0003	2.2003	6
	Riparian Thicket	0.2	0	0.200	1
	Exposed Sand / Gravel Shoreline	0	0	0	0
	Anthropogenic	1.9	0	1.900	5
	Total Low	**6.3**	**0.0053**	**6.305**	**18**
Total		**34.8**	**0.034**	**34.835**	**100**

Notes:

A. Habitat value ranking for caribou is summarized in Section 10.2.1.3.

B. Ecosystem units and ecotypes in the Project Area were determined from an Ecological Land Classification (ELC) Study (BSA.7, Attachment 7-D in the Valentine Gold EIS)

C. Refer to Figure 10-1 for the Project Area and Figure 10-8 for the Project Expansion; the Project Area was previously assessed in the Valentine Gold EIS.

D. Shrub / Graminoid Fen and Shrub Bog

E. Kalmia-Black Spruce Forest and Kalmia Heath

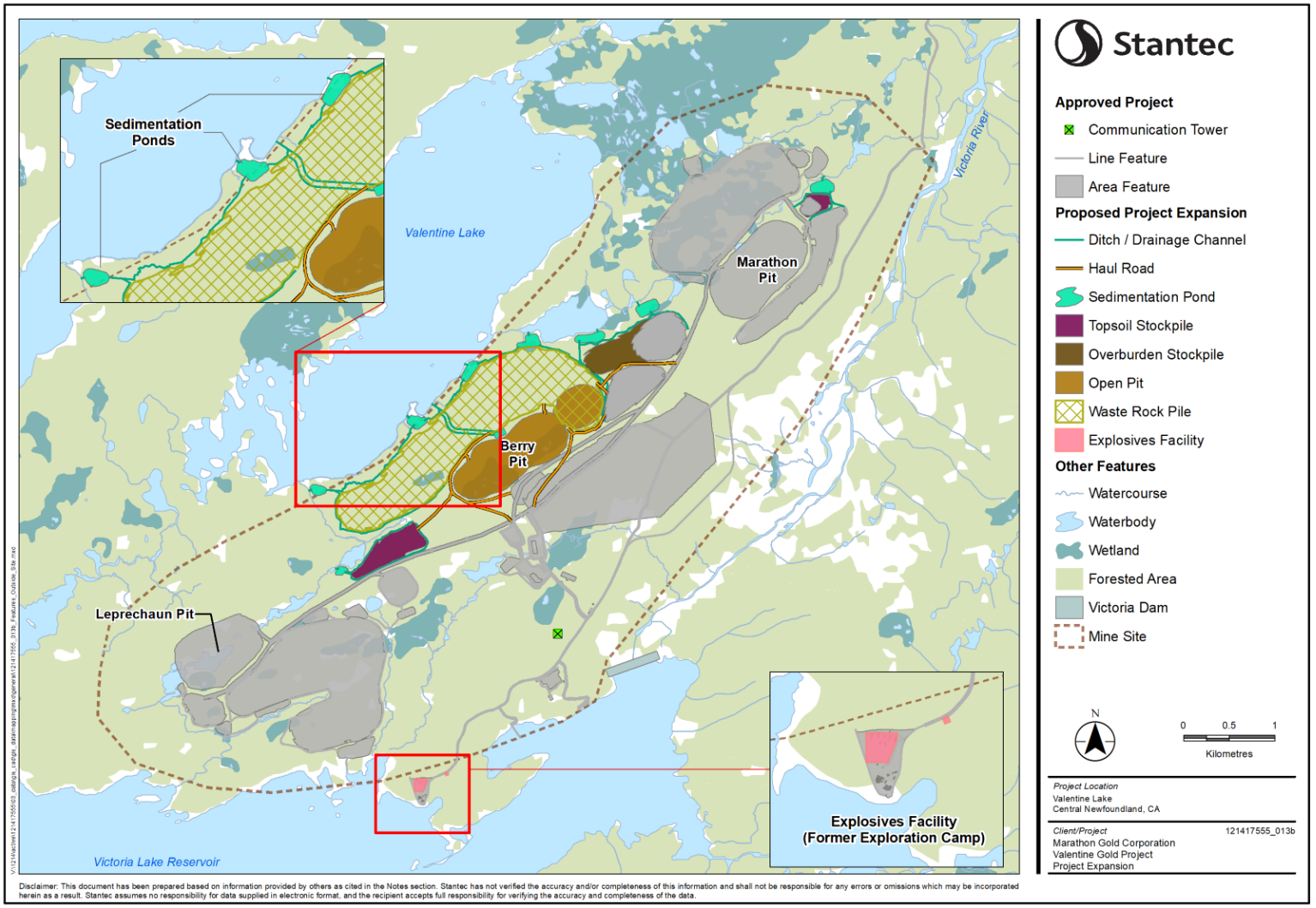

Figure 10-8 Project Expansion Features Located Outside of the Previously Assessed Mine Site

10.7.1.2 Indirect Habitat Change

Sensory disturbances such as noise, light, dust, vibration, and visible human activity are key disturbance stimuli for caribou and can decrease habitat quality (i.e., habitat degradation) and indirectly affect caribou movement through avoidance behaviours, as well as caribou mortality risk, particularly if these changes affect migration behaviour. Traffic and maintenance activities on the access road may also indirectly affect caribou habitat through dust deposition in adjacent areas (e.g., caribou may avoid consuming dust covered plants; changes in soil alkalinity may affect the availability of forage plants).

Sensory disturbance from the combined Projects includes noise, visual, vibration, dust, and human presence from physical activities such as vegetation clearing, development of haul roads, the construction and installation of water control structures, blasting, and the excavation and haulage of rock from the open pit. Sensory disturbance will occur throughout each phase and activity but are anticipated to be most pronounced during construction and operation (during blasting, heavy equipment and traffic operation and other mining activities).

Dust from combined Project activities will be generated during construction and operation activities, including blasting, material handling and processing, and wind erosion of stockpiles. Dust may reduce caribou habitat suitability by altering vegetation communities and functionally reducing caribou forage. Chen et al. (2017) examined dust and soil pH levels associated with the Misery Haul Road at the Ekati Diamond Mine and found significant increases in both dust and pH levels that corresponded with reductions in the percent cover of vascular plants and lichen. Increases in the amount of dust on leaves and a reduction in lichen cover was observed within 1 km of the road, and elevated pH levels and reduced vascular plant coverage was observed within 10 m of the road. Mitigation measures, including application of water to site roads and haul roads during dry periods, will serve to reduce potential adverse effects of dust on caribou.

During the decommissioning, rehabilitation, and closure phase, activities such as the removal of infrastructure and revegetation of disturbed areas may reverse some of the adverse effects on caribou habitat. While regenerating habitat is generally considered low-quality for caribou, the revegetated areas would mature during post-closure and become more suitable for caribou over time. However, some components of the combined Projects will not return to baseline conditions (e.g., open pits that will be flooded) and some vegetation communities are not expected to return to baseline conditions.

In the Valentine Gold EIS, sensory disturbance was assessed within a 500 m ZOI surrounding the Project Area to quantify indirect effects on caribou habitat. A total of 57.3 km^2 of high and moderate-ranked caribou habitat was predicted to be indirectly affected by the Approved Project. Given the incremental increase in assessed change in habitat from the Project Expansion (0.1% relative to the Project Area), indirect effects on caribou habitat are assumed to be accounted for in the Valentine Gold EIS predictions. Combined, the area of direct and indirect effects assessed represent 5.5% of the high and moderate-ranked habitats available in the ELCA. Because the ELCA is small relative to the population ranges of the four assessed caribou herds (i.e., RAA) (6.4% of 28,809 km^2), the estimated proportion of habitat affected by the Approved Project is larger, and therefore more conservative, than if it was compared to total caribou range use.

Predicted indirect effects from the Approved Project and Project Expansion on caribou habitat are expected to extend beyond the 500 m buffer. These effects are expected to decrease with increasing distance from the Project Area. For example, whereas Rudolph et al. (2012) showed that woodland caribou have reduced use of habitats within and beyond 2 km of roads, the analysis showed that reduced use dissipated exponentially with increasing distance. At distances of 500 m and 1,000 m from roads, the relative probability of caribou occurrence was approximately 60% and 80%, respectively, of the estimated maximum caribou occurrence (see Figure 13 in Rudolph et al. 2012). This suggests that while caribou may exhibit reduced use of habitats beyond the Project Area, reduced use is not uniform across the extent of sensory disturbance and therefore the suitability of caribou habitat and its subsequent use by caribou is not expected to be affected uniformly.

As indicated in Table 11.14 in the EIS, the literature is highly variable regarding an appropriate ZOI for caribou. Recent analyses by Boulanger et al. (2021) found significant ZOIs associated with two operational gold mines in the Northwest Territories, with ZOI distances ranging from 6.1 to 18.7 km over a 15-year period (standardized average of 7.2 km). The authors noted a high degree of annual variation in ZOI size due to several factors including environmental conditions (e.g., forage quality, drought), perceived level of disturbance (e.g., vehicles, blasting, etc.), herd size, and seasonal range size and location (Boulanger et al. 2021). Other researchers have estimated seasonal ZOIs of mine sites that range from 0.25 km and up to 23 km (e.g., Boulanger et al. 2012; Polfus et al. 2011; Plante et al. 2018). On the Island of Newfoundland, caribou showed avoidance of the Hope Brook Gold Mine at distances of up to 6 km during construction, and most caribou avoided the mine site within 4 km during the construction and operation phases (Weir et al. 2007).

There is variability in the literature regarding avoidance distances for linear features such as transmission lines and roads. Avoidance (which includes reduced use or partial avoidance as evidenced by differences in population density) of transmission lines by caribou of 2.5 km to 6 km has been reported (e.g., Nellemann et al. 2001; Vistnes and Nellemann 2001; Nellemann et al. 2003). However, other research has found no avoidance of transmission lines (Reimers et al. 2007; Plante et al. 2018), or avoidance only during construction (Eftestøl et al. 2016). Roads are also avoided by caribou, with avoidance increasing with greater disturbance levels (i.e., active roads compared to derelict roads) (Leblond et al. 2013) and during the highest traffic period (Dyer et al. 2001). Other ungulates (i.e., red deer) avoid crossing roads during periods of increased traffic (Kušta et al. 2017). While much of the research on caribou ZOIs reflects different disturbances, landscapes, topography, habitats, and caribou behaviours (e.g., migratory vs. sedentary) compared to the Island of Newfoundland, findings suggest that the ZOI for caribou in Newfoundland would also vary among years and herds. No studies that looked at the extent of sensory disturbance on caribou found total abandonment by caribou of the area within the ZOI.

The mechanisms that cause caribou to avoid mines and other anthropogenic disturbances are not fully understood but may include visual and other sensory disturbance, such as noise and dust (Boulanger et al. 2012, 2021) and perceived change in habitat resulting from construction activities. Responses by caribou are variable but can include a shift in individual home ranges to avoid overlap with the affected area (e.g., MacNearney et al. 2016), seasonal avoidance (e.g., Boulanger et al. 2012), alteration of behaviors and group sizes in the vicinity of the disturbance (e.g., Weir et al. 2007), and a change in the

timing and direction of migration (e.g., Mahoney and Schaefer 2002b). Sensory disturbance can also result in short-term physiological responses, including a startle response, elevated heart rate and increased hormone production (e.g., glucocorticoids) (ECCC 2020), the latter of which may indicate a physiological response to stress (MacDougall-Shackleton et al. 2019). Potential effects of increased stress identified for vertebrates have included reduced fitness (Bonier et al. 2009), poor body condition and potentially lower survival and reproductive rates (Escribano-Avila et al. 2013), reduced immune function and increased parasite load or susceptibility to disease (Hughes et al. 2009, Hing et al. 2016).

Table 10.11 (originally provided in the Caribou Supplemental Information Report; Marathon 2021) provides information on low, moderate, and high-ranked caribou habitat located within a range of potential ZOIs extending up to 15 km from the mine site. This distance was selected based on information in the scientific literature (e.g., Boulanger et al. 2012) and knowledge of the Approved Project and surrounding landscape. It is considered valid for the Project Expansion as well, as Project Expansion activities are similar in nature to those of the Approved Project and almost entirely limited to the Project Area (Section 1.3). As noted, mechanisms that may cause caribou to avoid mines and other anthropogenic disturbances are not well understood and there is a high degree of variation in the effect of ZOIs of different sizes on caribou.

Mitigation and management measures have been previously committed to in relation to the Approved Project to reduce potential indirect effects of sensory disturbance on caribou, including limiting lighting to that required to ensure safe and feasible mining-related activities and noise reduction strategies for vehicles and heavy equipment. Monitoring sensory and air quality thresholds are outlined in the CPEEMP for the Approved Project (Appendix 10B) and will be updated to include the Project Expansion (refer to Section 10.4). Potential effects due to noise during operation (e.g., blasting) are discussed in more detail in Section 10.6.2 in the context of change in movement for caribou.

Table 10.11 Amount of High-, Moderate-, and Low-value Caribou Habitat within the Project Area, Potential Zones of Influence, and the ELCA

Habitat Value Ranking[A]	PA[B]		Project Area + 500 m buffer		Potential Zone of Influence (Distance from Mine Site)[C,D]								Area in ELCA[B,D]	
					2 km		5 km		10 km		15 km			
	km²	%	km²	%	km²	%	km²	%	km²	%	km²	%	km²	%
High	18.7	53.9	48.1	42.6	42.6	44.5	117.9	49.4	308.7	52.2	481.7	50.3	849.1	46.4
Moderate	9.8	28.1	37.8	33.5	43.6	45.5	102.8	43.1	235.5	39.9	381.5	39.8	718.5	39.2
Low	6.2	18.0	26.9	23.9	9.6	10.0	17.8	7.5	47.2	8.0	94.5	9.9	263.0	14.4
Total	**34.7**	**100.0**	**112.8**	**100.0**	**95.8**	**100.0**	**238.6**	**100.0**	**591.5**	**100.0**	**957.7**	**100.0**	**1,830.6**	**100.0**

Notes:

A. Habitat value rankings for caribou are provided in Table 11.8 of the EIS. Existing anthropogenic areas are included in the rankings as low-quality habitat.

B. PA = Project Area and includes the mine site plus access road and 20 m buffer (around access road only); ELCA = Ecological Land Classification Area and indicates the areal extent of detailed habitat information for the Project. Habitat availability in the PA and ELCA are also found in Table 11.9 of the EIS.

C. ELC coverage of the 10 km and 15 km ZOIs is 98% and 85%, respectively; coverage is 100% in all other areas.

D. Percent of habitat represents the area covered by the ELCA only and does not infer habitat distribution for those areas where there are gaps in the ELCA.

10.7.1.3 Summary

Of the four assessed caribou herds, the effects of direct and indirect change in caribou habitat from the Approved Project were greatest for the Buchans and Grey River herds due to the overlap and/or proximity of caribou from these herds to the Project Area during some seasons (Section 11.2.2.1 and Table 11.16 in the Valentine Gold EIS), and the migration of the Buchans herd through the Project Area twice annually. The Gaff Topsails and LaPoile herds have little to no overlap with the Project Area (Table 11.16 in the Valentine Gold EIS) and therefore the effects of the Approved Project on change in habitat for these two herds was anticipated to be negligible. This effects prediction is still considered valid based on the assessment of the potential effects of the Project Expansion combined with the effects predicted for the Approved Project.

With mitigation, the Approved Project was anticipated to result in adverse residual effects on caribou habitat that were low in magnitude, occurred continuously, were long-term in duration, and irreversible. The geographic extent of the residual effect extended into the RAA, given caribou may avoid disturbances by more than 1 km (i.e., beyond the LAA boundary for the mine site). Change in habitat was predicted to occur during each phase of the Approved Project and was generally adverse in direction, although some neutral changes in habitat were predicted to occur during the decommissioning, rehabilitation, and closure phase. While residual effects on change in habitat primarily affect the Buchans and Grey River herds, the residual effect were anticipated to be low in magnitude for each assessed herd. The Project Expansion is almost entirely within the Project Area and the nature of Project Expansion activities is similar to the Approved Project. Due to conservative assumptions in the Valentine Gold EIS that all habitat in the Project Area would be changed (i.e., all habitat within the Project Area was assumed to be cleared), and all habitat within 500 m of the Project Area would be subject to indirect effects, the residual effects predictions for the Approved Project are considered valid based on the assessment of the potential effects of the Project Expansion combined with the effects predicted for the Approved Project. Residual effects associated with the operation phase will be extended by 1.4 years with the addition of the Project Expansion.

10.7.2 Change in Movement

Residual effects on a change in caribou movement are described for direct effects (i.e., loss of migration pathways) and indirect effects (e.g., sensory disturbance and avoidance behaviours).

10.7.2.1 Direct Effects on Change in Movement

Approved Project and Project Expansion activities have the potential to directly affect caribou movement through the physical placement of mine components in areas that overlap caribou migration paths. The updated dBBMM analysis (Appendix 10A) of the migration patterns of the Buchans caribou herd identified a migration corridor through the mine site, comprised of a network of migration paths (i.e., low-, moderate-, and high-use areas), between seasonal ranges on the Buchans Plateau (calving range) and Grey River (winter range). Consistent with information presented in the Valentine Gold EIS, there was only one distinct population-level pathway identified that is used by Buchans herd caribou during both spring (Figure 10-6) and fall (Figure 10-7) migration.

Within the primary corridor, areas of high use (stopover sites), and areas of moderate-high/moderate-low use (movement), were identified as overlapping the Marathon pit and Marathon waste rock pile, as well as portions of Berry / Marathon overburden stockpile, during spring (Figure 10-6) and fall (Figure 10-7) migration. The analysis also identified relatively low-use travel paths throughout the remainder of the mine site that overlap the Berry pit, Berry waste rock pile, Berry topsoil stockpile, and water management infrastructure (ponds).

While the Project Area only overlaps a portion of the migration corridor identified for Buchans herd caribou, maintaining the functionality of migration paths by preserving connectivity between seasonal ranges is vital to sustaining viable populations of migratory ungulates (Monteith et al. 2018). As acknowledged in the assessment of the Approved Project, the Marathon open pit and waste rock pile will be developed within the primary migration corridor for the Buchans herd, creating a permanent obstacle that migrating caribou will be forced to avoid. The results of the updated dBBMM indicate that some collared caribou migrate through and/or around the mine site along low-use pathways outside the primary pathway, including low-use pathways that will be directly affected by development of the Berry pit and Berry waste rock pile. These pathways were quantified in the dBBMM by the quartile in which the estimated utilization distribution for individual GPS collared caribou occurred, as either low (0-25%), low–moderate (26-50%), moderate–high (51-75%), or high (>76%). Although the entire Project Area was assumed to be affected by the development of the Approved Project, there may be residual effects on change in movement from the addition of the Project Expansion through the reduced availability of alternate routes through the Project Area (i.e., reduced permeability of the Project Area). Specifically, the areas where Berry pit and the Berry waste rock pile will be located were previously assessed as being cleared, and while that clearing could affect the use of movement pathways, use of those pathways was likely to remain feasible. The Berry pit and Berry waste rock pile will create physical impediments (i.e., change in topography as a barrier) to movement along those pathways, making the use of those pathways less likely. As caribou are generally expected to avoid the mine site during construction and operation, the potential residual effects on change in movement are more likely to occur during closure and continuing into post-closure.

Three potential migration scenarios were identified for the Buchans caribou herd in response to the development of the Approved Project (Caribou Supplemental Information Report, Appendix G of the Valentine Gold Project: Amendment to the Environmental Impact Statement). These scenarios remain applicable for the combined Projects:

1. Caribou could continue to migrate along paths that cross the Project Area
2. Caribou could avoid the Project Area (e.g., migrate along alternate pathways identified by the Caribou Alternate Migration Pathway Analysis)
3. Caribou could avoid the Project Area resulting in a failure to migrate (although considered unlikely at a population level), subsequently remaining either north or south of the Project Area year-round

These three scenarios could apply to caribou on an individual, group, or population basis. Continuation of migration through the Project Area could lead to reduced body condition and/or direct mortality from interaction with mine infrastructure or vehicles, and stress resulting from sensory disturbance. This could result in reduced calving rates and increased mortality. Potential residual effects on caribou movements,

should caribou avoid the mine site and migrate along alternate routes, include reduced body condition due to greater energetic requirements and reduced availability of suitable forage resulting in reduced body condition. The third scenario (i.e., failure to migrate) is considered unlikely at a population level; however, potential residual effects include reduced body condition, an increase in predation or hunting pressure, increased competition for resources with the adjacent herds and, ultimately, adverse effects on the population size and trend of Buchans herd caribou. More detailed discussions of these scenarios are provided in the Caribou Supplemental Information Report (Appendix G of the Valentine Gold Project: Amendment to the Environmental Impact Statement) and the CPEEMP (Appendix 10B).

10.7.2.2 Indirect Effects on Change in Movement

Indirect effects on change in movement for caribou can occur primarily through avoidance of the Project Area or of previously used migration paths due to sensory disturbance. As indicated in Section 10.7.1.2, the mechanisms that cause caribou to avoid mines and other anthropogenic disturbances are not fully understood but may include visual and other sensory disturbance, such as noise, dust (Boulanger et al. 2012, 2021), and perceived change in habitat resulting from construction activities. Information on caribou habitat within a range of potential ZOIs from the mine site are summarized in Table 10.11.

Sources of sensory disturbance from the Approved Project and Project Expansion include noise, visual, vibration, dust, and human presence from physical activities such as vegetation clearing, development of haul roads, general earthworks, the construction and installation of water control structures, blasting, and the excavation and haulage of rock from the open pits.

Noise and Vibration from Blasting

Blasting frequency is not anticipated to increase due to the Project Expansion, with the previously predicted number of blasts (roughly one blast per day) for the Approved Project being distributed between the three pits. Blasting, however, will occur over a longer time due to the extension of mine life by 1.4 years associated with the Project Expansion. Blasting at mines routinely follows best management practices, namely the Blasters Handbook (ISEE 2011) and the Environmental Code of Practice for Metal Mines (ECCC 2009). These guides include recommended threshold values for blasting and mitigation options to reduce air blast related noise and vibration during blasting events, and these will be consulted during blasting design (Section 5.5.3.1 in the Valentine Gold EIS). Blast vibration and noise monitoring is being conducted for the Approved Project and this data will be used to assess potential effects to caribou in consultation with NLDFFA – Wildlife Division for the Approved Project and the Project Expansion.

Predicted Sound Pressure Levels (Noise Modelling)

Updated noise modelling was completed to consider the effects of both the Approved Project and Project Expansion on caribou (Figures 10-9 and 10-10). Noise modelling conservatively assumed that construction activities would occur concurrently at the three pits (i.e., Leprechaun, Marathon, and Berry). This may not be the case, however, as specific timing of permit approvals are unknown and construction phases will likely be staggered. During operation, the model also conservatively assumed that during spring and fall migration, activities at the Marathon pit are suspended, but full operation is occurring at the Berry pit. The noise modelling for both the construction and operation phases will be refined during the

permitting process to better reflect actual construction schedules for Approved Project and Project Expansion infrastructure and to support consultation with NLDFFA – Wildlife Division related to acceptable levels of activities at the mine site during caribou migration based on predicted sound pressure levels per the CPEEMP.

While there are no provincial or federal noise thresholds for caribou, 40 dBA is typically used as a threshold for disturbance of caribou based on studies that have shown that effects of acoustic emissions on wildlife have the potential to occur above 40 dBA (Shannon et al. 2016). For caribou, interrupting resting bouts (late winter), increasing activity (during the insect season), or increasing activity and moving farther from the disturbance (post-calving) have been noted following exposure to noise levels of 46 dB to 127 dB associated with low-level jet aircraft overflights (Maier et al. 1998).

To reduce potential effects of noise disturbance on caribou from the Approved Project, Marathon has committed to suspending activities at the Marathon pit and TMF during caribou migration during construction and operation. These mitigation measures, which are operationalized in the CPEEMP (Appendix 10B), will act to reduce sound pressure levels on the preferred migration path used by the Buchans caribou herd.

Predicted sound pressure levels (40 dBA and 50 dBA contours) for the mine site with the addition of the Project Expansion are shown in Figure 10-9 and Figure 10-10 for the construction and operation phases, respectively, with and without the cessation of activities at the Marathon pit. During both construction and operation, sound pressure levels are expected to be above 50 dBA throughout much of the mine site. When activities are reduced at the Marathon pit, the 50 dBA contour shifts to center on the Leprechaun and Berry pits, during both construction (Figure 10-9) and operation (Figure 10-10). The 40 dBA contour also shrinks when activities at the Marathon pit are reduced, however, levels are still expected to be above 40 dBA in the Marathon pit and along portions of the high and moderate-high use caribou migration pathways identified for spring and fall migration (Figure 10-9 and Figure 10-10). As noted, the noise modelling completed for both construction and operation is conservative, and more refined modelling will inform optimum sequencing of mining activities to reduce sound pressure levels in the preferred migration path used by the Buchans caribou herd. As indicated in Section 10.4, Marathon will further evaluate sound pressure levels associated with various reduced activity scenarios at Berry pit, in consultation with NLDFFA – Wildlife Division, with the objective of meeting acceptable thresholds identified in the CPEEMP and providing increased flexibility/duration for suspended activities at the Marathon pit.

Figure 10-9 Predicted Equivalent Sound Pressure Levels (Leq) from Combined Project Construction Activities during Spring (above) and Fall (below) Caribou Migration. On-going Activities (left) and Reduced Activities at the Marathon Pit (right)

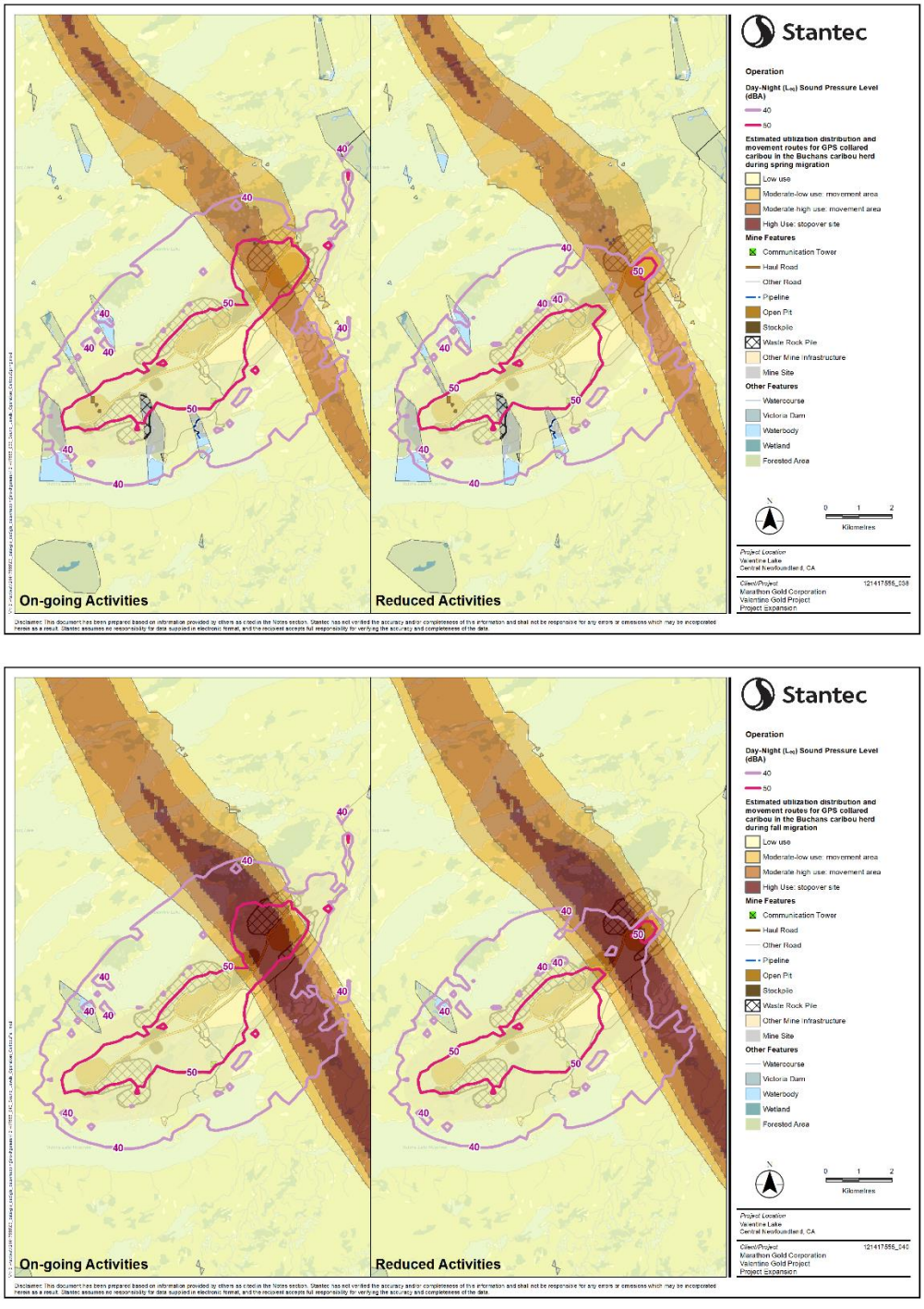

Figure 10-10 Predicted Equivalent Sound Pressure Levels (Leq) from Combined Project Operation Activities during Spring (above) and Fall (below) Caribou Migration. On-going Activities (left) and Reduced Activities at the Marathon Pit (right)

10.7.2.3 Summary

As stated in the Valentine Gold EIS, for the Approved Project, residual effects on change in movement of the Buchans herd are predicted to be high in magnitude, due to the overlap of the Project Area with a well-defined and well-used migration corridor. Based on the assessment of available data, the Approved Project was predicted to act as a barrier to the movement of Buchans herd caribou, directly and indirectly, with some degree of uncertainty with respect of caribou response. Although the entire Project Area was assumed to be affected by the development of the Approved Project, there may be residual effects on change in movement from the addition of the Project Expansion through the reduced availability of alternate routes through the Project Area (i.e., reduced permeability of the Project Area). Specifically, the areas where Berry pit and the Berry waste rock pile will be located were previously assessed as being cleared, and while that clearing could affect the use of movement pathways, use of those pathways was likely to remain feasible. The Berry pit and Berry waste rock pile will create physical impediments (i.e., change in topography as a barrier) to movement along those pathways, making the use of those pathways less likely. As caribou are generally expected to avoid the mine site during construction and operation, the potential residual effects on change in movement are more likely to occur during closure and continuing post-closure. Residual effects of the combined Projects will remain high in magnitude, but not be expected to extend beyond the Project Area for the combined Projects. Although residual effects predicted for the Approved Project will marginally increase with the addition of the Project Expansion, the characterization of those effects as presented for the Approved Project do not change for the combined Projects.

The Grey River herd moves between seasonal ranges (Figure 11-9 in the Valentine Gold EIS) but is not considered a migratory herd and does not have a distinct migration corridor. However, the assessment of the Approved Project identified the potential for individual Grey River caribou to interact with the Approved Project during some seasons, and therefore the potential for direct (e.g., crossing of access or site roads) and indirect (e.g., sensory disturbance) effects on change in movement. The residual effect on change in movement for the Grey River herd for the Approved Project was predicted to be adverse however low in magnitude, given the limited overlap of their summer range with the Project Area during each phase. As the Project Expansion has similar direct and indirect effects as the Approved Project, and those effects originate from similar activities in the Project Area, the addition of the Project Expansion is not predicted to alter the characterization of predicted residual effects of the Approved Project.

Seasonal ranges of the La Poile and Gaff Topsails herds do not overlap with the Project Area. As such, direct effects of the Approved Project on change in movement were expected to be negligible. It was however predicted that caribou in these herds could be affected indirectly by the Approved Project. While the Approved Project was anticipated to have the greatest effect on the movement of Buchans caribou, some Buchans caribou may fail to migrate and remain on their winter range year-round, potentially overlapping with the La Poile range from late fall to spring. As the assessed herds intermix on winter range with other South Coast herds (Weir et al. 2014), year-round use of the area by Buchans caribou could reduce forage availability (via competition for resources) for caribou that regularly winter in that area (e.g., La Poile). This could affect the body condition of not only the Buchans caribou, but also of the La Poile caribou. As the Project Expansion is expected to have similar effects on La Poile and Gaff Topsails

herds as the Approved Project, because effects originate from similar activities in the Project Area, the addition of the Project Expansion is not predicted to alter the characterization of predicted residual effects of the Approved Project.

Mitigation measures identified for the Approved Project, including but not limited to suspending mining activities at the Marathon pit and TMF during migration periods, delaying blasting activity if caribou are in the vicinity, facilitating caribou crossings across snowbanks or ditches, and aligning crossing points with existing migration paths, would also be applicable to the Project Expansion. As identified in Section 10.4, reduced activity scenarios at the Berry pit during construction and operation will also be modelled in consultation with NLDFFA – Wildlife Division to determine acceptable levels of activity during spring and fall migration consistent with thresholds established in the CPEEMP (Appendix 10B). Mitigation measures to reduce effects on movement will reduce sensory disturbance associated with the Approved Project and Project Expansion, but will not mitigate the physical alteration of the migration paths within the mine site.

With the implementation of mitigation measures, predicted residual adverse effects on caribou movement for the Approved Project were predicted to be continuous, high in magnitude, long-term in duration, and irreversible. The irreversible characterization arises because features of the Approved Project (e.g., Marathon and Leprechaun pits) will not be fully returned to their former state and the vegetation composition of revegetated areas may differ from baseline conditions. The geographic extent of indirect effects was expected to extend into the RAA as the presence of the Approved Project may alter movements of Buchans herd caribou before they reach the Project Area, potentially affecting their ability to reach their seasonal grounds. These predicted residual effects are also considered applicable to the combined Projects, with the Project Expansion adding additional permanent features within the mine site (i.e., the Berry pit and waste rock pile) that will continue to be present following rehabilitation and closure.

10.7.3 Change in Mortality Risk

Residual effects on a change in caribou mortality are described for direct effects (e.g., collision risk) and indirect effects (e.g., changes in predation).

10.7.3.1 Direct Mortality

Vehicle and equipment traffic on the haul roads present the greatest risk for collision due to the frequency of vehicle and equipment operation, particularly during winter when caribou are encountered between snowbanks along roads and when egress is impeded. Caribou interactions with the open pits could also result in direct caribou injury or mortality. While unlikely, it is possible that caribou moving through the mine site could enter or fall into an open pit, resulting in injury or mortality, and the Project Expansion adds an additional open pit to the landscape. There is a low risk of direct mortality through vegetation clearing and site preparation (i.e., mobile equipment operation), as caribou are expected to avoid the area during such activities due to sensory disturbance (Weir et al. 2007; Polfus et al. 2011; Boulanger et al. 2012; Leblond et al. 2013; Johnson et al. 2015; Eftestøl et al. 2019).

For the Approved Project, mortality caused by wildlife-vehicle collisions on the site access road was expected to occur infrequently, as traffic volume on the access road was estimated to be incremental to

existing traffic volumes and would be managed according to the Traffic Management Plan. The addition of the Project Expansion will increase traffic on the access road by 5-8% in comparison to the Approved Project alone. The increase in mine life associated with the combined Projects will extend the duration of operation-related traffic from 13 years to 14.4 years.

With mitigation, including the implementation of speed limits, the creation of breaks in snowbanks to facilitate caribou movements across roads, installation of barriers around the open pits as needed, and daily monitoring for caribou during sensitive periods (e.g., spring and fall migration), the risk of direct mortality was considered negligible to low for each assessed caribou herd for the Approved Project. These predicted residual effects and mitigation measures are also considered valid and applicable for the Expansion Project.

10.7.3.2 Indirect Mortality

Indirect effects on a change in mortality risk include increased predation rates, increased energy expenditure, increased stress, and decreased forage availability.

The risk of mortality, particularly for caribou calves, could increase through altered predator-prey dynamics. Predation is the primary cause of caribou calf mortality on the Island and a decrease in calf survival since the mid-1990s has been attributed to an increase in predation (Government of NL 2015). Vegetation clearing in the Project Area will create edge habitat, which is often associated with moose as it can provide high value browse (Ardea Biological Consulting 2004). Selection of this edge habitat by moose could increase their abundance in affected areas. This may result in an increase in predator populations (e.g., black bear, coyote), which in turn may increase mortality risk for caribou.

Indirect effects on change in mortality risk could occur if caribou continue to migrate through the Project Area, as they could be subject to reduced body condition resulting from increased stress and increased energetic cost (e.g., increased rate of movement through the site or less time spent foraging while moving through site). Use of alternate migration paths or failure of some caribou to migrate could also increase caribou mortality risk if avoidance of the Project Area causes caribou to use areas with higher predation risk or prolongs the amount of time that caribou spend in areas where predation risk is greater and/or forage availability is reduced.

Sensory disturbance can result in short-term behavioral and physiological responses by caribou, including a startle response, elevated heart rate, and increased hormone production. Stress hormones in caribou may increase with exposure to anthropogenic disturbance (Freeman 2008; Wasser et al. 2011; Renaud 2012; Ewacha et al. 2017; Plante et al. 2020), and have been associated with reduced body condition, survival, reproductive rates, and with increased susceptibility to parasites or disease (Hughes et al. 2009; Escribano-Avila et al. 2013; Hing et al. 2016). Prolonged exposure to stress could potentially lead to poor body condition and potentially lower survival and reproductive rates which could affect the population size and trend of both the Grey River and Buchans herds.

10.7.3.3 Summary

Of the four assessed caribou herds, the Approved Project and Project Expansion have the potential to result in direct and indirect changes in caribou mortality risk for the Buchans and Grey River herds due to the overlap and/or proximity of caribou relative to the Project Area during some seasons. In addition, there is potential for increased mortality risk related to change in movement (Section 10.7.2), which is most relevant for the Buchans caribou herd that migrates through the Project Area. The Gaff Topsails and LaPoile herds have little to no overlap with the Project Area and direct effects on change in mortality risk for these herds is assessed as negligible. There is also low potential for indirect effects on change in mortality risk through potential increases in predation for these two herds.

With the implementation of mitigation measures, change in mortality risk for caribou resulting from the Approved Project was predicted to be adverse. The magnitude of change in mortality risk was anticipated to be low in the construction and operation phases, and negligible to low during the decommissioning, rehabilitation, and closure phase for each assessed caribou herd. Effects of change in mortality risk was predicted to be greatest for the Buchans and Grey River herds as their ranges overlap the Project Area. However, all assessed caribou herds could experience an increase in mortality risk due to an increase in predation rates, and possibly increased competition for forage or a reduction in forage quality. The geographic extent was predicted to extend to the RAA based on home range sizes and movement patterns of predators and because of the previously discussed effects of Project activities on caribou habitat and movement. The direct risk of mortality from vegetation clearing, site preparation, operation, and vehicular collisions was predicted to be limited to the Project Area. Mortality events were expected to occur at an irregular frequency and the change in mortality risk was medium term in duration. The effect was anticipated to be reversible following closure. These residual effects are not anticipated to change with the addition of the Project Expansion and are therefore considered valid for the combined Projects.

10.7.4 Summary of Changes from the Approved Project

Table 10.12 presents a comparison between residual effects for the Approved Project and for the combined Projects (the Approved Project plus Project Expansion). There are no substantive differences between residual effects for the Approved Project compared to the combined Projects.

Table 10.12 Residual Effects on Caribou for Approved Project Plus Project Expansion

Residual Effect	Residual Effects Characterization for Approved Project								Change in Residual Effect Characterization with Addition of Project Expansion (i.e., Combined Effects of Approved Project and Project Expansion)
	Project Phase	Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Ecological and Socio-economic Context	
Change in Habitat	C	A	L	RAA	LT	C	I	D	No change
	O	A	L	RAA	LT	C	I	D	No change
	D	A/N	L	RAA	LT	C	I	D	No change
Change in Movement	C	A	H	RAA	LT	C	I	D	No change
	O	A	H	RAA	LT	C	I	D	No change
	D	A	H	RAA	LT	C	I	D	No change
Change in Mortality Risk	C	A	L	RAA	MT	IR	R	D	No change
	O	A	L	RAA	MT	IR	R	D	No change
	D	A	L	RAA	ST	IR	R	D	No change

KEY :
See Table 10.9 for detailed definitions

Project Phase
C: Construction
O: Operation
D: Decommissioning

Direction:
P: Positive
A: Adverse
N: Neutral

Magnitude:
N: Negligible
L: Low
M: Moderate
H: High

Geographic Extent:
PA: Project Area
LAA: Local Assessment Area
RAA: Regional Assessment Area

Duration:
ST: Short term
MT: Medium term
LT: Long term
P: Permanent

Frequency:
S: Single event
IR: Irregular event
R: Regular event
C: Continuous

Reversibility:
R: Reversible
I: Irreversible

Ecological / Socio-Economic Context:
D: Disturbed
U: Undisturbed

N/A: Not applicable

10.7.4.1 Change in Habitat

The residual environmental effects for change in habitat for caribou during all phases of the Project Expansion and Approved Project are adverse as there will be a change (loss or alteration) of 85.8 km^2 of high and moderate-ranked caribou habitat in the ELCA, a decrease of less than 6% from pre-construction conditions in the ELCA. The residual effects of the Project Expansion and the Approved Project on change in habitat will be low in magnitude, occur continuously, are long-term in duration, and irreversible. The geographic extent of the residual effect will extend into the RAA, given caribou may avoid disturbances by more than 1 km (i.e., beyond the LAA boundary for the mine site). Although changes to habitat will occur during all phases of the Project Expansion and Approved Project, some neutral changes in habitat may occur during decommissioning. While residual effects on change in habitat will primarily affect the Buchans and Grey River herds, the residual effect is anticipated to be low in magnitude for all assessed herds.

Overall, the assessment of the combined Project residual effects on a change in habitat does not change the conclusions presented in the Valentine Gold EIS.

10.7.4.2 Change in Movement

The residual environmental effects on change in movement for caribou during all phases of the Project Expansion and Approved Project are adverse as the preferred migration path of the Buchans caribou herd will be directly and/or indirectly affected, based on the area of overlap of high and moderate-high use migration areas and the Project Area. The preferred migration path has been used by more than 50% of caribou from the Buchans herd and there could be a range of outcomes based on how individual caribou from the herd respond. Caribou may continue to migrate along the paths that cross the mine site; avoid the mine site or other infrastructure that could result in migration occurring along alternate paths that are longer and require greater energetic costs; or fail to migrate (although considered unlikely at a population level). The long-term effects of each of these scenarios is that population size and trend could be adversely affected. The residual effects of the Project Expansion and the Approved Project on change in movement are predicted to be high in magnitude, continuous, long-term, and irreversible. The geographic extent of indirect effects is expected to extend into the RAA.

Overall, the assessment of the combined Project residual effects on a change in movement does not change the conclusions presented in the Valentine Gold EIS.

10.7.4.3 Change in Mortality Risk

The residual environmental effects on change in mortality risk for caribou during all phases of the Project Expansion and Approved Project are adverse. The residual effects of the Project Expansion and Approved Project on change in mortality risk are anticipated to be low in magnitude, occur irregularly, are medium-term in duration, and reversible following closure. Although residual effects may result in increased mortality risk of some individuals, a measurable change in the mortality risk of individuals in the RAA is not anticipated.

Overall, the assessment of the combined Project residual effects on a change in mortality risk does not change the conclusions presented in the Valentine Gold EIS.

10.7.5 Determination of Significance

A significant adverse residual effect on caribou and their habitat is one that threatens the long-term persistence or viability of one or more of the four assessed caribou herds within the RAA, including effects that are contrary to or inconsistent with the goals, objectives, and activities of recovery strategies, action plans, and management plans.

Residual environmental effects from the Approved Project on the Gaff Topsails, Grey River, and La Poile herds were predicted to be not significant, as they do not threaten the long-term persistence or viability of these herds and are not contrary to or inconsistent with the goals, objectives, and activities of recovery strategies, action plans, and management plans. With implementation of mitigation measures and given the uncertainties regarding how caribou will respond to an interruption of an existing migration corridor and the creation of physical obstacles to movement, the predicted residual environmental effects on Buchans herd caribou for the Approved Project was conservatively predicted to be significant, due to the overlap of the Project Area with the population-level migration corridor used by more than half of the Buchans herd.

The addition of the Project Expansion does not result in substantive changes in the residual effects for the Approved Project. The residual adverse effect of the Approved Project and Project Expansion on caribou is predicted to be significant, as was determined for the Approved Project.

10.8 ASSESSMENT OF CUMULATIVE EFFECTS ON CARIBOU

Cumulative effects on caribou resulting from past, present, ongoing, and reasonably foreseeable projects and activities, in combination with residual effects of the Approved Project, were presented in Chapter 20 of the Valentine Gold EIS, and in the Cumulative Effects Discussion, Appendix H of the Second Amendment to the EIS submitted to regulators in January 2022 (Marathon 2022). Information on where to access these documents online is provided in Table 1.8. In this updated cumulative effects assessment (CEA), new activities known or likely to be occurring in the RAA (Chapter 5, Table 5.6) have been updated since the Approved Project was assessed (Chapter 5, Table 5.6). This CEA focuses on incremental changes in the residual effects of the Approved Project in combination with the Project Expansion, which are summarized in Section 10.7.4, as well as incremental changes in potential cumulative effects due to differences in on-going and likely future activities since the Approved Project was released from the EA process.

