#7 Alternative Means:

1. **Provide a description and assessment of the environmental effects of any alternative means of carrying out the Project using the Agency's Operational Policy Statement *Addressing 'Purpose of' and 'Alternative Means' under the Canadian Environmental Assessment Act, 2012* as a guideline, as required under section 19(1)(g) of CEAA, 2012.**

The Canadian Environmental Assessment Agency (CEAA) has reviewed the Environmental Impact Assessment (EIA) during the screening process for the proposed Robb Trend Coal Mine Project (Project). CEAA has requested supplemental information to ensure all information is current for the review process. This document provides a description and assessment of the alternative means of carrying out the Project using CEAA's Operational Policy Statement (OPS) *Addressing 'Purpose of' and 'Alternative Means' under the Canadian Environmental Assessment Act, 2012* as a guideline, as required under section 19(1)(g) of CEAA, 2012.

Alternative means are the various technically and economically feasible options of carrying out a project. Throughout the design process, Coal Valley Resources Inc. (CVRI), a division of Westmoreland Coal Company (WCC), has made numerous mine plan changes to improve the overall development plan. These decisions were made based on assessing economic, technical, environmental, and social criteria. The following document summarizes potential alternative means to the proposed Project plan that was provided in the project description of the EIA Application.

To ensure alignment with CEAA's OPS regarding alternative means, the following items were taken into consideration:

- Environmental effects associated with the potential alternative means;
- Health or status of valued ecosystem components (VECs) that may be impacted by the alternative means;
- Potential for mitigation and the extent to which mitigation measures may address potential environmental effects; and,
- Level of concern expressed by Aboriginal groups or the public.

This section outlines the alternatives that have been considered and will be reviewed during the preparation of detailed mining plans for the Project. The alternative means considered to date include:

- Development of alternative coal reserves and alternative mining methods;
- Development of alternative access routes;
- Evaluation of the existing plant;

- Evaluation of production levels;
- Evaluation of pit and dump configurations, various backfilling options and mine sequencing;
- Evaluation of alternative coal transportation methodologies;
- Additional alternatives requiring investigation for social, environmental and technical merits;
- Alternative buffer and offsets from fish bearing waterways;
- Potential effects on Aquatic VEC's; and
- Potential effects on Wildlife VEC's.

A Summary of concerns expressed by Aboriginal Groups and the Public is also included at the end of this section.

1. **Alternate Coal Reserves:**

A range of development alternative assessments were carried out for the Project. Initially, CVRI considered development of the various coal reserves in the region.

Some of the evaluation factors that were considered in assessing the Project Development include:

- coal leases – held by CVRI or not;
- geological understanding of the coal reserves and quality;
- engineering and mining factors – technical feasibility, pit design, operating reliability,
- safety, operating and capital costs and abandonment and decommissioning;
- haul distances – distance from the current Plant site;
- biophysical factors/environment - fisheries, vegetation, timber, wildlife, soils, air quality, noise, groundwater, surface water and hydrological; and
- social factors including regulatory processes, land and resource uses, recreational uses, historical values, traditional land use values, public response and safety, and economic considerations.

CVRI evaluated each of the Project alternatives considering safety, environmental, social, geological understanding, mining and haul distance. Based on this review, the Project area was deemed the most suitable for development at this time.

2. **Development of Alternative Access Routes:**

The development of the Project requires construction of new access corridors in order to transport coal from the Project area to the existing Plant. CVRI identified and evaluated six different access corridor options. These options were evaluated based on:

- proximity to potential air and noise emission receptors;
- water management requirements;
- environmental sensitivities;
- coal haul characteristics including length of haul, slope grade; and
- overall construction cost.

The access corridor options were internally evaluated on the above criteria and externally evaluated during the consultative process including the open houses conducted during the application development. Limiting the number of water course crossings and requirements for additional settling ponds was part of the evaluation along with the goal to limit the overall disturbance. Haul distances, road characteristics and the need for large cut and fill operations were also factors as these access routes require the need to be safe in all weather conditions but at the same time be efficient and cost effective. The Project application presents the three access corridor options that are a balance of economic, environment and social factors.