The Valentine Gold EIS acknowledged that the effects of past and present projects and activities contributed to existing conditions upon which Approved Project effects were assessed. Therefore, the CEA focused on caribou resiliency or sensitivity to further environmental change resulting from the Approved Project in combination with other ongoing projects and future activities that could affect them. The CEA completed in this document takes a similar approach.

The seasonal distribution of caribou and seasonal changes in caribou vulnerability are important temporal considerations for the assessment of cumulative effects on caribou. Movement patterns and seasonal ranges of the assessed herds, as well as the increased vulnerability of caribou during sensitive periods (e.g., pre-calving, calving and post-calving) influence the nature and extent of interactions with the Approved Project and Project Expansion. It is also important to recognize that cumulative effects may be realized over a longer period (e.g., more than one generation) and may extend beyond the life of the Approved Project and Project Expansion.

The spatial boundaries for the assessment of cumulative effects on caribou are defined by the RAA (Figure 10-2), which accounts for the larger movements and distributions of caribou and encompasses the projects and activities outside of the Project Area and have potential to interact cumulatively with the Approved Project and Project Expansion.

As acknowledged in the Valentine Gold EIS, the development of the Approved Project will create risks to the Buchans herd, which migrates through the Project Area twice annually, and to the Grey River herd, whose calving grounds are located to the south of Victoria Lake Reservoir. This CEA discussion therefore focuses on potential cumulative effects of the Approved Project and Project Expansion on these two herds.

10.8.1 Cumulative Effects Environmental Context

Caribou were considered abundant on the Island during the early 1900s, however populations declined rapidly between 1915 and 1920 (Government of NL 2015). Following that decline, caribou herds remained in relatively low numbers until the 1980s (Government of NL 2015). In addition, by the late 1970s, a portion of the range of caribou in central Newfoundland had been flooded by several hydro developments, some of which overlapped the traditional migration corridor for the Buchans herd (Bergerud et al. 1984).

The effects of previous activities and natural environmental influences are important in determining present-day environmental conditions in which the Approved Project and Project Expansion are situated and predicting future cumulative effects of the combined Projects. Contributing factors affecting caribou populations include predation, hunting, parasites, climate change, habitat change (loss or alteration), and development (existing and future) within their range.

The decline in caribou populations since the late 1990s was precipitated by a combination of food limitation and high calf mortality, primarily a result of the establishment of coyote (*Canis latrans*) on the Island (Government of NL 2015). Woodland caribou require large, interconnected, lichen-rich, mature coniferous forests interspersed with barrens and wetlands (Environment Canada 2011; Weir et al. 2014; Government of NL 2020b). Research on the Island found that when caribou populations were declining in the 2000s, caribou diets showed an increase in the proportion of mosses consumed, and a decrease in the proportion of shrubs, graminoids, and lichens consumed (Schaefer et al. 2016). The shift in diet to low-quality forage and a decrease in body size during the population decline (Mahoney et al. 2011) indicated that the availability of preferred forage was limited by high caribou density (Schaefer et al. 2016).

Predation is the primary cause of caribou calf mortality on the Island with approximately 90% of calf deaths attributed to predation (Lewis and Mahoney 2014). While the current adult caribou mortality rate is thought to be similar to historic rates, the decrease in calf survival since the mid-1990s is due to increased predation (Government of NL 2015).

Climate change has the potential to affect caribou populations. Warmer temperatures and changing precipitation will alter landscape-level plant composition and plant and insect phenology (timing of recurring biological events). As the assemblage of plant species in boreal regions change (Boulanger et al. 2017), the habitats selected by caribou may become less suitable as the abundance and distribution of preferred forage plants change. Warmer temperatures may cause plants to undergo spring green-up earlier, which may result in a phenological disconnect in forage biomass availability and seasonal energetic needs of caribou. For example, as the length of time between green-up and calving increases, there has been an observed increase in calf mortality and a decrease in calf production (Post and Forchhammer 2008).

Snow conditions may affect several aspects of caribou ecology including distribution, movement, predation rates, calf survival, and population size. On the Island, the amount of early spring snowfall may affect site fidelity of the Buchans herd during calving (Mahoney and Schaefer 2002a). For some migratory caribou in Labrador and Quebec, the start and end of migration was linked to temperatures and amount of precipitation, possibly due to their effects on the snow (Le Corre at al. 2017). High amounts of snowfall during gestation can reduce calf birth weights (Adams 2005). While calf survival in some regions may be higher in years of early snow melt (Bergerud and Elliot 1986), Lewis and Mahoney (2014) found no relationship between climate and calf survival on the Island.

Habitat loss or alteration is an important factor affecting caribou populations across North America (Vors and Boyce 2009) and it is uncertain how anthropogenic disturbance is affecting caribou populations (NLDEC 2015). Other factors, such as parasites (e.g., brain worm, tapeworms, oestrid flies), can reduce caribou health (Hughes et al. 2009) and alter behaviour (Government of NL 2010a), including habitat selection (Skarin et al. 2004).

Defoliating insects and wildfires can have profound effects on caribou habitat. Areas burned by forest fire can have reduced use or seasonal avoidance by caribou, particularly in winter, as caribou tend to select undisturbed habitat types with greater thermal cover and higher amounts of forage (e.g., lichen; Schaefer and Pruitt 1991).

10.8.2 Other Activities and Projects and their Effects on Caribou

Past, present, and likely future projects and activities in the RAA that have contributed, or may contribute in the future, to anthropogenic pressures on caribou include mining and exploration; forestry; hunting, trapping and outfitting; hydroelectric development; linear features; and off-road vehicle use. Figure 5-3 illustrates the locations of projects and activities relative to the RAA used for the CEA. A detailed discussion of these projects and activities is provided in Appendix H of the Second Amendment to the EIS (Marathon 2022). The focus of discussion below is on incremental changes in these projects and activities since that time.

10.8.2.1 Mineral Exploration and Mining

Since the submission of the Valentine Gold EIS, there has been a considerable increase in exploration interest from companies, as reflected in the number and extent of mineral leases approved throughout central Newfoundland (Table 10.13). Most of this increase occurred between the submission of the Valentine Gold EIS and submission of the Second Amendment to the EIS in January 2022. Therefore, this increase was captured in the cumulative effects discussion in the Second Amendment. The current area of mineral claims (Figure 5-3) has been updated with information available as of April 2023, which has resulted in a slight decrease in mineral claims area from 2022 (Table 10.13). Note that exploration activities (and associated habitat disturbance) would only be expected to occur on a portion of the identified mineral claims. A review of nine exploration and mining projects that had undergone or were undergoing EA review in the province between 2010 and 2022 demonstrated that the proposed surface footprint of each project was a relatively small area compared with the mineral claim area (i.e., 2-32%; average 13%)

Table 10.13 Mineral Claim Area in the Buchans Herd Range, Grey River Herd Range and RAA

	Mineral Claim Area (km^2) Assumed for EIS Submission (January 2020)	Mineral Claim Area (km^2) Assumed for Second Amendment to the EIS (November 2021)	Mineral Claim Area (km^2) Assumed for Environmental Registration / EA Update (April 2023)
Buchans Herd Range	1116.74	4536.32	4447.76
Grey River Herd Range	904.60	7610.32	6956.08
Regional Assessment Area	2415.29	12558.45	11951.33

Mining and exploration activities result in changes to habitat (direct loss and indirect effects from sensory disturbance), which may result in changes in caribou habitat availability and use, including caribou movement, and potentially contribute to reduced caribou survival and population sustainability. Mineral exploration activities can alter habitat through the creation of trails, survey lines, and drill pads. If mineral exploration proceeds to development, development activities are generally located on the lands that were disturbed by exploration, as well as incremental effects on previously undisturbed land.

Mining and exploration activities can increase caribou mortality risk through landscape-level changes affecting caribou habitat availability and increasing access for predators and/or hunting activity, and through associated traffic that may lead to an increase in the risk of vehicle collisions.

Exploration programs must have an Exploration Approval before the activity can commence, with some exploration activities, or activities in designated environmentally sensitive areas, requiring registration under the provincial EA Regulations (Government of NL 2010b). Proposed future mining activities would require consideration of potential environmental and socio-economic effects and associated mitigation measures to protect the environment through regulatory EA and permitting processes.

Since the Approved Project was released, the proposed Cape Ray Gold Project, which was considered in the Valentine Gold EIS CEA, has since been withdrawn from the regulatory review process. For the Buchans Resources Limited Project, which was identified in the Valentine Gold EIS, exploration work was initiated in 2021 and is ongoing (Table 5.6).

In addition, since the Approved Project was assessed, several new quarries have been proposed or approved throughout the RAA. The closest to the Project is Newcrete Investments Limited's proposed Victoria River Quarry. The Province issued Environmental Preview Report (EPR) guidelines in March 2023 (Government of NL 2023b). The proposed quarry is < 500 m at the closest point to the mine site and is expected to cover an area of 5.5 ha on a site adjacent to the Victoria River. The EPR guidelines issued by the provincial EA Division are requiring Newcrete to justify sourcing sand and gravel in this relatively remote region and to provide an analysis of alternate quarry locations and access routes to limit potential effects on the Victoria River watershed and caribou migration routes. Newcrete has also been asked to provide an analysis of potential cumulative effects of their project on the Victoria River watershed, wildlife, and wildlife habitat in the area in consideration of existing and proposed mining activities, road and transmission line development, and other development near the proposed project area. Given the level of analysis required for that project, it is anticipated that appropriate mitigation measures will be in place, should it be approved, such that the resulting contribution to cumulative effects will be reduced.

10.8.2.2 Forestry

Forestry activities in the RAA have and will continue to result in the alteration of caribou habitat (including direct change through harvesting and indirect change due to sensory disturbance and edge effects), as well as changing the overall function of the landscape through the altered habitats and successional forest regeneration over time. The loss of habitat and a change in caribou movement can be compounded by an increase in forestry roads required for harvesting, which also contributes to potential changes in predator-prey dynamics and/or hunting access that can reduce caribou fitness and survival (e.g., calf recruitment, population demographics).

Since submission of the Valentine Gold EIS and subsequent submission of the Second Amendment to the EIS (Marathon 2022), forestry activities have continued to occur within the RAA. NL is divided into 24 Forest Management Districts (FMDs), with the Project Area located within FMD 12 and 13. Figure 5-4 illustrates the areas of additional forest harvesting that have occurred between 2020 and 2023, which are located to the east and north of Beothuk Lake. There is a new Zone 5 operating plan in place for the period 2021-2025. The Plan indicates that 1,332,436 m^3 will be harvested and approximately 182 km of roads will be constructed in District 12. For District 13, 113,262 m^3 will be harvested and 11 km of access road will be constructed. An amendment to this plan indicates that 33,000 m^3 of softwood and residual hardwood will also be harvested from the east side of the Victoria River. Mitigation measures specific to limiting adverse effects on caribou and marten are outlined in conditions of release from the EA process for this five-year plan.

10.8.2.3 Hunting, Trapping, and Outfitting

Although hunting, trapping, and outfitting activities do not generally result in direct habitat alteration, the creation of trails is possible (e.g., for trapping) and human activity can cause sensory disturbance that results in an indirect change in habitat, albeit likely in a negligible way. These disturbances have the potential to affect caribou habitat use within the RAA and hunting directly affects caribou survival. By the nature of the activity, there is mortality risk to caribou, however, because the province sets the annual quotas for each Caribou Management Area (CMA), the harvest levels are assumed to be sustainable.

The RAA overlaps with several CMAs (Figure 11-14 in Section 11.2.2.1 of the Valentine Gold EIS). The caribou quota in CMA 62 for 2022 / 2023 is 38 resident licenses and 37 non-resident licenses (Government of NL 2023a).

10.8.2.4 Hydroelectric Development

Hydroelectric developments in the RAA have altered the landscape since they were created, beginning in the 1960s by changing watercourse flow patterns, flooding large tracts of land, and installing transmission corridors. These developments have affected caribou habitat (e.g., through flooding) and movement patterns by altering caribou migration timing and routes. The current migration corridor of the Buchans herd, and ranges of the Buchans and Grey River herds, have adapted based on these and other developments and activities in the RAA (e.g., Star Lake development, inundation of the Victoria reservoir). These past developments have shaped current ranges, migratory routes, and movement patterns in the RAA, altering the migratory corridor.

There are no known plans for further expansion of hydroelectric development in the RAA since the Approved Project was assessed.

10.8.2.5 Linear Features

The development and maintenance of linear features results can cause a direct change in habitat and reduce habitat function as it may result in an unnatural landscape break. Not all linear features have the same effect however. For example, highways may present landscape obstacles and persistent noise that affects caribou movement and/or increases mortality risk for caribou. Conversely, forestry roads and power lines may increase mortality risk due to increased hunting or predation, but those features tend to have much less traffic and associated noise. Increased access to caribou habitat through development, and access to caribou herds, can contribute to an increase in hunter efficiency and harvest rates (Boulanger et al. 2011).

There are no known additional planned linear features within the RAA since the Approved Project was assessed. A new single pole transmission line linking the Star Lake generating station to the Approved Project was previously assessed in the Valentine Gold EIS and has since been approved. The approved routing for the transmission line closely follows existing right of ways. The transmission line was released from the EA review process in June 2022 and included several mitigation measures to reduce

environmental effects on caribou. Residual effects of the proposed transmission line are not predicted to threaten the long-term persistence or viability of caribou (Stantec 2022).

10.8.2.6 Off-Road Vehicle Use

Off-road vehicle use can affect habitat directly, due to creation of trails, especially in wetland areas, and indirectly through sensory disturbance (e.g., noise). Caribou may avoid off-road vehicle trails or activity, and thus may affect habitat use and movement. Trails created by off-road vehicle trails may be used by predators and hunters. Off-road vehicle use is not expected to have changed substantially since the Approved Project was released.

10.8.3 Cumulative Effects on Change in Habitat

Change in habitat can result from a direct loss or alteration of habitat arising from vegetation clearing and development of infrastructure. An indirect loss or alteration of habitat could result from sensory disturbance (e.g., noise; human activity), dust emissions, and habitat fragmentation. Caribou react adversely to both natural (e.g., forest fire) and anthropogenic (e.g., industrial development) disturbances. Avoidance of disturbed areas that contain suitable habitat could cause a shift in caribou distribution to less suitable habitat. Caribou home-range size and the size of calving ranges have been found to increase with increasing disturbance (McCarthy et al. 2011; Beauchesne et al. 2014), possibly to compensate for a reduction in available suitable habitat. Avoidance of development could affect movement patterns and could result in increased energetic costs resulting from use of less efficient migration paths (Fullman et al. 2017; Wyckoff et al. 2018).

As described in Section 10.8.1 and 10.8.2, past and ongoing activities have affected the availability and quality of caribou habitat in the RAA. As noted in the Valentine Gold EIS, development of the Project Area will result in a change in habitat (loss or alteration) of 34.7 km^2 of habitat (including all land cover types and previously disturbed lands) within the RAA (41,641 km^2), which is a change of < 0.1% from existing conditions. The Project Expansion will cause an additional change in habitat of 0.034 km^2. As previously noted, an indirect change in habitat will extend beyond the Project Area, and the Approved Project will affect an existing migration corridor that may disproportionately affect important habitat for migrating Buchans herd caribou. While the Project Expansion is almost entirely within the Project Area that was assessed in the Valentine Gold EIS as being fully affected with respect to change in habitat, the addition of the Project Expansion will add several permanent infrastructure features (i.e., the Berry pit and waste rock pile) to the mine site that will remain following decommissioning, rehabilitation, and closure. As described in Section 11.5 of the Valentine Gold EIS, Approved Project-related light and noise emissions may result in caribou avoidance due to sensory disturbance. The addition of the Project Expansion will also create light and noise emissions and will alter the location of sources of light and noise within the mine site. The intensity of the combined emissions, however, is not expected to exceed that which was described in the Valentine Gold EIS. In addition, mitigation measures have been identified to reduce these potential effects. With respect to activities beyond the mine site, the Project Expansion will result only in a small increase in the volume of Project-related traffic on the access road (5-8%) and will not require additional modifications to the access road. Based on the Project Expansion activities and infrastructure as discussed above, the addition of the Project Expansion to the Approved Project is not

predicted to substantively change the predicted residual effects of the Approved Project on caribou habitat, and therefore the combined Project's contribution to cumulative effects is not substantively different than that which was assessed for the Approved Project.

With respect to the on-going and likely future activities that have been identified since the Approved Project was assessed, Table 10.13 demonstrates that mineral claim areas in the Buchans herd range, Grey River herd range, and RAA has not increased since assessment of the Approved Project. The Buchans Resources Limited Project was identified in the Valentine Gold EIS and has continued to progress, with ongoing exploration work being initiated in 2021. It is expected to have activities that are similar to the Approved Project and Project Expansion, with similar potential effects on caribou habitat. Although the project area for the Buchans Resources Limited Project overlaps with the ranges of the Buchans and Gaff Topsails herds, based on spatial extent its project effects on caribou are likely to be negligible, and therefore have a relatively small contribution to cumulative effects.

With respect to the Victoria River Quarry, Newcrete has been asked to provide an analysis of potential cumulative effects of their project on the Victoria River watershed, wildlife, and wildlife habitat in the area in consideration of existing and proposed mining activities, road and transmission line development, and other development near the proposed project area. Given the level of analysis required for that project, it is anticipated, if it is approved, that appropriate mitigation measures will be put in place such that the resulting contribution to cumulative effects with respect to a change in caribou habitat will be reduced. This proposed quarry does appear to overlap with the migration corridor for the Buchans herd, but it is within a low use area for both spring and fall migration based on the dBBMM model (see Section 10.8.4). If caribou avoid the Project Area, as they are predicted to do, the quarry could overlap with alternate migration paths for caribou.

Regarding newly planned forestry activities, mitigation measures specific to limiting adverse effects on caribou and marten are outlined in conditions of release from the EA process for the 2021 to 2025 five-year plan.

Marathon provided an estimate of the cumulative disturbance to habitat within the four caribou herd ranges in Appendix H of the Second Amendment to the Valentine Gold EIS (Marathon 2022; Table 1.8). In that estimate, Marathon assumed for mineral claim areas that 100% of each claim area would be affected by exploration or mining activities. Further review of these metrics was completed following the submission of Appendix H to reflect a more realistic estimate based on a review of developed mineral claims (Table 10.14). Based on a review of exploration and mining projects that had or were undergoing EA review, where approved, project developments have ranged from 13–32% of the total claim area, indicating that an assumed 100% development scenario is unlikely and overly conservative. Marathon updated estimates to assume that 32% of each mineral claim area is developed, which is still conservative on the basis that it represents the upper value in the range of existing developed claims and assumes that all mineral claims will have a future exploration or mining development on them. Overall, conclusions do not change in that Gaff Topsails remains as the only herd identified as being below the undisturbed habitat threshold of 65%. The other three herd ranges remain above the undisturbed habitat threshold, although Buchans has slightly more undisturbed habitat than previously estimated, and Grey River and La Poile have slightly less undisturbed habitat than previously estimated. Based on the

guidance provided in ECCC (2020), it may be reasonable to infer that the quantity of undisturbed habitat available for caribou for the Buchans, Grey River, and La Poile herds is sufficient (i.e., not limiting) to provide a measurable probability that these populations can be self-sustaining. The undisturbed habitat within the range of the Gaff Topsails herd is below the undisturbed habitat threshold of 65% (ECCC 2020), estimated at 60%. This estimate of 40% disturbed habitat within their range is likely an overestimation as the Gaff Topsails range overlaps with a large area of mineral claims, and the assumption that 32% of all claims is disturbed is conservative.

Table 10.14 Estimated Undisturbed Habitat in the Regional Assessment Area

Caribou Herd	Undisturbed Habitat (per Second Amendment to the EIS)	Undisturbed Habitat (updated post-submission of the Second Amendment to the EIS)
Gaff Topsails	40%	60%
Buchans	77%	81%
Grey River	85%	79%
La Poile	94%	87%

The calculation also determined that the Approved Project resulted in a negligible contribution to a change in habitat (less than 1% of the area of disturbance for each of the assessed herds). Given the small incremental increase in habitat disturbance associated with the addition of the Project Expansion, the combined Projects' contribution to the area of disturbance remains less than 1%. With the implementation of Approved Project and Project Expansion mitigation measures, and the assumed mitigation measures that would be required for other approved future projects, it is anticipated that the combined Project's contribution to cumulative environmental effects resulting from a change in habitat will not affect the long-term persistence or viability of the four assessed caribou herds within the RAA.[5] It is recognized, however, that effects associated with a change in habitat extend beyond the physical footprints, and that sensory disturbance related to the Approved Project and Project Expansion infrastructure and activities, as functional aspects provided by the habitat (e.g., as a migratory pathway), are also affected. A change in habitat because of the Approved Project and Project Expansion infrastructure, (i.e., presence of the Marathon open pit and waste rock pile which overlap preferred migration paths of the Buchans herd) are discussed in Section 10.8.4 in the context of cumulative effects on change in movement. Cumulative effects on change in habitat, which may indirectly lead to a change in mortality risk, are discussed in Section 10.8.5.

[5] The Approved Project and Project Expansion do not affect directly or indirectly (i.e., within the 500 m buffer defined in ECCC (2020)) affect habitat within the Gaff Topsails herd range and therefore does not contribute to further affecting the long-term persistence or viability of that herd. There is a small amount of overlap (0.4 km^2) of the Gaff Topsails herd with the existing access road during the winter, but no additional habitat change is predicted.

10.8.4 Cumulative Effects on Change in Movement

A change in movement may result from long-term sensory disturbance and the creation of physical barriers for caribou. Past and present projects and activities that contribute to cumulative effects on caribou movement in the RAA include mining, mineral exploration, hydroelectric developments, forestry, linear features, hunting, outfitting, trapping, and off-road vehicle use. While these activities likely contribute cumulatively to affect caribou movements within the RAA, they have limited potential to interact with caribou movement in proximity to the Approved Project and Project Expansion because of where those activities occur within the RAA. The Approved Project and Project Expansion are predicted to affect caribou movement through the development of infrastructure that overlaps the primary migration corridor for the Buchans heard, and through an increase in sensory disturbance from emissions (noise, light, dust, olfactory) near to the Approved Project and Project Expansion.

Maintaining the functionality of migration paths by preserving connectivity between seasonal ranges is vital to sustaining viable populations of migratory ungulates (Monteith et al. 2018). As acknowledged in the assessment of the Approved Project, the Marathon open pit and waste rock pile will be developed within the primary migration corridor for the Buchans herd, creating a permanent obstacle that migrating caribou will be forced to avoid. The results of the updated dBBMM indicate that some collared caribou migrate through and/or around the mine site along low-use pathways outside the primary pathway, including low-use pathways that will be directly affected by development of the Berry pit and Berry waste rock pile. These pathways were quantified in the dBBMM by the quartile in which the estimated utilization distribution for individual GPS collared caribou occurred, as either low (0-25%), low–moderate (26-50%), moderate–high (51-75%), or high (>76%). Although the entire Project Area was assumed to be affected by the development of the Approved Project, there may be residual effects on change in movement from the addition of the Project Expansion through the reduced availability of alternate routes through the Project Area (i.e., reduced permeability of the Project Area). Specifically, the areas where Berry pit and the Berry waste rock pile will be located were previously assessed as being cleared, and while that clearing could affect the use of movement pathways, use of those pathways was likely to remain feasible. The Berry pit and Berry waste rock pile will create physical impediments (i.e., change in topography as a barrier) to movement along those pathways, making the use of those pathways less likely. As caribou are generally expected to avoid the mine site during construction and operation, the potential residual effects on change in movement are more likely to occur during closure and continuing into post-closure. In addition to physical obstacles, there are site activities (including access road traffic) and associated sensory disturbances that will also affect caribou in proximity to the mine site. Direct interactions with Approved Project and Project Expansion features and activities, such as with access road or haul road traffic, could result in injury or mortality.

The magnitude and duration of sensory disturbance effects are expected to be reduced during migration with certain key mitigation measures. Specifically, during spring and fall migration, a suspension of the Approved Project activities at the Marathon pit and TMF, and/or a potential reduction of Project Expansion activities at the Berry pit (to be determined in consultation with NLDFFA-Wildlife Division, a reduction of access road traffic, delaying blasting activity when caribou are nearby, facilitating caribou

crossings across snowbanks or ditches, and aligning crossing points with existing migration paths. These mitigation measures will not however reduce the physical disruption to the existing migration path.

On-going and potential future mining / quarry projects within the RAA (e.g., Buchans Resources Limited Projects, and Victoria River Quarry) may affect caribou movement if those project sites overlap with the migration corridor and those subsequent projects cause caribou to change their movement patterns. However, while the activities of those projects are expected to have similar effects as the Approved Project and Project Expansion, the Buchans Resources Limited mining project does not appear to overlap a caribou migration corridor. The proposed Victoria River Quarry (located < 500 m from the mine site) does appear to overlap with the migration corridor for the Buchans herd, but it is within a low use area for both spring and fall migration based on the dBBMM model (see Section 10.8.4). If caribou avoid the Project Area, as they are predicted to do, the quarry could overlap with alternate migration paths for caribou. The EPR guidelines for the quarry project request justification for sourcing sand and gravel in a relatively remote region and to provide an analysis of alternate quarry locations and access routes to reduce potential effects on the Victoria River watershed and caribou migration routes. It is anticipated that future developments, and the Victoria River quarry in particular, will have mitigation measures in place to reduce project-related effects on caribou movement. This may include a reduction or suspension of activities at the quarry during migration periods. Additional forestry activity could also affect caribou movement, however, mitigation measures specific to limiting adverse effects on caribou and marten are outlined in conditions of release from the EA process for the 2021 to 2025 five-year plan.

Even with the implementation of mitigation measures for the Approved Project, and the assumed mitigation measures that would be used by other approved future projects, the Approved Project's contribution to cumulative environmental effects on caribou movement is high and could potentially affect the long-term persistence or viability of the Buchans herd, and potentially also affect the resident Grey River herd (although potential effects are low in magnitude and not expected to adversely affect the population size and trend of the Grey River herd). The Project Expansion will occur almost entirely within the Project Area, however, will result in an incremental increase in Project infrastructure within the mine site that will be permanent following decommissioning, rehabilitation, and closure (i.e., the Berry pit and waste rock pile). Given the significant residual effect predicted for the Approved Project for the Buchans herd, the addition of the Project Expansion will not change the significance determination for the combined Projects for a change in caribou movement.

10.8.5 Cumulative Effects on Change in Mortality Risk

Caribou mortality can occur through direct encounters with people or projects and activities (e.g., vehicle collisions) and indirectly from altered predator-prey dynamics and hunting pressure, particularly relating to the creation of linear features. The Approved Project and Project Expansion will contribute to cumulative effects where the combined Project components have the potential to interact with caribou directly (e.g., traffic, entrapment in open excavations), and indirectly where mortality risk, including for calves, is elevated through potentially altered predator-prey dynamics or increased hunting pressure. As indicated in Section 10.7.3, while unlikely, it is possible that caribou moving through the mine site could enter or fall into an open pit, resulting in injury or mortality, and the Project Expansion adds an additional pit to the landscape. The addition of the Project Expansion will also increase traffic on the access road by 5-8% in

comparison to the Approved Project alone. The increase in mine life associated with the combined Projects will extend the duration of operation-related traffic from 13 years to 14.4 years.

With the implementation of mitigation measures, change in mortality risk for caribou resulting from the Approved Project was predicted to be adverse. The magnitude of change in mortality risk was anticipated to be low in the construction and operation phases, and negligible to low during the decommissioning, rehabilitation, and closure phase for each assessed caribou herd. Effects of change in mortality risk was predicted to be greatest for the Buchans and Grey River herds as their ranges overlap the Project Area. However, all assessed caribou herds could experience an increase in mortality risk due to an increase in predation rates. These residual effects are not anticipated to change with the addition of the Project Expansion. Therefore, the contribution of the combined Projects to cumulative effects on change in mortality risk are also not anticipated to change from that predicted for the Approved Project alone.

Additional proposed mining and quarrying projects in the RAA (e.g., Buchans Resources Limited Project and Victoria River Quarry) are expected to have similar direct mortality effects on caribou as the Approved Project and Project Expansion. These effects will primarily be associated with site clearing and related activities during the construction phase of each project. Cumulative direct mortality risk to caribou within the RAA may also increase due to vehicle-caribou collisions related to mining activities or vehicle use of linear features (e.g., roads, highways, trails). The Buchans Resources Limited Project occurs within the range of the Gaff Topsails and Buchans herds. The proposed Victoria River Quarry overlaps with the Buchans and Grey River herds. Mitigation measures proposed by Marathon, including road safety measures to reduce the risk of collision, restricting public access to the Project Area, and banning hunting by employees, will reduce caribou mortality risk for the Approved Project and Project Expansion. It is anticipated that future mining and quarrying developments in the area will have similar mitigation measures.

Hunting in the RAA contributes to a cumulative direct mortality risk to caribou. However, as indicated in Section 10.8.2.3, hunting of caribou is regulated by NLDFFA – Wildlife Division and one of the CMAs overlapping the Project Area (CMA 63-Grey River) is closed to hunting. Regulated harvest levels are therefore assumed to be sustainable.

The contribution of forestry, linear features, and off-road vehicles and recreation to a cumulative mortality risk are expected to be low and consistent with that predicted in the Valentine Gold EIS as the level of these activities in the RAA haven’t changed substantively.

Approved Project and Project Expansion-related activities could result in increased mortality risk (Section 10.7.3), for which mitigation measures will be applied (Appendix 2E). It is predicted that when the mitigation measures associated with the future projects / activities are also applied, the contribution of those projects’ effects in combination with the Approved Project and Project Expansion’s cumulative effects on change in mortality risk will not affect the long-term persistence or viability of the assessed caribou herds within the RAA.

10.8.6 Cumulative Effects Management

As described in Section 10.4, Marathon developed a CPEEMP (Appendix 10B) during the approval process for the Approved Project; the CPEEMP will be updated to include the Project Expansion. The CPEEMP currently includes mitigation measures aimed at reducing the risk of adverse effects on caribou during the construction, operation, and decommissioning, rehabilitation, and closure phases of the Approved Project. It also describes the follow-up and monitoring activities that will be undertaken to verify effects predictions and effectiveness of mitigation measures made in the Valentine Gold EIS. These follow-up and mitigation measures will be reviewed for applicability to Project Expansion activities and will be updated or revised as applicable.

Once the CPEEMP is reviewed and updated to include the Project Expansion, mitigation measures in the CPPEEMP applicable to limiting cumulative environmental effects on caribou within the RAA include will include the following:

- Implementation of seasonal alterations and/or operational reductions in mining activity that are timed to coincide with the spring and fall caribou migration periods to reduce Approved Project and Project Expansion-effects on caribou at a time when migrating caribou are most likely to interact with the combined Projects. Changes or reductions in mining activity will also be informed by refinements made to noise modelling, to be completed during the permitting stage and in consultation with the NLDFFA – Wildlife Division
- Development and implementation of a Rehabilitation and Closure Plan that will be regularly updated to reflect changes in the overall mine plan
- Contribution of detailed annual caribou demographic information within the RAA that will be used by provincial regulators to manage caribou and support conservation initiatives

A complete list of proposed mitigation measures is provided in Section 5 of the CPEEMP, which will be updated to include the Project Expansion. Mitigation is presented in the context of a defined hierarchy of protection levels recognizing the variation of risk to caribou based on seasonal distribution and sensitivities and caribou proximity to the Project Area, as well as a potential range of caribou responses to combined Project features and activities.

Marathon is committed to long-term follow-up monitoring of mitigation effectiveness for combined Project effects on caribou. A detailed monitoring program is presented in Section 6 of the CPEEMP, which is overarching and encompasses various spatial and temporal scales to understand effects on caribou at the individual, group, and herd levels. In particular, the monitoring program focuses on potential changes in caribou habitat and behaviour for the Grey River and Buchans herds. The monitoring program defines measurable performance indicators with defined response thresholds, and describes monitoring techniques (e.g., collars, remote cameras, on-site monitoring, drones) and analytical approaches.

The CPEEMP was developed in consultation with NLDFFA – Wildlife Division and was subject to the Wildlife Division's approval in advance of implementation. The CPEEMP will be reviewed and refined regularly over the life of the combined Projects, incorporating information from follow-up and monitoring activities as the combined Projects advance, and ongoing review with regulators, scientific experts, Indigenous groups, and stakeholders.

The continued implementation of the CPEEMP will help to understand and manage Approved Project and Project Expansion effects and cumulative effects on caribou over their life.

10.8.7 Cumulative Effects Assessment Summary and Evaluation

Caribou within the RAA have been and will continue to be affected by environmental factors and anthropogenic disturbance. So far, caribou in the RAA have shown resilience during more than a century of development, and large areas of undisturbed habitat continue to persist and support caribou. The Approved Project and Project Expansion are predicted to cause a change in habitat, movement, and mortality risk for caribou, which could affect caribou recruitment and/or survival. Based on the assessment of residual Approved Project and Project Expansion effects in combination with other past/present/future projects as presented in the previous sections, cumulative effects on caribou are predicted to include:

- A change in habitat, including a direct loss of habitat arising from vegetation clearing and Project development, and an indirect loss or alteration of habitat resulting from sensory disturbance, dust emissions, and habitat fragmentation
- A change in movement resulting from sensory disturbance and the creation of physical obstacles
- A change in mortality risk resulting from direct encounters with people, infrastructure, and traffic, and indirectly due to potentially altered predator-prey dynamics and hunting pressure

The potential cumulative effects on caribou of past, present, ongoing, and reasonably foreseeable projects and activities, in combination with the residual effects of the Project Expansion and Approved Project, are summarized in Table 10.15. Overall, the assessment of combined cumulative residual effects from the Approved Project and Project Expansion on change in habitat, movement, and mortality risk do not change the conclusions as presented in the Valentine Gold EIS:

- Cumulative effects on change in habitat are characterized as adverse, low magnitude (a measurable change in area of caribou habitat that is unlikely to affect the long-term persistence or viability of the four assessed caribou herds within the cumulative effects RAA), regional (within the cumulative effects RAA), short to long-term, continuous, irreversible (direct change in habitat) and reversible (indirect change in habitat), and occurring in both disturbed and undisturbed environments in the cumulative effects RAA.

Table 10.15 Summary of Potential Cumulative Effects for Caribou

Residual Cumulative Effect[A]	Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Ecological and Socio-economic Context
	A	L	RAA	LT	IR/C	R	R/D
Contribution from the Project Expansion and Approved Project to the Residual Cumulative Effect[A]	Combined Project-related contributions to cumulative effects on change in habitat will be low, with less than 0.2% change from existing conditions within the cumulative effects RAA. Combined Project-related contributions to cumulative effects on change in movement have the potential to disrupt the preferred migration path of the Buchans herd. The magnitude of change in movement is high for this herd, as the Approved Project and Project Expansion has the potential to affect greater than 50% of caribou migrating through this corridor (based on more than 50% of collared caribou known to be using the corridor and of relatively large counts of caribou from cameras placed in the corridor). Combined Project-related contributions to cumulative effects mortality risk will be primarily confined to the construction and development phase although traffic-related collisions and increased predation / harvesting will occur in all combined Project phases. Effects are anticipated to be low in magnitude and may affect individual animals with no substantial change in long-term persistence or viability of the four assessed caribou herds within the cumulative effects RAA.						
Significance[B]	Cumulative effects resulting from the Approved Project and Project Expansion and reasonably foreseeable future activities are predicted to be high in magnitude. While a comparatively small amount of caribou habitat will be lost by the combined Projects, suitable habitat remains abundant and widespread throughout the cumulative effects RAA. The movement of the Buchans herd will likely be affected because of the overlap of the combined Projects with a migration corridor and the primary and lower use migration paths within it. The combined Projects may contribute to a small change in caribou mortality risk; however, it is not anticipated to affect the viability of caribou in the RAA. Future activities combined with potential combined Project effects, specifically changes in movement, may measurably affect the abundance or sustainability of caribou (i.e., the Buchans herd) in the cumulative effects RAA. With mitigation, the cumulative effects from the combined Projects and reasonably foreseeable future activities are expected to be significant. The prediction confidence in the final determination of significance is considered low to moderate. There is uncertainty in how the movement of the Buchans herd will be affected by the combined Projects, and from other future projects, as well as the effectiveness of the mitigation measures to reduce effects on change in movement. This level of confidence is based on: the quantity and quality of data available, the conservative approach taken in the assessment (Section 11.3.5.1 of the Valentine Gold EIS), professional judgement and experience with similar projects, and the effectiveness of mitigation measures that reflect industry best practices.						

Notes:
[A] Descriptors are provided in Table 10.9
[B] Significance definitions are provided in Section 10.6.1.2.

- Cumulative effects on movement are characterized as having a high magnitude (defined as a change of more than 50% of the proportion of caribou use in the migration corridor) effect on the Buchans herd and a low magnitude effect on the Gaff Topsails, La Poile, and Grey River herds. The effect is predicted to be adverse, regional (within the cumulative effects RAA), short to long-term, continuous, irreversible (developed areas will not be rehabilitated to existing conditions) and reversible (e.g., sensory disturbance), and occurring in both disturbed and undisturbed environments in the cumulative effects RAA.
- Cumulative effects on mortality risk are characterized as adverse, low magnitude (a measurable change in mortality risk that is unlikely to affect the long-term persistence or viability of the four assessed caribou herds within the cumulative effects RAA), regional (within the cumulative effects RAA), long-term, irregular event, reversible, and occurring in both disturbed and undisturbed environments in the cumulative effects RAA.

With mitigation, cumulative effects on caribou from the Approved Project in combination with the Project Expansion, and reasonably foreseeable future activities, are expected to be significant.

10.9 FOLLOW-UP AND MONITORING

Marathon is committed to long-term follow-up monitoring of the effectiveness of mitigation measures and Approved Project and Project Expansion effects on caribou. Mitigation measures and follow-up monitoring for caribou are described in detail in the CPEEMP (Appendix 10B).

The current CPEEMP is designed to help understand and manage predicted Approved Project effects through long-term monitoring activities. The CPEEMP considers both direct and indirect Approved Project effects, and potential cumulative effects on caribou. The CPEEMP presents thresholds and adaptive management actions to be further developed in consultation with NLDFFA – Wildlife Division, with the goal of avoiding or reducing adverse effects on caribou and its habitat. The CPEEMP is updated regularly, based on conditions of authorization (EA release and permitting); collection of baseline data prior to construction; ongoing review with regulators, scientific experts, Indigenous groups, and stakeholders; and information from follow-up and monitoring activities as the Approved Project advances.

In consultation with NLDFFA – Wildlife Division, the CPEEMP will be reviewed and revised as needed to address planned Project Expansion activities, including triggers for reduction or suspension of Approved Project and/or Project Expansion activities. As such, no additional follow-up and monitoring measures are proposed at the current time for the Project Expansion.

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11.0 OTHER TERRESTRIAL COMPONENTS

This chapter, Other Terrestrial Components, considers terrestrial components that were assessed as Valued Components (VCs) in the Valentine Gold Environmental Impact Statement (EIS) (Marathon 2020), and the potential for the Berry Pit Expansion (Project Expansion) to change the residual effects predictions made in the Valentine Gold EIS for the Valentine Gold Project (Approved Project). The terrestrial components occurring or that have the potential to be affected by the Project Expansion include:

- Vegetation, Wetlands, Terrain and Soils
- Avifauna
- Other Wildlife (i.e., large mammals, small mammals and furbearers)

Species at Risk (SAR) and Species of Conservation Concern (SOCC) are also addressed in applicable sections, with the exception of woodland caribou (*Rangifer tarandus caribou*) that are discussed separately in Chapter 10. SAR are defined as those species listed as Extirpated, Endangered, Threatened, or Special Concern by the federal *Species at Risk Act* (SARA), the Newfoundland and Labrador (NL) *Endangered Species Act* (NL ESA), or by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). SOCC are defined as species that, while not listed or protected by legislation, are considered rare in NL, or whose populations may not be considered sustainable. SOCC are here defined to include species that are not SAR, yet are ranked S1 (critically imperiled), S2 (imperiled), or combinations thereof (e.g., S1S2) upon review by the Atlantic Canada Conservation Data Centre (AC CDC) (AC CDC 2023).

These terrestrial components are important as they may provide ecological, cultural, recreational, aesthetic and economic value to various stakeholders and Indigenous groups. Changes to vegetation, wetlands and soils, and avifauna and other wildlife may result from the construction, operation, and decommissioning, rehabilitation and closure of the Project Expansion.

This chapter first provides a summary of the existing conditions (Section 11.1) as originally presented in the Valentine Gold EIS for the relevant assessment areas (i.e., Project Area, Local Assessment Area [LAAs] and Regional Assessment Areas [RAAs]) (Figure 11-1) for the three terrestrial components identified above. As indicated in Chapter 5, the Project Area, LAA and RAA used to describe existing conditions and assess potential effects for the Approved Project are also considered applicable and valid for the Project Expansion.

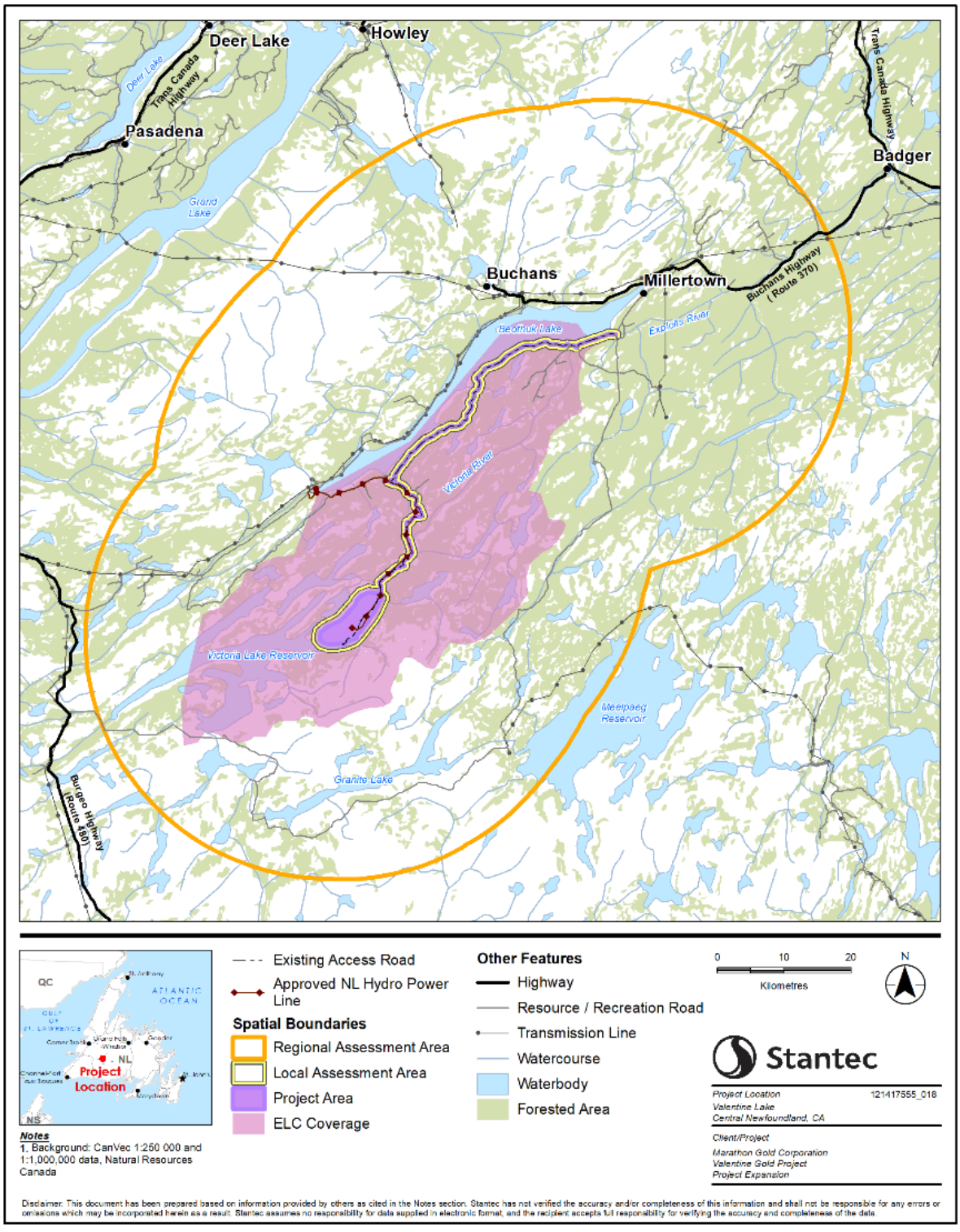

Figure 11-1 Project Area, LAA, RAA and ELC Boundaries for Other Terrestrial Components

Since the submission of the Valentine Gold EIS, Marathon Gold Corporation (Marathon) has completed additional surveys, both dedicated and incidental, in the planned area of the Project Expansion. A summary of that work is presented in Section 11.2, along with updated, publicly available data on existing conditions. While construction of the Approved Project was initiated in October 2022, reference to existing conditions in this Environmental Registration / Environmental Assessment (EA) Update refers to pre-construction conditions (refer to Section 5.2.1). This approach has been taken for several reasons:

- The additional surveys that have been conducted and the updated publicly available data reflect pre-construction conditions
- The conservative assessment approach is to assume that the potential effects of Project Expansion and the potential effects of the Project Expansion in combination with the Approved Project are in consideration of an existing environment undisturbed by construction activities
- Existing conditions within the Project Area and the mine site in particular are changing continually as construction of the Approved Project advances (as was anticipated in the Valentine Gold EIS); therefore, existing conditions reflective of construction activities would be constantly shifting and challenging to characterize in a meaningful way for assessment purposes

Following the existing environment update, this chapter presents a summary of the effects assessments completed in the Valentine Gold EIS (Section 11.3). The Valentine Gold EIS was prepared using a conservative approach and assumed that 100% of the habitat within the mine site would be lost as a result of mine development and activities. This approach allows for refinements to the site layout, as these typically occur through detailed Project design and planning. The Project Expansion will occur largely within the boundary of the Project Area that was assessed for the Approved Project. The area of additional ground disturbance required for Project Expansion infrastructure located outside of the Project Area (i.e., associated with the three sedimentation ponds) is 3.4 ha and represents an increase of 0.1% relative to the Project Area previously assessed for the Approved Project (3497 ha). As such, the assessments of the VCs (Vegetation, Wetlands, Terrain and Soils; Avifauna; and Other Wildlife) in the Valentine Gold EIS are applicable to the Project Expansion. This is further described in Section 11.4.

11.1 SUMMARY OF EXISTING ENVIRONMENT FROM THE APPROVED PROJECT

The following is a summary of the existing terrestrial ecological conditions as described in the Valentine Gold EIS and as obtained from background information and field studies collected from 2011 to 2019. These studies were appended to the Valentine Gold EIS as part of Baseline Study Appendix 7: Avifauna, Other Wildlife and Their Habitats (BSA.7). Information on how to access this BSA online is provided in Table 1.8.

11.1.1 Vegetation, Wetlands, Terrain and Soils

11.1.1.1 Vegetation

The Approved Project is located within the Central Newfoundland Forest Ecoregion (NLDFLR 2019a). The Project Area and LAA are also entirely within the Red Indian Lake Subregion. This subregion is

dominated by balsam fir (*Abies balsamea*), paper birch (*Betula papyrifera*), and black spruce *(Picea mariana*). Some rich, somewhat productive soils are present in this subregion, although these can succeed to alder (*Alnus* spp.) thickets following disturbances such as logging and fire (NLDFLR 2019b). The RAA for the Approved Project extends into the Long Range Barrens Ecoregion to the north and the Maritime Barrens Ecoregion to the south (NLDFLR 2019a) (Figure 11-1).

Information on vascular plants that exist within the Project Area and surrounding area was obtained through multiple sources, including an AC CDC data request for the area, and field surveys conducted in support of the Approved Project from 2014 to 2019 (Stantec 2015, 2017, 2019). The Ecological Land Classification (ELC) study identified 14 ecotypes in the 1,830.6 km^2 ELC Area (ELCA) (Figure 11-1). In the ELC, balsam fir forest, black spruce forest, *Kalmia*-black spruce woodland (*Kalmia*-black spruce forest and *Kalmia* heath), mixedwood forest, regenerating forest, and alder thicket were considered forested ecosystem units. Riparian thicket was listed as a riparian ecosystem unit, and wet coniferous forest, shrub / graminoid fen and shrub bog were classified as wetland ecosystem units. The remaining ecosystem units (exposed sand / gravel shoreline, open water, and anthropogenic) were grouped as 'sparsely vegetated, naturally non-vegetated and anthropogenically altered / disturbed' ecosystem units. The four most prevalent ecotypes in the Project Area, which in total account for 61% of the Project Area, are (in decreasing order) balsam fir forest, mixedwood forest, open wetlands (shrub/graminoid fen and shrub bog), and black spruce forest.

Through vegetation work conducted in support of the ELC in 2014 and 2015, and two vegetation field surveys conducted between 2017 and 2019, 290 vascular plant species were observed in the Project Area and adjacent portions of the LAA. While no vascular plant SAR were observed during the surveys conducted in support of the Valentine Gold EIS, the following vascular plant SOCC (based on rankings as of 2022 [AC CDC 2022]) were observed:

- Short-scale sedge (*Carex deweyana*, S2)
- Nodding water nymph (*Najas flexilis*, S2)
- Perennial bentgrass (*Agrostis perennans*, S2)

Short-scale sedge was observed within a balsam fir forest and *Kalmia*-black spruce forest ecotypes, and perennial bentgrass was observed on the rocky bank of a stream; both were observed within the surrounding LAA, outside of the Project Area. Nodding water nymph was observed within a pond overlapped by the planned footprint of the Marathon pit.

Of the species recorded during work completed in support of the Valentine Gold EIS, 38 were determined to be exotic, or not native to the Island of Newfoundland; these were mainly ruderal species, typically found along roadsides or in other disturbed habitats, that are not considered invasive. Although there is no official list of invasive species for NL, four species identified through field surveys to occur in the Project Area have the potential to be invasive, based on their growth form and status in other parts of the Atlantic Provinces:

- Reed canary grass (*Phalaris arundinacea*)
- Creeping buttercup (*Ranunculus repens*)

- Coltsfoot (*Tussilago farfara*)
- Broad-leaved cattail (*Typha latifolia*)

11.1.1.2 Wetlands

The Red Indian Lake Subregion consists of rolling hills, dense forest and organic deposits occurring in valleys and basins. Terrain (i.e., topography and landforms) varies across the LAA, ranging from boggy areas with thin to thick till layers, to bedrock outcrops. Soils across the LAA are complexes of organic and mineral soils reflecting the underlying topography. Elevation in the Project Area ranges from 160 m above sea level (m asl) to 437 m asl. The landscape is characterized by upland forests and interspersed lowlands (i.e., wetlands and peatlands, and treed wetlands) and open water habitats. Scattered wetlands (specifically patterned fens and bogs) are common in the LAA and Project Area; these occupy 280.3 km^2 (15.3%) of the ELCA. Based on the descriptions of ecotypes in the ELCA and the nationally accepted definition of wetlands (National Wetlands Working Group 1997), the majority of alder thicket and of riparian thicket is likely wetlands. Wetlands are also present within black spruce forest and likely other forest types, although typically in localized areas that are difficult to differentiate using remote sensing. Therefore, the percentage of wetland within the Project Area and LAA is likely over 30%, rather than 22.4% as indicated by the results of the ELC.

11.1.1.3 Terrain and Soils

Soils across the LAA are complexes of organic and mineral soils reflecting the underlying topography. Elevation in the Project Area ranges from 160 m above sea level (m asl) to 437 m asl. In the LAA and the Project Area, morainal deposits, or till, is the most commonly mapped parent material, covering approximately 70% of the LAA and approximately 67% of the Project Area. Organic deposits were mapped as the dominant parent material for 13% of the LAA and 20% of the Project Area. Bedrock was mapped intermittently throughout the LAA and was primarily associated with hummocks and upper elevation ridge areas. Other less frequently mapped deposits include colluvial, fluvial, glaciofluvial, lacustrine, and anthropogenic deposits, along with bedrock and weathered bedrock.

Based on a review of the site topography and geological conditions (overburden and bedrock) for the Project Area, the potential for issues related to terrain stability is low. Slow mass movement (i.e., soil creep) was noted as the most common geomorphological process; however, areas with this process were not identified in spatial data. There are no recorded cases of landslides in the Project Area (NLDNR 2020), and there is no evidence of landslide deposits in the Project Area based on spatial and field data (Stantec 2015). Subsidence related terrain stability concerns are also considered low for the Project Area, based on the low seismic hazard risk and the absence of subsidence-prone overburden soil types. Upland or mineral soils and organic / wetland soils are common through the LAA and Project Area, representing the varied topography of the underlying bedrock, depth of surficial materials, and drainage conditions.

The Valentine Gold EIS (Marathon 2020) provides a description of soils in the Project Area in terms of conditions that can affect vegetation growth, including soil suitability for rehabilitation, soil quality, and soil quantity. Methods for describing each of these are presented in Section 9.2.1.5 of the Valentine Gold EIS.

In general, the majority of the Project Area consists of upland forested ecosystem soils, with variable ratings from Poor to Fair rehabilitation soil suitability ratings (i.e., shallow soils associated with bedrock) to Fair to Good for thick soils located along valley bottoms with minimal coarse fragments, medium textures, and productive soil chemistry conditions (Marathon 2020).

11.1.2 Avifauna

The Central Newfoundland Forest Ecoregion includes a variety of avifauna species commonly found in boreal forests on the Island of Newfoundland. Broadly, the avifauna groups present in this Ecoregion and the Project Area include passerines, waterfowl, upland gamebirds, and raptors. As noted in the Valentine Gold EIS (Chapter 10), a total of 98 species of birds were identified as having the potential to occur in or near the LAA. During avifauna field programs in 2011 and 2019, the most commonly recorded species were forest-dwelling passerines such as white-throated sparrow (*Zonotrichia albicollis*), ruby-crowned kinglet (*Corthylio calendula*), Swainson's thrush (*Catharus ustulatus*), boreal chickadee (*Poecile hudsonicus*), black-capped chickadee (*Poecile* atricapillus), Canada jay (*Perisoreus canadensis*), black-and-white warbler (*Motacilla varia*), and yellow-bellied flycatcher (*Empidonax flaviventris*). Three raptor species were identified in the Approved Project Area during the breeding season: bald eagle (*Haliaeetus leucocephalus*), northern harrier (*Circus hudsonius*), and osprey (*Pandion haliaetus*). Three SAR (olive-sided flycatcher [*Contopus cooperi*], common nighthawk [*Chordeiles minor*] and rusty blackbird [*Euphagus carolinus*]) and three SOCC (Caspian tern [*Hydroprogne caspia*], bay-breasted warbler [*Setophaga castanea*], and Nashville warbler [*Leiothlypis ruficapilla*]) were also observed in or near the LAA.

In general, waterfowl were common in wetland and open water habitats in the LAA during spring breeding and fall staging periods. Canada goose (*Branta canadensis*), American black duck (*Anas rubripes*), and ring-necked duck (*Aythya collaris*) were common in the wetlands, while common loon (*Gavia immer*) commonly occurred on the lakes. Other species, including green-winged teal (*Anas carolinensis*) and common merganser (*Mergus merganser*), were observed in the RAA. A Sensitive Wildlife Area along the Victoria River was identified as containing important waterfowl habitat (NL-EHJV 2008). While this area overlaps with the Project Area and LAA, the waterfowl habitat that was likely the focus of this designation are the "steadies" on the Victoria River system located north of the mine site, before the river drains into Beothuk Lake (B. Adams, pers. comm, 2020).

Seven species of overwintering birds, including three upland gamebird species (ruffed grouse [*Bonasa umbellus*], spruce grouse [*Canachites canadensis*], and willow ptarmigan [*Lagopus lagopus*]), are also known to occur in the Project Area.

Avifauna species assessed as part of the Valentine Gold EIS include passerines (key species: Lincoln's sparrow [*Melospiza lincolnii*] and yellow-bellied flycatcher), waterfowl (key species: Canada goose and American black duck), upland game birds (spruce grouse and ruffed grouse), and SAR/SOCC (key species: olive-sided flycatcher and rusty blackbird). Other SAR/SOCC not assessed as key species in the Valentine Gold EIS, yet noted as being potentially within the LAA by other data sources (e.g., Breeding Bird Surveys [BBSs], Christmas Bird Counts or the AC CDC) were gray-cheeked thrush (*Catharus minimus*), red crossbill (*Loxia curvirostra*), evening grosbeak *(Hesperiphona vespertina*), and bank

swallow (*Riparia riparia*). While not identified as key species, the loss / alteration of habitats associated with these SAR/SOCC was assessed in the Valentine Gold EIS.

11.1.3 Other Wildlife

Mammal species confirmed in the Project Area through baseline studies from 2011 to 2019 include moose (*Alces alces*), black bear (*Ursus americanus hamiltoni*), Canada lynx (*Lynx canadensis subsolanus*), coyote (*Canis latrans*), red fox (*Vulpes vulpes deletrix*), American marten (Newfoundland population *Martes americana atrata*; hereafter "Newfoundland marten"), muskrat (*Ondatra zibethicus obscurus*), river otter (*Lontra canadensis degener*), southern red-backed vole (*Myodes gapperi*), meadow vole (*Microtus pennsylvanicus terranovae*), snowshoe hare (*Lepus americanus*), and American red squirrel (*Tamiasciurus hudsonicus*). As described in the Valentine Gold EIS, American mink (*Neogale vison*), ermine (*Mustela erminea*), northern myotis (*Myotis septentrionalis*), and little brown myotis (*Myotis lucifugus*) were also expected to occur in the vicinity of the Approved Project. The two species of myotis (bats) have since been confirmed in the Project Area (refer to Section 11.2.3). While woodland caribou also occur in the Project Area, caribou was assessed as a separate VC in the Valentine Gold EIS and are discussed in Chapter 10 of this Environmental Registration / EA Update.

Of the mammal species confirmed or suspected in the Project Area, Newfoundland marten, northern myotis, and little brown myotis are listed under the federal SARA and/or the NL ESA. Winter track surveys conducted in 2013 identified Newfoundland marten tracks in the Project Area and genetic analysis of hair samples collected in the Project Area in 2013 and 2018 confirmed the presence of one and five individuals, respectively. While neither species of myotis was detected during baseline studies for the Approved Project, both were presumed to occur based on presence of suitable roosting habitat (e.g., balsam fir forest, black spruce forest, mixedwood forest) and the proximity of a confirmed bat hibernation site approximately 12 km from the Project Area. An updated status for Newfoundland marten, northern myotis, and little brown myotis is provided in Section 11.2.3.

11.2 EXISTING ENVIRONMENT UPDATE

The following sections provide an update to the terrestrial existing environment based on surveys completed since the Valentine Gold EIS was submitted and newly available public information. Surveys and reports completed since submission of the Valentine Gold EIS (by year) are listed and described below. These surveys and reports are available on request. No changes to terrain or soils are known or documented since the Valentine Gold EIS was submitted.

<u>2021 Surveys and Reports</u>

- Valentine Gold Project: 2021 Vegetation Study. Final Report – Vegetation survey of the planned access road upgrades and nodding water nymph transplantation trials: Year 1.
- Valentine Gold Project: 2021 Bat Baseline Survey. Final Report – Deployment of Autonomous Recording Units (ARUs) to passively monitor for bats.

- Valentine Gold Project: 2021 Avifauna Baseline Study. Final Report – Breeding bird point-count surveys, passive acoustic monitoring via ARUs and a reconnaissance survey for olive-sided flycatcher.
- Relevant updated listings under the NL ESA.

2022 Surveys and Reports

- Nodding Water Nymph Transplantation Program: Year 2, Technical Data Report. Draft Report.
- Berry Pit Expansion: Vascular Plant Survey – Technical Data Report. Draft Report.
- Valentine Gold Project: 2022 Bat Baseline Survey. Draft Report. – Deployment of ARUs to passively monitor for bats.
- COSEWIC Assessment and Status Report on the American Marten (Newfoundland population) *Martes americana atrata* in Canada. May 2022.
- Berry Pit Expansion: 2022 Avifauna Survey. Draft Report – Breeding bird point-count and ARU survey.
- Relevant updated listings under the NL ESA.

11.2.1 Vegetation, Wetlands, Terrain and Soils

In addition to the field studies conducted in support of the Valentine Gold EIS, supplemental rare plant surveys were performed in 2021 and 2022. The 2021 survey was a follow-up survey to the EIS and focused on the planned access road upgrades. During these surveys, 297 vascular plant species were recorded, which included 81 species not previously recorded during past surveys, two of which are SOCC: slender spike-rush (*Eleocharis nitida*, S1), and Host's sedge (*Carex hostiana*, S2). Slender spike-rush was observed in a wet ditch adjacent to the site access road, and Host's sedge was observed in a wetland classified as a shrub fen / shrub bog ecotype. In total, the following five SOCC have been found in the Project Area:

- Slender spike-rush (S1)
- Host's sedge (S2)
- Nodding water nymph (S2)
- Perennial bentgrass (S2)
- Short-scale sedge (S2)

The only recorded population of nodding water nymph in the surveyed areas was within the footprint of planned Approved Project components. In response to an information requirement from the NL Department of Fisheries, Forestry and Agriculture (NLDFFA), a transplantation plan was developed for nodding water nymph. A transplantation trial program for nodding water nymph was developed and implemented in 2021, which evaluated the conditions within the pond where the nodding water nymph was located, and identified accessible potential receptor sites that best matched the conditions of the source pond. Small amounts of nodding water nymph were transplanted in late August 2021 (Stantec 2021a). Surveys conducted in 2022 verified the success of the trial transplantation conducted in 2021, and nodding water nymph plants were transplanted throughout accessible areas of the receptor site in late August 2022 (Stantec 2022a).

During vegetation surveys conducted in 2022 in support of the Project Expansion, 222 vascular plant species were recorded (Stantec 2022b), including 14 species not previously recorded during surveys within the Project Area. Surveys covered approximately 37 linear km and traversed through each of the 11 ELC ecosystem units present within the Project Expansion footprint. No vascular plant SAR or SOCC (i.e., ranked S1-S2 by the AC CDC [2022]) were recorded during the 2022 survey. Nine of the species recorded in the Project Expansion area are currently ranked S3 (Vulnerable) by the AC CDC on the Island of Newfoundland (Table 11.1), however are not considered Vulnerable by the NLDFFA. Field surveyors noted these species as uncommon for the area and, to be thorough, these species are included herein.

Table 11.1 AC CDC S3 (Vulnerable) Ranked Vascular Plant Species Observed within the Project Expansion Area

Scientific Name	Common Name
Carex scoparia	pointed broom sedge
Eriophorum russeolum	russet cotton-grass
Hypopitys monotropa	American pinesap
Poa pratensis	Kentucky bluegrass
Rhinanthus minor	little yellow-rattle
Schizachne purpurascens	purple oat
Schoenoplectus subterminalis	water bulrush
Solidago brendae	Brenda's goldenrod
Utricularia geminiscapa	twin-stemmed bladderwort

No additional studies, desktop or field based, were completed specific to terrain and soils for the Project Expansion. The existing environment described for the Project Area in the Valentine Gold EIS is applicable and relevant to the Project Expansion as well.

11.2.2 Avifauna

Additional avifauna field surveys were completed in 2021 (Stantec 2021b) and 2022 (Stantec 2022c). The 2021 surveys expanded on previous efforts (i.e., 2011 and 2019), both spatially and temporally, and included: pre-survey planning and an initial site reconnaissance (primarily for olive-sided flycatcher) to determine the distribution and preferred locations of survey sites; breeding bird point-count surveys; and the deployment of ARUs for longer term monitoring within the survey area (Figure 11-2).

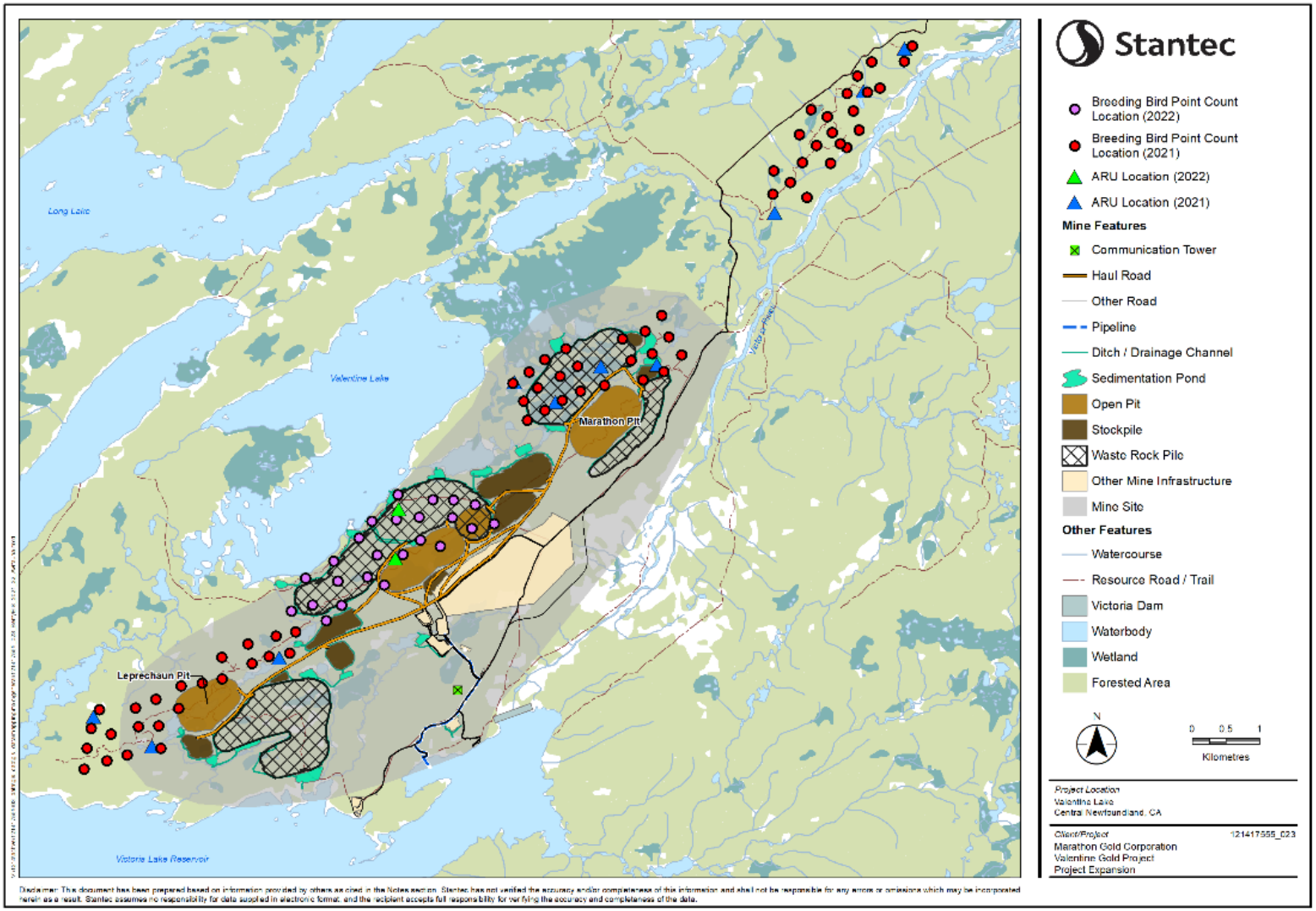

Figure 11-2 2021 and 2022 Avifauna Survey Locations

Breeding bird point-count surveys in 2021 were conducted in early June and again in late June near the Marathon pit, Leprechaun pit, and in a control area approximately 5 km northeast of the Marathon waste rock pile. A total of 38 species were detected during 68 point-counts, including one previously documented SAR (olive-sided flycatcher) and one previously documented SOCC (Nashville warbler). Olive-sided flycatchers were detected in the same areas as they had been in 2011 and/or 2019, near the Leprechaun and Marathon deposits and in the control area. No new occurrences of this species were found despite search efforts in other accessible areas. An additional eight species were observed incidentally (e.g., in transit to a point-count), including one previously documented SAR (rusty blackbird). The most abundant species observed across the point-counts were white-throated sparrow and ruby-crowned kinglet.

Ten ARUs were deployed in 2021 from early June to late June / early July (Figure 11-2). The ARUs detected a total of 29 species of avifauna. The list of species included three species that were not detected during the 2021 point-count surveys nor incidentally, however were previously detected in surveys conducted in 2011 and/or 2019: hairy woodpecker (Leuconotopicus villosus); northern goshawk (Accipiter gentilis); and swamp sparrow (Melospiza georgiana). One species, orange-crowned warbler (Leiothlypis celata), was detected that had not been previously documented in the area during avifauna or other baseline investigations. Orange-crowned warbler was detected by three ARUs, all located in the control area. The most abundant songs recorded across the ARUs were of white-throated sparrow, yellow-bellied flycatcher, and magnolia warbler (Setophaga magnolia).

Efforts in 2022 were focused entirely in the Project Expansion footprint, as the 2021 avifauna survey had not overlapped with that area (Figure 11-2). Twenty-two point-counts were performed in June 2022, all within the area of the Project Expansion. Consistent with previous findings, the most abundant species observed included white-throated sparrow, dark-eyed junco (*Junco hyemalis*), and ruby-crowned kinglet. Winter wren (*Troglodytes hiemalis*) and Tennessee warbler (*Leiothlypis peregrina*) were recorded during the point-count survey, which was the first documented detection of these species in the LAA during baseline investigations.

Red crossbill was also documented for the first time in the LAA during the point-count surveys in 2022. The *percna* / Type 8 subspecies of red crossbill, one of ten recognized forms in North America, is listed as Threatened under SARA (COSEWIC 2016) and was recently reassessed and downlisted from Endangered to Threatened under the NL ESA (NLDFFA 2022). The presence of the *percna* subspecies was confirmed on the Avalon and in eastern, western and central Newfoundland during 2005-2011 investigations (COSEWIC 2016). However, other subspecies may also occur on the Island of Newfoundland and a combination of morphometric (e.g., large bill size) and bioacoustic data are required to definitively identify *percna* individuals (COSEWIC 2016). As indicated in the Valentine Gold EIS, there is one prior record of red crossbill (subspecies unreported) relatively close to the Approved Project, in Buchans, NL, when a single individual was heard signing along BBS route NL 5704 in 1984. Red crossbills are known to change their location based on cone availability and the 2006 recovery document describes the key habitat feature for this species as “a mosaic of conifer seed availability” (Environment Canada 2006). Being a large-billed crossbill, the *percna* subspecies is considered a pine forest associate, with red pine (*Pinus resinosa*) and white pine (*Pinus strobus*) likely important habitat features (COSEWIC

2016). The 2016 status report indicates that the *percna* subspecies is “reliably detected” annually in red pine stands in eastern, western and central Newfoundland, as well in backyard feeders on the Avalon Peninsula and eastern Newfoundland (COSEWIC 2016). Given the relative rarity of native pine stands on the Island of Newfoundland, other habitats that may be important to *percna* include mature black spruce, balsam fir, and white spruce (*Picea glauca*) forests (COSEWIC 2016).

To complement point-count surveys, ARUs were deployed at two locations in the footprint of the Project Expansion in 2022 (Figure 11-2). ARUs recorded data from late June to late July, corresponding with peak breeding season for birds in the region. A total of 33 species were detected and identified through the analysis of ARU recordings, including white-winged crossbill (*Loxia leucoptera*), which had not been detected during point-count surveys however was previously detected during earlier baseline investigations. Of the 33 species detected, one SAR (olive-sided flycatcher) was identified. The ARU detections of singing olive-sided flycatcher confirm the habitat use of this species in the area of the Project Expansion. Song-type vocalizations are infrequent in tyrant flycatchers unless an individual is presently occupying a breeding territory, which indicates that this habitat is within the breeding territory of this SAR.

There were also several avifauna species that were only observed incidentally in 2022 (i.e., during non-avian studies) however are included as observations in the area. These include Wilson’s snipe (*Gallinago delicata*), spruce grouse, gray-cheeked thrush, and northern goshawk. The Newfoundland gray-cheeked thrush is currently listed as Threatened by the NL ESA. Gray-cheeked thrush was observed in late July 2022 and represents the first detection of this species in the LAA during any of the baseline surveys. As indicated in the Valentine Gold EIS, this species has also been observed along BBS route NL 5704 in Buchans, with the most recent record in 2002. Breeding habitat for gray-cheeked thrush has been identified as dense low thickets including willow (*Salix* spp.) and alder thickets, young regenerating coniferous forest, dense coniferous scrub, coastal elfin and, in western Newfoundland, old growth balsam fir forests (SSAC 2010).

11.2.3 Other Wildlife

Relevant supplemental baseline studies in support of the Valentine Gold EIS included a 2021 and 2022 bat survey, whereby ARUs were deployed in the LAA to passively monitor for bats (passive echolocation survey) between late June and early October (i.e., during summer roosting and fall migration / swarming periods). In addition, since submission of the Valentine Gold EIS, the status of myotis species in NL and of Newfoundland marten has been reassessed under the NL ESA and by the COSEWIC, respectively. Information from the bat baseline surveys and status updates for myotis and Newfoundland marten are summarized below.

11.2.3.1 Bats

Northern myotis and little brown myotis were emergency listed as Endangered under the federal SARA in 2014 (Environment Canada 2015) due to dramatic declines across much of their range as a result of white-nose syndrome (WNS). In 2021, following the confirmation of WNS in NL in 2017, both species were listed as Endangered under the NL ESA, making it, “illegal to disturb, harass, injure, or capture bats,

or to disturb or destroy their residences, including overwintering sites (hibernacula) and roost sites, such as maternal colonies" (NLDFFA 2021). Critical habitat for little brown myotis and northern myotis has been partially defined (to date) as any location where these species hibernated (at least once since 1995), and includes sites where swarming has been observed near suitable potential habitat, regardless of whether hibernation was verified (Environment Canada 2015). In the 2015 recovery strategy (Environment Canada 2015), the only critical habitat identified in NL was a single 50 km x 50 km grid square covering the eastern and western portion of White Bay on the Island of Newfoundland. However, as indicated in the Valentine Gold EIS, there is one known hibernaculum in the RAA, located approximately 12 km from the Project Area. This site has tested positive for WNS.

Both the northern myotis and little brown myotis were confirmed in the Project Area, based on manual verification of echolocation calls collected by ARUs during the 2021 (Stantec 2021c) and 2022 (Stantec 2022d) bat surveys (Figure 11-3). These surveys were developed to document species occurrence in the LAA, including migratory species, and to gather information on habitats used by bats, based on ARU sampling locations. Survey locations included one ARU in the area of the Project Expansion in 2021 and two ARUs in 2022. Little brown myotis tend to forage in an area <2 km^2, although females are known to reduce their home range size when lactating (Henry et al. 2002, COSEWIC 2013). Northern myotis roost and forage within the same area and travel distances of 1.6 km (mean distance) from their roosting sites (Divoll et al. 2022).

Little brown myotis was recorded at all ARU sampling locations in 2021 (four ARUs) and 2022 (five ARUs) and was consistently the most common species detected. Northern myotis was detected in low numbers at most sites, including in the Project Expansion footprint in 2021. Overall, 2,524 myotis calls were recorded in 2021, comprised of 2,076 little brown myotis calls, 320 northern myotis calls, and 128 unidentified myotis calls. In 2022 there were 446 call files assessed as little brown myotis and only 37 as northern myotis, with an additional 257 unconfirmed myotis species calls. There were also unconfirmed high frequency calls recorded that could be a myotis species however was indistinguishable from eastern red bat (*Lasiurus borealis*), another high frequency species recently documented in Newfoundland (J. Humber, pers. comm, 2022).

In 2021, the highest number of calls recorded for both little brown myotis (76%) and northern myotis (96%) was in the LAA and Project Expansion area, at the end of a grassy road leading to Valentine Lake. The combination of the tree-lined linear access road with the presence of balsam fir likely provides suitable habitat and foraging opportunities in that area. The relatively high call activity for both species at this location suggests the possibility of swarming in that area; due to the presence of operating machinery, however, this site could not be resampled in 2022.

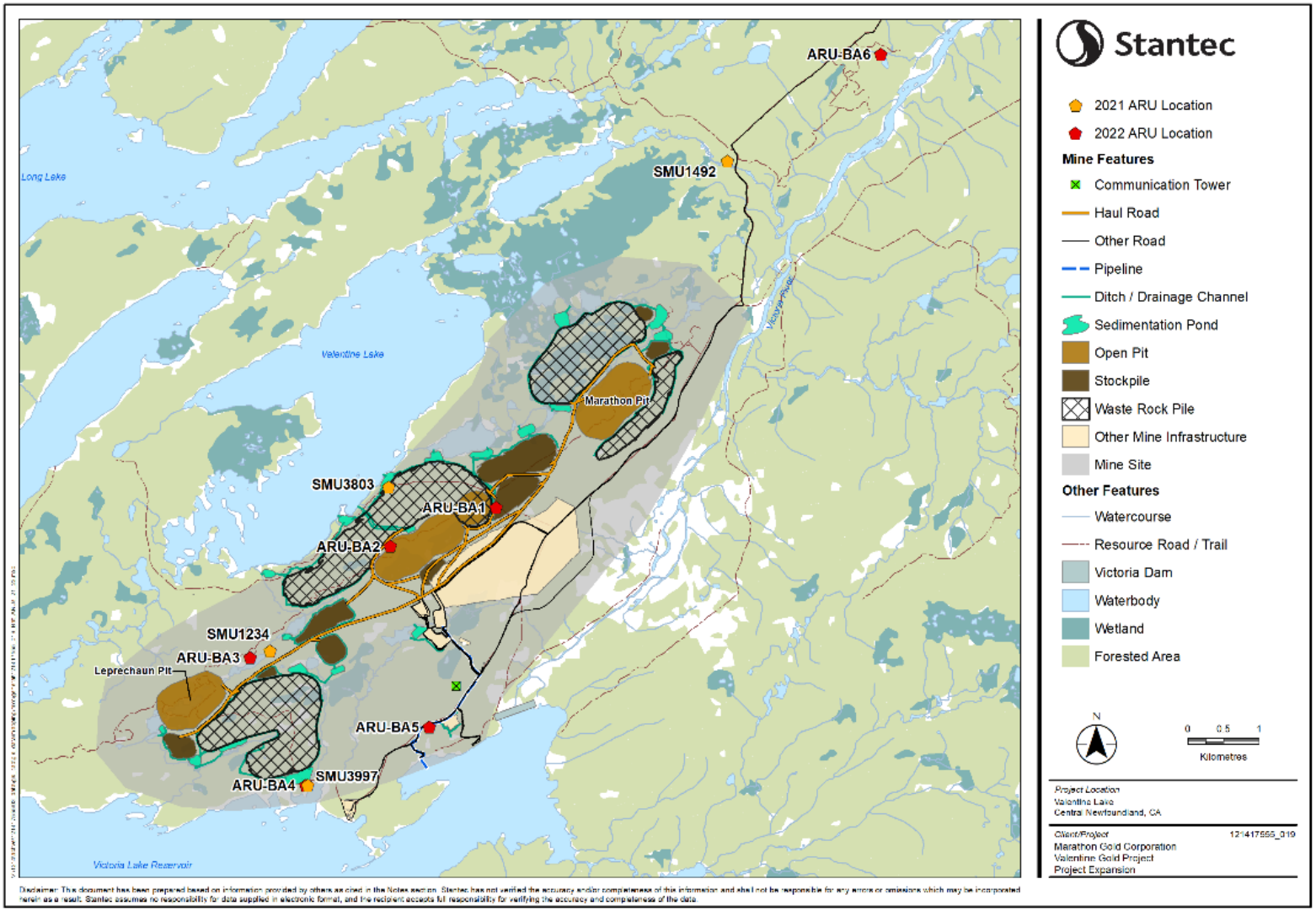

Figure 11-3 Locations of 2021 and 2022 Bat ARUs

In 2022, the highest numbers of little brown myotis (74%) and northern myotis (43%) calls were recorded on the Victoria Lake Reservoir, near the existing exploration camp. Another 41% of northern myotis calls were recorded in the LAA (however outside the Project Area), approximately 7 km northeast of the Marathon waste rock pile. Silver-haired bat (*Lasionycteris noctivagans*), a migratory species with a distinctive low frequency call, was also recorded during the surveys. This species was detected during the expected migratory period (October 1, 2022) on the Victoria Lake Reservoir. Two other unidentified low-frequency calls were also recorded on the same date; however, the species could not be confirmed owing to similarities in call characteristics with big brown bats (*Eptesicus fuscus*) (McBurney and Segers 2021). There was also evidence of other low-frequency calls during July and August of 2022 (mixed with high-frequency and/or social calls), however the species could not be confirmed due to poor recording quality.

11.2.3.2 Newfoundland Marten

The Newfoundland population of American marten is listed as Threatened under SARA and the NL ESA; however, was recently reassessed as Special Concern by COSEWIC in May 2022 (COSEWIC 2022). The recommendation for the designation of Special Concern is largely based on an estimated increase in the total number of mature individuals on the Island of Newfoundland (2,558-2,837 in 2019 compared to 320-622 in 2007) that is attributed to several factors including: reduced incidental mortality; increased prey base (though the introduction of southern red-backed vole); and a decreased rate of forest harvesting / habitat loss (COSEWIC 2022). The extent of its occurrence is also increasing, and it is believed to occupy a wider range of habitats, including disturbed habitats and younger aged forests (COSEWIC 2022).

The 2018 baseline surveys for the Approved Project included one hair snag station in the vicinity of the Project Expansion, along the grassy road leading to Valentine Lake, where two individual females were identified. As indicated in the Valentine Gold EIS, approximately 6.3 km^2 of the Project Area and 41.8 km^2 of the LAA overlaps with critical habitat for marten. There is currently 6,200 km^2 of critical habitat identified on the Island of Newfoundland (The Newfoundland Marten Recovery Team 2010; COSWEIC 2022).

11.3 POTENTIAL EFFECTS FROM PROJECT EXPANSION

The Valentine Gold EIS was prepared using a conservative approach, whereby it was assumed that all habitat within the mine site would be changed (i.e., all habitat would be cleared), when in reality there will be some localized areas within the Project Area where vegetated areas will be retained. This conservative approach allows for refinements to the site layout without changing predicted residual effects. As a result, change in habitat associated with the Project Expansion was already incorporated within the effects assessment in the Valentine Gold EIS, either as a direct or indirect (e.g., within the LAA) change.

11.3.1 Vegetation, Wetlands, Terrain and Soil

The Approved Project predicted the residual effect of direct loss or change of approximately 34.8 km^2 of habitat and associated vegetative species in the Project Area (Table 11.2), comprised of 32.0 km^2 within the footprint of the mine site and approximately 2.8 km^2 within the access road upgrades. These areas include associated vegetation species (including some SOCC), vegetation communities, and wetlands. Additional changes to wetland functions are predicted to occur through hydrological changes associated with groundwater drawdown and hydrological discharges. These changes could affect up to an additional 6.3 km^2 of wetland vegetation communities outside of the Project Area. Indirect disturbances to vegetation and vegetation communities (e.g., through edge effects) could affect an additional 24.7 km^2 of habitats, largely adjacent to the access road footprint. In total, the area predicted to be potentially directly and indirectly affected by the Approved Project represents approximately 3.6% of the Approved Project ELCA (the area used to assess quantitative effects on vegetation, wetlands, terrain and soils) and with the successful application of mitigation measures, predicted effects were anticipated to be low in magnitude for all assessed residual effects in all phases of the Approved Project.

Vegetation surveys in support of the Project Expansion were conducted in areas that had not been surveyed as part of the assessment for the Approved Project; these were completed before the layout of components of the Project Expansion was finalized. In total, approximately 3.4 ha or 0.034 km^2 of non-anthropogenic habitat associated with the Project Expansion is outside the Project Area, however within the LAA of the Approved Project (Table 11.2). This area represents an additional 0.1% relative to the area conservatively assumed to be lost in the Valentine Gold EIS for the Approved Project. The explosives facility will be located within a disturbed area classified as anthropogenic and does not represent additional habitat loss.

Table 11.2 Ecosystem Units Within the Project Expansion and Outside of the Project Area of the Approved Project

Ecosystem Unit	Ecotype	Project Area		Project Expansion		
		Ecotype (km^2)	% of Area	Additional Habitat Loss / Alteration* (km^2)	% Relative to Ecotype within Project Area	% Relative to Total Project Area
Balsam Fir Forest	Balsam Fir Forest	6.2	18.0	0.004	0.06	0.011
Black Spruce Forest	Black Spruce Forest	4.3	12.5	0.008	0.17	0.022
Kalmia-Black Spruce Woodland	*Kalmia*-Black Spruce Forest	3.6	10.3	0.003	0.08	0.008
	Kalmia Heath					
Mixedwood Forest	Mixedwood Forest	6.0	17.3	0.004	0.07	0.012
Regenerating Forest	Regenerating Forest	2.0	5.6	0.005	0.23	0.013
Alder Thicket	Alder Thicket	2.2	6.5	0.0003	0.01	0.001
Riparian Thicket	Riparian Thicket	0.2	0.4	-	-	-

Table 11.2 Ecosystem Units Within the Project Expansion and Outside of the Project Area of the Approved Project

Ecosystem Unit	Ecotype	Project Area		Project Expansion		
		Ecotype (km^2)	% of Area	Additional Habitat Loss / Alteration* (km^2)	% Relative to Ecotype within Project Area	% Relative to Total Project Area
Wet Coniferous Forest	Wet Coniferous Forest	2.5	7.2	0.009	0.36	0.026
Open Wetlands	Shrub / Graminoid Fen	4.6	13.3	0.002	0.04	0.006
	Shrub Bog					
Open Water	Open Water	1.3	3.7	-	-	-
Exposed Sand / Gravel Shoreline	Exposed Sand / Gravel Shoreline	-	-	-	-	-
Anthropogenic	Anthropogenic	1.9	5.4	-	-	-
Total		**34.8**	**100.0**	**0.034**	**-**	**0.1**

Note:
* Habitat loss outside the Project Area

There is some limited potential for several of the vascular plant SOCC observed in the LAA of the Project Area to exist within areas of the Project Expansion that represent additional direct loss beyond what was directly accounted for. Short-scale sedge was observed in two ecotypes (balsam fir forest and *Kalmia*-black spruce forest) that are present within the Project Expansion area outside of the Project Area. Host's sedge was observed in a shrub fen/shrub bog wetland, an ecotype that is also present in the portion of the Project Expansion area outside of the Project Area. Other vascular plant SOCC observed in and around the Project Area are unlikely to be found in habitats within the area of the Project Expansion.

As indicated, the loss or alteration of habitat associated with the Project Expansion was already assessed within the Valentine Gold EIS, either directly within the Project Area or indirectly within the LAA. The EIS for the Approved Project concluded that the long-term persistence of vegetation species, including vascular plant SOCC, was not predicted to be threatened by the Approved Project and that no vegetation community type would be lost within the RAA as a result of the Approved Project. Similarly, the Approved Project was not predicted to result in a non-compliance with section 5.1 of the NL Policy for Development in Wetlands and was expected to result in the potential loss of less than 1% of wetland area within the RAA. Although the EIS for the Approved Project predicted that the residual effects on vegetation and wetlands would be adverse, with the application of planned mitigation measures (Appendix 2E), they were concluded to be not significant.

The Project Expansion will not affect vegetation species, communities, or wetlands outside of the LAA. It is possible, however unlikely, that vascular plant SAR/SOCC exist within the additional habitat area expected to be directly affected beyond the Project Area, based on an assessment of the vegetation habitat communities within that additional area. The additional area within the Project Expansion footprint

that is beyond the previously assessed Project Area, and expected to be directly affected represents an additional 0.1% of the Project Area. With the application of mitigation measures discussed in the Valentine Gold EIS (Appendix 2E), Project Expansion-related residual adverse environmental effects on vegetation, wetlands, terrain and soils are predicted to be not significant.

With respect to terrain, no unique landscape features were identified in the Project Area during Approved Project field studies. In the Valentine Gold EIS, Marathon committed to completing geotechnical investigations for all site infrastructure (open pits, waste rock piles and stockpiles) and avoiding construction in areas deemed to be unstable or potentially unstable. Marathon concluded that with the implementation of mitigation measures, adverse residual effects related to terrain and terrain stability would have low magnitude and would be associated with single or irregular events throughout the life of the Approved Project. The Valentine Gold EIS also concluded that effects from terrain stability are considered reversible with mitigation and monitoring (e.g., landslide rehabilitation, stream sedimentation monitoring). This assessment remains valid for the Project Expansion.

The Valentine Gold EIS concluded that with mitigation (Appendix 2E), the Approved Project would result in a low adverse residual effect on soil quality. Soil handling plans are typically described in a Rehabilitation and Closure Plan (RCP) and address appropriate storage and replacement of topsoil and subsoil during all phases of a project. Other mitigation measures described in the Valentine Gold EIS include using stockpiled soils for progressive rehabilitation over the life of the Approved Project and using direct placement techniques and prompt progressive rehabilitation wherever practicable to limit changes to chemical and biological soil properties. Soil processes may take some time to gain a state of equilibrium within the newly reclaimed landscape, however, soil recovery is anticipated to occur over time with stockpiled soils having been successfully used as a growth medium to rehabilitate disturbed sites. The duration of the effect would be long-term, as the change in soil quality would extend beyond the life of the Approved Project. The residual effect would be reversible as adverse effects on soils would be mitigated through best practices during construction and operation and through implementation of the RCP. Natural recovery would be encouraged throughout the Project Area through soil and revegetation monitoring, and adaptive management techniques. These monitoring and management techniques would support post-closure ecosystems and wildlife habitat end land use objectives.

It should also be noted that general requirements related to terrain, terrain stability and soils for mining projects are outlined in the NL *Mining Act* and the NL EPA. The *Mining Act* requires the implementation and documentation of progressive rehabilitation and an RCP including applicable records.

11.3.2 Avifauna and Other Wildlife

Residual effects predicted in the Valentine Gold EIS for avifauna identified approximately 34.8 km^2 of avifauna habitat that would be lost within the Project Area (based on the conservative assumption that all habitat within the Project Area would be lost due to a combination of site clearing, habitat fragmentation, and sensory disturbance), and approximately 50.9 km^2 that would be altered due to sensory effects (i.e., within the LAA). The percentage of high to moderate-value habitats for focal avifauna species ranged from 1.9% to 8.9% of the Approved Project ELCA (the area used to assess quantitative effects on habitat), and predicted effects were anticipated to be low in magnitude for non-SAR species, and

moderate in magnitude for representative avifauna SAR. With the successful application of mitigation measures, the magnitude of a change in mortality risk to avifauna was anticipated to be low for all phases of the Approved Project.