3. Evaluation of Alternative Mining Methods:

CVRI has considered surface and underground mining in its evaluation of the Project. Other methods, such as Highwall Mining and Auger Mining will be evaluated in the development of detailed mining plans for endwall development and areas with coal seam dips and geology that is suited to this technology.

Surface mining is currently considered the safest and most economic and technically feasible option. Coal Valley Mine (CVM) operation personnel are trained in surface mining techniques and equipment currently in use is suited for surface mining. The two methods for surface mining that will be utilized in the development of detailed mine plans are Dragline and Truck Shovel methods.

Truck and Shovel mining methods will be utilized in areas where Dragline methods are not appropriate due to pit geometry, and may be staged within Dragline pits as pre-stripping (in advance of the Dragline) or post-stripping (deepening pits after the Dragline advance is complete) operations . Truck and Shovel methods typically result in a higher cost movement of overburden materials as compared to Dragline operations, but are advantageous when mining large, multi-stage, multi-bench pits. These pits are well suited to this method as they provide options for multiple bench development and provide opportunities to backfill sections of completed pits during the mining operations, facilitating the development of the final desired reclamation profile.

Dragline mining methods result in lower cost movement of overburden materials, but can be restricted by the geometry of the economic pit shells. Dragline mining will be utilized to uncover coal in areas that are suited to the geometry restrictions of this mining method, and

excavators will follow the Dragline development to remove the coal from the pits. CVRI will evaluate multiple pit configurations, including utilization of the existing Page 752 Dragline, other Draglines that may be available within the economic constraints of the Project and Dragline pits with Truck and Shovel pre-stripping or post-stripping. CVRI will utilize both existing engineering staff and qualified mining consultants to evaluate these alternatives during the detailed mine planning process in advance of mine license preparation.

A combination of surface mining methods, Dragline and Truck and Shovel, is the best option to maximize efficiency in the varying terrain and geology and is the safest form of mining at this time.

Underground methods have not been evaluated in detail at this time. CVRI has previously tested underground mining at the existing CVM in the early 1980's. While it may be technically feasible, there were concerns with the geotechnical stability of the geological formations and the safety of employees. Further drilling information is required in terms of rock and coal strength to evaluate the technical feasibility of underground mining in the Project Area. Updated special equipment would be required for underground mining which would increase overall mine expenditures and involve training existing staff or the need to hire new experienced staff. At this time, due to the previous experience of CVRI in an area with coal seam dips more favorably suited to underground mining CVRI is not optimistic that underground mining will be a viable alternative in the Project area.

4. Evaluation of the Existing Plant:

The existing Plant at the CVM will continue to be utilized into the future processing the coal mined in the Project area. The Plant is located within the existing Mine Permit and is licenced by the AER with operating approvals under EPEA. In 2005 CVRI invested significant capital funds to modernize and expand the Plant capacity in order to meet expected increased foreign market demand. The approved production level for the Plant is 4.4 million tonnes per year. The capital costs to continue to use the Plant are negligible. Required infrastructure is in place to wash, dry, store and load the coal on trains. There are nearby areas to store the Plant rejects and coal tailings materials. CVRI has determined that using the existing Plant is the best option at this time.

The construction of a new coal processing Plant would require a significant capital investment projected to be greater than $300 million. Moving the existing Plant is also not a viable option as this would take a great amount of time to complete, the risk of damaging current infrastructure would be high and supporting infrastructure (rail, tailings management) would need to be reclaimed and replaced. These expensive additions are not economically enticing for the minimal gains in decreasing the haul distance.

5. **Evaluation of Production Levels:**

A variety of production levels will be evaluated during the development of detailed mining plans. Production levels at the CVM have varied in the past based on Plant capacity restrictions, market conditions, rail and port contracts, capacity restrictions and mine production capacity. At this time, production levels between 2M and 4M Clean Metric Tonnes per annum are considered the minimum and maximum production levels. As mentioned above the Plant was refurbished in 2005 to increase capacity and with current market demands and overall economy. The Plant is not expected to require any further expansion in the future.