Other wildlife species assessed as part of the Valentine Gold EIS include SAR/SOCC (key species: Newfoundland marten, northern myotis, and little brown myotis); large mammals (key species: moose and black bear); furbearers (key species: beaver [*Castor canadensis*], Canada lynx, and muskrat); and small mammals (key species: meadow vole and southern red-backed vole). The percentage of high to moderate -value habitats for focal species ranged from 2.1% to 8.0% of the ELCA. Predicted effects were anticipated to be low in magnitude for representative large mammal, furbearer, and small mammal species, and moderate in magnitude for Newfoundland marten. The high-value muskrat habitat mentioned in the Valentine Gold EIS is not affected by the Project Expansion. With the successful application of mitigation measures, the magnitude of a change in mortality risk to Other Wildlife was anticipated to be low for all phases of the Approved Project. Marathon concluded that for both Avifauna and Other Wildlife and with the application of mitigation measures described in the Valentine Gold EIS, residual effects were predicted to be not significant, as they do not threaten the long-term persistence or viability of avifauna or other wildlife in the RAA, including SAR, and are not contrary or inconsistent with the goals, objectives, and activities of recovery strategies, action plans, and management plans. This assessment included habitats within the Project Expansion footprint (assessed as direct effects) and the additional estimated 0.034 km^2 of habitat directly affected by the Project Expansion that is outside the Project Area however within the LAA (assessed through indirect effects on a change in habitat for avifauna and for other wildlife).

Planned mitigation measures (Appendix 2E) include pre-clearing surveys for active nests or, preferably, avoidance of the migratory bird breeding season (where practicable); maintaining natural roosting habitat for bats (e.g., large-diameter trees) to the extent possible; reducing sensory disturbance (e.g., dust and light control); and implementing measures to reduce the risk of collisions with vehicles and infrastructure (e.g., speed limits). In addition, monitoring and adaptive mitigation measures outlined in the respective follow-up monitoring plans for the Approved Project will be revised to also apply to the Project Expansion and therefore will monitor species of avifauna and other wildlife (e.g., myotis and Newfoundland marten), including SAR, that have the potential to occur in the footprint of the Project Expansion. This includes monitoring for gray-cheeked thrush and red crossbill that were previously not identified as key species in the Valentine Gold EIS.

Overall, given the small size of the additional area to be affected (i.e., 0.034 km^2), and with the successful implementation of mitigation measures outlined in the Valentine Gold EIS and follow-up monitoring programs, direct or indirect effects on a change in mortality risk and change in habitat resulting from the Project Expansion are not anticipated to have significant residual adverse effects on avifauna or other wildlife, including SAR.

A follow-up monitoring program was developed in 2022 to verify predictions made in the Valentine Gold EIS and evaluate the effectiveness of mitigation strategies for the environmental effects on avifauna and avifauna habitat (i.e., change in habitat and mortality risk), including SAR, particularly as they relate to uncertainty in the assessment. A second objective is to establish a framework for adaptive management

that can be used to modify or enhance mitigation strategies for wildlife and wildlife habitat. Adaptive mitigation measures will be implemented should post-construction breeding bird densities, species richness, or SAR habitat occupancy fall below baseline and/or control values, or where avifauna mortalities are reported from vehicle collisions or interactions with on-site infrastructure (e.g., sedimentation ponds, powerlines, windows). Additional adaptive mitigation measures included in the plan relate to avifauna use of water management facilities. The follow-up and monitoring program will be updated in consideration of the Project Expansion, as applicable. A follow-up monitoring plan for bats (as a component of the "Other Wildlife Follow-up Monitoring Plan") was developed in 2022 to gather additional information on bat species' occurrence and distribution in the Project Area and to assess whether their occurrence (detections) changes during the construction and operation phases of the Approved Project, compared to baseline conditions. This plan includes mitigation measures that may be adapted should bats be observed roosting in Project structures, maternity colonies found in the Project Area, or if post-construction bat occurrences are below construction and/or baseline occurrences.

This follow-up and monitoring program will be updated to incorporate the Project Expansion. A follow-up monitoring program was developed in 2022 to assess whether American marten occurrence changes during the construction and operation phases of the Approved Project, compared to baseline conditions. This plan (a component of the "Other Wildlife Follow-up Monitoring Plan") includes mitigation measures that may be adapted if post-construction occurrences of this SAR are below construction and/or baseline occurrences. This follow-up and monitoring program will be updated as applicable to incorporate the Project Expansion.

11.4 SUMMARY OF CHANGES FROM THE APPROVED PROJECT

The Project Expansion will result in an additional 3.4 ha, or 0.034 km^2, of direct loss of habitat that is within the LAA however outside the Project Area of the Approved Project (representing a 0.1% increase in size). As indicated, the assessment of the Valentine Gold Project conservatively assumed that all habitat within the Project Area would be lost due to the construction and operation of the Approved Project. This conservative approach allows for refinements to the site layout without changing predicted residual effects. As such, residual effects from the Project Expansion on Other Terrestrial Components (including Vegetation, Wetlands, Terrain and Soil, Avifauna, and Other Wildlife) were assessed in the Valentine Gold EIS, either as a direct or indirect (e.g., within the LAA) change. Given the small additional area of habitat to be directly affected and, with the application of mitigation measures and follow-up monitoring programs for the Approved Project that include the Project Expansion, there are no anticipated changes from the Approved Project in terms of predicted residual effects (Table 11.3). That is, the combined effects from the Approved Project and the Project Expansion are not anticipated to result in significant residual adverse environmental effects on Other Terrestrial Components.

Table 11.3 Project Residual Effects for Approved Project* and Project Expansion

Residual Effect	Residual Effects Characterization for Approved Project								Change in Residual Effect Characterization with Addition of Project Expansion (i.e., Combined Effects of Approved Project and Project Expansion)
	Project Phase	Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Ecological and Socio-economic Context	
Avifauna									
Change in Habitat	C	A	L-M	LAA	LT	C	I	D	No Change
	O	A	L-M	LAA	MT	C	R	D	
	D	P/A	L-M	LAA	MT	C	R	D	
Change in Mortality Risk	C	A	L	LAA	ST	IR	R	D	
	O	A	L	LAA	MT	IR	R	D	
	D	A	L	LAA	MT	IR	R	D	
Other Wildlife									
Change in Habitat	C	A	L-M	LAA	LT	C	I/R	D	No Change
	O	A	L-M	LAA	LT	C	R	D	
	D	A	L-M	LAA	LT	C	R	D	
Change in Mortality Risk	C	A	L	PA	MT	IR	R	D	
	O	A	L	PA	MT	IR	R	D	
	D	A	L-N	PA	ST	IR	R	D	
Vegetation, Wetlands, Terrain and Soils									
Change in Species Diversity	C	A	L	LAA	LT	C	R/I	D	No Change
	O	A	L	LAA	LT	C	I	D	
	D	N	L	LAA	MT	C	R	D	
Change in Community Diversity	C	A	L	LAA	LT	C	I	D	
	O	A	L	LAA	LT	C	I	D	
	D	N	L	LAA	MT	C	R	D	
Change in Wetland Function	C	A	L	LAA	LT	C	I	D	
	O	A	L	LAA	LT	C	I	D	
	D	N	L	LAA	MT	C	I	D	
Changes in Soil Quality	C	A	L	LAA	LT	C	R	D	
	O	A	L	LAA	LT	C	R	D	
	D	N	L	LAA	LT	C	R	D	

Table 11.3 Project Residual Effects for Approved Project* and Project Expansion

Residual Effect	Residual Effects Characterization for Approved Project								Change in Residual Effect Characterization with Addition of Project Expansion (i.e., Combined Effects of Approved Project and Project Expansion)
	Project Phase	Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Ecological and Socio-economic Context	
Changes in Soil Quantity	C	A	L	PA	ST	S/IR	R/I	D	No Change
	O	A	L	PA	MT	S/IR	R/I	D	
	D	N	L	LAA	LT	S/IR	R/I	D	
Changes in Terrain (unique landforms)	C	A	L	LAA	LT	C	I	D	
	O	A	L	LAA	LT	C	I	D	
	D	N	L	LAA	LT	C	I	D	
Changes in Terrain Stability	C	A	L	LAA	LT	IR	R	D	
	O	A	L	LAA	LT	IR	R	D	
	D	N	L	LAA	LT	IR	R	D	

KEY
See Table 5.5 and Appendix 5A for detailed definitions

Project Phase
C: Construction
O: Operation
D: Decommissioning

Direction:
P: Positive
A: Adverse
N: Neutral

Magnitude:
N: Negligible
L: Low
M: Moderate
H: High

Geographic Extent:
PA: Project Area
LAA: Local Assessment Area
RAA: Regional Assessment Area

Duration:
ST: Short term
MT: Medium term
LT: Long term

N/A: Not applicable

Frequency:
S: Single event
IR: Irregular event
R: Regular event
C: Continuous

Reversibility:
R: Reversible
I: Irreversible

Ecological / Socio-Economic Context:
D: Disturbed
U: Undisturbed

*Tables 10.20, 12.23 and 9.13 in the Valentine Gold EIS refer to residual effects characterization of assessed VCs

In the Valentine Gold EIS, Marathon completed a comprehensive cumulative effects assessment (CEA) that included these terrestrial components (Chapter 20). That CEA considered if and how residual effects of past, ongoing and reasonably foreseeable projects and activities (Table 20.1, Marathon 2020) interacted with the residual effects of the Approved Project (Table 9.13, Marathon 2020) to amplify effects on the various terrestrial components. An updated list of past, ongoing, and reasonably foreseeable projects and activities is presented in Table 5.5 of this document. Since the Approved Project was assessed, several new quarries have been proposed or approved throughout the RAA. The closest to the Project is Newcrete Investments Limited's proposed Victoria River Quarry. The Province issued Environmental Preview Report (EPR) guidelines in March 2023 (Government of NL 2023b). The proposed quarry is less than 500 m at the closest point to the mine site and is expected to cover an area

of 5.5 ha on a site adjacent to the Victoria River. The EPR guidelines issued by the provincial EA Division are requiring Newcrete to justify sourcing sand and gravel in this relatively remote region and to provide an analysis of potential cumulative effects of their project on the Victoria River watershed, wildlife, and wildlife habitat in the area in consideration of existing and proposed mining activities, road and transmission line development, and other development near the proposed project area. Given the level of analysis required for that project, it is anticipated that appropriate mitigation measures will be in place, should it be approved, such that the resulting contribution to cumulative effects will be reduced.

In consideration of the residual effects assessment completed for these terrestrial components (Table 11.3) for the combined Project Expansion and Approved Project, with the new projects and activities in the RAA (Table 5.5) since 2020, the Project Expansion does not result in a change to the CEA completed for these components in the Valentine Gold EIS.

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12.0 SOCIO-ECONOMIC COMPONENTS

This chapter, Socio-Economic Components, considers socio-economic components that were assessed as Valued Components (VCs) in the Valentine Gold Environmental Impact Statement (EIS) (Marathon 2020), and the potential for the Berry Pit Expansion (Project Expansion) to change the residual effects predictions made in the Valentine Gold EIS for the Valentine Gold Project (Approved Project). The socio-economic components that have the potential to be affected by the Project Expansion include:

- community services and infrastructure
- community health
- employment and economy
- land and resource use
- Indigenous groups

Land and resource use was also considered in Chapter 4 of this Environmental Registration / EA Update. Project Expansion activities and the Project Expansion labour force may affect access to infrastructure and services and to the land for traditional and recreational purposes. It may also affect the regional economy and labour supply and the overall health and well-being of local communities, including Indigenous groups. However, given the conservative approach to assessment in the Valentine Gold EIS, effects from the Project Expansion are anticipated to be limited in nature, within the Project Area, and consistent with those effects previously assessed for the Approved Project.

12.1 SUMMARY OF EXISTING ENVIRONMENT FROM THE APPROVED PROJECT

This section provides a summary of existing socioeconomic environment information presented in the Valentine Gold EIS. As indicated in Chapter 5, the Project Area, Local Assessment Area (LAA) and Regional Assessment Area (RAA) used to describe existing conditions and assess potential effects for the Approved Project are also considered applicable and valid for the Project Expansion. Information on socio-economic topics for which data have been updated since submission of the Valentine Gold EIS, including demographics, housing, health, and economic and employment indicators is provided in section 12.2.

12.1.1 Community Services and Infrastructure

As described in Chapter 13 of the Valentine Gold EIS, community services and infrastructure includes housing and temporary accommodations, transportation and local services and infrastructure (water, sewer, solid waste, education, recreation, safety and health care). These services and infrastructure are used by residents and may be operated and maintained by municipal, provincial and/or federal government authorities. Several municipalities are included within the community service and infrastructure LAA/RAA, including Grand Falls-Windsor, Badger, Buchans, Bishop's Falls and Millertown, as well as the local service district (LSD) of Buchans Junction.

Housing for communities in the LAA/RAA ranges from 6,406 private dwellings in Grand Falls-Windsor to 54 private dwellings in Buchans Junction with average housing costs ranging from $217,610 in Grand Falls-Windsor to $71,224 in Millertown (Statistics Canada 2017). Other temporary accommodations within the LAA/RAA include recreational vehicle parks, inns, hotels, motels, cabin rentals, lodges, campgrounds and a bed and breakfast.

Transportation in the LAA/RAA includes a combination of provincial highways, gravel roads and old forestry roads. There is one port in the RAA, the Port of Botwood, used as a shipping port for pulp and paper products from the mill at Grand Falls-Windsor.

Each municipality and the LSD of Buchans Junction receive potable water from surface water sources including Northern Arm Lake, Exploits River, Little Indian Brook, Buchans Lake, Lapland Pond and Water Pond, which are treated at local water treatment facilities. Wastewater infrastructure for the communities in the LAA/RAA include a lagoon system, wastewater treatment plant, wetland treatment system, communal septic tank with contour disposal bed and raw wastewater outfalls. Waste management services for the communities in the LAA/RAA are provided by Central Newfoundland Waste Management and the regional waste management site and the main landfill for the LAA/RAA is the Norris Arm Waste Management Facility. The site has a life expectancy of approximately 90 years.

Education services within the LAA/RAA are provided by the Central Newfoundland and Labrador (NL) English School District and include a combination of public elementary schools, junior high schools and high schools. Post-secondary institutions in the RAA include: College of the North Atlantic, Keyin College and Corona College in Grand Falls-Windsor and the Central Training Academy in Badger.

Outdoor recreation facilities in the LAA/RAA include sports fields/tracks/courts, skateparks, a beach, several playgrounds and the Mary March Wilderness Park. Indoor recreation includes stadiums in Grand Falls-Windsor and Buchans, as well as community centers, curling clubs, the Bishop's Falls Heritage Center, the Salmonid Interpretation Center, the Mary March Museum, the Gordon Pinsent Centre for the Arts and the Lewis Miller Room Museum.

Policing services in the LAA/RAA are provided by the Royal Canadian Mounted Police (RCMP) pursuant to the Provincial Policing Agreement. The RCMP operates a detachment in Grand Falls-Windsor, which provides services to Badger, Buchans, LSD of Buchans Junction, Bishop's Falls and Millertown, in addition to other communities. Fire services in the LAA/RAA include a combination of community fire departments and volunteer firefighters.

The major health care facility servicing central Newfoundland, including the communities within the LAA/RAA, is the Central Newfoundland Regional Health Centre located in Grand Falls-Windsor. Within the LAA/RAA, ambulance services are based in Grand Falls-Windsor and Buchans. There is one health care facility in Buchans, the A.M. Guy Memorial Health Centre, which has 22 beds. Millertown and Buchans Junction have no community health care facility and are serviced by the hospital in Buchans, which is approximately 30 minutes away.

12.1.2 Community Health

As described in Chapter 14 of the Valentine Gold EIS, existing conditions for community health within the LAA/RAA considered educational attainment, availability of services, infrastructure, and housing, rates of chronic and communicable disease and disability, mental health status, rates of substance abuse, crime and family violence, social connectivity, and community well-being based on community well-being index scores. The LAA/RAA for community health includes those communities where the Approved Project workforce may live and/or use health services and infrastructure: the Town of Buchans, the LSD of Buchans Junction, the Town of Millertown, the Town of Badger, the Town of Grand-Falls Windsor and the Town of Bishop's Falls.

In general, educational attainment (e.g., secondary and post-secondary education) was similar in the LAA/RAA to the rest of the province. Within the LAA/RAA, 50.2% of the total population and 51.9% of the Indigenous population had completed post-secondary education compared to provincial averages of 51.6% and 49.5%, respectively (Statistics Canada 2017, 2018). Overall, females within the LAA/RAA accounted for a greater proportion of the total population with a college or university certificate, diploma or degree (59.2% of the population), while males generally accounted for a greater proportion of the population with an apprenticeship or trades certificate or diploma (50.1% of the population).

The communities in the LAA/RAA fall within what was previously NL's Central Health Regional Health Authority (Central Health). As of April 1, 2023, NL's health authorities have combined to form one provincial authority, however, due to how recently this change has occurred, community health data for the LAA/RAA have been obtained from and presented for Central Health. Community health characteristics for the LAA/RAA are based largely on data from Central Health. In summary, the Central Health Region showed higher rates of arthritis, diabetes, asthma and high blood pressure than the province, and females had higher rates of chronic disease than males in most instances (other than high blood pressure). From 2017 to 2018, 72.2% of Central Health residents perceived their mental health to be very good or excellent, which was slightly higher than 69.1% of the NL population. Rates of smoking and alcohol consumption were higher in the province than in the Central Health Region in 2017 to 2018, with approximately 20% of the provincial population smoking daily or occasionally versus 16.6% of the Central Health Region. Sexually transmitted and bloodborne pathogens were the most prevalent type of communicable disease in the province in 2016. Central Health had 7.3% of the total of these cases in 2016 relative to the province. The second most prevalent category of communicable disease in the province in 2016 was vaccine-preventable disease; NL had 217 cases of which Central Health had 18 cases (8.3%) (NLDHCS 2016).

Between 2014 and 2018, the total number of violent criminal code offences (e.g., murder, manslaughter, sexual assault, criminal harassment) in the Grand Falls-Windsor RCMP District increased 18.8% from 425 to 505. In NL in 2018, the number of child and youth family violence victims increased 3.0% from the previous year to 258 for a rate of 289 per 100,000 population (NL Statistics Agency 2019). Social connectivity was shown to be generally higher in NL relative to the rest of Canada, with 67% of Newfoundlanders and Labradorians reporting close ties to at least five family members, measurably higher than the national average of 55%.

An analysis of the community well-being index, which factors in education, labor force activity, income and housing, showed that scores have increased for communities within the LAA/RAA from 1991 to 2016, with Millertown showing the highest score in 2016 at 80. Community well-being index scores for Grand Falls-Windsor, Badger, Buchans and Bishop's Falls, ranged from 69 to 77 in 2016, compared to the province's score of 72.

12.1.3 Employment and Economy

As described in Chapter 15 of the Valentine Gold EIS, existing conditions for employment and economy within the LAA and RAA included consideration of the total and Indigenous population within the LAA and RAA; educational attainment within the LAA and RAA; labour force indicators; total and employment incomes; the mining industry, mineral exploration, the contribution of mining industries to the provincial economy and direct mining employment; and economic contributions of outfitting businesses.

The LAA includes the Project Area and aligns with the administrative boundary of Statistics Canada's Census Division (CD) Number 6 (No. 6). CD No. 6 includes the following communities: Town of Appleton, Town of Badger, Town of Bishop's Falls, Town of Botwood, Town of Buchans, Town of Gander, Town of Glenwood, Town of Grand-Falls Windsor, Town of Millertown, Town of Norris Arm, Town of Northern Arm, Town of Peterview, as well as unorganized CD No. 6 Census Subdivisions (CSDs) A (which includes the Designated Place of Buchans Junction), C, D and E. The RAA for employment and economy is the Province of NL.

Population demographics of the LAA and RAA are summarized in Table 12.1. In general, educational attainment (e.g., secondary and post-secondary education) was similar in the LAA, as seen across the RAA (province). Within the LAA, 50.2% of the total population and 51.9% of the Indigenous population had completed post-secondary education compared to RAA (provincial) averages of 51.6% and 49.5%, respectively (Statistics Canada 2017, 2018). Overall, females within the LAA accounted for a greater proportion of the total population with a college or university certificate, diploma or degree, while males generally accounted for a greater proportion of the population with an apprenticeship or trades certificate or diploma.

Table 12.1 Population Change – 2011 to 2016

Location	Dataset	Total Population			Indigenous Population[A]		
		Total	Male	Female	Total	Male	Female
LAA	2016	38,340	18,495	19,845	2,360	1,125	1,235
	% Change 2011-2016	2.8	2.8	2.8	43.0	55.2	33.5
RAA (NL)	2016	519,720	253,930	265,790	45,730	22,105	23,625
	% Change 2011-2016	1.0	1.3	0.7	27.7	23.9	31.5

Notes:
[A]. Indigenous and non-Indigenous totals may not sum to equal total population counts as they are based on a 25% population sample size.
2011 'Total Population' data from 2011 Census of the Population – Census Profile. 2011 'Aboriginal Population' data taken from 2011 National Household Survey – Aboriginal Profile.
Values shown in "Total" columns are the sum of male and female CSD subsets taken from Statistics Canada's 2011 and 2016 Census Profile (Census of the Population). Due to Statistics Canada rounding totals may not exactly align with those shown on CSD Census Profiles and may not sum across tables.
Sources: Statistics Canada 2012, 2014, 2017, 2018

In 2016, the total size of the LAA labour force was 17,785 of which 6.5% identified as Indigenous (Statistics Canada 2017, 2018). Generally, unemployment rates within the LAA and RAA were higher among males and Indigenous members of the labour force. Unemployment rates for the LAA were 20.1% and 11.2% for males and females, respectively, while unemployment in the RAA (provincial average) was 18.6% and 12.5%, for males and females, respectively. In the LAA, mining and construction employment fields are dominated by a male workforce (95.3% and 91.4%, respectively), with a similar trend observed for the Indigenous population within the LAA (60% and 100%, respectively). Average hourly wages in natural resource extraction for NL was $36.50, while average hourly wage for construction and professional services was $28.70 and $33.00, respectively. Except for mean total income among Indigenous males in the LAA, total incomes (mean and median) and employment incomes (mean and median) of the LAA were lower than RAA (provincial) incomes.

There is a long history of mining in the province, dating back to 1905 with the construction of the first base metals mine in 1926 by the Buchans Minerals Corporation. In 2018, mining and quarrying (inclusive of support activities) accounted for 6.6% ($2.0 billion) of total provincial gross domestic product (GDP) ($30.4 billion), of which, metal ore mining accounted 97.3% (Statistics Canada 2020a). Except for 2009 (slightly less than $55 million), annual exploration expenditures in NL between 2006 and 2013 remained above $100 million, hitting a high of nearly $200 million in 2012. Gross Value of Mineral Shipments is anticipated to increase 163% from $1.5 billion in 2005 to a forecasted value of $4.1 billion in 2020 (DNR 2020). The only producing mines within the LAA are associated with Barite Mud Services Inc. (barite) near Buchans, China Minmetals Rare Earth Group Co. Ltd (antimony) near Glenwood and Hi-Point Industries (1991) Ltd. (peat) near Bishop's Falls. From 2005-2020 in NL, exploration employment accounted for an annual average of 220 jobs while operational mining accounted for an annual average of 5,380 jobs.

Within the LAA, 13 outfitting companies offer bear (*Ursus americanus)*, caribou (*Rangifer tarandus*) and moose (*Alces alces*) hunting, as well as angling. Rates range from approximately $6,100 to $11,900 for a moose hunt, $2,600 to $6,500 for a bear hunt, $5,750 to $13,000 for a caribou hunt, and $3,500 to $4,000

for salmon and trout fishing (Lake Douglas Hunting and Fishing Inc. 2016, Migule Mountain Outfitters 2017, Where-Ya-Wannabee Outfitters n.d., Red Indian Lake Outfitting and Tours 2020, Central Newfoundland Outfitters 2020). Most of the 13 outfitting companies within the LAA (11 confirmed) offer camp or lodge accommodation.

The nearest active outfitters to the Project Area include:

- Notch Mountain Outfitters located at the southwest end of Beothuk Lake
- Red Indian Lake Outfitting and Tours with their main lodge on the northern shore of Beothuk Lake
- Victoria Outfitters and Lodge, Snowshoe Lake Hunting and Fishing, Lake Douglas Hunting and Fishing Inc., Black Ridge Outfitters Ltd., and 2G Outfitters located within approximately 30 km of the southern shore of Beothuk Lake

12.1.4 Land and Resource Use

As described in Chapter 16 of the Valentine Gold EIS, land and resource use includes activities and infrastructure related to the use of land and resources, including designated land use (e.g., protected areas, communities), resource use (e.g., hunting, trapping, fishing, forestry) and recreational use (e.g., hiking, fishing, snowmobiling). The LAA for land and resource use included a 1 km buffer around the mine site and a 500-m buffer around the access road. The RAA comprised of a 35-km buffer of the Project Area encompassing Victoria River and Beothuk Lake.

The Approved Project is in a rural setting, outside of municipal boundaries, and therefore is not located in an area subject to development and zoning controls. There are three communities within the RAA for land and resource use: Millertown, Buchans and Buchans Junction. Protected water supply areas in the RAA, designated under section 39 of the *Water Resources Act*, include Buchans Lake, Water Pond and Lapland Pond, located 43 km, 60 km and 63 km from the mine site, respectively. The RAA mainly includes unoccupied provincial Crown land, and recreational cabin use is permitted. There are 171 cabin plots and two cabin developments registered with Crown lands within the RAA. There are 21 outfitters registered with the Land Division, nine of which are active according to Tourism NL. The nearest active outfitter is the Notch Mountain Outfitters Lodge, located approximately 11 km from the LAA. There are four commercial Crown land licences, which are associated with mining activities and hydroelectric dams.

Three provincial protected areas overlap the RAA: Little Grand Lake Ecological Reserve; Little Grand Lake Wildlife Reserve; and T'Railway Provincial Park. There are no provincially protected areas within the Project Area or LAA. Mary March Wilderness Park is the only privately-owned park near the Approved Project. The park covers an area of 0.32 km² and includes hiking trails, all-terrain vehicle (ATV) trails, 25 designated campsites, and 23 picnic sites. Moose, bear, caribou, small game, and furbearing management areas / units also overlap the RAA and LAA. The Project Area overlaps <1% of the wildlife management areas / units; except for the furbearing trapzone #83, with the Project Area overlapping 11% of this trapzone.

Resource use in the LAA/RAA includes mining, hydropower, forestry, hunting, trapping, outfitting and angling. Hunting for big game includes moose, caribou, and black bear and for small game includes

showshoe hare (*Lepus americanus*), Arctic hare (*Lepus arcticus*), willow ptarmigan (*Lagopus lagopus*), rock ptarmigan (*Lagopus muta*), ruffed grouse (*Bonasa umbellus*) and spruce grouse (*Falcipennis canadensis).* Trapping of furbearing species also occurs in zones that overlap with the Project Area and LAA. The RAA overlaps with two Trap Zones in Fur Zone 4 and 16 Trap Zones in Fur Zone 7 while the Project Area overlaps with Trap Zones 14, 83, 221 and 239, all of which are in Fur Zone 7. Migratory bird game hunting also occurs in NL and could occur within the RAA. Angling occurs on a number of waterbodies in the RAA. There is an active recreational salmon fishery on the Exploits River, which flows northeast from Beothuk Lake. Brook trout (*Salvelinus fontinalis*), arctic char (*Salvelinus alpinus*) and Ouananiche (*Salmo salar ouananiche*) are also commonly fished in the RAA.

The Valentine Lake area has been subject to exploration and mineralogical studies since the 1960s. There are nine quarry permits within the RAA; however, no quarries are located in the Project Area. Two quarries are located within the LAA: one less than 10 m from the mine site, and the other along the proposed upgraded site access road. There are twelve mineral tenure impost lands in the RAA, two of which also overlap with the Project Area and LAA. The Approved Project is in Forest Management Districts (FMDs) 12 and 13 and is part of Planning Zone 5. The RAA is also an area of substantial hydroelectric development; however only the Victoria Dam and spillway, which are part of the Bay d'Espoir Hydroelectric Development, are located within the LAA.

Recreational activities within the RAA primarily include hunting, trapping and fishing activities. Hiking, backcountry camping, snowmobiling, ATV use, canoeing and kayaking activities also take place. There are two groomed snowmobile trails in the RAA leading to the communities of Buchans and Millertown; however, there are no groomed trails in the LAA or Project Area (NLSF 2020).

12.1.5 Indigenous Groups

As described in Chapter 17 of the Valentine Gold EIS, existing conditions for the First Nation groups considered health and socio-economic conditions, current use of lands and resources for traditional purposes and physical and cultural heritage. The LAA for Indigenous groups includes a 40-km by 40-km buffer around the mine site and a 500-m buffer around the access road to capture the area where effects on current use are likely to be most prevalent (e.g., effects to harvested species and country foods and sensory disturbance effects to nearby Indigenous land users). There are two Mi'kmaq First Nation groups on the Island of Newfoundland potentially affected by / interested in the Approved Project: Miawpukek First Nation (Miawpukek) and Qalipu Mi'kmaq First Nation (Qalipu). The Miawpukek Reserve is located at the mouth of the Conne River on the south coast of the Island of Newfoundland, approximately 113 km from the Project Area. The area of the reserve is approximately 620 ha. The total registered membership of Miawpukek is 3,063, of which approximately 33% live on reserve. Miawpukek's population is relatively young, with 34% of residents under the age of 25 (Michelin 2019). Languages spoken on the Miawpukek reserve include Mi'kmaq and English Crown-Indigenous Relations and Northern Affairs Canada 2021).

Qalipu was registered as a band under the *Indian Act* in 2011. Although a registered band, Qalipu does not manage reserve lands. Its members reside within 67 communities across the Island, including within the nearby communities of Buchans and Millertown. Qalipu maintains satellite administrative offices in

Glenwood, Grand Falls-Windsor, Stephenville and St. George's with a head office in Corner Brook. Qalipu currently has approximately 22,000 members.

12.1.5.1 Miawpukek

According to traditional oral history, the Miawpukek reserve was established in 1870 and was one of many semi-permanent camping sites used by their people travelling throughout the Mi'kmaq Domain of Newfoundland, Labrador, Quebec, New Brunswick, Nova Scotia, Prince Edward Island and Maine (MFN n.d.). Miawpukek ancestries include Mi'kmaq, Innu, Abenaki and European lines (MFN n.d.). Land located in Conne River was set aside as a Colonial Reserve by Governor William McGregor in 1872 (Joe 2007).

Following establishment as a reserve in 1987, Miawpukek has become a self-proclaimed strong, vibrant community with nearly 100% full / part-time employment (MFN n.d.). Members are employed in various roles such as nurses, educators, trades people, business owners, lawyers and care givers (Joe 2007). There are many Miawpukek owned and operated small businesses, such as Christmas tree farms, hunting camps and small fisheries and the Miawpukek Gas Bar and Convenience Store (BP 2018). The community has also partnered with several outside communities and corporations in tourism and aquaculture ventures (INAC 2012).

Conne River Health and Social Services provides community health services, including clinical nursing services, a wellness centre, youth centre, nutrition centre, ambulance services and on-call nurses (CRHSS n.d.). There is a volunteer fire department provided under the Conne River Health and Social Services Centre (MFN 2020). In 2017, Miawpukek opened a new school in the community, accommodating 240 students from pre-kindergarten to grade 12.

Based on the First Nations Food, Nutrition and Environment Study (FNFNES), obesity was identified by participants of the study as a concern and is a major risk factor for diabetes and heart disease. Miawpukek has indicated that these results related to health from the FNFNES are representative of current conditions on reserve (MFN 2020). Miawpukek has seen a decline in recent years in the number of diabetics due to the use of modern medicine, educational awareness and improved nutrition (MFN 2020). In addition to diabetes and heart disease, cancer was noted as an increasing health concern for the Miawpukek (MFN 2020).

Harvesting efforts are undertaken by most of the on-reserve Miawpukek members. Approximately 75% participate in hunting activities, 60% participate in fishing activities and 60% participate in gardening (MFN 2020). In recent years, Miawpukek has seen an increase in traditional harvesting activity due in part to the increase in grocery costs (MFN 2020). Commonly consumed traditional foods by Miawpukek members include moose, caribou, beaver (*Castor canadensis*), rabbit (*Lepus americanus*), muskrat (*Ondatra zibethicus obscurus)*, grouse (*Bonasa umbellus, Canachites canadensis, Lagopus lagopus*), goose *(Branta spp.*, duck (*Anas rubripes)*, blueberry (*Vaccinium uliginosum*), raspberry (*Rubus idaeus*), Newfoundland tea berry (*Gaultheria hispidula*), partridge berry (*Vaccinium vitis-idaea*) and bakeapple (*Rubus chamaemorus*) (MFN 2020). The most frequently consumed fish by Miawpukek include cod (*Gadus morhua),* American eel (*Anguilla rostrata),* redfish (*Lutjanus campechanus)*, herring (*Clupea harengus harengus*), lobster (*Homarus americanus)*, caplin (*Mallotus villosus*) and squid *(Illex*

illecebrosus) (MFN 2020). Due to declining populations, salmon (*Salmo salar)* is now generally reserved for special occasions, such as feasts, powwows and other celebrations. Miawpukek harvest plants that support medicinal activities, such as cherry bark (*Prunus pensylvanica*) (used to treat sore throats, coughs and colds), lily pad roots (*Nuphar spp.*) (used to treat tumors, ulcers and inflamed skin) and alder (*Alnus*) (used for a variety of medicinal purposes including treatment of headaches and migraines) (MFN 2020). White pine (*Pinus strobus*) is also harvested. Miawpukek has noted that, while in the past its members harvested for traditional purposes in the area in which the Approved Project is located, use of land and resources in this area has declined in recent years (MFN 2020).

12.1.5.2 Qalipu

In 1972, the Federation of Newfoundland Indians was formed, and its primary goal was to obtain Mi'kmaq recognition and claim status under the federal *Indian Act* (Qalipu First Nation n.d.). In 2008, the Government of Canada and Federation of Newfoundland Indians signed the Agreement for the Recognition of the Qalipu Mi'kmaq Indian Band to establish a landless band (Crown-Indigenous Relations and Northern Affairs Canada 2021). In 2011, Qalipu was registered as a band under the federal *Indian Act*.

Qalipu members live in communities throughout NL which are occupied by Indigenous and non-Indigenous people, and therefore, use the infrastructure and services provided in these communities. Qalipu members access services and programs, including health and educational services, provided by municipal and provincial agencies, private businesses and service agencies in communities and regions where they reside (Qalipu First Nation n.d.). The Qalipu have several wholly owned commercial enterprises, including Mi'kmaq Commercial Fisheries Incorporated, Qalipu Management Services Incorporated, Qalipu Marine Holdings, and Qalipu Project Support Services Limited (Qalipu First Nation 2019). There are also business partnerships between the Qalipu and several construction firms. Qalipu members also harvest firewood and produce artisan crafts, which makes up an important component of the subsistence economy.

An Aboriginal Traditional Knowledge Study was completed in 2020 by Qalipu to further Marathon Gold Corporation's (Marathon) understanding of current use in central Newfoundland by the Qalipu. Survey topics included hunting moose, bear, caribou, and waterfowl, trapping furbearing animals, frequency of consumption of wild game, harvesting medicinal and food plants and berries as well as sacred Mi'kmaq sites. Twenty-two Qalipu members responded to the online survey. An Area of Interest (approximately a 10- to 20-km buffer of the mine site and a smaller buffer around the access road) was identified for the study. A total of 466 points were placed on a map of central Newfoundland, illustrating areas of current use. Of these 466 points, three were placed within the Area of Interest (0.64%) and zero were placed within the Project Area. Two of the three areas identified by the participants were related to trout harvesting, while the third was related to ptarmigan harvesting. No further information on the history of their activity in these areas were provided. Participants were asked if they actively participated in land use activities within the Area of Interest; all, except one participant, said no. The one participant indicated that they hunted moose and fished in the area.

12.2 EXISTING ENVIRONMENT UPDATE

This section provides information on socio-economic topics for which data have been updated since submission of the Valentine Gold EIS, including demographics, housing, health and economic and employment indicators. Those topics for which updated information is not available are not described in this section.

The publicly available sources of socio-economic data that were used to prepare the existing conditions section of the Valentine Gold EIS were revisited to search for updates to the information presented in the original EIS. These sources of information are:

- Statistics Canada (2021 Census of Canada and National Household Survey) and other federal government sources
- Newfoundland and Labrador Statistics Agency / Community Accounts
- Municipal corporations
- Provincial agencies, boards and commissions
- Planning boards and boards of trade
- School and health boards
- Police and other emergency response organizations
- Housing agencies

Since the submission of the Valentine Gold EIS, a Mi'kmaq Knowledge, Land Use and Occupancy Study for the Approved Project was prepared by the Miawpukek First Nation and a summary of the results is provided in Section 12.2.8.

12.2.1 Population

In 2021, the total population of the LAA was 37,339 (51.6% female), a decrease of 2.6% from 2016 (Table 12.2) (Statistics Canada 2017, 2023a). Total population decreases in the LAA were greater than the provincial average of 1.8%. Grand Falls-Windsor, the largest community in the LAA, accounted for 37.1% of the total population (13,853 people). Approximately 6.9% or 2,595 people (52.6% female) within the LAA identified as Indigenous, compared to the provincial average of 9.1%.

Table 12.2 Population Change – 2016 to 2021

Location	Dataset	Total Population			Indigenous Population [A]		
		Total	Male	Female	Total	Male	Female
LAA	2021	37,339	18,075	19,265	2,595	1,230	1,365
	% Change 2016-2021	-2.6	-2.3	-2.9	10	9.3	10.5
NL	2021	510,550	250,075	260,475	46,545	22,520	24,030
	% Change 2016-2021	-1.8	-1.5	-2.0	1.8	1.9	1.7

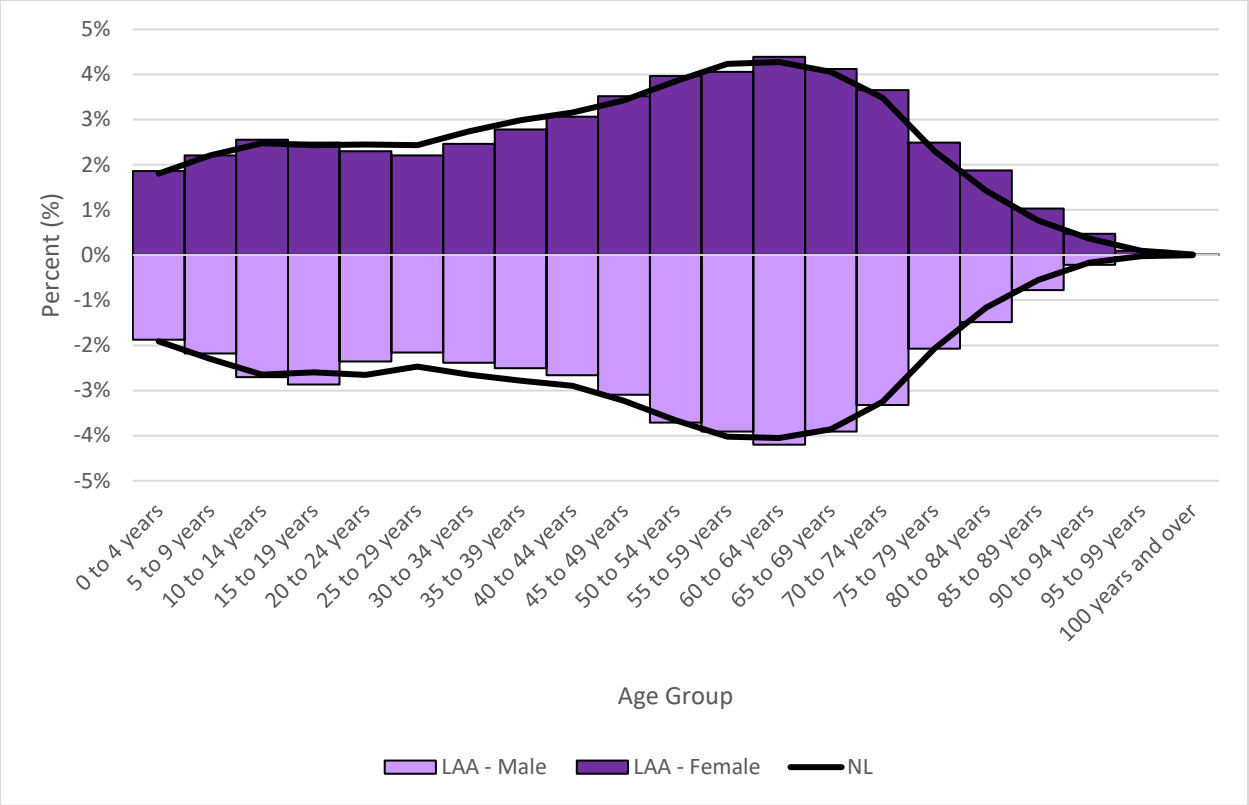
Notes:

[A.] Indigenous and non-Indigenous totals may not sum to equal total population counts as they are based on a 25% population sample size.

2016 'Total Population' data from 2016 Census of the Population – Census Profile. 2016 'Aboriginal Population' data taken from 2016 National Household Survey – Aboriginal Profile.

Values shown in "Total" columns are the sum of male and female CSD subsets taken from Statistics Canada's 2016 and 2021 Census Profile (Census of the Population). Due to Statistics Canada rounding (Statistics Canada 2023a) totals may not exactly align with those shown on CSD Census Profiles and may not sum across tables.
Sources: Statistics Canada 2017, 2023a

Figure 12-1 shows the distribution of the 2021 LAA population (total population) by age cohort compared to the provincial average. Generally, there is a smaller percentage of males within the LAA population between 0 to 4 years of age and 20 to 34 years of age than across the province, and a greater percentage between 55 to 64 years of age (Statistics Canada 2018, 2023a). Among females, there is a smaller percentage between 20 to 29 years of age than measured across the province and a greater percentage between 55 to 59 years of age.



Source: Statistics Canada 2022

Figure 12-1 Population Pyramid 2021, Total Population

12.2.2 Permanent and Temporary Accommodations

In 2016, there were a total of 8,770 private dwellings and 8,196 dwellings occupied by permanent residents in the LAA. In 2021, this had increased to 8,952 (2.1%) and 8,233 (.45%), respectively (Table 12.3). In 2021, 74.4% of dwellings occupied by permanent residents in the LAA were in Grand-Falls Windsor. The average cost of a home in the LAA in 2021 ranged from $62,000 in Buchans to $237,800 in Grand-Falls Windsor (Statistics Canada 2023a). All communities saw an increase in average housing price with the exception of Buchans, which saw a decrease of 22.6%. Housing costs in Millertown, however, nearly tripled between 2016 and 2021 (Statistics Canada 2023a).

Table 12.3 Housing Characteristics, LAA/RAA, 2016 and 2021

	Grand Falls-Windsor	Badger	Buchans	Buchans Junction	Bishop's Falls	Millertown
2016						
Number of private dwellings	6,406	325	417	54	1,502	66
Number of dwellings occupied by permanent residents	6,091	302	331	38	1,396	38
Average value of home	217,610	143,230	80,109	94,999	165,864	71,224
Average rent	759	736	603	-	787	-
2021						
Number of private dwellings	6,628	357	338	40	1,540	49
Number of dwellings occupied by permanent residents	6,122	313	304	32	1,422	40
Average cost of home	237,800	156,000	62,000	110,000	182,000	210,000
Average rent	853	-	740	-	752	-
Source: Statistics Canada 2023a						

Between 2016 and 2017, the vacancy rate in Grand Falls-Windsor increased by 4.8% to 7.7% and then dropped to 5.7% in 2018 (NL Department of Finance 2018; CMHC 2019). In October 2022, the total vacancy rate in Grand-Falls Windsor was 3.2% (CMHC 2023).

In 2017, the occupancy rate of temporary accommodations in NL's Central Tourism Region was 46.3%, compared to 51.1% for the province and up from 45.3% in 2016 (TCII 2017, 2018). Between 2019 and 2020, the Central Region's occupancy rate for temporary accommodations fell from 42.6% to 30.1% and then increased to 35.2% in 2021. During those same years, the province's occupancy rate decreased from 46.2% in 2019 to 26.9% in 2020 and then increased to 37.2% in 2021 (TCAR 2022a). These dates correspond with the height of the Covid-19 pandemic, which had an effect on travel and tourism in NL (TCAR 2022b).

12.2.3 Health Infrastructure and Services

The major health care facility servicing the LAA/RAA, including the Towns of Badger and Bishops Falls, is the Central Newfoundland Regional Health Centre located in Grand Falls-Windsor. The A.M. Guy Memorial Health Centre in Buchans also services Millertown and Buchans Junction (Central Health 2023). Long-term care in the LAA/RAA is available at Carmelite House in Grand Falls-Windsor and the A. M. Guy Memorial Health Centre in Buchans, with a combined total of 83 long-term care beds (Central Health n.d.). Construction on a new 60-bed long-term care home in Grand Falls-Windsor began in 2019 and was completed in spring 2022 (NLDHCS and NLDTW 2019; Central Health 2023).

Table 12.4 provides community health characteristics for the LAA/RAA which are based largely on data from Central Health.

Table 12.4 Health Characteristics, Newfoundland and Labrador and Central Health Region, 2019/2020

Health Characteristic	Newfoundland and Labrador			Central Health Region		
	Total	Male	Female	Total	Male	Female
General Health Indicator (%)						
Perceived health (very good or excellent)	63.9	61.0	66.6	63.1	60.4	65.6
Has a regular healthcare provider	87.1	83.2	90.8	84.8	80.1	89.4
Mental Health Status (%)						
Perceived mental health (very good or excellent)	68.9	70.7	67.3	69.5	71.5	67.6
Sense of community belonging (very strong or somewhat strong)	80.1	78.8	81.3	84.9	85.9	83.9
Perceived life stress (Population aged 12 and over who reported perceiving that most days in their life were quite a bit or extremely stressful)	13.4	13.7	13.0	11.7	11.5	11.8
Life satisfaction (satisfied or very satisfied)	93.3	93.7	92.9	93.3	92.7	93.9
Rates of Chronic Disease (%)						
Arthritis (15 years and over)	29.0	25.8	32.0	30.4	29.8	31.0
Diabetes	11.0	11.3	10.8	15.7	16.2	15.2
Asthma	8.7	7.3	10.1	6.4	5.6	7.1
Chronic obstructive pulmonary disease (35 years and over)	5.3	5.4	5.1	4.9	4.3	5.4
High blood pressure	23.6	23.6	23.7	30.3	31.1	29.4
Rates of Substance Abuse and Healthy Living Indicators (%)						
Current smoker, daily or occasional	19.3	20.8	17.8	23.1	27.4	19.0
Heavy drinking	22.3	28.4	16.5	22.8	26.9	13.3
Source: Statistics Canada 2023b						

In 2019/20, the Central Health Region showed higher rates of arthritis, diabetes and high blood pressure than the province however, lower rates of asthma and chronic obstructive pulmonary disease. Females in the Central Health Region had higher rates of chronic disease than males in most instances (other than high blood pressure and diabetes). In 2019/20, Central Health Region residents perceived their mental health to be very good or excellent. This is lower than what was reported for the region in 2018 (72.2%) and slightly higher than that of the province (68.9%). Perceived life stress was lower in the Central Health

Region (11.7%) than the province (13.4%) in 2019/20 while the Region's sense of community belonging was higher (84.9%) than that of the province (80.1%) (Statistics Canada 2023b).

Rates of smoking and alcohol consumption were higher in the Central Health Region than the province in 2019/20. This is a change from 2018 when rates of these behaviours were higher in the province than in the Central Health Region with more than 20% of the Region's population smoking daily or occasionally versus 16.6% of the Central Health Region (Statistics Canada 2023b).

12.2.4 Police Services

The RCMP operates a detachment in Grand Falls-Windsor, which provides service to Badger, Buchans, Buchans Junction, Bishop's Falls and Millertown, in addition to other communities. As of March 2020, the detachment had 25 regular members on staff. The staffing levels are governed by the 2012 Provincial Policing agreement and the number of agreed upon positions by the province (Bryan, pers. comm. 2020).

The crime severity index (CSI) for the Grand Falls-Windsor detachment decreased 9.5% from 73.38 in 2016 to 66.75 in 2018. The CSI measures changes in the level of crime severity in Canada from year to year and includes Criminal Code violations including traffic and drug violations and Federal Statutes (Statistics Canada 2020). Updated data on CSI for the Grand Falls-Windsor detachment are not available from Statistics Canada, the previous source, however, NL Statistics Agency reports a CSI of 65.7 for the detachment in 2021 (NL Statistics Agency 2022a).

Between 2014 and 2018, the total number of violent criminal code offences (e.g., murder, manslaughter, sexual assault, criminal harassment) in the Grand Falls-Windsor RCMP District increased 18.8% from 425 to 515. By 2021, this number had increased to 570, an increase of 10.7% (NL Statistics Agency 2022b).

12.2.5 Labour Force

Table 12.5 provides a summary of labour force indicators for the LAA and the province. In 2021, the total size of the LAA labour force was 16,885 (50.8% female) (Statistics Canada 2023a). Of the total LAA labour force, 6.5% identified as Indigenous (1,155 people, of whom 50.2% were female).

In 2021, the LAA total labour force participation rate[1] (53.5%) was lower than the provincial average, while the participation rate of the Indigenous portion of the labour force was slightly greater (48.8%) (Statistics Canada 2017, 2018). Minor variations in labour force participation rates were observed between males and females (total and Indigenous population) within the LAA and province.

[1] The participation rate is the total labour force (employed and unemployed, combined) relative to the working-age population.

Table 12.5 Labour Force Indicators, 2021

Topic	Total Population		
	Total	**Male**	**Female**
LAA			
Population aged 15 years+	31,590	15,270	16,320
Labour force	16,885	8,310	8,580
Participation rate (%)	53.5	54.4	52.6
Employed	12,975	6,520	7,455
Unemployed	2,910	1,790	1,125
Unemployment rate (%)	17	22	13
NL			
Population aged 15 years+	433,960	211,180	222,775
Labour force	243,330	123,685	119,645
Participation rate (%)	56.1	58.6	53.7
Employed	206,285	101,475	104,810
Unemployed	37,045	22,210	14,835
Unemployment rate (%)	15.2	18	12.4

Notes:
Values shown in "Total" columns are the sum of male and female CSD subsets taken from Statistics Canada's 2021 Census Profile (Census of the Population). Due to Statistics Canada rounding (Statistics Canada 2023a) totals may not exactly align with those shown on CSD Census Profiles and may not sum across tables.
Source: Statistics Canada 2023a

Generally, unemployment rates within the LAA and the province were higher among males and Indigenous members of the labour force. Unemployment rates for males across total LAA (22%) labour force were higher than the provincial average (18%), while unemployment rates for females across total LAA (13%) labour force were higher than the provincial average (12.4%) (Statistics Canada 2023a). The unemployment rates in the LAA increased slightly since 2016 (15.7%) while the provincial unemployment rates decreased since 2016 (15.6%). Of the Indigenous portion of the LAA population, the unemployment rate was lower for males (24.3%) than the provincial average (25.9%) and higher for females (19.0%) than the provincial average (16.9%).

12.2.6 Employment

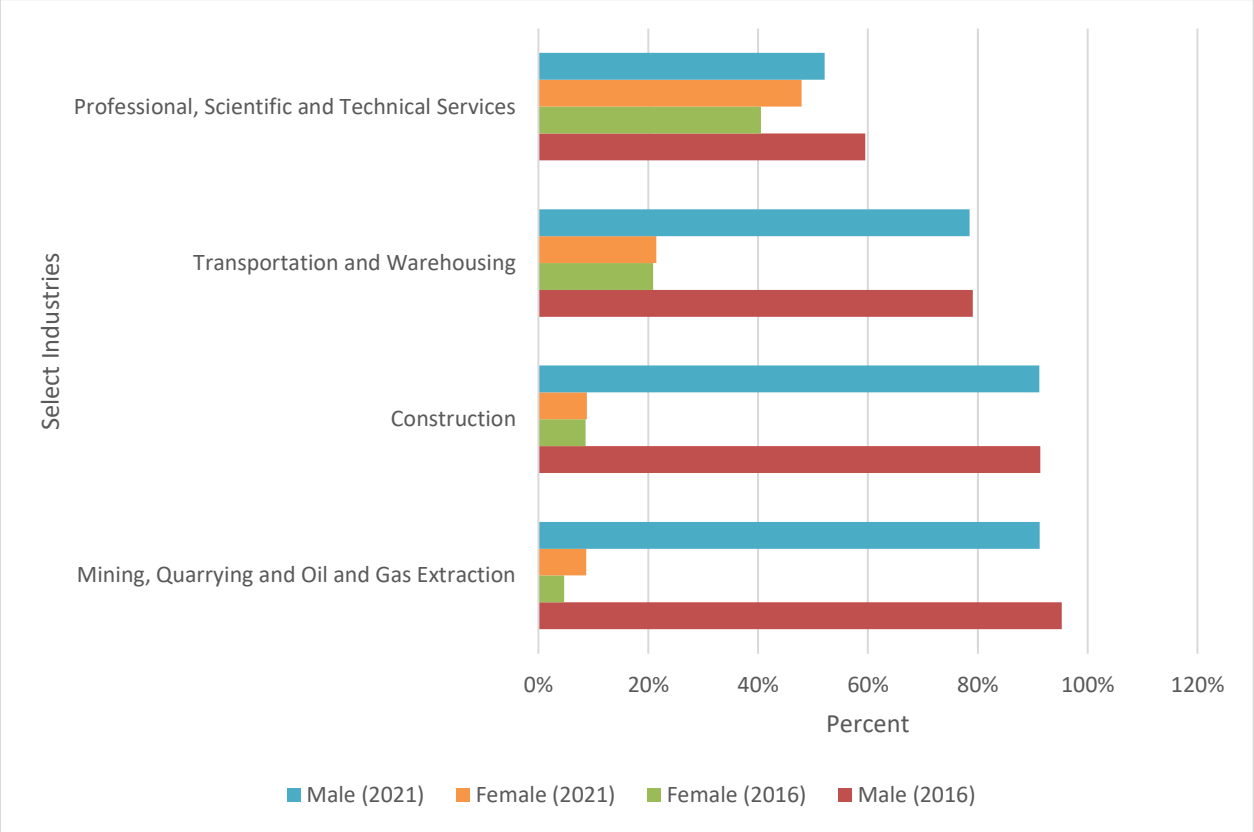
Employment indicators for 2016 and 2021 (by sex) across the LAA are provided in Table 12.6. Not including variations in employment across male and female components of the labour force, industry employment within the LAA was similar to provincial averages.

Table 12.6 and Figure 12-2 provides a summary of LAA employment (by sex) in industries most likely to be called upon to provide direct and indirect labour and goods and services to the Approved Project and Project Expansion. From 2016 to 2021, there was a 25.9% decline in employment in Construction, however, a 22.4% increase in employment in Mining, Quarrying and Oil and Gas Extraction. The

distribution of labour for females also increased since 2016, with the largest increase of 7.4% female employees in Professional, Scientific and Technical Services.

Table 12.6 LAA Employment (by Sex) in Select Industries, 2016 and 2021

	2016			2021		
	Total (#)	Male (%)	Female (%)	Total (#)	Male (%)	Female (%)
Total Labour Force						
Mining, Quarrying and Oil and Gas Extraction	425	95.3	4.7	520	91.3	8.7
Construction	1,450	91.4	8.6	1,075	91.2	8.8
Transportation and Warehousing	1,125	79.1	20.9	1,095	78.5	21.5
Professional, Scientific and Technical Services	420	59.5	40.5	470	52.1	47.9
Sources: Statistics Canada 2017, 2018, 2023a						



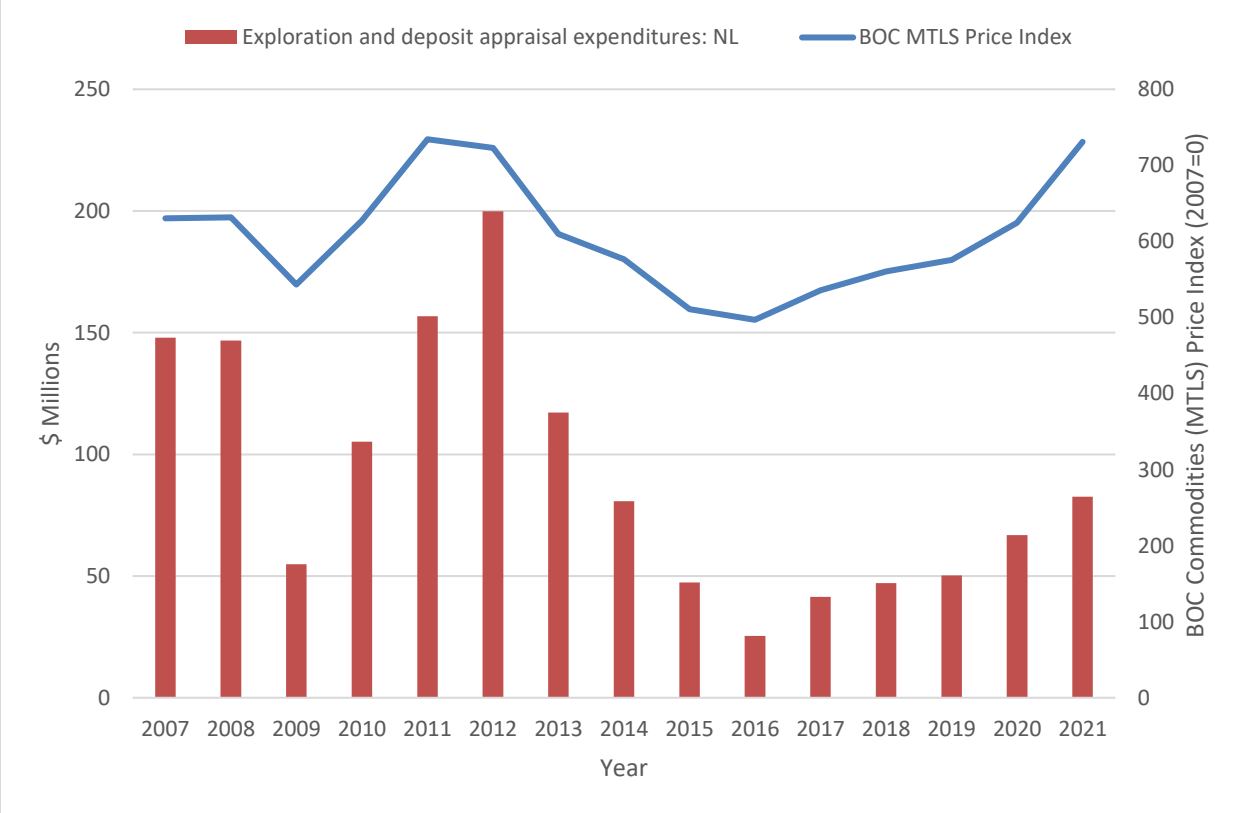
Sources: Statistics Canada 2017, 2023a

Figure 12-2 LAA Employment (by Gender) in Select Industries, 2016 and 2021

12.2.7 Industries

12.2.7.1 Mining

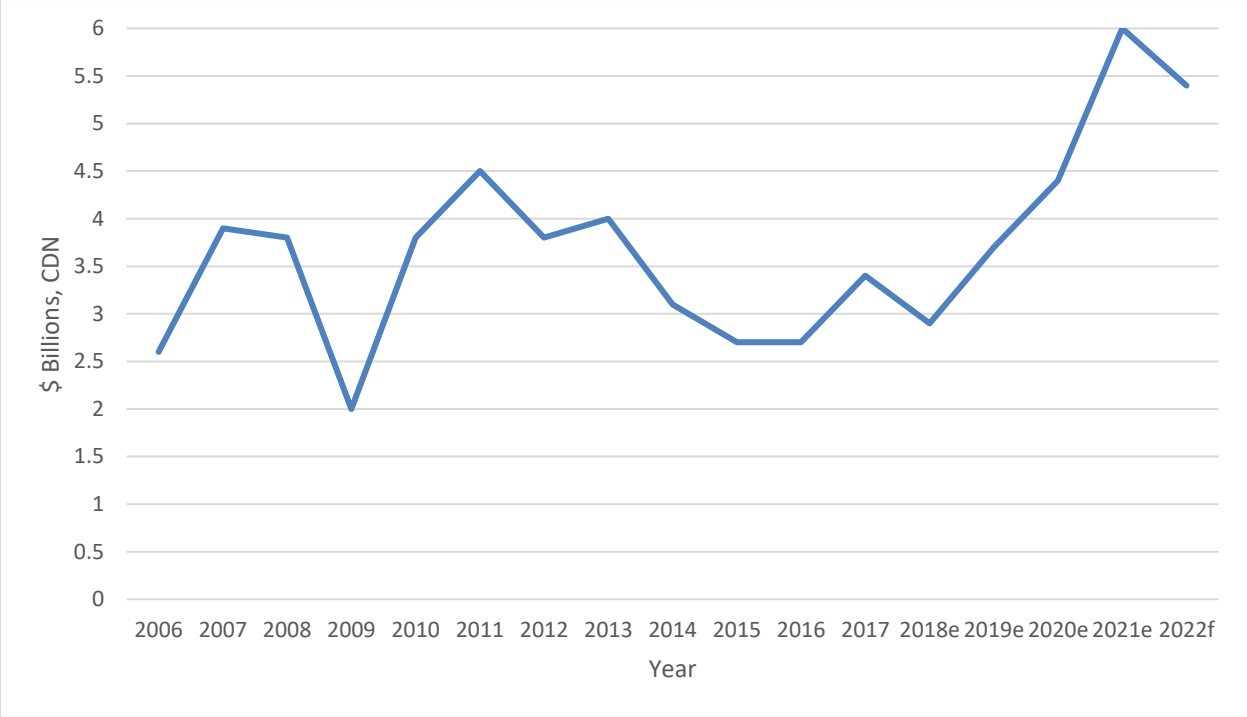
Mining continues to be one of the largest industries in NL and has a measurable effect on the provincial economy (Government of NL 2020). Mineral exploration is a key indicator of the long-term viability of the mining industry as it may lead to the discovery and subsequent development of mineral deposits (DNR 2022a). In general, mineral exploration is highly dependent on commodity prices (DNR 2022b). This relationship is illustrated in Figure 12-3 where a positive correlation is observed between mineral and metal commodity prices and expenditures on mineral exploration in NL between 2006 and 2020. Except for 2009 (slightly less than $55 million), annual exploration expenditures between 2006 and 2013 remained above $100 million, hitting a high of nearly $200 million in 2012. Between 2012 and 2016, exploration expenditures trended downward hitting a low of just over $25 million. Since 2016, annual exploration expenditures have increased, which corresponds with the rise of commodity prices (Statistics Canada 2017, 2023a).



Notes: 2021 exploration and deposit appraisal expenditures are estimates; 2021 represent spending intentions. BOC Commodities (MTLS) Price Index is based on annual calculations (Jan).
Sources: BOC 2022, Mining Association of Canada 2022.

Figure 12-3 NL Mineral Exploration and Deposit Appraisal Expenditures and Bank of Canada (BOC) Metals Commodity Price

The Gross Value of Mineral Shipments (GVMS), calculated as the value of commodity shipments made by producing mining companies for a given year, is a standard measure used in NL to quantify the mining industries contribution to the provincial economy (DNR 2019). Between 2005 and 2022 (forecast), GVMS increased 230% from $2.6 billion in 2006 to an estimated value of $6.0 billion in 2021 before dropping to a forecasted value of $5.4 billion in 2022 (DNR 2022c). Despite an overall increase, GVMS was variable over the 15-year period increasing to a high of $6.0 billion in 2021, dropping to a low of $2.0 billion in 2009, and was marked by a period of general decline between 2011 and 2016 (Figure 12-4).



Notes: f = forecast; e = estimate
Source: DNR 2019, 2022c, d

Figure 12-4 Gross Mineral Shipments, NL

Notwithstanding a $700 million reduction between 2017 and 2018, total GVMS has trended upward since 2016. Based on forecast data, 78% ($4.2 billion) of total GVMS in 2022 will be associated with shipments of iron ore, 15% ($825 million) will be associated with nickel, 3% ($176 million) will be associated with copper, with the remaining 3% ($184 million) and 1% ($68 million) associated with other-metals and non-metals respectively (DNR 2022d).

12.2.7.2 Outfitting

Outfitting is an important industry throughout rural Canada, including in NL. A study by Southwick Associates (2019) presented information on participation, spending, and the economic contributions of fishing and hunting outfitters in Canada in 2017. The study included surveys of outfitters belonging to a provincial association and their clients to estimate outfitted activity and spending, with resulting economic contributions estimated by Statistics Canada's Interprovincial Input-Output economic model.

The study estimated that in 2017 more than 730,000 clients used the services of a fishing or hunting outfitter in Canada, with outfitters and their clients spending more than $3.8 billion on service offerings (Southwick Associates 2019). In 2017, average spending by foreign visitors for all-inclusive packages in Canada was $2,288 per outfitted fishing trip and $7,537 per outfitted hunting trip, compared to $1,031 and $3,198 for Canadian residents (Southwick Associates 2019). In 2017, the outfitting industry contributed nearly $2.7 billion to GDP and supported more than 37,000 jobs, providing nearly $1.6 billion in labour income (Southwick Associates 2019). The outfitting industry contributed more than $657 million in federal, provincial and municipal taxes (Southwick Associates 2019).

While primarily engaged in guided hunting and angling services, many Canadian outfitters also offer nonhunting and non-fishing activities, including wildlife viewing and photography, hiking, canoeing and kayaking, snowmobile and ATV tours and horseback riding (Southwick Associates 2019). Packages and service offerings offered by Canadian outfitting operations not only appeal to hunters and anglers but also to other outdoor recreational users.

Since 2020 when the Valentine Gold EIS was submitted, there has been no change in the number of outfitting operators that are active within the LAA.

12.2.8 Indigenous Groups

Following the completion of the Valentine Gold EIS, a Mi'kmaq Knowledge, Land Use and Occupancy Study for the Approved Project was prepared by the Miawpukek First Nation in March 2022. The study included two primary forms of data collection: conducting a map biography and an oral history interview with participants. A total of 25 participants were interviewed for the study. A Study Area was selected that included a 50-km buffer from Approved Project infrastructure such as open pits, tailings facility, and process plant, and a 30-km buffer from linear features such as roads and transmission lines as well as a 250-km track following waterways downstream of the tailings management facility, with a 100-m buffer encompassing the riparian area (MFN and Tamarack Environmental Associates Inc. 2022).

A total of 432 sites of historic and current land use, ecological knowledge and occupancy were identified and 127 of these were mapped within the Study Area, including places of fishing, cultural significance, ecological significance (especially mammal migration and mammal habitat) and gathering (MFN and Tamarack Environmental Associates Inc. 2022). Within the Study Area, concentrations of mapped sites were focused near Meelpaeg Reservoir (cultural, Indigenous Ecological Knowledge [IEK], changes, trapping and snaring), Beothuk Lake (cultural, fishing and gathering) and around Victoria Lake (IEK, cultural and fishing) (MFN and Tamarack Environmental Associates Inc. 2022).

The study's conclusions indicate that there is land and resource use in the Study Area but also recognizes that, as a result of MFN's settlement in Conne River, much of their modern-day land use is concentrated in that area (MFN and Tamarack Environmental Associates Inc. 2022).

12.3 POTENTIAL EFFECTS FROM PROJECT EXPANSION

As described in Chapters 13 to 17 of the Valentine Gold EIS, both positive and adverse effects were predicted for the socio-economic components as a result of the Approved Project. Positive effects were predicted through the improvement of some infrastructure and services, including road improvements which may benefit local cabin owners and land and resource users.

Positive effects were also predicted due to Approved Project spending on goods and service contracts, as well as indirect and induced employment effects. This was also predicted to lead to positive effects on the well-being of community LAA and RAA residents.

As predicted in the Valentine Gold EIS, adverse effects of the Approved Project, including those on the capacity of local infrastructure and services, economic activity of outfitters, labour supply, community well-being (social connectivity and physical and mental health) and access to the land and harvested species for Indigenous and non-Indigenous land users were generally predicted to be of low magnitude.

Based on new labour information for the Project Expansion, the operation phase will require a slightly larger labour force than that of the Approved Project. Table 12.7 provides estimates of the cumulative total direct employment in full-time equivalents (FTEs) to be generated during the 14.4 years of operation of the Approved Project and Project Expansion (peaking in 2028), and the related National Occupation Classification (NOC) codes for Canadian labour. A FTE of employment is typically equivalent to approximately 2,000 hours of work. For this estimate, 2,190 hours was used to measure FTE-years of employment for operation jobs based on the planned work schedule of a 24-hour operation with two 12-hour shifts.

Table 12.7 Operation-Related Estimate of Direct Employment (FTEs) by Four-Digit NOC Code

Category	NOC	Description	Operation (Approved Project)	Operation (Approved Project + Expansion)
Trades and Production Occupations	7521	Heavy equipment operators (except crane)	1,354	1,680
	7311	Construction millwrights and industrial mechanics (except textile)	141	316
	7511	Truck drivers	166	166
	7237	Welders and related machine operators	84	107
	9411	Machine operators, mineral and metal processing	186	193
	7312	Heavy-duty equipment mechanics	187	187
	7242	Industrial electricians	62	80
	9611	Labourers in mineral and metal processing	110	139
	8614	Mine labourers	76	76
	7452	Material handlers	-	-
	7371	Crane operators	-	-
	7611	Construction trades helpers and labourers	36	36
	7252	Steamfitters, pipefitters and sprinkler system installers	-	-
	9241	Power engineers and power systems operators	-	-
	7372	Drillers and blasters - Surface mining, quarrying and construction	464	722
	7612	Other trades helpers and labourers	48	48
	7271	Carpenters	-	-
	7251	Plumbers	-	-
Professional and Physical Science Occupations	2113	Geologists, geochemists and geophysicists	55	55
	2143	Mining engineers	19	19
	2121	Biologists and related scientists	24	24
	2131	Civil engineers	12	12
Human Resources and Financial Occupations	1111	Financial auditors and accountants	-	-
	0112	Human resources managers	-	-
	0111	Financial managers	12	12
	1121	Human resource professionals	12	12
	1112	Financial and investment analysts	-	-

Table 12.7 Operation-Related Estimate of Direct Employment (FTEs) by Four-Digit NOC Code

Category	NOC	Description	Operation (Approved Project)	Operation (Approved Project + Expansion)
Support Workers	1414	Secretaries (except legal and medical)	-	-
	2263	Inspectors in public and environmental health and occupational health and safety	12	12
	2261	Non-destructive testers and inspection technicians	33	33
	9415	Inspectors and testers, mineral and metal processing	-	-
	1523	Production clerks	23	23
	1525	Dispatchers and radio operators	13	13
	6322	Cooks	-	-
	1241	Administrative clerks	9	9
	2234	Construction estimators	-	-
	6541	Security guards and related security service occupations	48	48
	2262	Engineering inspectors and regulatory officers	-	-
Technical Occupations	2154	Land surveyors	22	22
	2171	Information systems analysts and consultants	-	-
	2243	Industrial instrument technicians and mechanics	48	48
	2232	Mechanical engineering technologists and technicians	8	8
	2212	Geological and mineral technologists and technicians	96	96
	2211	Chemical technologists and technicians	-	-
	2231	Civil engineering technologists and technicians	-	-
	2253	Drafting technologists and technicians	-	-
	2241	Electrical and electronics engineering technologists and technicians	48	48
	2255	Mapping and related technologists and technicians	-	-
	2254	Land survey technologists and technicians	-	-
	2233	Industrial engineering and manufacturing technologists and technicians	12	12
	2221	Biological technologists and technicians	12	12

Table 12.7 Operation-Related Estimate of Direct Employment (FTEs) by Four-Digit NOC Code

Category	NOC	Description	Operation (Approved Project)	Operation (Approved Project + Expansion)
Supervisors, Coordinators, and Foremen	0811	Primary production managers (except agriculture)	59	59
	8221	Supervisors, mining and quarrying	69	69
	9211	Supervisors, mineral and metal processing	21	21
	0211	Engineering managers	21	21
	0711	Construction managers	-	-
	7301	Contractors and supervisors, mechanic trades	22	22
	7203	Contractors and supervisors, pipefitting trades	-	-
		Total	**3,624**	**4,453**

Note:
- Not applicable
Sources: Adopted from SC 2020; Mining Industry Human Resources Council 2015

For the Valentine Gold EIS, it was assumed that construction would require a peak labour force of approximately 625 (FTEs) (an average of 320 FTEs) and operation was estimated to require a peak workforce of approximately 480 FTEs (an average of 300 FTEs). It was estimated that 90% of the construction and operation workforces will be sourced from NL. Approximately 65% will come from communities within the LAA/RAA (Chapter 15), although it is expected that all workers, regardless of whether they reside in the LAA/RAA communities, will stay at the accommodations camp for the duration of their rotation and not commute to the mine site each day. Employees will work for two-week rotations, with a weekly rotation change of employees.

The total number of FTEs during the construction, decommissioning, rehabilitation and closure will not change from the Valentine Gold EIS with the inclusion of the Project Expansion. It is expected that there will be a 21.7% increase in employment in mining staff during the operation phase of the Project Expansion. Operation of the Project Expansion, in combination with the Approved Project, is estimated to require a peak workforce of approximately 524 FTEs (44 FTEs above the Valentine Gold EIS estimate and an average of 366 FTEs). Employment estimates by four-digit NOC provided in Table 12.7 are considered preliminary and are subject to change as mine planning / engineering progresses.

For those VCs for which effects are related to Project Expansion employment and the associated demographic change in the LAA and RAA, the relatively small increase in the labour force during operation is unlikely to change the effects predicted in the Valentine Gold EIS. The planned accommodations camp will house all workers during the mine operation phase, including spare capacity for consultants, contractors, and other potential short-term requirements. Even with an additional 44 employees at peak, the operation workforce is not likely to place additional demands on local housing and accommodations or other local infrastructure and services. Operation workers who do not already reside in the LAA/RAA communities will likely return to their home communities during the off-time portion of

their work rotation and they are not expected to create additional traffic on LAA/RAA roads. Scheduling of rotation changes so that the entire workforce does not arrive at or leave the mine site on the same day (e.g., split shifts) will help reduce Approved Project and Project Expansion-related demands on roads on a given day.

With respect to community health, the Valentine Gold EIS predicted minimal Approved Project-related changes in population (less than a one percent change from baseline). Mitigation measures included implementation of workforce sensitivity training (expected to reduce the likelihood of adverse interactions with local residents), access to an Employee Assistance Program for Approved Project personnel and work rotations that will limit the amount of time workers spend in LAA/RAA communities. The Project Expansion is therefore not likely to adversely affect social connectivity and other factors of community well-being.

As the Approved Project transitions into decommissioning, rehabilitation and closure, the Project Expansion will result in a slightly larger decrease in workforce that ultimately results in the loss of employment. However, this loss will be known and anticipated by mine workers as the operational life of the mine will be communicated at early stages and updated throughout the life of the mine. As stated in the Valentine Gold EIS, mitigating the magnitude of this loss of employment is the gained labour income, skills and experience workers realize while employed with the Approved Project. In the case of gained skills and experience, these improved qualifications will aid with securing employment on other and future projects within the LAA, RAA (province), or elsewhere.

The quality of experience by land and resource users, including outfitters, could be adversely affected due to the presence of, and increased hunting pressure from, the Approved Project and Project Expansion's workforce and from improved year-round access to hunting areas; however, Marathon will prohibit workers from bringing firearms and fishing gear to the site while working. This mitigation measure will be in place during all phases of the Project Expansion and the slight increase in the operation labour force is not likely to result in a change to the predicted effects on outfitters and recreational and Indigenous land and resource use.

A human health risk assessment completed for the Approved Project evaluated the potential for changes in contaminant concentrations air, soil, water, and country foods to the health of Indigenous and non-Indigenous community members and off-duty workers (note that while on duty, worker health and safety are addressed through compliance with the *Occupational Health and Safety Act* and regulations). The results demonstrated that the predicted changes in inhalation exposures, direct contact exposures to soil and surface water, and ingestion exposures from the consumption of country foods represent a negligible change in human health risk for the Indigenous and non-Indigenous receptors. The results also demonstrated a negligible risk to off-duty workers at the accommodations camp. As described in the Valentine Gold EIS, exposure to noise was below health-based limits. Project Expansion activities are not anticipated to result in changes to the quality of environmental media (i.e., air, soil, water and, by extension, country foods), and sound levels are not expected to exceed health-based guidelines. Therefore, the risk of adverse effects to physical health conditions from exposure to contaminants and noise from the Approved Project in combination with the Project Expansion remains unchanged from the Valentine Gold EIS.

Given the relatively small reduction in land area available for outfitting activities (roughly equivalent to 1% of the total moose / bear management area) that will be caused by the Approved Project, as well as the limited use of the area for resource use, the assessment of change in land and resource use remains unchanged for the Project Expansion. Marathon has concluded an Outfitters Environmental Effects Monitoring Agreement with the Newfoundland and Labrador Outfitters Association (NLOA), which provides for ongoing engagement with outfitters and Marathon will also continue to engage local resource users regarding the overlap of the Approved Project and Project Expansion with hunting, trapping and fishing areas in the Project Area. This will include the communication of Approved Project and Project Expansion information, updates on ongoing and planned activities, and a discussion of issues and concerns and a potential means of addressing them.

The Valentine Gold EIS described the current use in the area of the mine site by Miawpukek and Qalipu as limited; however, it conservatively assumed that resources harvested for traditional purposes may be present at the mine site. The Valentine Gold EIS also predicted that, given the low potential for air emissions and water discharges to affect the quality of country foods combined with the limited harvesting activities, the potential for the Approved Project to result in a change in Indigenous health related to country foods consumption is low. Since the footprint of the Project Expansion is mostly contained within the Project Area assessed for the Approved Project and specifically within the mine site (the Project Area for the Approved Project was composed of the mine site and access road), the prediction with respect to effects on the Approved Project on use of the land by Indigenous groups is not expected to change as a result of the Project Expansion. As described in Chapter 6 (Atmospheric Environment) of this Environmental Registration / Environmental Assessment (EA) Update, the Project Expansion is not expected to result in a change in the predicted effects to the atmospheric environment. Therefore, a change to the effects on the health of Indigenous Groups predicted in the Valentine Gold EIS are not expected to change as a result of the Project Expansion.

Marathon has concluded a Socio-Economic Agreement (SEA) with each of Miawpukek and Qalipu which provides for ongoing engagement. Each agreement also provides for the establishment of an environmental stewardship committee mandated to consider the potential effects of Marathon's operations upon Indigenous land and resource use, including potential effects upon associated health and socioeconomic conditions. Marathon has committed to ongoing engagement with both Indigenous groups pursuant to the terms of the respective SEA and will take into consideration information provided by each group respecting both current land and resource use and traditional knowledge in the development of mitigation measures and the implementation of follow-up monitoring programs.

12.4 SUMMARY OF CHANGES FROM THE APPROVED PROJECT

Based on a review of updated existing information for the socio-economic environment, results of the Valentine Gold EIS, details on the Project Expansion, and with the implementation of mitigation and management measures described in Sections 13 to 17 of the Valentine Gold EIS, including efforts to hire locally to the extent possible, the use of an accommodations camp, access to an Employee Assistance Program for Approved Project and Project Expansion personnel, prohibiting workers from bringing

firearms and fishing gear to the site while working, residual adverse effects of the Project Expansion are predicted to be unchanged from the effects predicted in the Valentine Gold EIS (Table 12.8).

In the Valentine Gold EIS, Marathon completed a fulsome cumulative effects assessment (CEA) of these socioeconomic components (Chapter 20). That CEA considered if and how residual effects of past, ongoing and reasonably foreseeable projects and activities (Table 20.1, Marathon 2020) interacted with the residual effects of the Approved Project to amplify effects on the various socioeconomic components. An updated list of past, ongoing and reasonably foreseeable projects and activities is presented in Table 5.9 of the Environmental Registration / EA Update. Based on the residual effects assessment completed for these socioeconomic components (Table 12.8) for the combined Project Expansion and Approved Project that considers the addition of new projects and activities in the RAA (Table 5.9) since 2020, Marathon has concluded that there should be no change to the CEA completed for these components in the Valentine Gold EIS as a result of the Project Expansion.

Table 12.8 Project Residual Effects for Approved Project* and Project Expansion

Residual Effect	Residual Effects Characterization for Approved Project								Change in Residual Effect Characterization with Addition of Project Expansion (i.e., Combined Effects of Approved Project and Project Expansion)
	Project Phase	Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Ecological and Socio-economic Context	
Community Services and Infrastructure									
Change in Local Housing and Accommodation	C	A	N	LAA/RAA	ST	C	R	R	No Change
	O	A	N	LAA/RAA	MT	C	R	R	
	D	A	N	LAA/RAA	ST	C	R	R	
Change in Local Services and Infrastructure	C	A	L	LAA/RAA	ST	C	R	R	No Change
	O	A	L	LAA/RAA	MT	C	R	R	
	D	A	L	LAA/RAA	ST	C	R	R	
Community Health									
Change in Community Well-Being	C	A/P	L	LAA/RAA	ST	C	R	R	No Change
	O	A/P	L	LAA/RAA	MT	C	R	R	
	D	A/P	L	LAA/RAA	ST	C	R	R	
Change in Physical Health Conditions	C	A	N-L	PA/LAA	ST-MT	C	R	D	No Change
	O	A	N-L	PA/LAA	ST-MT	C	R	D	
	D	A	N-L	PA/LAA	ST-MT	C	R	D	

Table 12.8 Project Residual Effects for Approved Project* and Project Expansion

Residual Effect	Residual Effects Characterization for Approved Project								Change in Residual Effect Characterization with Addition of Project Expansion (i.e., Combined Effects of Approved Project and Project Expansion)
	Project Phase	Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Ecological and Socio-economic Context	
Employment and Economy									
Change in Regional Labour Force	C	P	H	LAA/RAA	ST	C	R	R	No Change
	O	P	H	LAA/RAA	MT	C	R	R	
	D	A	M	LAA/RAA	ST	C	I	R	
Change in Regional Business	C	P / A	L	LAA/RAA	ST	C	R	R	No Change
	O	P / A	L	LAA/RAA	MT	C	R	R	
	D	P / A	L	LAA/RAA	ST	C	I	R	
Change in Economic Activity of Outfitters	C	A	N-L	LAA	ST	C	R	R	No Change
	O	A	N-L	LAA	LT	C	R	R	
	D	A	N-L	LAA	LT	C	R	R	
Change in Economy	C	P	L	LAA/RAA	ST	C	R	R	No Change
	O	P	M	LAA/RAA	MT	C	R	R	
	D	P	L	LAA/RAA	ST	C	R	R	
Land and Resource Use									
Change in Land Use	C	A	L	PA/LAA	ST	IR	R	R	No Change
	O	A	L	PA/LAA	MT-P	C	R / IR	R	
	D	A	L	PA/LAA	ST	IR	R / IR	R	
Change in Resource Use	C	A	N-L	PA/LAA	ST	IR	R	R	No Change
	O	A	N-L	PA/LAA	MT-P	C	R / IR	R	
	D	A	N-L	PA/LAA	ST	IR	R / IR	R	
Change in Recreational Use	C	A	N-L	PA/LAA	ST	IR	R	R	No Change
	O	A	N-L	PA/LAA	ST-P	C	R / IR	R	
	D	A	N-L	PA/LAA	ST	IR	R / IR	R	

Table 12.8 Project Residual Effects for Approved Project* and Project Expansion

Residual Effect	Residual Effects Characterization for Approved Project								Change in Residual Effect Characterization with Addition of Project Expansion (i.e., Combined Effects of Approved Project and Project Expansion)
	Project Phase	Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Ecological and Socio-economic Context	
Indigenous Groups									
Change in Current Use	C	A	N-L	PA / LAA	ST	IR / C	R	R	No Change
	O	A	N-L	PA / LAA	ST-P	IR / C	R / IR	R	
	D	A	N-L	PA / LAA	ST-P	IR / C	R / IR	R	
Change in Health Conditions	C	A	N-L	PA / LAA	ST	C	R	R	No Change
	O	A	N-L	PA / LAA	ST-MT	C	R	R	
	D	A	N-L	PA / LAA	ST-MT	C	R	R	
Change in Socio-economic Conditions	C	A / P	N-L	PA / RAA	ST	IR / C	R	R	No Change
	O	A / P	N-L	PA / RAA	ST-P	IR / C	R / IR	R	
	D	A	N-L	PA / RAA	ST-P	IR / C	R / IR	R	
Change to Physical and Cultural Heritage (inside Project footprint)	C	A	N-H	PA	ST-P	S	R / IR	R	No Change
	O	A	N-L	PA / LAA	ST	IR / C	R	R	
	D	A	N-L	PA / LAA	ST-P	IR / C	R / IR	R	
Change to Physical and Cultural Heritage (outside Project footprint)	C	A	N-L	PA / LAA	ST-P	IR / C	R / IR	R	No Change
	O	A	N-L	PA / LAA	ST	IR / C	R	R	
	D	A	N-L	PA / LAA	ST-P	IR / C	R / IR	R	

KEY:

See Appendix 5A for detailed definitions

Project Phase
C: Construction
O: Operation
D: Decommissioning

Direction:
N: Neutral
P: Positive
A: Adverse

Magnitude:
N: Negligible
L: Low
M: Moderate
H: High

Geographic Extent:
PA: Project Area
LAA: Local Assessment Area
RAA: Regional Assessment Area

Duration:
ST: Short-term
MT: Medium-term
LT: Long-term
P: Permanent

N/A: Not applicable

Frequency:
S: Single event
IR: Irregular event
R: Regular event
C: Continuous

Reversibility:
R: Reversible
I: Irreversible

Ecological / Socio-Economic Context:
R: Resilient
NR: Not Resilient

*Tables 13.6, 14.14, 15.25, 16.19, and 17.6 in the Valentine Gold EIS refer to residual effects characterization of assessed VCs

12.5 REFERENCES

12.5.1 Personal Communications

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13.0 ACCIDENTAL EVENTS

13.1 INTRODUCTION

This chapter assesses environmental effects of accidents or malfunctions that may occur because of the Berry Pit Expansion (Project Expansion). Accidents or malfunctions are events that occur outside the normal planned function or activity of the Project Expansion. Through good planning and design, the risks of accidents or malfunctions can be reduced or controlled.

Marathon has developed emergency response and contingency plans for the Valentine Gold Project (Approved Project), which are being updated to include the Project Expansion, to help mitigate adverse environmental effects should an accidental event or malfunction occur. These plans include environmental protection plans, follow-up and monitoring plans, and emergency response and contingency plans (Table 2.13), which serve to manage, mitigate and remediate adverse effects resulting from accidental events or malfunctions. Several of these plans are required under various provincial and federal regulations and conditions of regulatory approvals; in some cases, there is crossover with health and safety plans. The various plans are aligned under Marathon's corporate Environmental and Social Management System (ESMS) and Health and Safety Management System (HSMS). Rather than referencing individual plans or a list of plans that may apply to a particular aspect of the combined Projects, this section references the overarching ESMS/HSMS.

13.2 APPROACH

Accidents and malfunctions were assessed in the Valentine Gold Environmental Impact Statement (EIS) (Marathon 2020). This assessment was updated for the Project Expansion, using the following approach:

- Selection of accidents or malfunctions that could occur during construction, operation, and decommissioning, rehabilitation and closure of the Project Expansion, and result in potential environmental effects that require assessment
- Description of the accidental event and malfunction scenarios and identification of the design and safety measures that will be implemented to reduce or control the potential of each accident or malfunction
- Assessment of the potential residual adverse effects (after design and safety measures and emergency response measures have been applied) on Valued Components (VCs) that could result from each accident or malfunction scenario. This includes the VCs fully assessed in this Environmental Registration / EA Update (Atmospheric Environment, Groundwater Resources, Surface Water Resources, Fish and Fish Habitat and Caribou) and the VCs considered in Other Terrestrial Components (Chapter 11) and Socio-economic Components (Chapter 12)
- Determination of the significance of residual effects (after design and safety measures and emergency response measures have been applied) of each accident or malfunction

Effects of accidents or malfunctions that might occur as a result of the Project Expansion are assessed, using the same spatial boundaries (Figures 5-1 and 5-2), residual effects criteria, and methods and thresholds for determining significance as those used for environmental effects from routine Project Expansion activities (Chapters 6-12). Quantitative analysis was used, where possible, to characterize residual effects, including for credible worst-case scenarios. Qualitative considerations were used where quantitative analysis was not possible, such as for a fire.

13.3 MARATHON'S APPROACH TO ACCIDENT PREVENTION AND EMERGENCY RESPONSE PLANNING

As noted in the Valentine Gold EIS, Marathon's environmental management approach is based on evolving best-practice standards for environmental performance in the mining industry. The approach to preventing accidents and planning for emergency response is built on the same principles. Marathon will use the framework outlined below, as described in the Valentine Gold EIS and applicable to the Project Expansion, to prevent accidents and malfunctions:

- Review the individual steps involved in Project Expansion construction, operation and decommissioning, rehabilitation and closure activities prior to the start of each phase
- Analyze each step in the process to verify and update, if needed, the accident scenarios identified in this assessment of accidental events
- Review available best practice documents for each potential accident scenario
- Prepare site-specific accident prevention and emergency response and contingency plans, to be maintained on site and reviewed annually

While accident scenarios can be identified in advance and best practices will be in place to reduce the potential for occurrence, Marathon will also undertake the following steps and measures to be ready should an accident or emergency occur:

- Establish an incident command system (ICS)
- Conduct annual emergency response exercises under the ICS system, including annual refresher training for key response personnel
- Review the potential accident scenarios annually and update as required with new best practices or newly identified potential accident scenarios, as applicable
- Maintain on site the supplies required to respond to the potential accident scenarios identified in the emergency response plans

During an emergency, Marathon's hierarchy of key priorities and objectives is as follows:

- People – protect human life including Marathon employees and in the surrounding communities
- Environment – reduce harm to the environment
- Property – protect Marathon property and assets and respond to reduce additional negative impacts

13.4 ACCIDENTAL EVENTS OR MALFUNCTIONS IDENTIFIED FOR THE APPROVED PROJECT AND APPLICABILITY TO THE PROJECT EXPANSION

As noted in the Valentine Gold EIS, a number of broad accident categories were identified where potential accident or malfunction scenarios could occur during the construction, operation, and/or decommissioning, rehabilitation and closure phases of the Approved Project. These are:

- Tailings Management Facility (TMF) Malfunction
- Open Pit Slope Failure
- Low-Grade Ore (LGO) and High-Grade Ore (HGO) Stockpiles, and Waste Rock Piles Slope Failure
- Fuel and Hazardous Materials Spill
- Unplanned Release of Contact Water (either from the failure of stormwater management infrastructure [e.g., ditching, ponds, erosion control] or the water treatment)
- Sewage Treatment Plant Failure
- Over Blasting
- Fire/Explosion
- Vehicle Accident
- Watercourse Crossing Failure

The following sections discuss each of these scenarios, identifying those that were assessed in detail for the Approved Project, and those that require further assessment due to addition of the Project Expansion.

In determining applicability of these accidental events or malfunctions to the Project Expansion, the nature, extent and geographic location of Project Expansion activities were considered. The Project Expansion will not introduce new types of activities or infrastructure beyond those assessed in the Valentine Gold EIS. The Project Expansion will include the addition / modification of the following components:

- New open pit (i.e., the Berry pit)
- New waste rock pile
- New topsoil stockpile
- Increased Marathon topsoil stockpile and temporary sedimentation pond (construction phase only)
- Combined Berry / Marathon overburden stockpile and LGO stockpile
- Associated water management infrastructure
- Relocation of the explosives storage facility to maintain required setbacks
- Tailings disposal in mined-out Berry pit (relocation from Leprechaun pit)
- Replacement of the TMF polishing pond described in the Valentine Gold EIS with a smaller submerged attached growth reactor (SAGR®)

The Project Expansion will not include modification or expansion of the tailings impoundment area, mill, access road, power distribution, material shipping, gold shipment to market, or site buildings (including accommodations) previously approved for the Approved Project. Marathon is proposing to replace the planned polishing pond, a component of the TMF used to treat tailings wastewater, with a SAGR® unit. This newer technology is smaller, can operate in colder temperatures, and can more efficiently remove ammonia, thereby expediting treatment and shortening retention time prior to release to the receiving environment. In Years 9-13 of the life of mine, tailings will be disposed of in the mined out southern basin of the Berry pit and flooded. Beginning in Years 6 and 8, waste rock will be deposited in the mined-out central and northern basins of the Berry pit. Further information on planned Project Expansion components and activities is provided in Chapter 2.

13.4.1 Accidental Events or Malfunctions Not Considered Further for the Approved Project nor for the Project Expansion

Four of the categories listed above (i.e., Open Pit Slope Failure, Sewage Treatment Plant Failure, Over Blasting, and Watercourse Crossing Failure) were not carried forward for further assessment for the Approved Project for the reasons described in Section 21.4.1 of the Valentine Gold EIS and summarized below. The subsections below discuss their potential applicability to the Project Expansion.

13.4.1.1 Open Pit Slope Failure

The Berry pit will be developed as three basins, with maximum approximate dimensions of 1,250 m southwest to northeast by 670 m southeast to northwest, and a maximum depth of 270 m below current ground level.

Terrane Geoscience Inc. (Terrane) completed a geotechnical assessment of the Berry deposit (Terrane 2022 and Ausenco 2022), as they did for the Marathon and Leprechaun deposits. The proposed slope design considers the overall slope stability of a pit wall (i.e., benches and ramps from the pit floor to the surface) and the bench design (i.e., bench width, bench face angle, and bench height) (Ausenco 2022). The slope angle, inter-ramp angle, and bench face angles are designed to comply with the Newfoundland and Labrador (NL) Occupational Health and Safety Regulations and are based on acceptable design risk standards (Ausenco 2022). At the bench scale, local rock structure or combinations of structures are the primary failure mechanisms affecting stability, which involve the movement of intact rock masses along one or more discontinuity sets. These failures are commonly classified in three categories or three kinematic failure modes, including planar sliding, wedge sliding, and toppling instabilities (Ausenco 2022).

While bench face angles could be designed to avoid all possible failures, this would result in uneconomically flat slope angles; therefore, the proposed design assumes that some relatively small, intermittent failures will occur and that these will be contained by the catch benches. Catch benches are designed to add protection against rock fall at the bench scale in open pit mines. These kinematic failures are not anticipated to involve failure of the entire bench; rather, small blocks on the bench face (Ausenco 2022). In large open pits, it is considered best practice to include an extra-wide catch bench at regular intervals for the purpose of providing additional safety to operators and equipment; the design of Berry pit has incorporated these accordingly.

Slope failure in the open pit could occur due to unanticipated geological or hydrogeological conditions (Chapter 7 of this document), which could cause areas around the open pit to slump into the open pit. Ground conditions mapping and slope behavior monitoring will be a routine part of pit slope management. While there is potential to affect Project Expansion operation or infrastructure, as well as the health and safety of Project Expansion workers, slope failure is anticipated to be confined to the Project Area and, by design, specifically within the open pit. As slope failure is unlikely to result in residual adverse effect on the VCs, no further effects assessment is required. Open pit slope failure was also not assessed further for the Approved Project. Potential health and safety concerns of Project Expansion workers are addressed in the ESMS / HSMS, as well as under the emergency response plans discussed in Section 13.3.

13.4.1.2 Sewage Treatment Plant Failure

The sewage treatment plant is a component of the Approved Project and was comprehensively described in the Valentine Gold EIS. A failure of the treated effluent discharge pipeline could result in the release of treated effluent and thereby indirectly affect the Project Expansion. However, should effluent from the discharge pipeline be accidentally released to the environmental via a leak or spill, this effluent will have already been treated to meet applicable regulatory requirement (i.e., NL *Environmental Control Water and Sewage Regulations)*. Therefore, negligible residual adverse effects on VCs are anticipated due to a failure of the sewage treatment plant and no further effects assessment is required related to the Project Expansion. This was also the conclusion reached for the Approved Project in the Valentine Gold EIS.

13.4.1.3 Over Blasting

As described in the Valentine Gold EIS, over blasting describes the event where rock fragmentation is displaced behind or below the intended blast boundaries due to improper stemming of the blastholes or over-drilling resulting in excessive sound or vibration. While an uncontrolled explosion could also occur where proper safety measures are not applied as required, this would only occur due to negligence and, therefore, is not discussed further. For both the Approved Project and Project Expansion, the contractor/supplier of explosives will also manage the explosives facility. Marathon will perform construction and operation blasting; all Marathon blasters will have a valid blasters certificate issued by the NL Department of Environment and Climate Change. Marathon developed an Explosives and Blasting Management Plan (titled Marathon Operations Blasting Procedure) for the Approved Project that will be updated as applicable to reflect activities associated with the Project Expansion. This Plan will comply with the NL Occupational Health and Safety Regulations, including standards related to employee responsibilities, notification, inspections, signage, clean-up, and the safe use of materials and equipment.

Blasting operation will be carried out in accordance with applicable regulations to reduce the potential for an uncontrolled explosion. The buffer around the open pit is sufficient to safeguard VCs from the potential effects of fly rock. Given the safety measures and buffers in place for the Project Expansion (i.e., the same safety measures and buffers being followed for the Approved Project), no residual adverse effects on VCs are anticipated beyond those effects assessed for routine blasting; therefore, no further effects assessment is required related to the Project Expansion. This was also the conclusion reached for the Approved Project in the Valentine Gold EIS.

13.4.1.4 Watercourse Crossing Failure

As described in the Valentine Gold EIS, failure of a watercourse crossing could result from a precipitation or snowmelt event that exceeds the design capacity, causing the loss of channel form due to erosion, or damage to other watercourse crossings downstream. Failure of drainage culverts included along Approved Project and Project Expansion roads could result in an impediment to fish movement and sedimentation to downstream waterbodies. This would result in potential adverse effects on surface water resources and fish and fish habitat. As with the Approved Project, culverts installed as part of the Project Expansion will be inspected periodically for stability and accumulated material and debris removed as required to maintain proper functionality. The watercourse crossings are designed to handle the applicable design precipitation events including climate change parameters, and regular maintenance and monitoring, and timely and effective response to watercourse crossing failures, will reduce the potential for adverse effects on VCs. Should an extreme event lead to flooding or culvert damage, repairs will be prioritized and undertaken quickly to restore flows. With the implementation of proposed mitigation measures, negligible residual adverse effects on VCs are anticipated and, therefore, no further effects assessment is required. This was also the conclusion reached for the Approved Project in the Valentine Gold EIS.

13.4.2 Accidental Events or Malfunctions Considered Further for the Approved Project and their Applicability to the Project Expansion

The following accidental event or malfunction scenarios were selected for further assessment in the Valentine Gold EIS for the Approved Project:

- TMF Malfunction
- LGO and HGO Stockpiles, and Waste Rock Piles Slope Failure
- Fuel and Hazardous Materials Spill
- Unplanned Release of Contact Water (either from the failure of stormwater management infrastructure [e.g., ditching, ponds, erosion control] or the water treatment)
- Fire/Explosion
- Vehicle Accident

Table 13.1 summarizes the in-design safety and emergency response measures for the above-noted scenarios and describes the residual effects and the likelihood of the events occurring for the Approved Project. The applicability of the accidental event or malfunction scenario to the Project Expansion is also identified. Below the table, scenarios are further assessed in the context of the Project Expansion, including describing whether the conclusions presented in the Valentine Gold EIS are changed by the addition of the Project Expansion.

Table 13.1 Summary of Accidental Events and Malfunctions for the Approved Project and Applicability to Project Expansion

Accident / Malfunction*	In-design Safety Measures	Emergency Response Measures	Description of Residual Effects	Likelihood of Event[1] (Approved Project)	Applicability of Event to Project Expansion
TMF Malfunction	• Design is carried out to exceed minimum allowable factors of safety under static and pseudo-static loading conditions recommended in the current Canadian Dam Association (CDA) *Dam Safety Guidelines* • The TMF is inspected, maintained and repaired in accordance with the NL *Water Resources Act* • An emergency spillway is located on the northeastern abutment of the dam • As outlined in the CDA *Dam Safety Guidelines*, dam surveillance is a critical component of dam safety for all phases of the life of most dams	• Stop/shut down pumping of tailings to the TMF • Notification to authorities, emergency responders and others who are to be notified under the Public (Stakeholder) Safety Plan • Notification to Engineer of Record • Immediately engaging the *Metal and Diamond Mining Effluent Regulations* (MDMER) tailings / effluent emergency response plan and developing a remedial action and monitoring plan for the event, and initiate remedial action such as deploying earthworks equipment to reduce further damage to the dam and stabilize escaped tailings to the extent feasible, establishing additional containment as needed around the inundation area, and deploying turbidity curtains and/or other similar mitigation measures within affected watercourses	Depending on the timing and extent of a potential failure, effects to groundwater, surface water resources, fish and fish habitat, vegetation and wetlands and wildlife habitat may occur. Effects on these environmental components could then affect local land uses and historic resources. There is also potential for impacts to infrastructure. As assessed in Section 21.5.1 of the Valentine Gold EIS, moderate to high magnitude effects were predicted for surface water resources, fish and fish habitat, vegetation, wetlands, terrain and soils, avifauna, caribou and other wildlife and historic resources. Effects were characterized as both short- and long-term and both reversible and irreversible (given large amounts of sediment may remain). A significant effect was predicted for surface water resources, fish and fish habitat, caribou and community health in the event of a large-scale release into the environment (e.g., major TMF failure with discharges of tailings into local waterbodies and other habitats outside the Project Area).	Very Low	The Project Expansion does not require modification or changes to the design of the tailings impoundment or TMF dams. While the polishing pond, a component of the TMF used to treat tailings effluent, will be replaced with a SAGR® unit with improved treatment of nitrogen species, this change does not affect the tailings impoundment or dam or the malfunction scenarios described in the EIS. Therefore, the Project Expansion does not alter the effects assessment included in the Valentine Gold EIS for an accident or malfunction affecting the TMF (Table 13.2).
Topsoil, Overburden, Low and High-Grade Ore Stockpiles, and Waste Rock Pile Slope Failure	• Waste rock piles are benched and constructed to an overall slope of 3H:1V to promote long-term stability • Mine waste disposal piles are constructed according to design requirements for closure (i.e., long-term slope stability factors of safety) • Waste rock piles are progressively rehabilitated as benches or sections are completed (ongoing over life of Project) • Mitigation measures are applied to reduce the potential for waste rock slumping, including displacement monitoring/surveys to identify potential instability and early movements and progressive rehabilitation (e.g., placement of soil cover and vegetation over waste rock piles) of the pile to reduce infiltration into waste rock piles by increasing evapotranspiration capacity to the extent feasible	• Emergency response measures and standard operating procedures for slope failure, including stopping work in that area, developing a specific response plan, installing silt fencing and berms as necessary, return and recontour material, were developed during detailed Approved Project design	The worst-case failure scenario would be a large-scale failure of a waste rock pile, which could result in slumping and release of mine rock. Slope failure related to waste rock piles can affect surface water quantity and quality as there is potential for material to enter nearby waterbodies and fish habitat at some locations. As assessed in Section 21.5.2 of the Valentine Gold EIS, residual adverse effects to surface water and fish and fish habitat were predicted to be moderate in magnitude, localized to the LAA, short-term and reversible. No significant effects were predicted.	Very Low	The Project Expansion will see the addition or modification of the following stockpiles: Berry topsoil pile; Berry waste rock pile; combined Berry / Marathon overburden stockpile; and combined Berry / Marathon LGO stockpile (however, will not affect the design of the HGO stockpile). Slope failure could therefore occur as a result of Project Expansion activities.

Table 13.1 Summary of Accidental Events and Malfunctions for the Approved Project and Applicability to Project Expansion

Accident / Malfunction*	In-design Safety Measures	Emergency Response Measures	Description of Residual Effects	Likelihood of Event[1] (Approved Project)	Applicability of Event to Project Expansion
Fuel and Hazardous Materials Spill	• Fuel is obtained from a licensed contractor who is required to comply with federal and provincial regulations • Regular vehicle and equipment inspections and maintenance are carried out to reduce the potential effects of hydraulic fluid spills • Reagent preparation and storage facilities are located within containment areas designed to accommodate more than the content of the largest tank • Storage tanks are equipped with level indicators, instrumentation and alarms to prevent spills and are visually inspected annually for their liquid-containing integrity, with repairs made as required • Spill containment systems are inspected every ten years, by a means other than visual inspection, for their liquid-containing integrity, with repairs made, as required • Transportation of hazardous materials is conducted in compliance with the federal *Transportation of Dangerous Goods Act* and the provincial *Dangerous Goods Transportation Act*. • Appropriate Project personnel are trained in fuel handling, equipment maintenance, and fire prevention and response measures	• Emergency response and spill contingency plans under the ESMS include consideration of spills and releases of hazardous substances, including petroleum products, accidents involving hazardous substances, medical emergencies, explosion and fire • In the event of a spill at the mine site, the spill would be immediately contained and cleaned up using on-site spill kits and appropriate absorbent materials • Available resources including trained responders, and spill response equipment and supplies, would be redirected to the spill area to provide response • To determine the requirement for further excavation, soils would be tested for hydrocarbon in the vicinity of a spill	A spill of fuel or hazardous material from a vehicle accident along the access road can affect surface water quality if it occurs in or near a watercourse or waterbody. Therefore, there is potential for adverse effects to surface water resources, fish and fish habitat, vegetation, wetlands, terrain and soils, avifauna, caribou, other wildlife, community health, land and resources use, Indigenous groups and historic resources. In the event of a worst-case scenario spill, residual adverse effects are generally predicted to be moderate (elevated above baseline, however within acceptable limits) to high (elevated above acceptable limits or regulatory objectives) in magnitude for surface water, as well as for fish and fish habitat. The primary migration path for the Buchans caribou herd, which may be used by over 50% of the herd, overlaps the Project Area. Due to the importance of this migratory path, effects of a fuel or hazardous material spill and subsequent clean-up efforts would likely cause caribou to avoid the affected areas. In the event of a large spill, effects may be additive to the high magnitude effect predicted for the Buchans caribou herd associated with routine (i.e., non-accidental) Project effects, particularly if a spill were to occur during the migration period for the herd. With the implementation of emergency response measures, no significant effects were predicted.	Low	Fuel will be required to support Project Expansion activities, including a small increase in mining equipment. The Project Expansion will extend the operation of the mine by 1.4 years, which will extend the need for fuel deliveries to the mine site. A fuel spill could therefore occur as a result of Project Expansion activities.
Unplanned Release of Contact Water	• The water management design for contact water treatment is focused on limiting sedimentation, as reduced sedimentation will result in lower total suspended solids (TSS) concentrations and the particulate fraction of metals • Design parameters for water management infrastructure includes a 15 m setback from fish-bearing waterbodies; consideration of climate change-associated precipitation events and associated flow; and maintaining flow to fish-bearing waterbodies where feasible (draining mine site components to pre-development catchment areas, where practicable) • Sedimentation pond embankments are designed to reduce seepage and are constructed out of locally sourced, low permeability glacial till • A geotextile or granular soil filter layer are placed between materials to reduce the opportunity for piping	• Sediment fencing is routinely deployed, inspected and maintained as needed adjacent to wetlands and slow-moving watercourses • Where feasible, contact water would be pumped back into the collection system, which may require the installation of additional pumps should the volume of pump-back water exceed predicted rates in the TMF seepage collection ditches • The water management structure would be repaired and/or improved as required to avoid reoccurrence • Affected waterbodies would be monitored and remedial actions and reporting, if required, would take place in consultation with regulators	An unplanned release of contact water to the environment can adversely affect groundwater, surface water quality, fish and fish habitat and vegetation and wetlands. Waterbodies that could be affected include Victoria River, Victoria Lake Reservoir, Valentine Lake and their tributaries. As assessed in Section 21.5.4 of the Valentine Gold EIS, in general, residual adverse effects are predicted to be low in magnitude, short-term and reversible, except for adverse effects to fish and fish habitat where a moderate magnitude effect is predicted due to the potential for the physical disturbance of fish habitat. With the implementation of emergency response measures, no significant effects were predicted.	Low	Project Expansion infrastructure will include sedimentation ponds and ditching for the Berry pit, Berry waste rock pile, and stockpiles. An unplanned release of contact water could therefore occur as a result of Project Expansion activities.

Table 13.1 Summary of Accidental Events and Malfunctions for the Approved Project and Applicability to Project Expansion

Accident / Malfunction*	In-design Safety Measures	Emergency Response Measures	Description of Residual Effects	Likelihood of Event[1] (Approved Project)	Applicability of Event to Project Expansion
Fire / Explosions	• Facilities have fire suppression systems in accordance with each structure's function and in accordance with regulatory requirements, including NL *Occupational Health and Safety Act* and *Occupational Health and Safety Regulations* • Buffers are provided, as required, between infrastructure and equipment and the surrounding environment • Employee training in fuel handling, fire prevention and emergency response measures are completed as part of the Project-wide ESMS, and health and safety management systems. • Fire prevention and suppression systems, as well as response equipment and supplies, are maintained on site at designated locations • The explosives storage facility meets government regulations including required separation distances as regulated by the Explosives Regulatory Division of Natural Resources Canada (NRCAN) • Explosives and accessories are stored at an NRCAN-approved explosives storage facility • An Explosives and Blasting Management Plan details the safe use and storage of explosives, in accordance with environmental protection measures, provincial and federal legislation and guidelines, and corporate policies for explosives	• The emergency response plans developed for the Approved Project and Project Expansion will include measures to be implemented in the event of a fire or explosion, including actions to limit the immediate risk to the safety of employees and the public, and communication and reporting requirements • In the event of an incident affecting the Victoria Dam, Marathon will communicate and coordinate with NL Hydro as required • While emergency response capabilities at the mine site (e.g., firefighting and health care) will be sufficient for most accidents, a major accident may require additional support from surrounding communities; fire departments in Grand Falls-Windsor, Buchans, and Millertown and the hospital in Buchans may be called to aid in response to larger fires or emergencies	In the event of a Project-caused fire, the immediate concern would be for human health and safety, as well as concerns for habitat loss, direct mortality to wildlife and loss or damage of property. Depending on the extent of a fire, effects to atmospheric environment, surface water resources, fish and fish habitat, vegetation and wetlands and wildlife may occur. As assessed in Section 21.5.5 of the Valentine Gold EIS, adverse residual effects are predicted to be low in magnitude, short-term and reversible. However, effects may be additive to the high magnitude effect of routine Approved Project and Project Expansion activities on movement of the Buchans caribou herd. A significant effect has, therefore, been predicted for caribou. The occurrence and effects of a natural fire are addressed in Chapter 14.	Low	The Project Expansion will require blasting and operation of equipment and vehicles. Therefore, as with the Approved Project, a fire or explosion could result from Project Expansion activities.

Table 13.1 Summary of Accidental Events and Malfunctions for the Approved Project and Applicability to Project Expansion

Accident / Malfunction*	In-design Safety Measures	Emergency Response Measures	Description of Residual Effects	Likelihood of Event[1] (Approved Project)	Applicability of Event to Project Expansion
Vehicle Accident	• The haul road, site roads and the access road are maintained in good condition • Project vehicles are required to comply with posted speed limits on the access road, site roads and the haul road • Marathon has developed and implemented a Traffic Management Plan to manage transportation of workers and materials to site, product leaving site, the number of vehicles accessing the site and to reduce traffic delays • Marathon has implemented traffic control measures, which may include gating approaches, placing large boulder and/or gated fencing to restrict public access to the mine site • Project vehicles are driven by trained and competent drivers who use approved routes • Project vehicles are manually inspected on a regular schedule to confirm serviceability	• Emergency response services will be available at the Project site, as well as fire departments in Grand Falls-Windsor, Buchans and Millertown, and the hospitals in Buchans and Grand Falls-Windsor to aid in emergencies • Marathon will consult and establish communications with appropriate local, provincial and federal emergency response departments as determined to be required for environmental and health and safety related emergencies • Marathon will cooperate with local officials in the incident investigation process and conduct an internal incident investigation • Where necessary, remedial action will be taken by Marathon in accordance with the results of the investigations	A vehicle collision could adversely affect wildlife and/or members of the public using the access road. Potential effects resulting from a spill from a vehicle accident are discussed in the assessment of a fuel or hazardous material spill (Section 21.5.3 of the Valentine Gold EIS). Potential adverse effects caused by vehicle collisions with wildlife are assessed in Avifauna, Caribou and Other Wildlife Chapters (Chapters 10, 11 and 12 of the Valentine Gold EIS, respectively). A vehicle accident can result in injury to or loss of life. Although public injury or mortality from a vehicle accident cannot be ruled out, the likelihood is very low given the mitigation measures and emergency response prescribed above. In the unlikely event of a vehicle collision resulting in serious injury or loss of life, residual adverse effects on community health would be high in magnitude and irreversible. A significant effect, therefore, has been predicted for community health.	Low	As with the Approved Project, vehicle collisions, spills from a vehicle accident, and vehicle collisions with wildlife could result from Project Expansion activities.

[1]Federal environmental assessment guidance notes that if there is a low probability of occurrence of significant adverse environmental effects, then significant adverse environmental effects are unlikely (IAAC 2012)

As noted in the Valentine Gold EIS, in the instance where a major accidental event or malfunction results in the combined Projects being temporarily suspended, there is potential for a low magnitude adverse effect to local and regional economies through effects to wages, government revenues and, depending on the length of the suspension, gross domestic product. There may also be increased localized spending with short-term benefit to nearby communities for businesses supplying goods and services in support of the emergency responses (Marathon 2020). The Valentine Gold EIS (Section 21.4.2) concluded that effects to the economic environment would be short-term in duration and likely reversible within approximately one month. This conclusion is also applicable to the Project Expansion and, therefore, residual effects to employment and economy from an accident or malfunction perspective are not discussed further.

Emergency response capabilities at the mine site (e.g., firefighting and health care) are expected to be sufficient for most accidents. A major incident may require additional support from surrounding communities (Marathon 2020). As with the Approved Project, emergency response services will be available at the Project Expansion site, and fire departments in Grand Falls-Windsor, Buchans and Millertown, and the hospital in Buchans, may be called to aid in larger fires or emergencies. However, such support would not be frequent and would not be anticipated to put excessive demand on these external capabilities. The Valentine Gold EIS (Section 21.4.2) concluded that effects to community services and infrastructure would be short-term in duration and this conclusion is also applicable to the Project Expansion. Therefore, residual effects to community services and infrastructure from an accident or malfunction are not discussed further.

13.5 ASSESSMENT OF EFFECTS

13.5.1 TMF Malfunction

The potential environmental effects of a TMF failure were fully assessed in the Valentine Gold EIS for the Approved Project (Section 21.5.1). As indicated in Table 13.1, the Project Expansion does not require modification or changes to the design of the tailings impoundment or TMF dams. While the polishing pond, a component of the TMF used to treat tailings wastewater, will be replaced with a SAGR® unit with improved treatment of nitrogen species, this change does not affect the tailings impoundment or dam or the malfunction scenarios described in the Valentine Gold EIS. Therefore, the Project Expansion does not alter the effects assessment included in the Valentine Gold EIS for an accident or malfunction affecting the TMF (Section 13.6).

13.5.2 Slope Failure of Topsoil, Overburden, Low Grade Ore Stockpiles, or Waste Rock Pile

The Project Expansion will see the addition or modification of four different stockpiles: Berry topsoil pile, Berry waste rock pile, combined Berry / Marathon overburden stockpile, and combined Berry / Marathon LGO stockpile.

Failure or slumping of materials in stockpiles or the waste rock pile could result in the release of waste rock, ore or soils outside the storage areas and increase the footprint of the pile. Should a failure occur, solid material from the pile areas could enter adjacent areas, which could include lakes and streams.

While overburden and LGO stockpiles may experience slumping, these stockpiles are temporary and, in the event of a failure, released material would be reinstated in a timely manner. Adverse effects are therefore not anticipated as a result of overburden or LGO stockpile failure. This assessment scenario is therefore focused on the failure or slumping of materials from the waste rock pile.

13.5.2.1 Design and Safety Measures to Reduce Environmental Effects

The Berry waste rock pile will be benched and constructed to an overall slope of 3H:1V to promote long-term stability. The waste rock pile will be constructed according to design requirements for closure (including long-term slope stability factors of safety) and assume a final closure slope angle of 30°. To accomplish this, the waste rock pile will be constructed in single lifts with a 35° face angle and a 6.1 m safety bench. The Berry waste rock pile will be progressively rehabilitated as benches or sections are completed (ongoing over life of mine). The waste rock pile will be constructed from the ground up using slopes and benches of 10 m height. When a bench is finished in one area, the horizontal bench and slope will be covered with overburden / organics (anticipated 0.3 m in total thickness) and revegetated.

Mitigation measures will be applied to reduce the potential for waste rock slumping, including displacement monitoring / surveys to identify potential instability and early movements, and progressive rehabilitation of the pile (e.g., placement of soil cover and vegetation over waste rock) to reduce infiltration into waste rock piles by increasing evapotranspiration capacity to the extent feasible. As part of Project Expansion planning and design, Marathon is undertaking geotechnical and hydrogeological investigations which will be used to support the design, including incorporating appropriate geotechnical design parameters and factors of safety and proper construction.

13.5.2.2 Emergency Response Measures

Emergency response measures and standard operating procedures for slope failure (e.g., stopping work in that area, developing a specific response plan, installing silt fencing and berms as necessary, replacing and recontouring material) will be developed during detailed design of the Project Expansion.

13.5.2.3 Environmental Effects Assessment

The worst-case scenario for this event would be a large-scale failure of the Berry waste rock pile, which could result in slumping and release of waste rock into fish habitat. Slope failure related to waste rock piles can affect surface water quantity and quality as there is potential for material to enter nearby waterbodies and fish habitat at some locations. As described in Section 21.5.2 of the Valentine Gold EIS, residual adverse effects to surface water and fish and fish habitat were predicted to be moderate in magnitude, localized to the LAA, short-term and reversible. No significant effects were predicted.

While the Project Expansion includes a waste rock pile, a topsoil pile, and combined Berry / Marathon overburden and LGO stockpiles, the scenarios in which this type of accident may occur are the same as those assessed in the Valentine Gold EIS. Therefore, there will be no change in environmental effects for any of the VCs from those assessed in the Valentine Gold EIS, and the conclusion that the residual adverse environmental effects of a stockpile or waste rock pile slope failure would be not significant remains unchanged from the Valentine Gold EIS (Section 13.6).

13.5.3 Fuel and Hazardous Materials Spill

Fuel will be required throughout the life of the Project Expansion to operate vehicles and machinery. While there is no increase in annual production from the addition of the Project Expansion, there will be some increase in mining equipment and therefore an increase in fuel requirements. The Project Expansion will also result in a 1.4-year increase in mine life, extending the requirements for fuel to be transported to the mine site. During construction of the Project Expansion, the permanent fuel supply which is part of the Approved Project will be installed and operational. Temporary fueling storage will therefore not be needed to support the Project Expansion. Hazardous materials are primarily associated with the Approved Project, as these are to be used in the process plant (e.g., quicklime, sodium cyanide, frother, promoter, flocculant, hydrochloric acid, copper sulphate pentahydrate, sodium metabisulphite, sodium hydroxide, activated carbon, smelting fluxes). Again, as the Project Expansion will not result in an increase in annual production rates, use of hazardous materials in the process plant will not change as a result of the Project Expansion; however, their use will be extended by 1.4 years.. Blasting will also not increase as a result of the Project Expansion, so there is no additional risk associated with transportation of bulk emulsion to the mine site. .

A spill of fuel and/or hazardous material could occur as a result of factors such as equipment or vehicle malfunction, human error, or severe weather conditions (as described in Chapter 22 of the Valentine Gold EIS and Chapter 14 of this document). Potential spill mechanisms including the following:

- Equipment leakage / failure: Relatively small spills of fuel may occur during construction or operation through refuelling of or leaks from machinery, such as hydraulic hoses. The volume of material from these spills is usually less than a few litres. These spills are typically highly localized and readily cleaned up by on-site crews using standard equipment and materials.
- Storage tank leak or rupture: A spill from a storage tank could occur as a result of structural failure of the tank or as a result of an accidental impact to a tank from a vehicle, for example. Failure of the fuel storage and fueling stations could result in the release of petroleum-based pollutants.
- Spill from vehicles on-site: An on-site vehicle accident could result in an unplanned release of fuel or hazardous materials on site roads or the haul road within the Project Area. Drainage collection around the mine site would possibly direct free product back towards the TMF, where it could be collected and cleaned up. Due to the relatively low level of wildlife activity expected in the immediate areas of work and the restricted public access of the mine site (i.e., requirement to maintain a safety zone for blasting), there is less chance for a spill on site to interact with wildlife or resource users.

- Spill from vehicles along the access road: A worst-case scenario would be considered a large spill of fuel or hazardous material resulting from a vehicle accident or malfunction involving a bulk tanker during any phase of the Approved Project or Project Expansion. Fuels, reagents, and combustibles used for the Project will be transported to the site via the access road; therefore, there is a risk of an accident / collision resulting in a spill of these transported materials. Spills may also occur if a vehicle malfunctions, or if vehicles (not involved in the transport of fuels and hazardous materials) collide, leading to the release of fluids or lubricants from these vehicles onto the ground. A spill as a result of a vehicle accident or malfunction has the potential to affect surface water resources if the spill occurs near a waterbody, either on site or along the access road.

A spill can affect land or water within or outside the mine site if not remediated in a timely manner. Adverse environmental effects can result from an accidental release of hazardous liquids due to their ability to flow in an uncontrolled manner and seep into porous material, and the toxicity of some liquids to plants and wildlife. There is also potential for air emissions of volatile compounds from a fuel spill. However, adverse effects will generally be localized, rapidly dispersed, and not in high enough concentrations to affect wildlife, which tend to avoid a spill and cleanup activities (Marathon 2020)

13.5.3.1 Design and Safety Measures to Reduce Environmental Effects

Fuel will be obtained from a licensed contractor who will be required to comply with federal and provincial regulations including federal *Sulphur in Diesel Fuel Regulations*, and provincial *Storage and Handling of Gasoline and Associated Products Regulations.* Regular vehicle and equipment inspections and maintenance will be carried out to prevent hydraulic fluid spills, and Marathon will consider the use of biodegradable hydraulic fluid in compatible machinery.

Sumps and sump pumps will be installed for spillage control. Fueling locations and procedures will conform to applicable regulatory requirements.

Areas in which chemicals are used or stored shall have spill containment systems constructed with impermeable floors, walls, dykes or curbs as applicable and be configured, maintained, inspected and repaired as follows:

- No discharge to the environment.
- Effective secondary containment capacity of at least 110% of the chemical storage tank capacity, in the case of a single storage container.
- Where there is more than one storage container, the spill containment system will be able to retain no less than 110% of the capacity of the largest container or 100% of the capacity of the largest container plus 10% of the aggregate capacity of additional containers, whichever is greater.
- Kept clear of material that may compromise the containment capacity.
- Include a floor drain system provided that the floor drains, and the place or device to which they drain, are configured in such a manner that the required effective secondary containment capacity is maintained.

- Will be visually inspected annually for their liquid-containing integrity, with repairs made as required.
- Spill containment systems will be inspected every ten years, by a means other than visual inspection, for their liquid-containing integrity, with repairs made as required.

As noted in Section 21.3 of the Valentine Gold EIS, emergency response and spill contingency plans under the ESMS have been developed and implemented by Marathon to facilitate responses to emergency situations that may occur at the mine site (e.g., spills and releases of hazardous substances including petroleum products, accidents involving hazardous substances, explosion and fire). In the event of a spill at the mine site, the spill would be immediately contained and cleaned up using on-site spill kits and appropriate absorbent materials, and available resources including trained responders, and spill response equipment and supplies, would be redirected to the spill area to provide response. Given quick response, it is anticipated that relatively small spills (i.e., generally less than a few litres) would have limited potential to affect water resources, as these would be confined to the soils and excavated before they could migrate to the groundwater table or a surface waterbody. To determine the requirement for further excavation, soils would be tested for hydrocarbon in the vicinity of a larger spill.

Transportation of fuels, reagents and combustibles for the Approved Project and Project Expansion (as applicable) will be by road; therefore, there is a risk of a collision or accident resulting in a spill of transported materials both on and off site. Transportation safety measures which will be implemented to reduce the potential for a vehicle accident include the following:

- Transportation of hazardous materials will be conducted in compliance with the federal *Transportation of Dangerous Goods Act* and the provincial *Dangerous Goods Transportation Act.*
- The haul road, site roads and the access road will be maintained in good condition; this will include periodically re-topping, regrading and ditching to improve water flow and reduce erosion, and managing vegetation growth.
- Vehicles will use existing roads / trails while operating at the mine site.
- Vehicles will be required to comply with posted speed limits on the access road, site roads and haul road. Speed limits will be set in accordance with provincial regulations and industry standards (e.g., for haul roads), as well as safety / environmental concerns (wildlife).
- Marathon has developed a Traffic Management Plan, which will be updated for the Project Expansion, to manage transportation of workers and materials to site, product leaving site, and the number of vehicles accessing the site, and to reduce traffic delays.
- Appropriate personnel will be trained in fuel handling, equipment maintenance, and fire prevention and response measures.
- Fuels and lubricants used during construction and operation will be stored according to regulated containment methods in designated areas; to reduce the likelihood that deleterious substances will enter watercourses, refueling, servicing of equipment, and waste storage will not take place within 30 m of watercourses and spill kits will be maintained at numerous locations on-site during construction and operation.
- Marathon will regularly inspect and monitor infrastructure and equipment and take required action to maintain, repair and upgrade infrastructure / equipment as needed.

13.5.3.2 Environmental Effects Assessment

Section 21.5.3.4 of the Valentine Gold EIS assessed environmental effects of a spill of fuel or hazardous material for the Approved Project. The assessment modelled the worst-case scenario of a spill of hydrocarbon (i.e., diesel fuel), cyanide or ammonium nitrate[1] at the bridge crossing of the Victoria River. The bridge crossing of the Victoria River was selected based on concerns identified through engagement activities regarding potential effects on the Exploits River. This location represents the highest probability of adverse effects from within the Project Area reaching the Exploits River. That assessment is also applicable to the Project Expansion, as Project Expansion activities will not change the methods and routes for transportation of fuel or hazardous materials to the mine site, nor methods for storage and handling of these materials while on site. The relocation of the explosives storage facility as part of the Project Expansion will also not result in additional risks associated with transportation and a potential spill of bulk emulsion, beyond that assessed in the Valentine Gold EIS, as a spill at the bridge crossing of the Victoria River would still represent a worst-case scenario.

As described in the Valentine Gold EIS, a spill of fuel or hazardous material from a vehicle accident along the access road can affect surface water quality if it occurs in or near a watercourse or waterbody. Therefore, there is potential for adverse effects to surface water resources, fish and fish habitat, caribou, terrestrial components (including vegetation, wetlands, terrain and soils; avifauna; other wildlife) and socioeconomic components (including community health; land and resource use; Indigenous groups; and historic resources). In the event of a worst-case scenario spill, residual adverse effects are generally predicted to be moderate (elevated above baseline, however within acceptable limits) to high (elevated above acceptable limits or regulatory objectives) in magnitude for surface water, as well as for fish and fish habitat. The primary migration path for the Buchans herd, which may be used by over 50% of the herd, overlaps the Project Area. Due to the importance of this migratory path, effects of a fuel or hazardous materials spill and subsequent clean-up efforts would likely cause caribou to avoid the areas, and in the event of a large spill effects may be additive to the high magnitude effect predicted for the Buchans caribou herd from routine effects of the Approved Project, particularly if a spill were to occur during the migration period for the herd.

While the Project Expansion may change the frequency or duration (1.4-year extension in mine life) of fuel deliveries to the site, it will not result in changes to the methods or routing of transport to the mine site. Therefore, the residual environmental effects predicted for the Approved Project in the Valentine Gold EIS for a worst-case spill of fuel or hazardous materials is considered valid and unchanged with the addition of the Project Expansion. The conclusion that the residual adverse environmental effects of a fuel or hazardous material spill would be not significant remains unchanged from the Valentine Gold EIS (Section 13.6).

[1] The Valentine Gold EIS did not specify the type of explosive that would be used. Marathon has since decided to use a bulk emulsion that does not require the use or transport of ammonium nitrate.

13.5.4 Unplanned Release of Contact Water

Contact water is runoff, groundwater or process water that has come into direct contact with mine rock, tailings or terrain where mine workings and infrastructure occur. Contact water will be collected and managed through a variety of drainage ditches, pipes and sump pits constructed around Approved Project and Project Expansion infrastructure and directed to either the TMF or sedimentation ponds. Water collected in the sumps and / or small ponds and during open pit dewatering will be pumped to sedimentation ponds located at each complex. Contact water will be held and/or treated as required to meet MDMER requirements prior to being discharged directly to the environment at identified Final Discharge Points (FDPs). The Project Expansion adds an additional independently functioning water management complex (the Berry complex) to the overall mine site. Runoff from the Berry complex will be captured and discharged through five different FDPs that ultimately drain to the Victoria River via Valentine Lake.

Malfunction of the catchment sumps, ditches, channels or sedimentation ponds could lead to the unplanned release of contact water into the receiving environment. There is also potential for accidental seepage wherever contact water is stored. Accidental discharge from the collection or seepage of mining effluent can cause changes to groundwater, surface water, and sediment quality, as well as indirect or direct effects on fish (e.g., toxicity, bioaccumulation, avoidance of area, alteration of planktonic and benthic communities), vegetation and wetlands (Marathon 2020). Waterbodies that could potentially be affected include Victoria River, Victoria Lake Reservoir, Valentine Lake, and their tributaries.

13.5.4.1 Design and Safety Measures to Reduce Environmental Effects

A Water Management Plan (Appendix 2A) was developed for the Approved Project and has been updated to incorporate the Project Expansion. The Water Management Plan will support and guide the construction, operation and closure of the combined Projects. The water management design for contact water treatment is focused on reducing sedimentation and the particulate fraction of metals. Acid rock drainage and metal leaching (ARD/ML) studies are ongoing. Based on work completed, ARD/ML issues are not expected to affect requirements for the treatment of contact water. Further information on water quality predictions is presented in the Surface Water Resources VC, Chapter 8 of this document.

Water management infrastructure for the combined Projects is designed to reduce operational risks and adverse environmental effects, with the following objectives:

- Reduce water inventory through perimeter berms, separation of groundwater and surface water flows and promote overland flow of non-contact runoff.
- Effectively control potential high precipitation events and provide water management design that produces effluent achieving regulatory effluent criteria.
- Reduce FDPs through grading of ditches and construction of diversion channels to combine discharge points to collective effluent discharge points and or sedimentation ponds.

- Maintain flow to fish-bearing streams and wetlands/bogs by maintaining pre-development catchments.
- Reduce water management costs during operation through gravity drainage, where feasible, thus reducing pump requirements.

Water management across the Project Expansion site (as with the Approved Project) will be implemented and operated as follows:

- Diversion of non-contact water where feasible. Channels and berms will be constructed around the crest of the open pit and up-hill of the waste rock pile and other developed areas to divert natural precipitation and surface runoff away to natural water drainage areas and away from contact with the mining operation, where feasible.
- Precipitation and groundwater entering the open pit will be managed in-pit via sloped pit floors and catchment sumps, as required. These catchment sumps are the first opportunity to reduce sedimentation and chemistry impacts (e.g., residual ammonia), and appropriately sized sumps with screened intakes and hydrocarbon absorption booms will be employed in-pit. Water collecting in the in-pit sumps will be pumped to the crest of the pit and discharged into an engineered sedimentation pond.
- Sedimentation ponds are appropriately sized for retention and removal (by gravity) of suspended solids (sediment), such that discharge is expected to comply with the applicable regulatory requirements including MDMER pursuant to the *Fisheries Act.*
- Precipitation runoff from the waste rock pile and other developed areas of the site will be collected via ditches and channels and directed to downstream sedimentation ponds similar to those to be constructed for management of water from the open pit.
- Sedimentation ponds will be constructed in-ground and/or using earthen berms with till or synthetic liners, where required, for water retention. Sedimentation ponds with dams >2.5 m high and holding back over 30,000 m^3 of water follow CDA guidelines for dam design. Although not all sedimentation ponds associated with the Project Expansion have dams >2.5 m, all are designed to CDA guidelines. In NL, the province defers to CDA guidelines for dam design, and all dams >1 m high must be submitted for provincial approval.
- Sedimentation ponds have been sited based on topography and geotechnical conditions. Where feasible, water collected in pit and in the sedimentation ponds will be used for other purposes on site rather than discharged to the environment.

Design parameters for water management infrastructure include a 15 m setback from fish-bearing waterbodies; consideration of climate change-associated precipitation events and associated flow. Where feasible, flow to fish-bearing waterbodies will be maintained by draining mine site components via perimeter ditches and treating for sediment prior to release to pre-development catchment areas, where practicable. Sedimentation pond embankments are designed to reduce seepage and will be constructed out of locally sourced, low permeability glacial till. Erosion protection will be provided through riprap lining of the embankment and spillway and a scour pad at the toe of slope of spillways. A geotextile or granular soil filter layer will be placed between materials to reduce the need for water management via piping. The

design of the sedimentation ponds accounts for climate change, ice thickness during the winter, operating water levels, inactive storage to promote settling, and freeboard requirements.

Sedimentation ponds are designed with multiple outlets to incorporate system flexibility to manage water under variable climatic conditions. These ponds are designed to store runoff from the Project Expansion component areas for storm events up to 1:100 annual exceedance probability (AEP) with spring snowmelt, and emergency spillways to accommodate the 1:200 AEP flow. The capacity of each sedimentation pond is designed such that effluent is discharged gradually from the pond, to enhance baseflow augmentation in order to provide flood attenuation and reduce downstream scour and erosion.

The sedimentation ponds are designed such that effluent is expected to meet MDMER limits prior to release to the receiving environment. Berms were designed to be constructed lower than 2.5 m from the toe of the downstream slope to the dam crest and therefore do not trigger CDA safety guidelines. In order to reduce effects to the environment, the footprint of the water management infrastructure avoids fish-bearing watercourses and waterbodies and, therefore, associated discharge of deleterious substances.

Surface water and groundwater quantity and quality monitoring programs will be implemented to confirm and document regulatory compliance, verify predictions of effects of the Project Expansion on water quality, identify changes in drainage patterns and surface water flow, and determine if additional mitigation measures are required. The updated Water Management Plan (Appendix 2A) provides detail on runoff and seepage collection strategies and systems (e.g., local seepage collection ponds, berms, drainage ditches, pumps) to collect and contain surface water runoff and groundwater discharge from major Project Expansion components (open pit, waste rock pile, and combined Berry / Marathon overburden stockpile) during climate normal and extreme weather conditions. Additional details on the water monitoring programs are provided in Chapter 8 of this document and in the updated Water Management Plan.

13.5.4.2 Emergency Response Measures

Sediment fencing will routinely be deployed, inspected and maintained as needed adjacent to wetlands and slow-moving watercourses. In the event of an unplanned release of contact water due to failure of the water management system, sediment fencing would serve to reduce potential effects and, where feasible, contact water would be pumped back into the collection system. The water management structure would be repaired and/or improved as required to avoid reoccurrence. Affected waterbodies would be monitored, and remedial actions and reporting, if required, would take place in consultation with applicable regulators (Marathon 2020).

13.5.4.3 Environmental Effects Assessment

As generally described in Section 21.5.4 of the Valentine Gold EIS, residual adverse effects were predicted to be low in magnitude, short-term and reversible, for the groundwater, surface water, and vegetation, wetlands and terrain VCs. Residual adverse effects to fish and fish habitat were predicted to be moderate and temporary due to the potential for the physical disturbance of fish habitat. Residual

effects were not predicted for other VCs assessed in the Valentine Gold EIS. With the implementation of emergency response measures, no significant effects were predicted for the Approved Project.

While the Project Expansion requires additional water management infrastructure (i.e., ditching and sedimentation ponds), they will be designed and operated consistent with the Approved Project and as outlined in the updated Water Management Plan (Appendix 2A). The scenarios in which an accident or malfunction may occur do not differ from those assessed in the Valentine Gold EIS; therefore, the residual environmental effects predicted for the Approved Project in the Valentine Gold EIS are considered valid and unchanged with the addition of the Project Expansion. The conclusion that the residual adverse environmental effects of an unplanned release of contact water would be not significant remains unchanged from the Valentine Gold EIS (Section 13.6).

13.5.5 Fire/Explosions

Accidental events associated with Approved Project activities, such as equipment malfunction, human error, or uncontrolled explosions could result in a fire related directly to Approved Project infrastructure and facilities, or within the Project Area as a forest fire. Fire that is not related to the Project, such as those resulting from lightning strikes, originating off site, or with undefined causes, are assessed as a potential effect of the environment on the combined Projects in Chapter 14.

The potential for fire or explosions exists from Approved Project activities such as vehicle or equipment accidents or malfunctions smelter or kiln malfunctions, electrical accidents, welding activities, kitchen fires, or human carelessness. Scenarios include a fire or explosion within the processing facility, a fire and/or explosion resulting from a fuel spill that spreads outside of the Project Area, as well as a fire arising from an off-site (i.e., along the access road) vehicle accident. A fire and/or explosion in the processing facility may occur due to the failure / malfunctioning of technology or equipment. Fire or explosion may also occur during fuel transfers during construction and operation.

Project Expansion activities are similar to those previously assessed for the Approved Project (i.e., activities related to open pit mining). Therefore, the risk of fire or explosions and the scenarios in which they may occur are the same as those assessed in the Valentine Gold EIS.

The Project Expansion includes relocating the explosives storage facility to the site of the exploration camp. This move is required to maintain required safety setbacks. Design of and activities at the explosives storage facility are the same as those assessed in the EIS. The new proposed location is closer to the Victoria Dam (2,382 m distance) and, therefore, an assessment to establish the risk level related to a surface detonation at the explosives storage facility and / or the magazine site on the Victoria Dam was completed by DynoConsult (Appendix 2D). DynoConsult concluded that “in the case of an unplanned detonation of the emulsion storage and / or magazine site, there is no risk for the Victoria Dam. This includes all damage coming from ground vibration and air overpressure generated by the surface detonation.”

13.5.5.1 Design and Safety Measures to Reduce Environmental Effects

Fire and explosion prevention measures and management will reduce the likelihood of accidents and potential fires to as low a level as is reasonably practicable. For the most part, fire water will be accessed from an underground ring of water pipes around the mine structure facilities (e.g., accommodations camp, processing facility), which will be supplied by the bottom section of the raw water tank. Appropriate fire suppression systems will be provided in buildings for reagents according to their Materials Safety Data Sheet. Mine water trucks will be fitted with fire-fighting equipment and foam injection tanks (Marathon 2020).

A gated, 150 m by 150 m explosives storage and mixing area will be constructed for mine operation. It will be located southeast of the TMF at the site of the former exploration camp, bulk emulsion storage, storage for blasting accessories (e.g., detonators, boosters, detonating cords), bulk transfer facilities, garage for mobile equipment, and trailers for personnel. The explosives storage facility will meet government regulations including required separation distances as regulated by the Explosives Regulatory Division of NRCAN. Explosives and accessories will be stored at the planned NRCAN-approved magazine site and explosives storage facility and will be transported to the open pit as needed. An Explosives and Blasting Management Plan will be updated for the safe use and storage of explosives, in accordance with environmental protection measures, provincial and federal legislation and guidelines, and corporate policies for explosives. Plans will be updated prior to the use of explosives for the Project Expansion.

The above measures and reasonable precautions will be taken to avoid fires and limit the potential for fires beyond the Project Area. Buffers will be established and maintained, as required, between infrastructure and equipment. Equipment will be maintained in good working order. Employee training in fuel handling, fire prevention, and emergency response measures will be completed as part of the site-wide ESMS and Health and Safety management systems. Fire prevention and suppression systems, as well as response equipment and supplies, will be maintained on site at designated locations.

13.5.5.2 Emergency Response Measures

The emergency response plans developed for the Approved Project include measures to be implemented in the event of a fire or explosion, including actions to limit the immediate risk to the safety of employees and the public, and communication and reporting requirements. These plans will be reviewed and updated as needed to include Project Expansion activities. While emergency response capabilities at the mine site (e.g., firefighting and health care) will be sufficient for most accidents, a major accident may require additional support from surrounding communities. Fire departments in Grand Falls-Windsor, Buchans and Millertown, and the hospital in Buchans, may be called to aid in response to larger fires or emergencies. Should Project Expansion activities inadvertently result in a forest fire, the appropriate provincial authorities will be notified immediately. The management, monitoring and control of forest fires in NL is the responsibility of the Department of Forestry, Fisheries and Agriculture. Forest fires would be reported to the Provincial Forest Fire Communications Centre (and respective regional centres). In developing, reviewing and updating emergency response plans, Marathon will consult with local, provincial and federal emergency response departments / agencies, as appropriate.

13.5.5.3 Environmental Effects Assessment

In the event of a fire, the immediate concern would be for human health and safety, as well as concerns for habitat loss, direct mortality to wildlife, and loss or damage of property. A fire also can remove riparian vegetation near watercourses, resulting in temporarily elevated water temperature and increased sedimentation. A Project-related accidental fire and/or explosion could affect air quality. Depending on the extent of a fire, effects to atmospheric environment, surface water resources, fish and fish habitat, vegetation and wetlands, and wildlife may occur. As described in Section 21.5.5 of the Valentine Gold EIS, adverse residual effects are predicted to be low in magnitude, short-term and reversible. However, effects may be additive to the high magnitude effect of routine Approved Project activities on movement of the Buchans caribou herd. A significant effect has therefore been predicted for caribou.

As the accident scenarios for the Project Expansion are the same as those for the Approved Project, Marathon does not predict a change in environmental effects from those assessed in the Valentine Gold EIS for caribou. Therefore, the conclusion that the residual adverse environmental effects of a fire or explosion would be significant for caribou remains unchanged from the Valentine Gold EIS (Section 13.6).

13.5.6 Vehicle Accidents

Accident scenarios involving vehicles (as described in Section 21.5.6 of the Valentine Gold EIS) also apply to the Project Expansion. A vehicle accident could result in the release to the environment of hydrocarbon, sodium cyanide, or other chemicals (assessed in Section 13.5.3 of this document). Accidental collisions from the operation of Project vehicles or heavy equipment could also result in human mortality or injury, or a fire (Marathon 2020).

13.5.6.1 Design and Safety Measures to Reduce Environmental Effects

Several traffic safety measures will be implemented to reduce the potential for vehicle malfunctions or accidents as a result of the Project Expansion. These include the following:

- The haul road and site roads will be maintained in good condition; this will include periodically regrading and ditching to improve water flow and reduce erosion, and managing vegetation growth.
- Project Expansion vehicles will be required to comply with posted speed limits on site roads and the haul road; speed limits will be set in accordance with road conditions and industry standards (e.g., for haul road).
- The Traffic Management Plan will be updated to manage transportation of workers and materials to site, product leaving site, and the number of vehicles accessing the site, and to reduce traffic delays.
- Marathon will implement traffic control measures, which may include gating approaches, placing large boulders, and/or gated fencing to restrict public access to the mine site.
- Project Expansion vehicles will be driven by trained, licenced and competent drivers who will use approved routes.

- Project Expansion vehicles will be manually inspected to confirm serviceability and maintained on a regular schedule.
- Driving safety will be a part of the employee orientation program.
- Workers will be bussed from nearby communities to the mine site for shifts, which will also reduce potential for a vehicle collision.

13.5.6.2 Emergency Response Measures

Emergency response services will be available at the mine site, as well as through fire departments in Grand Falls-Windsor, Buchans and Millertown, and the hospital in Buchans. Marathon will consult and establish communications with appropriate local, provincial and federal emergency response departments as determined to be required for environmental and health and safety related emergencies. Marathon will cooperate with local officials in the incident investigation process and conduct an internal incident investigation. Where necessary, remedial and corrective actions will be taken by Marathon in accordance with the results of the investigations.

13.5.6.3 Environmental Effects Assessment

Vehicle-related wildlife mortality can affect a wide range of species, including migratory birds, species at risk and species of conservation concern, and mammals. Vehicles will abide by posted speed limits and multi-passenger vehicles will be used, where practicable, to reduce the potential for wildlife-vehicle collisions. To reduce the risk of caribou-vehicle collisions, caribou will have the right of way, except where deemed unsafe for site personnel. If wildlife is on a road, speed will be reduced and the vehicle stopped, if necessary, to allow wildlife to leave the road.

Although public injury or mortality from a vehicle accident cannot be ruled out, the likelihood is very low given the mitigation measures and emergency response procedures. In the unlikely event of a vehicle collision resulting in serious injury or loss of life, residual adverse effects on community health would be high in magnitude, irreversible and significant.

Project Expansion-related transportation along the access road is expected to result in less than a 5-8% increase from that of the Approved Project. With no substantial change in vehicle volume, the scenarios in which an accident may occur during the Project Expansion are the same as those assessed in the Valentine Gold EIS. Therefore, the Project Expansion does not change the effects assessment included in the Valentine Gold EIS (Section 13.6).

13.6 SUMMARY

The Project Expansion will be planned, designed, constructed, operated and monitored to avoid accidents or malfunctions through adherence to regulations, guidelines and best practices. The Project Expansion will not introduce additional risk for an accidental event or malfunction beyond that assessed for the Approved Project. In the event of an accident or malfunction, emergency response procedures and contingency measures will be implemented to reduce adverse effects to the environment. Environmental management plans and emergency response plans for the Approved Project will be updated for the

Project Expansion, as applicable, including communication roles and responsibilities, training requirements, and requirements for on-site response infrastructure and equipment. These are described in Section 2.7.3 of the Valentine Gold EIS (Marathon 2020) and Section 2.9 of this document, and further detailed in specific management plans, (e.g., Environmental Protection Plan, Emergency Response and Contingency Plan).

The Valentine Gold EIS predicted that, in the unlikely event of a major industrial accident or malfunction which resulted in a large-scale release into the environment (e.g., major TMF failure with discharges of tailings into local waterbodies and other habitats outside the Project Area, or a major spill of hazardous materials from a vehicle malfunction or collision), there was potential for significant residual adverse effects from the Approved Project to surface water resources, fish and fish habitat, caribou, and community health (Table 13.2). A significant effect could also occur in the unlikely event of a major accident that resulted in loss of life (e.g., vehicle accident or TMF failure). However, a significant effect was unlikely to occur given the Project design and safety measures in place to reduce the likelihood of an accident or malfunction, and the emergency response plans and contingency measures to limit the extent and nature of potential environmental effects, including conformance with industry standards, best management practices, and regulatory requirements. The residual effects from accidental events with a higher likelihood of occurring (e.g., small hydrocarbon spills from equipment) were not likely to be significant, as these would be contained within the mine site and readily cleaned up). The addition of the Project Expansion will not increase the risk of or change the nature or consequences of the accidental event and malfunction scenarios assessed for the Approved Project. Therefore, the residual effects predictions for the Approved Project remain valid and unchanged with the addition of the Project Expansion.

Table 13.2 Summary of Significance Determinations – Approved Project and Addition of Project Expansion

VC/Component Name	Accident or Malfunction Scenario Significance Determination for Approved Project					
	TMF Malfunction	**Slope Failure**	**Fuel and Hazardous Material Spills**	**Unplanned Release of Contact Water**	**Fire / Explosion**	**Vehicle Accident**
Atmospheric Environment	NS	NS	NS	NS	NS	NS
Groundwater Resources	NS	NS	NS	NS	NS	NS
Surface Water Resources	S*	NS	NS	NS	NS	NS
Fish and Fish Habitat	S*	NS	NS	NS	NS	NS
Caribou	S*	NS	NS	NS	S*	NS
Other Terrestrial Components • Avifauna • Vegetation, Soils and Terrain • Other Wildlife	NS	NS	NS	NS	NS	NS
Socio-economic Components • Community Services and Infrastructure • Community Health** • Employment and Economy • Land and Resource Use • Indigenous Groups	NS	NS	NS	NS	NS	S**
Change in Significance Determination with Addition of Project Expansion	**No change**	**No change**	**No change**	**No change**	**No change**	**No change**

Notes:
* Accident/malfunction unlikely to occur
** Specific to community health only

The determination of significance was made with a moderate to high level of confidence, with a higher level of confidence associated with the minor accidental events or malfunctions that may occur (e.g., small to medium sized spills). A moderate level of confidence has been assigned for larger scale and far less likely events, such as a TMF failure or major fuel / hazardous material spill outside the confines of the mine. Given this lower level of predictability, a worst-case assumption has been used in this assessment in the determination of significance. Marathon has developed contingency plans and will implement engineering and quality controls during the design, construction and operation phases to mitigate potential adverse environmental effects that could result from accidental events and malfunctions. During the operation phase, monitoring (including passive monitoring with technology, active monitoring with scheduled inspections, and opportunity inspections during heavy rain and/or runoff events) for scenarios with higher potential to result in substantial adverse environmental effects (e.g., slope failures) will be part of standard operating procedures.

13.7 REFERENCES

Ausenco (Ausenco Engineering Canada Inc.). 2022. Valentine Gold Project- NI 43-101 Technical Report & Feasibility Study. Available at: Valentine Gold Project | Technical Reports | Marathon Gold (marathon-gold.com)

IAAC (Impact Assessment Agency of Canada). 2012. Reference Guide: Determining Whether a Project is Likely to Cause Significant Adverse Environmental Effects. Available online: https://www.canada.ca/en/impact-assessment-agency/services/policy-guidance/reference-guide-determining-whether-project-is-likely-cause-significant-adverse-environmental-effects.html

Marathon (Marathon Gold Corporation). 2020. Valentine Gold Project Environmental Impact Statement. Available online: Valentine Gold Project - Environment and Climate Change (gov.nl.ca)

Terrane (Terrane Geoscience Inc.) 2022. Preliminary Open Pit Slope Design – Berry Deposit. Technical Memorandum, August 28. 2022.

14.0 EFFECTS OF THE ENVIRONMENT ON THE PROJECT EXPANSION

14.1 INTRODUCTION

This chapter discusses the potential effects of the environment on the Berry Pit Expansion (Project Expansion), including its design, construction, operation, and decommissioning, rehabilitation and closure phases. It considers how severe weather events or natural hazards (e.g., earthquakes, extreme precipitation events, extreme wind events) could affect or damage Project Expansion infrastructure, the construction schedule, costs, and operational performance, thereby resulting in failures, malfunctions, or accidental events, which in turn could result in adverse effects to the environment.

This chapter also references the analysis completed in Chapter 22 of the Valentine Gold Environmental Impact Statement (EIS) (Marathon 2020) for the Valentine Gold Project (Approved Project) and considers whether the assessment of effects of the environment on the Approved Project is materially different for the Project Expansion. The analysis completed in the Valentine Gold EIS was regional in scope and encompassed both the Approved Project and Project Expansion footprints. A summary of the assessment work completed in Chapter 22 of the Valentine Gold EIS is presented in this chapter, including details of planning, design, construction and operation strategies that aim to reduce the potential for adverse effects of the environment. A determination is then made whether that assessment is applicable to the Project Expansion.

The potential effects of the environment on the Approved Project and Project Expansion are largely addressed through planning and design and by applying industry standards, best management practices (BMP), and operational procedures in consideration of the expected and the potential extreme environmental conditions. As noted in the Valentine Gold EIS, engineering design will adhere to applicable provincial, national and international codes and standards that document the proper engineering design for site-specific normal and extreme physical environmental conditions and provide design criteria that regulatory agencies consider satisfactory for withstanding potential physical environmental criteria such as temperature, wind, rain, snow and ice loading, drainage, and climate change resistance (Marathon 2020). The design life of the Project Expansion will be taken into consideration so that selected materials have sufficient durability and corrosion protection.

Comprehensive prevention and response plans and procedures initiated for the Approved Project to reduce or prevent unplanned or accidental events (e.g., prevention and response procedures for forest fires) are also applicable to, and will be implemented during, the Project Expansion. In this way, the Project Expansion will be designed, operated and managed in a manner intended to reduce adverse effects of the environment. In addition to causing adverse effects on Project Expansion infrastructure, equipment, schedules, and operational performance, such effects could in turn result in adverse effects to the environment (e.g., water control malfunctions affecting downstream habitats).

14.2 SCOPE OF ASSESSMENT

Effects of the environment that are considered in this assessment are those that could result in:

- A substantial change to the Project Expansion schedule
- A long-term interruption in Project Expansion operations
- Damage to Project Expansion infrastructure or equipment resulting in a release of hazardous materials into the environment
- Damage to Project Expansion infrastructure resulting in a substantial increase in risks to the health and/or safety of Project Expansion personnel and/or the public, or substantial risk of an interruption to business
- Damage to Project Expansion infrastructure resulting in repairs that are not able to be technically or economically implemented

The possible environmental conditions and events that were considered for the Approved Project in the Valentine Gold EIS and are now considered for the Project Expansion are:

- Climate and climate change (including extreme weather)
- Geologic hazards (including seismic activity, erosion, landslides and subsidence)
- Forest fires

Potential changes to hydrological and hydrogeological systems, including surface water withdrawals and effects of groundwater regimes on mining operations, are assessed for the Project Expansion in the Groundwater Resources chapter (Chapter 7) and Surface Water Resources chapter (Chapter 8), and are not further considered in this chapter. Similar assessments for the Approved Project can be found in Chapter 6 and Chapter 7 of the Valentine Gold EIS (Marathon 2020).

The environmental components that are applicable to the geographic location of the Project Expansion are outlined in Table 14.1.

Table 14.1 Scope of Factors Considered for Effects of the Environment on the Project Expansion

Source of Environmental Effect	Environmental Category	Environmental Component
Weather and Climate	Climate	Temperature
		Precipitation (e.g., rain, snow)
		Wind
		Fog
	Extreme Weather Events	Snow
		Rain
		Wind
	Climate Change	Climate Projections
Natural Hazards	Geological	Landslides
		Rockfalls
		Subsidence
		Erosion
		Avalanches
		Earthquakes
	Forest Fires	Forest Fires

This assessment is linked to the Accidental Events chapter (Chapter 13) of this document. For the Approved Project, the following accidental events and malfunctions were assessed (Chapter 21 of the Valentine Gold EIS):

- Tailings Management Facility (TMF) Malfunctions
- Open Pit Slope Failure
- Low-Grade Ore and High-Grade Ore Stockpiles and Waste Rock Piles Slope Failure
- Fuel and Hazardous Materials Spill
- Unplanned Release of Contact Water (e.g., failure of water management infrastructure [ditching, ponds, erosion control] or a water treatment plant release)
- Sewage Treatment Plant Failure
- Over Blasting
- Fire / Explosion
- Vehicle Accident
- Watercourse Crossing Failure

The assessment of accidental events for the Project Expansion (Chapter 13 of the document) considers the applicability of these scenarios to the Project Expansion and updates the effects assessment where appropriate.

14.3 BOUNDARIES

The temporal and spatial boundaries for the assessment of effects of the environment on the Project Expansion are identified in the following sections.

14.3.1 Spatial Boundaries

The area identified for assessing effects of the environment on the Project Expansion is the Project Area, which is consistent with that for the Approved Project (Figure 14-1). As identified in Section 1.3 of this document, almost all Project Expansion features will be constructed inside the Project Area, with the exception of three sedimentation ponds and associated ditching/drainage channels, which are located partially or fully outside of the mine site and occupy 3.4 ha (representing 0.097% of the Project Area). In addition, to maintain required setbacks, the explosives facility location, previously assessed as part of the Approved Project, will be relocated to the former exploration camp location, a previously disturbed site with existing access. As with the Approved Project, a Local Assessment Area (LAA) and Regional Assessment Area (RAA) are not defined for the assessment of effects of the environment on the Project Expansion; adverse environmental effects of the environment on the Project Expansion are those that have the potential to directly affect schedules, infrastructure and operations, all of which are contained within the Project Area. Effects of the environment, such as damage to infrastructure, can adversely contribute to and/or complicate malfunctions and accidental events. Project Expansion malfunctions and accidental events, with relevant spatial boundaries, are addressed in Chapter 13.

14.3.2 Temporal Boundaries

The temporal boundaries for the Project Expansion are:

- Construction Phase – four to six months, beginning in Q3 2024
- Operation Phase – estimated nine-year operation life, with start-up beginning in 2025
- Decommissioning, Rehabilitation and Closure Phase – closure rehabilitation to occur once it is no longer economical to mine or resources are exhausted

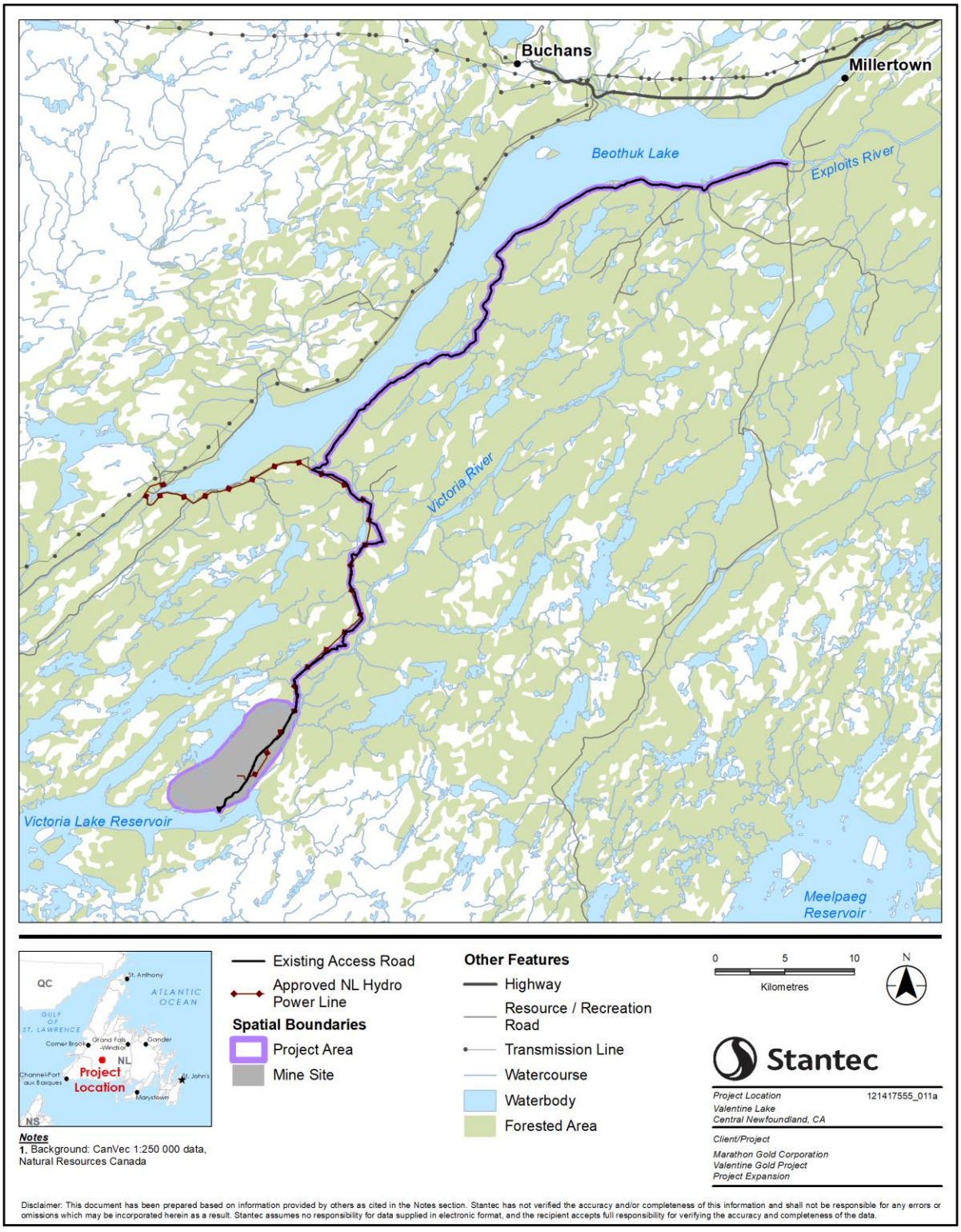

Figure 14-1 Spatial Boundaries for Effects of the Environment on the Project Expansion

14.4 OVERVIEW OF ASSESSMENT OF EFFECTS OF THE ENVIRONMENT ON THE APPROVED PROJECT

An overview of the assessment of potential effects of the environment on the Approved Project, as presented in the Valentine Gold Project EIS (Marathon 2020), is provided in the following sections. Given the shared Project Area, the assessment completed in the Valentine Gold EIS is also considered applicable to the Project Expansion.

14.4.1 Weather and Climate

14.4.1.1 Existing Conditions

The existing climate was discussed in the Valentine Gold EIS using 1981 to 2010 climate normals for the Buchans station, except for wind data which, due to non-availability, were sourced from the Deer Lake station. The wind data presented focused on the most recent 5-year data, rather than the 30-year climate normal for other parameters presented. The Valentine Gold EIS presented information on the following parameters:

- Metadata from weather stations in proximity to the Approved Project
- 30-year temperature normals from the Buchans weather station
- 30-year precipitation normals from the Buchans weather station
- Wind climate normals from the Deer Lake weather station
- Fog and visibility climate normals from the Deer Lake weather station
- Extreme weather events
- Climate change

General Climate Conditions

The 30-year normal temperature data indicate that the daily average temperatures at Buchans range between -8.4°C to 16.3°C, with the lowest average temperatures occurring in February and the highest occurring in July. Extreme historical daily maximum and minimum temperatures range between -33.5°C (occurring in February 1993) to 33°C (occurring in July 1995). The annual average temperature is 3.8°C.

The 30-year normal precipitation data indicate that the total annual average precipitation at Buchans is 1,236 mm, with 359 cm of snow and 877 mm of rain. Monthly average precipitation ranges between 86 to 123 mm, with the least occurring in April and the most occurring in December. On average, there have been 30.7 days each year with rainfall greater than 10 mm, and 7.1 days each year with rainfall greater than 25 mm. Average monthly snowfall peaks at 88.3 cm in January, with the most snowfall typically observed from December to February. On average, there have been 15.1 days each year with snowfall greater than 10 cm and 1 day each year with snowfall greater than 25 cm. On average, 148 days per year have a snow depth >1 cm.

Monthly average wind speeds from the 30-year climate normals measured at the Deer Lake station range from 11.7 to 15.3 km/hr, with an annual average wind speed of 13.6 km/hr (Marathon 2020). The dominant wind direction is from the southwest for all months except for April and May when the dominant wind direction is from the northeast. Maximum hourly wind speeds range from 59 km/hr (recorded in June and July) to 93 km/hr (recorded in January). Maximum gusts for the same period range from 89 km/hr (recorded in September) to 133 km/hr (recorded in January) (Marathon 2020). On average, there have been 4.7 days each year with hourly mean winds greater than 52 km/hr and 0.8 days each year with hourly winds greater than 63 km/hr.

Fog is defined as a ground-level cloud and consists of tiny water droplets suspended in the air and with visibility reduced to less than 1 km (ECCC 2017). The 1981 to 2010 climate normals for visibility for the Deer Lake station indicates that there is a measured increase in the hours of reduced visibility (less than 1 km) in fall and winter relative to the summer months (ECCC 2019). The Deer Lake station has experienced, on average, 79.6 hours (3.32 days) per year when visibility is less than 1 km (Marathon 2020).

Extreme weather events that could affect the Project Expansion and could occur at or near the Project Area include severe storms, hurricanes and tornadoes, and drought. Severe storms can occur throughout the year on the Island of Newfoundland (Island), and can result in threats to public safety, disruptions to transportation systems, and damage to utilities and/or property. Winter storm events can consist of high winds, snow, ice, and freezing rain. During the summer and fall months, the Island is prone to hurricanes and tropical storms, which can bring strong winds and heavy rains. Other forms of severe weather can develop during warmer months including thunder, lightning, hail and, occasionally, tornadoes (Marathon 2020).

Climate Change

While climate refers to the historical average weather conditions, climate change is an acknowledged change in climate that has been documented over two or more periods, each with a minimum duration of 30 years (Catto 2006). The Intergovernmental Panel on Climate Change (IPCC) defines climate change as “a change in the state of the climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties and that persists for an extended period, typically decades or longer” (IPCC 2014). Climate change can be a result of naturally occurring internal processes (e.g., volcanic activity), external forces (e.g., solar cycles), or anthropogenic activities altering the composition of the atmosphere or land use (IPCC 2014). The United Nations Framework Convention on Climate Change (UNFCCC) distinguishes between climate change attributed to anthropogenic activities and the variability attributed to natural causes. The UNFCCC defines “Climate Change” as the change that is attributed, whether directly or indirectly, to human activities, which is in addition to the naturally occurring climate variability observed over comparable periods (IPCC 2007).

The Valentine Gold EIS considered climate change projections for four locations on the Island: Port Aux Basques, Burgeo, Bay d’Espoir, and Exploits Dam. The precipitation and temperature results at these four locations are presented in Tables 22.6 and 22.7 of the EIS, respectively. The mean daily precipitation, mean intensity of precipitation events, and mean annual precipitation are expected to

increase at each of the four locations annually and during each of the seasonal periods presented. The daily mean temperature, daily minimum temperature, and daily maximum temperature are expected to increase at the four locations annually and during each of the seasonal periods assessed. In addition to increases in mean precipitation and temperatures, climate change is expected to increase the intensity, frequency, and duration of adverse weather events. The life of the Project Expansion, including the decommissioning, rehabilitation and closure phase, is expected to end by approximately 2045, which corresponds with the beginning of the mid-century climate-induced projected changes.

In the Valentine Gold EIS, intensity-duration-frequency (IDF) curve projections for precipitation were used to quantify projected changes of extreme adverse weather events. These IDF curves can be compared to historical curves and predictions made. With climate change, the frequency of intense rainfall episodes is expected to increase, with what was historically considered a 100-year storm now expected to occur, in the worst-case scenario presented, every 10 years. For example, a historical 100-year storm at Deer Lake received 85.16 mm of precipitation over a 24-hour duration, while by mid-century, a 25-year storm at Deer Lake is expected to receive 93.74 mm of precipitation over a 24-hr duration, and by end of century, a 10-year storm is expected to receive 92.22 mm of precipitation over a 24-hour duration. Although by the end of the century, a 10-year storm may result in more rainfall in the Project Area than what was historically considered a 100-year storm, the combined Projects will be ending when mid-century climate change projections become applicable.

14.4.1.2 Existing Conditions Update

Since the majority of Project Expansion infrastructure is located within the Project Area assessed for the Approved Project, the existing conditions presented within the Valentine Gold EIS (Marathon 2020) also apply to the Project Expansion, with minor updates provided below.

Extreme Weather Events

Agriculture and Agri-Food Canada (AAFC) publishes monthly records of droughts dating back to 2002 through their Canadian Drought Monitor tool (AAFC 2020). The records were reviewed for the surrounding area from 2002 to the end of 2019 for the Valentine Gold EIS (Section 22.3.1, Marathon 2020). The records were again reviewed for the same surrounding area from 2019 to the end of 2022. During that period, there were several months in which most or part of the surrounding area was classified as “Abnormally Dry”, and one month in which a “Moderate Drought” occurred. There were no occurrences of severe, extreme, or exceptional droughts within the Project Expansion footprint during this period.

14.4.1.3 Potential Effects

Climate, climate change and weather are important considerations in Project Expansion planning, as interactions may occur that could result in changes to schedules or cause damage to infrastructure. Examples of potential effects of climate change on the Project Expansion from extreme temperatures, heavy precipitation, fog, winds and storms include, but are not limited to:

- Reduced visibility and inability to maneuver construction and operation equipment
- Delays in receipt of materials and/or supplies and delays in product delivery to market
- Changes to the ability of workers to access the site (e.g., road wash out)
- Damage to infrastructure and equipment (e.g., increased structural loading)
- Loss of electrical power resulting in potential loss of production
- Additional snow clearing efforts
- Delays to construction activities
- Interruptions to operations

Extreme precipitation and associated surface water runoff from snowmelt, rainfall and freezing rain events can cause flooding, erosion, washout of site roads, the haul road and overload the Project Expansion's water management infrastructure. These events could lead to the erosion of topsoil, the degradation of soil quality, structure and stability, changes to slope stability, the failure of erosion or sedimentation control structures and failure of Project Expansion infrastructure. These events could, in turn, result in the release of sediment to surface waterbodies, or the unplanned release of contact water, considered in Chapter 13 of this document and Chapter 21 of the Valentine Gold EIS. Other potential effects of weather can include:

- Failure of a watercourse crossing that exceeds the design capacity, causing the loss of channel form due to erosion, or damage to other watercourse crossings downstream
- In the event of access road washout, access to and from the site could be restricted, thereby delaying the transport of materials, products and workers
- Extreme snowfall can cause delays to winter construction and winter mining operations, in delivery of materials and shipping of products, or in workers getting to site due to affected access to facilities
- Construction and mining operations could be halted during an extreme snow event or ice storm if safety becomes a concern
- Extreme snowfall and ice storms can also require additional effort for clearing and removal and could affect regular maintenance schedules
- Extreme snow and ice can increase loadings on buildings and other infrastructure and result in damage if the accumulated loading exceeds design loads
- Ice accumulation on power lines and associated infrastructure could cause power outages and delays to operational activities
- Extreme snow and ice could also increase the risk of vehicle accidents on combined Project and access roads (assessed in Chapter 21), which could result in a spill of hazardous materials (assessed in Chapter 21), damage to equipment, or injury to vehicle operators
- Low winter temperatures can result in increased ice thickness on local lakes, including Victoria Lake Reservoir where water intake and discharge will occur

- Ice can constrain the flow in water and effluent lines, thereby affecting water intake and effluent discharge
- Very low temperatures can reduce construction material flexibility, making these more susceptible to breakage
- Reduced visibility can be caused by fog, heavy rainfalls, and extreme winds causing blowing snow, dust or debris; this could make maneuvering of equipment difficult and result in possible delays to construction schedules, mining operations, material movement, and/or the delivery of equipment and supplies
- The operation of equipment could be halted during heavy fog if safety is a concern
- Droughts could reduce water levels in surrounding watersheds, such as Victoria Lake Reservoir, where the water intake will be located

Further details about the potential effects of weather and climate on the Approved Project can be found in Section 22.3.1 of the Valentine Gold EIS (Marathon 2020).

14.4.1.4 Residual Effects

To reduce the potential for damage to Project Expansion infrastructure and equipment, weather and climate effects will be considered during the planning and design of Project Expansion phases. Routine maintenance, inspections and monitoring will be regularly conducted to prevent deterioration of Project Expansion infrastructure and equipment, support Project Expansion compliance with applicable design criteria, codes and standards, and identify potential problems and promptly apply mitigation measures. Climate change projections will be incorporated into the design criteria, although the life of the Project Expansion (including the decommissioning, rehabilitation and closure phase) would be ending as mid-century climate change projections become applicable. Project Expansion delays due to poor weather will be anticipated and allowance for them will be included in the construction and operational schedules. Extreme weather conditions could also increase the potential for spills of various materials and magnitudes. Marathon's Environmental and Social Management System (ESMS), several components of which include emergency response plans to meet various requirements, will be comprehensive and detail spill avoidance and response procedures to reduce the potential for adverse environmental effects on valued components (VCs) from spill events. Environmental effects from Project Expansion-related accidents and malfunctions are addressed in Chapter 13.

14.4.2 Geological Hazards

The Geological Survey of NL defines a geological disaster as one "that occurs when natural geological processes impact on our activities, either through loss of life, injury or economic loss" (NLDNR 2020a). The Valentine Gold EIS considered several geological hazards that could result in a geological disaster including landslides, rockfalls, erosion, subsidence, and seismic activity (Marathon 2020). As for the Approved Project, geological hazards can adversely impact Project Expansion infrastructure and equipment, which could result in effects to the environment. Adverse environmental effects from the malfunction of Project Expansion infrastructure are assessed in Chapter 13 and an assessment of accidental events for the Approved Project can be found in Chapter 21 of the Valentine Gold EIS (Marathon 2020).

14.4.2.1 Existing Conditions

A comprehensive description of the existing conditions in the Project Area regarding geological hazards is presented in the Valentine Gold EIS (22.3.2.1) and considers surficial geology, bedrock geology, seismic activity, and terrain stability (i.e., landslides, rockfalls, erosion, subsidence and avalanches).

Surficial Geology

In general, the surficial geology of the Project Area may be summarized as organic soil, overlying glacial till which in turn overlies bedrock. Further details regarding the surficial geology of the site are provided in Section 22.3.2.1 of the Valentine Gold EIS.

Bedrock Geology

The bedrock geology of the Project Area is based on descriptions by Tettelaar and Dunsworth (2016). The Valentine Lake Intrusive Complex (VLIC) hosts the gold mineralization of the Approved Project, and also hosts the Berry deposit. It is an elongated northeast trending intrusion consisting dominantly of fine- to medium-grained trondhjemite and quartz-eye porphyry with lesser aphanitic quartz porphyry, gabbro and minor pyroxenite units of the Upper Precambrian. All intrusive rocks demonstrate varying degrees of sausseritization of plagioclase and strong alteration of mafic minerals to chlorite and epidote. The east end of the VLIC consists of medium- to coarse-grained, equigranular quartz monzonite to monzonite (Ausenco 2022).

Seismic Activity

The Island, including the Project Area, is categorized as having a low seismic hazard by the Geological Survey of Canada (GSC 2015). From 1985 to the present, there have been a total of 44 earthquakes on the Island; none were recorded within the Project Area and all were small, ranging in magnitude from 1.9 to 2.9 (NRCAN 2020).

Terrain Stability (Landslides, Rockfalls, Erosion, Subsidence and Avalanches)

The landscape within the Project Area is gently sloping with rolling hills, with no exposed high relief bedrock ridges. The combination of site topography with the overburden and bedrock characteristics limits the potential for landslides and rockfalls. There are no recorded cases of landslides in the Project Area (NLDNR 2020b), and there is no evidence of landslide deposits in the Project Area based on spatial and field data (Stantec 2015).

Based on the soil types and topography in the Project Area, the potential for erosion-related geological hazards is low (Marathon 20220). Based on the soil and bedrock conditions and seismic hazard within the Project Area, the risk related to subsidence is low. Historically, there have been no recorded avalanches in the Project Area or environs (NLDNR 2020c). The risk of landslides and slope instability will be evaluated during detailed site design and engineering through a geotechnical assessment (Marathon 2020).

14.4.2.2 Potential Effects

Geological hazards have the potential to impact Project Expansion infrastructure and equipment, which could result in effects to the environment (e.g., releases to surface water and fish habitat).

Seismicity

While there are no past seismic events recorded for the immediate Project Area, and the risk of adverse seismic activity in Newfoundland and Labrador (NL) is low, Project Expansion infrastructure (e.g., dams, ore, waste rock piles, and overburden stockpiles) will be designed accounting for potential seismic event in accordance with recommendations provided by the National Building Code of Canada (NBCC) (National Research Council of Canada 2015) and the Canadian Foundation Engineering Manual (Canadian Foundation Engineering Management [CANFEM]; Canadian Geotechnical Society 2006).

With the low seismic hazard risk of the Project Area and the adoption of design standards, there is low probability of a seismic event occurring within the Project Expansion area that could result in damage or interruption to the Project Expansion.

Terrain Stability (Landslides, Rockfalls, Erosion and Subsidence)

There is no evidence of landslides or rockfalls in the Project Area, and the probability of such an event occurring is considered low based on a review of the terrain and geological conditions.

Erosion can result in sedimentation, removal or movement of topsoil, degradation of soil quality, structure and stability, and related adverse environmental effects. It can also damage roads, dams, water management infrastructure, and other surface infrastructure with shallow foundations.

Subsidence could cause damage to infrastructure or equipment. Road and underground infrastructure may also be damaged due to twisting movements during ground shifts, leading to cracks or breaks.

Slope failure in the open pits could occur due to unanticipated geological or hydrogeological conditions, which could cause areas around the open pit to slump into the open pit.

Further details about the potential effects of geologic hazards on the Approved Project can be found in Section 23.3.2 of the Valentine Gold EIS (Marathon 2020). The potential for slope failure is addressed in Chapter 13 of this document and in Chapter 21 of the Valentine Gold EIS.

14.4.2.3 Residual Effects

Consideration of geological hazards in engineering design reduce the potential for damage to infrastructure and equipment, and for unplanned changes to construction or operation schedules. With the implementation of design standards and guidelines, geological hazards are not predicted to have adverse residual effects on the Project Expansion. In the event of an accidental event or malfunction, the environmental effects associated with these unplanned events, including a release of untreated contact water, are addressed in Chapter 13 of this document or in Chapter 21 of the Valentine Gold EIS (Marathon 2020).

14.4.3 Forest Fires

14.4.3.1 Existing Conditions

Forest fires occur infrequently in the area surrounding the Project Area, mainly due to relatively long winters and abundant precipitation in the region. There were seven forest fires within 100 km of the Project Area from 1986 to 2018. Forest fires caused by lightning are infrequent in NL as the occurrence of lightning is low. Most forest fires in the area are caused by people (Marathon 2020). The 2021 fire season included a total of 26 fires in the Western region of the Island, a decrease over the ten-year average (NLDFFR 2021). Two large forest fires occurred in Central Newfoundland in August 2022; although they were not within 100 km of the mine site, air quality was affected. A substantial response effort and favourable weather prevented the fires from reaching communities. Proper fire breaks will be considered and cleared where warranted during clearing and site layout.

14.4.3.2 Potential Effects

Forest fires can impact the Project Expansion in the following ways:

- Reduced visibility due to smoke, causing difficulty in maneuvering equipment on site, or delays in the receipt and/or delivery of materials and supplies
- Health and safety concerns for personnel who inhale smoke
- Delays in schedule and subsequent loss of production
- Damage to infrastructure and/or equipment or obstruction of roads
- Effects to site accessibility if the access road becomes impassable due to forest fire
- Explosion caused by contact of a forest fire with fuel storage tanks or explosives storage facility
- Loss of electrical power

Forest fires are distinguished from fires that could result from Project Expansion activities and spread to surrounding areas. Marathon's response to, and the potential effects of, Project Expansion-related fire and explosion scenarios are addressed in Chapter 13 of this document and in Chapter 21 of the Valentine Gold EIS (Marathon 2020).

14.4.3.3 Residual Effects

If a forest fire were to occur within the Project Area, Marathon will quickly mobilize personnel, coordinate with provincial responders, and implement appropriate response measures in accordance with Project emergency response plans. These actions would reduce the risk to the health and safety of Project Expansion personnel and infrastructure. The same fire prevention and response measures identified in Chapter 21 of the Valentine Gold EIS (Marathon 2020) would also be applied if a forest fire were to reach Project Expansion infrastructure. Further details about the potential effects of forest fires on the Approved Project can be found in in Section 23.3.3 of the Valentine Gold EIS (Marathon 2020).

The management, monitoring and control of forest fires in NL are the responsibility of the NL Department of Fisheries, Forestry and Agriculture. Forest fires are reported to the Provincial Forest Fire Communications Centre (or respective regional centres). Should NLDFFA not be able to gain control of a large forest fire and it were to spread to the mine site, substantial damage to mine infrastructure could occur, including to buildings, equipment, and other infrastructure. Reagents, diesel fuel, and blasting material stored within the mine site could create the risk of explosion. Damage resulting from a fire could result in a substantial delay in mine production. Given the history of forest fire in the region, however, the risk of a large, uncontrolled forest fire affecting the mine site is considered low.

14.5 MITIGATION MEASURES AND RESIDUAL EFFECTS - EFFECTS OF THE ENVIRONMENT

Table 14.2 presents a summary of potential effects of the environment on the Approved Project, and identifies potential changes in these effects as a result of the addition of the Project Expansion. It also provides mitigation measures identified for the Approved Project, which will be applied to the Project Expansion, where applicable.

Table 14.2 Summary of Potential Effects and Mitigation Measures - Effects of the Environment

Condition/Event	Potential Effects - Approved Project	Mitigation Measures	Change in Potential Effects - Project Expansion
Weather and Climate Change	• A substantial change of the schedule • A long-term interruption in operations • Damage to infrastructure or equipment that results in a release of hazardous materials into the environment • Damage to infrastructure resulting in a substantial increase in risks to the health and/or safety of personnel and/or the public, or substantial risks of a business interruption • Damage to infrastructure resulting in repairs that could not be technically or economically implemented	The Approved Project will be designed and constructed to meet applicable engineering codes, standards and BMPs, such as the *National Building Code of Canada (NBCC), the National Fire Code of Canada (NFCC),* and *the Canadian Dam Association (CDA) Guidelines*. The codes and standards account for weather variables, including extreme conditions, that could affect the structural integrity of buildings and infrastructure. Designs will also consider projected climate change over the life of the Approved Project. For example, the NBCC contains design requirements to account for extreme weather on infrastructure such as: • critical structures, piping, tanks and steel selection to prevent brittle fracture at low ambient temperatures • electrical grounding structures for lightning protection • maximum motor ambient temperature • ice and freeze protection	The assessment provided in the Valentine Gold EIS remains unchanged as it is regional in scope and incorporates the Project Expansion footprint. Note that construction, maintenance and management of the tailings impoundment will not change as a result of Project Expansion activities. The replacement of the polishing pond with a SAGR® unit is expected to make the wastewater treatment process more resilient to extreme weather. The SAGR has few moving parts, has demonstrated operational success at sites operating at 100-200% of full design flows, and successfully operates in some of the coldest populated areas in North America (Nexom 2023). Data from these sites demonstrate that the SAGR provides consistent nitrification in hostile climates.
		The potential effects of extreme weather including storms, precipitation, flooding/ice jams and drought will be considered in Approved Project planning, design and operation strategies, including the selection of materials and equipment and design of components, such as water management infrastructure and the TMF. These designs will consider projected climate change conditions over the life of the Approved Project.	
		Marathon will regularly inspect and monitor Approved Project infrastructure and equipment that may be impacted by the environment (in addition to its normal function) and take required action to maintain, repair and upgrade infrastructure / equipment as needed.	
		Work activities will include allowance / procedures for delays due to poor weather.	
		Contingency plans, including emergency back-up power for necessary operations, will be in place to manage delays, such as temporary power outages.	
		Weather forecasts will be considered when planning construction and operation activities that may be affected by adverse conditions, such as TMF embankment raises, receipt of materials and supplies and product deliveries, particularly deliveries of chemicals, reagents and diesel fuel. Where required, these activities will be scheduled for periods of favourable weather conditions.	
		Weather forecasts will be regularly monitored and prior to extreme weather events, appropriate preventative measures will be taken to reduce the risk of damage to the Approved Project. This will include site inspection by staff to secure loose items and identify other risks (for wind events), and inspection / maintenance of sediment and erosion control measures prior to and following precipitation events.	
Geological Hazards	• A substantial change of the schedule • A long-term interruption in operations • Damage to infrastructure or equipment that results in a release of hazardous materials into the environment • Damage to infrastructure resulting in a substantial increase in risks to the health and/or safety of personnel and/or the public, or substantial risks of a business interruption • Damage to infrastructure resulting in repairs that could not be technically or economically implemented	The Approved Project will be designed and constructed to meet applicable engineering codes, standards, and BMPs, including the NBCC and CANFEM, which provide standards of safety to account for geological hazards, including seismic activity.	The assessment provided in the Valentine Gold EIS remains unchanged as it is regional in scope and incorporates the Project Expansion footprint. Note that construction, maintenance, and management of the tailings impoundment will not change as a result of Project Expansion activities.
		Water retaining structures, including dams for the TMF, will be designed, constructed, operated and closed in accordance with the recommendations provided by CDA; these guidelines also outline the minimum design criterion to account for geological hazards.	
		Implementation of site-specific erosion and sedimentation control plans that will be developed during detailed design phase of the Approved Project.	
		Geotechnical investigations for site infrastructure, open pits and waste and ore piles will be completed prior to construction to further assess the site-specific conditions and associated risk of geological hazards; information obtained from these site-specific investigations will be used to complete the designs and meet the requirements as presented in NBCC, CANFEM and CDA.	
Forest Fires	• A substantial change of the schedule • A long-term interruption in operations • Damage to infrastructure or equipment that results in a release of hazardous materials into the environment • Damage to infrastructure resulting in a substantial increase in risks to the health and/or safety of personnel and/or the public, or substantial risks of a business interruption • Damage to infrastructure resulting in repairs that could not be technically or economically implemented	Marathon's ESMS will describe emergency response measures, training requirements, roles and responsibilities and contact and reporting procedures in the event of a fire at or near the mine site or along the access road.	The assessment provided in the Valentine Gold EIS remains unchanged as it is regional in scope and encompasses the Project Expansion footprint.
		Marathon will actively monitor wildfires that could affect the mine site and/or access road and coordinate with provincial authorities with respect to response, including the need for potential shutdown and evacuation of employees.	
		On-site fire prevention and response equipment will be provided and maintained, and Marathon will have employees / teams that will be trained in safe fire response. While the purpose of this response training and equipment is to respond to fire scenarios on the mine site, NLDFFA would be responsible for response to a forest fire in the area not related to the Approved Project.	
		Approved Project-related activities will be adjusted in case of a severe fire and as needed to protect the health and safety of employees.	

14.6 SUMMARY OF EFFECTS OF THE ENVIRONMENT

The assessment of the effects of the environment on the Approved Project completed in the Valentine Gold EIS was regional in scope and incorporates the Project Expansion footprint. The mitigation measures proposed for the Approved Project in Table 14.2 are therefore also applicable to the Project Expansion. Similarly, the residual effects predicted in the Valentine Gold EIS, as they relate to the effects of the environment on the Approved Project, also apply to the Project Expansion.

Potential adverse effects on the combined Projects from the physical environment through climate normal NL weather, extreme weather events linked to climate change, geological hazards, and forest fires have been and will continue to be an important consideration throughout planning and engineering of the mine. These potential effects will be considered during the construction, operation, and decommissioning, rehabilitation and closure stages. The Approved Project and Project Expansion will rely on design standards and proven mining methods and technologies that have been tested and proven successful in similar environments across Canada. Marathon will also follow industry standards and best practices in designing for and preventing adverse effects of the environment on the Project Expansion, reducing the potential for:

- A substantial change to the schedule
- A long-term interruption in operations
- Damage to infrastructure or equipment that results in a release of hazardous materials into the environment
- Damage to infrastructure resulting in a substantial increase in risks to the health and/or safety of personnel and/or the public, or substantial risks of a business interruption
- Damage to infrastructure resulting in repairs that could not be technically or economically implemented

As with the Approved Project, the design of the Project Expansion, including the integration of mitigation measures, will reduce the potential for substantial adverse effects of the environment.

14.7 REFERENCES

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15.0 SUMMARY AND CONCLUSIONS

Marathon Gold Corporation (Marathon) is currently constructing an open pit gold mine (Valentine Gold Project; Approved Project) near Valentine Lake, located in the central region of the Island of Newfoundland, southwest of the Town of Millertown, Newfoundland and Labrador (NL). The Approved Project consists primarily of two open pits, associated waste rock piles, crushing and stockpiling areas, conventional milling and processing facilities (the mill), a tailings management facility (TMF), personnel accommodations camp, and supporting infrastructure including an upgraded gravel access road from Millertown to the mine site, haul roads, site roads, on-site power lines, buildings, and water and effluent management facilities.

The Approved Project was subject to environmental assessment (EA) under the federal *Canadian Environmental Assessment Act*, *2012,* and the NL *Environmental Protection Act* (NL EPA). Marathon submitted an Environmental Impact Statement (Valentine Gold EIS) to both federal and provincial regulators on September 29, 2020 and November 3, 2020, respectively. The Approved Project was released from the EA process with conditions, provincially on March 17, 2022, and federally on August 24, 2022.

Marathon is proposing the development of a third open pit largely within the Project Area of the Approved Project. The Berry Pit Expansion (Project Expansion) is proposed to include an open pit (Berry pit), new waste rock pile and topsoil stockpile, expansion of the Marathon pit low-grade ore (LGO) and overburden stockpiles to accommodate Berry pit LGO and overburden, in-pit tailings storage in a mined-out basin of the Berry pit, relocation of the explosives facility, replacement of the TMF polishing pond described in the Valentine Gold EIS with a smaller SAGR® wastewater treatment unit, and additional water management infrastructure.

Since the Valentine Gold EIS was prepared, drilling programs have continued to expand understanding of the mineralization in Marathon's mineral leases, refine resource estimates, and further delineate potential resources. As a result of continued resource delineation, the mineable resources from both the Marathon and Leprechaun pits have been reduced. In addition, macro-economic impacts (e.g., inflation) have affected the economics of the Approved Project. The addition of the Project Expansion improves the overall combined Projects' sustainability, life of mine (LOM), and employment and economic benefits, without requiring additional or altered mineral processing rates.

This chapter provides a summary of the following:

- Regulatory context and engagement
- Potential Project Expansion-related effects
- Residual environmental effects of the Approved Project in combination with the Project Expansion, including cumulative effects and accidental events, and changes from residual effects predicted for the Approved Project in the Valentine Gold EIS

- Changes to or new mitigation measures, monitoring and / or follow-up commitments required due to the Project Expansion
- Conclusions

15.1 REGULATORY CONTEXT AND ENGAGEMENT

This Environmental Registration / EA Update has been prepared in accordance with the requirements of the provincial NL EPA and per federal conditions related to changes to the Approved Project found in EA Conditions 2.16 and 2.17. The federal EA release conditions require Marathon to notify the Impact Assessment Agency of Canada (IAAC) in writing in advance if they propose to carry out activities associated with the Designated Project (Approved Project) that differ from how it was described in the Valentine Gold EIS. Per EA release condition 2.16, this document serves to provide:

- a description of the proposed change(s) to the Designated Project and the environmental effects that may result from the changes
- any modified or additional measure to mitigate any environmental effect that may result from the change(s) and any modified or additional follow-up requirement
- an explanation of how, taking into account any modified or additional mitigation measure, the environmental effects that may result from the change(s) may differ from the environmental effects of the Designated Project identified during the environmental assessment

Condition 2.17 requires Marathon to submit to IAAC any additional information required by the Agency about the proposed change(s) referred to in condition 2.16, which may include the results of consultation with Indigenous groups and relevant authorities on the proposed change(s) and environmental effects and the modified or additional mitigation measures and follow-up requirements.

Marathon has conducted Indigenous, community, stakeholder and public engagement on the Project Expansion. A Project Summary was prepared and distributed to communities and Indigenous groups, public open houses were conducted as described in Chapter 3, and meetings have been held with Indigenous groups, communities, regulators and stakeholders.

Consistent with Marathon's ongoing engagement program in relation to the Approved Project, the objectives of Marathon's Expansion Project engagement efforts are to:

- Provide Project Expansion information and updates on a regular and continuing basis
- Engage Indigenous groups, communities, and stakeholders throughout the EA process and over the life of the Project Expansion
- Identify issues or concerns from Indigenous groups, communities and stakeholders early in the EA process
- Integrate input from Indigenous groups, communities and stakeholders into Project Expansion planning and execution, identify potential Project Expansion-related effects, and design and implement mitigation measures
- Demonstrate how issues and concerns raised during engagement have been addressed

Feedback received during these engagement efforts, along with Marathon's approach to addressing concerns, are provided in Chapter 3.

15.2 SUMMARY OF POTENTIAL EFFECTS

This document includes an evaluation of the potential environmental effects for valued components (VCs) that may result from routine Project Expansion activities, routine Project Expansion activities in combination with Approved Project activities, and potential accidental events. An evaluation of potential cumulative effects has also been completed, considering whether residual environmental effects of the Project Expansion in combination with residual environmental effects of the Approved Project could interact cumulatively with the residual environmental effects of other past, present, or reasonably foreseeable future physical activities near the mine site. Effects of the environment on the Project Expansion have also been assessed. For this Environmental Registration / EA Update, the assessment also considers whether the Project Expansion activities, in combination with the Approved Project, change the residual effects predictions made for the Approved Project in the Valentine Gold EIS.

Environmental effects were assessed for the following VCs:

- Atmospheric Environment
- Groundwater Resources
- Surface Water Resources
- Fish and Fish Habitat
- Caribou

For each potential effect, the physical activities that may interact with the VC and therefore potentially result in an environmental effect, were identified and assessed further as summarized in each VC chapter. Marathon also completed updated modelling for a number of components to better predict environmental effects due to the Project Expansion. This includes updates to air dispersion, noise, groundwater, water quantity and quality, assimilative capacity, and caribou migration models to better understand the environmental effects pathways and identify mitigation measures and monitoring strategies.

In addition to the five VCs selected for assessment, summary chapters were prepared for the socioeconomic VCs and other terrestrial VCs assessed in the Valentine Gold EIS to verify that the Project Expansion will not change the effects assessments or mitigation measures presented in the Valentine Gold EIS for those VCs.

15.3 SUMMARY OF RESIDUAL EFFECTS

15.3.1 Routine Project Activities

The environmental effects assessments for construction, operation, and decommissioning, rehabilitation and closure for each VC are presented in Chapters 6 to 12. The general results of the assessment for routine Project Expansion activities are summarized below.

- **Atmospheric Environment**: Air contaminant dispersion modelling and noise modelling were updated considering activities associated with the combined Approved Project and Project Expansion. This approach was taken as it represents the worst-case scenario emissions during construction and operation of the Project Expansion. Air quality modelling showed that, in most cases, the maximum predicted concentrations resulting from releases associated with the Project Expansion in combination with the Approved Project are slightly less than, or remain similar, to those predicted for the Approved Project alone (as originally presented in the Valentine Gold EIS). While Approved Project and Project Expansion activities are predicted to result in a change in sound levels to nearby sensitive receptors, the resulting levels are below applicable guidelines and limited to the LAA / RAA. Approved Project and Project Expansion activities will result in a relatively small change in light levels to nearby sensitive receptors, however this effect will be reversed post-closure. GHG emissions were estimated based on the year with the most GHG intensive activities; the combined Approved Project and Project Expansion are estimated to contribute 1.5% and 0.02% CO_{2e} annually to total provincial and national GHG emissions, respectively (based on provincial and national totals in 2021).

  The assessment of effects on the atmospheric environment (i.e., air quality, GHG emissions, noise and light levels) determined that the addition of Project Expansion activities to the Approved Project does not result in substantial changes to the residual effects of the Approved Project alone. There are no significant residual effects predicted on the atmospheric environment resulting from routine Project Expansion activities combined with Approved Project activities, or from the cumulative effects of the Approved Project and Project Expansion in combination with other past, present, or reasonably foreseeable future projects.

- **Surface Water Resources:** Mine contact water discharged from the Final Discharge Points (FDP) will comply with the *Metal and Diamond Mining Effluent Regulations* prior to entering the receiving environment, and non-contact water is expected to remain at baseline water quality conditions. Localized effects are expected in the receiving watercourses and waterbodies immediately downstream of BER-FDP-05 and are expected to extend into Valentine Lake for 300 m before water quality is predicted to return to either baseline conditions or below recommended guidelines. Mean annual flow may be reduced in some watersheds within the LAA during all phases of mine life; however, other watersheds will receive an increase in flow that may provide a positive change. If follow-up monitoring over the life of the Project confirms this prediction, passive treatment system(s) will be required to treat TMF seepage to regulated limits. The selection and design of passive treatment system(s) will be based on water chemistry, flow rate, local topography, and/or site characteristics. Overall, the EA determined there are no significant residual effects on surface water resources resulting from routine Project Expansion activities, routine Project Expansion activities combined with Approved Project activities, or from the cumulative effects of the Approved Project and Project Expansion in combination with other past, present, or reasonably foreseeable future projects.

- **Groundwater Resources:** The main adverse residual environmental effect on groundwater quality identified in this assessment is the increase in concentrations of POPCs in groundwater due to seepage from the Berry waste rock pile, the Berry / Marathon LGO stockpile, and the TMF. Groundwater quality may also be affected by the tailings deposited in the Berry pit. Overall, however,

the EA determined there are no significant residual effects on groundwater resources resulting from routine Project Expansion activities, routine Project Expansion activities combined with the Approved Project, or from the cumulative effects of the Approved Project and Project Expansion in combination with other past, present, or reasonably foreseeable future projects.

- **Fish and Fish Habitat:** The EA has determined that there are no significant residual Project Expansion-related effects to fish habitat quality and fish health and survival during construction and operation. Post-closure, seepage from the TMF draining to Victoria River is conservatively predicted to exceed MDMER limits for cyanide, un-ionized ammonia, and copper, unless treated. If follow-up monitoring over the life of the Project confirms this prediction, passive treatment system(s) will be required to treat TMF seepage to regulated limits. The selection and design of passive treatment system(s) will be based on water chemistry, flow rate, local topography, and/or site characteristics. The EA predicted that, with the implementation of mitigation measures, no significant effects on fish and fish habitat will result from routine Project Expansion activities, or from the cumulative effects of the Approved Project and Project Expansion in combination with other past, present, or reasonably foreseeable future projects. Construction and operation of water management infrastructure will result in a loss of fish habitat in some small streams and ponds. Marathon will develop and implement a Fish Habitat Offsetting Plan in consultation with Fisheries and Oceans Canada (DFO) to offset for lost habitat.

- **Caribou**: Changes in habitat, movement, and mortality risk for caribou are characterized and assessed for the Project Expansion in combination with the Approved Project because the activities of both are interrelated functionally, spatially and temporally. The Valentine Gold EIS was prepared using a conservative approach by assuming that 100% of the habitat within the Project Area would be changed because of mine development and activities. This approach allows for refinements to the site layout, as these typically occur through detailed Project design and planning. The Project Expansion will occur largely within the boundary of the Project Area that was assessed for the Approved Project. The area of additional ground disturbance required for Project Expansion infrastructure outside of the Project Area is associated with three sedimentation ponds and accounts for 3.4 ha, or an increase of 0.1% relative to the Project Area.

  With respect to change in movement, although the entire Project Area was assumed to be affected by the development of the Approved Project, there may be residual effects on change in movement from the addition of the Project Expansion through the reduced availability of alternate routes through the Project Area (i.e., reduced permeability of the Project Area). Specifically, the areas where Berry pit and the Berry waste rock pile will be located were previously assessed as being cleared, and while that clearing could affect the use of movement pathways, use of those pathways was likely to remain feasible. The Berry pit and Berry waste rock pile will create physical impediments (i.e., change in topography as a barrier) to movement along those pathways, making the use of those pathways less likely. As caribou are generally expected to avoid the mine site during construction and operation, the potential residual effects on change in movement are more likely to occur during closure and continuing post-closure.

For change in mortality risk, the Project Expansion is expected to increase traffic on the access road by approximately 5-8% in comparison to the Approved Project alone. This increase is not expected to lead to a substantial increase in mortality risk from a vehicle collision. Other potential sources for change in mortality risk are predicted to be negligible for the Project Expansion as those effects are largely tied to, and confounded with, the Approved Project.

The addition of the Project Expansion does not change the residual effects predictions made for the Approved Project in the Valentine Gold EIS. Consistent with those predictions, potential residual effects of the combined Projects on change in habitat and mortality risk are predicted to be low magnitude for all four herds. The potential residual effects for change in movement for the Gaff Topsails, Grey River, and La Poile herds is also predicted to be low in magnitude. Also consistent with the residual effects predictions for the Approved Project, the potential residual effect for change in movement for the Buchans herd is predicted to be high because of the amount of overlap of the Project Expansion and Approved Project with an existing migration corridor. As a result, the Approved Project and Project Expansion has the potential to affect greater than 50% of caribou migrating through this corridor (based on more than 50% of collared caribou known to be using the corridor and of relatively large counts of caribou from cameras placed in the corridor). The prediction of a significant effect for the Approved Project was established on a conservative basis. It reflected both the uncertainty in how the Approved Project activities will affect the migratory movements of the Buchans herd and what long-term effects on the herd may result, and the uncertainty of the effectiveness of proposed mitigation measures. This significance determination is also considered valid for the combined Projects.

Marathon will continue to monitor migration patterns and populations of caribou herds in the area, particularly the Buchans herd, through the Caribou Protection and Environmental Effects Monitoring Program (CPEEMP). Marathon will also continue to engage with Indigenous groups and stakeholders, and work with provincial regulators to review and update the CPEEMP as needed to avoid and reduce adverse effects from Project Expansion activities.

15.3.2 Residual Effects Summary

The residual effects characterizations of the Approved Project in combination with the Project Expansion, in comparison to those of the Approved Project alone, are presented in Table 15.1. As summarized in Table 15.2, there are no changes to the characterization of residual effects for the Approved Project alone compared to the Approved Project plus the Project Expansion. Consistent with the predictions provided in the Valentine Gold EIS, the residual environmental effects of routine Project Expansion activities in combination with the Approved Project are determined to be not significant for all VCs, except for caribou.

Table 15.1 Comparison of Residual Effects between Approved Project and Combined Projects

Valued Component	Residual Effect	Residual Effects Characterization for Approved Project								Change in Residual Effect Characterization with Addition of Project Expansion (i.e., Combined Effects of Approved Project and Project Expansion)
		Project Phase	Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Ecological / Socio-Economic Context	
Atmospheric Environment	Change in Air Quality	C	A	L-M	LAA / RAA	ST	C	R	U	No change
		O	A	M	LAA / RAA	MT	C	R	U	No change
		D	A	L	PA	ST	R	R	U	No change
	Change in Greenhouse Gas Emissions	C	A	L	N/A	ST	C	I	D	No change
		O	A	M	N/A	MT	C	I	D	No change
		D	A	N	N/A	ST	IR	I	D	No change
	Change in Sound Quality	C	A	L	LAA / RAA	ST	C	R	U	No change
		O	A	M	LAA / RAA	MT	C	R	U	No change
		D	A	L	LAA / RAA	ST	R	R	U	No change
	Change in Light Levels	C	A	L	LAA / RAA	ST	IR	R	U	No change
		O	A	L	LAA / RAA	MT	C	R	U	No change
		D	A	L	LAA / RAA	ST	IR	R	U	No change
Groundwater Resources	Change in Groundwater Quantity	C	A	L	PA	ST	C	R	U	No change
		O	A	M	LAA / RAA	LT	C	I	U	No change
		D	A	L	LAA / RAA	LT	C	I	U	No change
	Change in Groundwater Quality	C	N	-	-	-	-	-	-	No change
		O	A	L	LAA / RAA	LT	C	I	U	No change
		D	A	L	LAA / RAA	LT	C	I	U	No change
Surface Water Resources	Change in Surface Water Quantity	C	A	L	LAA	LT	C	R / I	D	No change
		O	A	L	LAA	LT	C	R / I	D	No change
		D	A	L	LAA	LT	C	R / I	D	No change

Table 15.1 Comparison of Residual Effects between Approved Project and Combined Projects

Valued Component	Residual Effect	Residual Effects Characterization for Approved Project								Change in Residual Effect Characterization with Addition of Project Expansion (i.e., Combined Effects of Approved Project and Project Expansion)
		Project Phase	Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Ecological / Socio-Economic Context	
Surface Water Resources	Change in Surface Water Quality	C	A	L	LAA	LT	C	R / I	D	No change
		O	A	L	LAA	LT	C	R / I	D	No change
		D	A	L	LAA	LT	C	R / I	D	No change
Fish and Fish Habitat	Change in Fish Habitat Quantity	C	A	M	PA	LT	C	I	D	No change
		O	A	M	PA	LT	C	I	D	No change
		D	A	M	PA	LT	C	R / I	D	No change
	Change in Fish Habitat Quality	C	A	L	LAA	LT	C	R / I*	D	No change
		O	A	L	LAA	LT	C	R / I*	D	No change
		D	A	L	LAA	LT	C	R / I*	D	No change
	Change in Fish Health and Survival	C	A	L/M	LAA	LT	C	R / I*	R	No change
		O	A	N/L	LAA	LT	C	R / I*	R	No change
		D	A	L/M	LAA	LT	C	R / I*	R	No change
Vegetation, Wetlands, Terrain and Soils	Change in Species Diversity	C	A	L	LAA	LT	C	R/I	D	No change
		O	A	L	LAA	LT	C	I	D	No change
		D	N	L	LAA	MT	C	R	D	No change
	Change in Community Diversity	C	A	L	LAA	LT	C	I	D	No change
		O	A	L	LAA	LT	C	I	D	No change
		D	N	L	LAA	MT	C	R	D	No change
	Change in Wetland Function	C	A	L	LAA	LT	C	I	D	No change
		O	A	L	LAA	LT	C	I	D	No change
		D	N	L	LAA	MT	C	I	D	No change

Table 15.1 Comparison of Residual Effects between Approved Project and Combined Projects

Valued Component	Residual Effect	Residual Effects Characterization for Approved Project								Change in Residual Effect Characterization with Addition of Project Expansion (i.e., Combined Effects of Approved Project and Project Expansion)
		Project Phase	Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Ecological / Socio-Economic Context	
Vegetation, Wetlands, Terrain and Soils	Changes in Soil Quality	C	A	L	LAA	LT	C	R	D	No change
		O	A	L	LAA	LT	C	R	D	No change
		D	N	L	LAA	LT	C	R	D	No change
	Changes in Soil Quantity	C	A	L	PA	ST	S/IR	R/I	D	No change
		O	A	L	PA	MT	S/IR	R/I	D	No change
		D	N	L	LAA	LT	S/IR	R/I	D	No change
	Changes in Terrain (unique landforms)	C	A	L	LAA	LT	C	I	D	No change
		O	A	L	LAA	LT	C	I	D	No change
		D	N	L	LAA	LT	C	I	D	No change
	Changes in Terrain Stability	C	A	L	LAA	LT	IR	R	D	No change
		O	A	L	LAA	LT	IR	R	D	No change
		D	N	L	LAA	LT	IR	R	D	No change
Avifauna	Change in Habitat	C	A	L-M	LAA	LT	C	I	D	No change
		O	A	L-M	LAA	MT	C	R	D	No change
		D	P/A	L-M	LAA	MT	C	R	D	No change
	Change in Mortality Risk	C	A	L	LAA	ST	IR	R	D	No change
		O	A	L	LAA	MT	IR	R	D	No change
		D	A	L	LAA	MT	IR	R	D	No change
Caribou	Change in Habitat	C	A	L	RAA	LT	C	I	D	No change
		O	A	L	RAA	LT	C	I	D	No change
		D	A/N	L	RAA	LT	C	I	D	No change

Table 15.1 Comparison of Residual Effects between Approved Project and Combined Projects

Valued Component	Residual Effect	Residual Effects Characterization for Approved Project								Change in Residual Effect Characterization with Addition of Project Expansion (i.e., Combined Effects of Approved Project and Project Expansion)
		Project Phase	Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Ecological / Socio-Economic Context	
Caribou	Change in Movement	C	A	H	RAA	LT	C	I	D	No change
		O	A	H	RAA	LT	C	I	D	No change
		D	A	H	RAA	LT	C	I	D	No change
	Change in Mortality Risk	C	A	L	RAA	MT	IR	R	D	No change
		O	A	L	RAA	MT	IR	R	D	No change
		D	A	L	RAA	ST	IR	R	D	No change
Other Wildlife	Change in Habitat	C	A	L-M	LAA	LT	C	I/R	D	No change
		O	A	L-M	LAA	LT	C	R	D	No change
		D	A	L-M	LAA	LT	C	R	D	No change
	Change in Mortality Risk	C	A	L	PA	MT	IR	R	D	No change
		O	A	L	PA	MT	IR	R	D	No change
		D	A	L-N	PA	ST	IR	R	D	No change
Community Services and Infrastructure	Change in Local Housing and Accommodation	C	A	N	LAA / RAA	ST	C	R	R	No change
		O	A	N	LAA / RAA	MT	C	R	R	No change
		D	A	N	LAA / RAA	ST	C	R	R	No change
	Change in Local Services and Infrastructure	C	A	L	LAA / RAA	ST	C	R	R	No change
		O	A	L	LAA / RAA	MT	C	R	R	No change
		D	A	L	LAA / RAA	ST	C	R	R	No change
Community Health	Change in Community Well-Being	C	A/P	L	LAA / RAA	ST	C	R	R	No change
		O	A/P	L	LAA / RAA	MT	C	R	R	No change
		D	A/P	L	LAA / RAA	ST	C	R	R	No change

Table 15.1 Comparison of Residual Effects between Approved Project and Combined Projects

Valued Component	Residual Effect	Residual Effects Characterization for Approved Project								Change in Residual Effect Characterization with Addition of Project Expansion (i.e., Combined Effects of Approved Project and Project Expansion)
		Project Phase	Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Ecological / Socio-Economic Context	
Community Health	Change in Physical Health Conditions	C	A	N-L	PA / LAA	ST-MT	C	R	D	No change
		O	A	N-L	PA / LAA	ST-MT	C	R	D	No change
		D	A	N-L	PA / LAA	ST-MT	C	R	D	No change
Employment and Economy	Change in Regional Labour Force	C	P	H	LAA / RAA	ST	C	R	R	No change
		O	P	H	LAA / RAA	MT	C	R	R	No change
		D	A	M	LAA / RAA	ST	C	I	R	No change
	Change in Regional Business	C	P / A	L	LAA / RAA	ST	C	R	R	No change
		O	P / A	L	LAA / RAA	MT	C	R	R	No change
		D	P / A	L	LAA / RAA	ST	C	I	R	No change
	Change in Economic Activity of Outfitters	C	A	N-L	LAA	ST	C	R	R	No change
		O	A	N-L	LAA	LT	C	R	R	No change
		D	A	N-L	LAA	LT	C	R	R	No change
Employment and Economy	Change in Economy	C	P	L	LAA / RAA	ST	C	R	R	No change
		O	P	M	LAA / RAA	MT	C	R	R	No change
		D	P	L	LAA / RAA	ST	C	R	R	No change
Land and Resource Use	Change in Land Use	C	A	L	PA / LAA	ST	IR	R	R	No change
		O	A	L	PA / LAA	MT-P	C	R / I	R	No change
		D	A	L	PA / LAA	ST	IR	R / I	R	No change
	Change in Resource Use	C	A	N-L	PA / LAA	ST	IR	R	R	No change
		O	A	N-L	PA / LAA	MT-P	C	R / I	R	No change
		D	A	N-L	PA / LAA	ST	IR	R / I	R	No change

Table 15.1 Comparison of Residual Effects between Approved Project and Combined Projects

Valued Component	Residual Effect	Residual Effects Characterization for Approved Project								Change in Residual Effect Characterization with Addition of Project Expansion (i.e., Combined Effects of Approved Project and Project Expansion)
		Project Phase	Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Ecological / Socio-Economic Context	
Land and Resource Use	Change in Recreational Use	C	A	N-L	PA / LAA	ST	IR	R	R	No change
		O	A	N-L	PA / LAA	ST-P	C	R / I	R	No change
		D	A	N-L	PA / LAA	ST	IR	R / I	R	No change
Indigenous Groups	Change in Current Use	C	A	N-L	PA / LAA	ST	IR / C	R	R	No change
		O	A	N-L	PA / LAA	ST-P	IR / C	R / I	R	No change
		D	A	N-L	PA / LAA	ST-P	IR / C	R / I	R	No change
Indigenous Groups	Change in Health Conditions	C	A	N-L	PA / LAA	ST	C	R	R	No change
		O	A	N-L	PA / LAA	ST-MT	C	R	R	No change
		D	A	N-L	PA / LAA	ST-MT	C	R	R	No change
	Change in Socio-economic conditions	C	A / P	N-L	PA / RAA	ST	IR / C	R	R	No change
		O	A / P	N-L	PA / RAA	ST-P	IR / C	R / I	R	No change
		D	A	N-L	PA / RAA	ST-P	IR / C	R / I	R	No change
	Change to Physical and Cultural Heritage (inside Project footprint)	C	A	N-H	PA	ST-P	S	R / I	R	No change
		O	A	N-L	PA / LAA	ST	IR / C	R	R	No change
		D	A	N-L	PA / LAA	ST-P	IR / C	R / I	R	No change
	Change to Physical and Cultural Heritage (outside Project footprint)	C	A	N-L	PA / LAA	ST-P	IR / C	R / I	R	No change
		O	A	N-L	PA / LAA	ST	IR / C	R	R	No change
		D	A	N-L	PA / LAA	ST-P	IR / C	R / I	R	No change

Table 15.1 Comparison of Residual Effects between Approved Project and Combined Projects

Valued Component	Residual Effect	Residual Effects Characterization for Approved Project								Change in Residual Effect Characterization with Addition of Project Expansion (i.e., Combined Effects of Approved Project and Project Expansion)
		Project Phase	Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Ecological / Socio-Economic Context	

KEY
See Appendix 5A and Tables 6.5, 7.3, 8.9, 9.9 and 10.9 for detailed definitions

Project Phase
C: Construction
O: Operation
D: Decommissioning

Direction:
P: Positive
A: Adverse
N: Neutral

Magnitude:
N: Negligible
L: Low
M: Moderate
H: High

Geographic Extent:
PA: Project Area
LAA: Local Assessment Area
RAA: Regional Assessment Area

Duration:
ST: Short term
MT: Medium term
LT: Long term
P: Permanent
N/A: Not applicable

Frequency:
S: Single event
IR: Irregular event
R: Regular event
C: Continuous

Reversibility:
R: Reversible
I: Irreversible

Ecological / Socio-Economic Context:
D: Disturbed
U: Undisturbed

Notes:

* The Valentine Gold EIS predicted Irreversible but was modified to Reversible during the regulatory review process

Table 15.2 Summary of Significance – Approved Project Plus Project Expansion

Valued Component	Significance of Residual Effect	Likelihood of Significant Effect	Change in Significance with Addition of Project Expansion (i.e., Approved Project and Project Expansion)
Atmospheric Environment	Not Significant	Not Applicable	No Change
Surface Water Resources	Not Significant	Not Applicable	No Change
Groundwater Resources	Not Significant	Not Applicable	No Change
Caribou	Significant	Low	No Change
Fish and Fish Habitat	Not Significant	Not Applicable	No Change
Other Terrestrial Components	Not Significant	Not Applicable	No Change
Socioeconomic Components	Not Significant	Not Applicable	No Change

Residual effects for change in caribou habitat and mortality risk are predicted to be low in magnitude. However, the magnitude of residual effects for change in movement of caribou is assessed to be high in magnitude due to the amount of overlap of the combined Projects with an existing migration corridor of the Buchans herd, one of four herds in the Regional Assessment Area (RAA), and the proportion of Buchans caribou that use the corridor overlapping the mine site.

A significant adverse effect for caribou is defined as one that threatens the long-term persistence or viability of one or more of the four assessed caribou herds (Buchans, Gaff Topsails, Grey River, La Poile) within the RAA, including effects that are contrary to or inconsistent with the goals, objectives and activities of recovery strategies, action plans and management plans. While caribou may be able to circumnavigate the mine site, it is unclear what effects a deviation from a migratory corridor will have on the Buchans herd, some of which may not be realized for several years. Given these uncertainties and additional uncertainties related to the effectiveness of planned mitigation, the residual adverse effect of change in movement for the Buchans herd for the Approved Project and Project Expansion is conservatively predicted to be significant, which is consistent with the significance determination for the Approved Project alone in the Valentine Gold EIS.

15.3.3 Cumulative Effects

Residual adverse effects from Approved Project and Project Expansion activities may combine with other mining projects; exploration activities; forestry; hunting, outfitting, trapping, and / or fishing; off-road vehicles; hydroelectric development; and linear features (e.g., power lines) to result in cumulative environmental effects. A cumulative effects assessment (CEA) on VCs was presented in the Valentine Gold EIS (Marathon 2020). As indicated in the Valentine Gold EIS, the potential cumulative effects on VCs, apart from caribou, were predicted to be not significant. In this document, known new activities occurring in the LAA and RAA since the Approved Project was released from EA processes were considered, including a new quarry being proposed less than 500 m from the mine site. The updated CEA

demonstrates that the cumulative effects predictions for the Approved Project provided in the Valentine Gold EIS remain valid for cumulative effects associated with the combined Approved Project and Project Expansion (Table 15.3).

Table 15.3 Summary of Cumulative Effects – Approved Project Plus Project Expansion

Valued Component	Significance of Potential Cumulative Effects – Approved Project	Change in Potential Cumulative Effects with Addition of Project Expansion (i.e., Approved Project and Project Expansion)
Atmospheric Environment	Not significant	No change
Surface Water Resources	Not significant	No change
Groundwater Resources	Not significant	No change
Caribou	Significant	No change
Fish and Fish Habitat	Not significant	No change
Other Terrestrial Components	Not significant	No change
Socioeconomic Components	Not significant	No change

As summarized in Section 15.2.1, the Approved Project is conservatively predicted to result in significant adverse effects on caribou, specifically related to change in movement for the Buchans herd. This prediction remains valid for the Approved Project in combination with the Project Expansion. Future activities associated with other projects are expected to combine with potential effects from the Approved Project and Project Expansion, which contributes to the predicted high magnitude effect on movement of the Buchans herd, as described in Chapter 10, and may measurably affect the abundance and / or sustainability of the Buchans herd in the RAA.

VC-specific mitigation and management measures that were identified for the Approved Project will be applied during Project Expansion activities, as applicable, to reduce and / or avoid adverse environmental effects. A full list of mitigation measures is available in Appendix 2E. It is assumed that other existing and future projects and activities in the RAA will also be required to comply with various mitigation measures and regulatory requirements, which may include reduction or suspension in activities at the newly proposed quarry during caribou migration, thereby reducing cumulative effects. No additional or revised monitoring or follow-up is required or proposed specifically for potential cumulative environmental effects beyond the mitigation measures and monitoring proposed for the Approved Project and Project Expansion, and those assumed to be required and implemented as part of other projects and activities.

15.3.4 Accidental Events

This document also considers potential environmental effects of accidents or malfunctions that may occur as a result of the Project Expansion. It then compares whether the addition of the Project Expansion results in changes to the residual effects predictions made in the Valentine Gold EIS. Accidents and malfunctions were assessed using the approach outlined in the Valentine Gold EIS (Section 21.1). The spatial boundaries, residual effects criteria, and methods and thresholds for determining significance used

for routine Project activities was also used for the assessment of potential accidental events. While the Project Expansion will include the addition / modification of components, as discussed in Chapter 2, it will not introduce new types of activities or infrastructure beyond those already assessed in the Valentine Gold EIS.

For the Approved Project, a number of potential accident and malfunction scenarios that could occur during the construction, operation, and / or decommissioning, rehabilitation and closure phases were identified. Some were screened out from further assessment, including a potential open pit slope failure, sewage treatment plant failure, over blasting, and watercourse crossing failure. The following scenarios were fully assessed for the Approved Project:

- TMF Malfunction
- Low-Grade Ore and High-Grade Ore Stockpiles and Waste Rock Piles Slope Failure
- Fuel and Hazardous Materials Spill
- Unplanned Release of Contact Water
- Fire / Explosion
- Vehicle Accident

Of these scenarios, the limited nature of the Project Expansion activities results in a further reduction of accidental scenarios that are applicable to the Project Expansion. Specifically, the assessment of a TMF malfunction for the Approved Project focused on a breach of the impoundment and resulting loss of containment of tailings and water. The addition of planned Project Expansion activities will not affect this malfunction scenario.

The Project Expansion will be planned, designed, constructed, operated and monitored to avoid accidents and malfunctions through adherence to regulations, guidelines and best practices, and will not introduce additional risk for an accidental event or malfunction beyond that assessed for the Approved Project. In the event of an accident or malfunction as identified in the remaining scenarios, emergency response procedures and contingency measures will be implemented to reduce adverse effects to the environment. Emergency response plans applicable to the Approved Project are being updated for the Project Expansion, specifying communication roles and responsibilities, training requirements, requirements for on-site response infrastructure and equipment, and mitigation / response measures in the event of an unplanned accident or malfunction. These are described in Section 2.7.3 of the Valentine Gold EIS (Marathon 2020) and will be further detailed in specific management plans (e.g., Waste Management Plan, Emergency Response and Contingency Plan).

For the Approved Project, the potential for significant residual adverse effects to surface water resources, fish and fish habitat, caribou, and community health were identified in the unlikely event of a major industrial accident or malfunction that results in a large-scale release into the environment (e.g., major TMF failure with discharges of tailings into local waterbodies and other habitats outside the Project Area, or a spill of hazardous materials from a vehicle malfunction or collision) (Table 15.3). A significant effect could also occur in the unlikely event of a major accident resulting in a loss of life (e.g., vehicle accident or TMF failure). However, a significant effect was considered unlikely to occur given the Approved Project design and safety measures in place to reduce the likelihood of an accident or malfunction, and the

emergency response plans and contingency measures that will be in place to limit the extent and nature of potential environmental effects in the event of an accident or malfunction. These include conformity with industry standards (e.g., dam design and monitoring, and emergency response and contingency planning) and legislated regulatory requirements. The residual effects from accidental events with a higher likelihood of occurring (e.g., small hydrocarbon spills from equipment) were not likely to be significant, as these would be contained within the mine site and readily cleaned up.

Based on the assessments in Section 13.5, the assessment of residual effects for the Approved Project are not anticipated to change with the addition of the Project Expansion, as summarized in Table 15.4.

Table 15.4 Summary of Significance Determinations for Accidents and Malfunctions – Approved Project Plus Project Expansion

VC / Component Name	Accident or Malfunction Scenario Approved Project						Addition of Project Expansion
	TMF Malfunction***	Slope Failure	Fuel and Hazardous Material Spills	Unplanned Release of Contact Water	Fire / Explosion	Vehicle Accident	
Atmospheric Environment	NS	NS	NS	NS	NS	NS	No change
Groundwater Resources	NS	NS	NS	NS	NS	NS	No change
Surface Water Resources	S*	NS	NS	NS	NS	NS	No change
Fish and Fish Habitat	S*	NS	NS	NS	NS	NS	No change
Caribou	S*	NS	NS	NS	S*	NS	No change
Other Terrestrial Components • Avifauna • Vegetation, Soils and Terrain • Other Wildlife	NS	NS	NS	NS	NS	NS	No change
Socio-economic Components • Community Services and Infrastructure • Community Health** • Employment and Economy • Land and Resource Use • Indigenous Groups	NS	NS	NS	NS	NS	S**	No change

Notes:
* Accident / malfunction unlikely to occur
** Specific to community health only
***Addition of Project Expansion activities will not affect this malfunction scenario

15.4 MITIGATION AND MONITORING COMMITMENTS

15.4.1 Mitigation Measures

Most of the potential adverse environmental effects identified in this document can be managed effectively with best management practices and standard operating procedures, and through the application of standard and VC-specific mitigation measures. Each VC assessment describes how the mitigation measures will reduce or eliminate potential adverse effects on the VC. Mitigation measures proposed to reduce or eliminate potential adverse effects as a result of the Project Expansion and Approved Project are found in Appendix 2E. Marathon will comply with applicable regulatory environmental mitigation, and implement commitments made in this document and in the Valentine Gold EIS, as well as those made during the EA review process and the conditions of EA release.

Existing follow-up, monitoring and mitigation plans established for the Approved Project will be updated to reflect Project Expansion activities, as applicable, and both the Approved Project and Project Expansion will be included in plans that are to be developed for the operation phase. These plans include the following:

- Water Management Plan (Appendix 2A)
- Acid Rock Drainage / Metal Leaching Management Plan (Proposed Revision to Address the Berry Pit Expansion) (Appendix 2F)
- Caribou Protection and Environmental Effects Monitoring Plan (Appendix 10B)
- Environmental Protection Plan
  - Avifauna Management Plan
  - Air Emissions Management Plan (including Greenhouse Gas Emissions)
  - Erosion and Sediment Control Plan
  - Wildlife Management Plan
  - Soils and Rock Management Plan
  - Historic Resources Protection Plan
  - Hazardous Materials & Products Program and a Hazardous Waste Storage and Tracking SOP
- Traffic Management Plan
- Waste Management Plan
- Environmental Effects Monitoring Plan (MDMER)
- Tailings / Effluent Release Emergency Response Plan (MDMER)
- Fish Rescue Plan
- Explosives and Blasting Management Plan
- TMF Operations, Maintenance and Surveillance Manual
- Accidents and Malfunctions Prevention and Response Plan
- Emergency Response Plan
- Wildlife Response Plan
- Current Use of Lands and Resources for Traditional Purposes – Indigenous Communications Plan
- Outfitters Environmental Effects Monitoring Plan
- Gender Equity, Diversity and Inclusion Plan

- Benefits Agreement
- Rehabilitation and Closure Plan

15.5 CONCLUSIONS

This Registration Document / EA Update has been prepared to satisfy provincial and federal EA requirements for the proposed Project Expansion.

Overall, the Project Expansion does not alter the characterization of residual effects predictions for the Approved Project during construction, operation, and decommissioning, rehabilitation and closure. The Registration Document / EA Update predicts that routine Project Expansion activities in combination with Approved Project activities will not cause significant adverse environmental effects on any of the VCs, with the exception of caribou, which is consistent with the conclusions in the Valentine Gold EIS. Similar results were determined for cumulative effects, where combined Project effects are considered in combination with the effects of other projects (past, present and reasonably foreseeable future projects). Effects predictions for the Approved Project in the Valentine Gold EIS relative to potential accidental events and malfunctions also remain valid with the addition of the Project Expansion.

The Project Expansion will extend the life of the Valentine Gold Project, resulting in additional employment and economic benefits to the local communities, the central region of NL, and the province. By extending the life of the mine without the requirement for additional processing or tailings impoundment infrastructure, the Project Expansion also increases the efficiency of gold production at the mine with limited additional effects on the environment. Marathon is confident that the Project Expansion can be developed and operated in a manner that provides environmental protection for VCs and long-term socioeconomic benefits for the region.

15.6 REFERENCES

Marathon Gold Corporation (Marathon). 2020. Valentine Gold Project: Environmental Impact Statement. September 2020.