6. **Evaluation of Pit and Dump Configurations:**

During the development of detailed mining plans, CVRI will complete an extensive analysis of multiple pit sizes and shells given economic constraints, engineering/geotechnical factors as well as environmental and safety factors. CVRI mine engineering staff and qualified consultants will work with geotechnical consultants to determine acceptable wall angles and develop Lerch-Grossman pit shells. During the development of detailed mining plans, improvements to pit sequencing will be evaluated with the end goal to reduce the overall footprint of the mine, accelerate reclamation and provide the maximum coal recovery possible. This will be facilitated through the evaluation of multiple mining methodologies, including Dragline, Truck and Shovel, advanced recovery using auger/highwall mining techniques and multi-staged combinations thereof.

Safety constraints and the requirement to meet environmental standards/guidelines will be factored into the pit and dump evaluation. Locations to sensitive habitat, watercourses and major wildlife corridors will be included in the pit and dump design.

7. **Evaluation of Alternative Coal Transportation Methodologies:**

Alternatives being considered for coal transportation include the base-case of raw coal transport to the Plant using existing mining trucks and other options. These options include:

- Conveyor transportation;
- Pre-screening of raw coal prior to transport to minimize dust and diesel emissions and lower cost of transport;
- Transport of coal using a variety of truck classes; and
- Hydraulic transportation.

At this time the most favorable option is the current coal transport method which utilizes existing mining trucks. Existing haulroads on the current CVM site will be used to connect the Project to the Plant. Further considerations will include:

- wildlife passage;

- noise levels;
- footprint requirements of each option;
- dust and diesel emissions;
- Impacts to coal recovery; and
- long term economic viability.

8. Additional alternatives requiring investigation for social, environmental and technical merits:

CVRI is continuously evaluating new technologies and new methods in order to gain efficiencies and overall production. Alternative means of carrying out the Project will continue to be evaluated as technology advances, consultation continues and environmental parameters remain to be a main focus.

9. Alternative buffer and offsets from fish bearing waterways:

The Project components that affect aquatic resources are related to construction, operation and reclamation activities (Table 1). These activities have the potential to directly and indirectly affect fish, fish habitat and benthic invertebrates.

Table 1 Robb Trend Project activities with potential to affect aquatic resources.

Phase	Description/Activities
Construction	• Tree clearing • Watercourse crossings (haulroad) • Water management facilities (settling ponds)
Operation	• Watercourse diversions • Water management facilities (settling ponds) • Development of mine pits • Rock dumps
Reclamation	• Reclamation of functioning lotic (stream) and lentic (end pit lake) aquatic habitats • Reclamation of watercourse crossings

Several changes to the mine and water management plan occurred during the planning/design phase and three rounds of supplemental information requests (SIRs). The alternative means selected for directly reducing aquatic environmental effects are:

- Watercourse diversions;
- Reclamation of lotic (stream) and lentic (end pit lake) aquatic habitats; and
- Buffer zones around critical fish habitat.

To facilitate mine planning, the Project was divided into four areas: Robb West, Robb Main, Robb Centre, and Robb East. After consultation with stakeholders and regulators, CVRI initiated a review of the original mine plan to identify solutions to address concerns raised. Through this process CVRI produced updated mine plans that will result in reduced impacts to fish and fish habitat if the revised plans are to be approved. A description of the mine changes and associated fish habitat impacts for each mining area are provided in Table 2, summation of some of the alternatives is provided below.

9.1 Watercourse Diversions

In the original Project Application (CVRI, 2012), submitted in April 2012, temporary diversions were required on 15 watercourses. As mine plans changed to address specific concerns (e.g. critical fish habitat impacts, flow regime issues, post-mining reclamation revisions) raised by stakeholders and regulators, the number of diversions were reduced to 12. These reductions have:

- Minimized direct impacts to high quality fish habitat (i.e. spawning, rearing, and feeding); and
- Maintained natural flows to critical downstream watercourses.

9.2 Reclamation of Aquatic Habitat

Final reclamation of aquatic habitat consists of reconstructed channels and end pit lakes. Key to the compensation strategy proposed by CVRI is the reconstruction of disturbed stream reaches to provide viable fish habitat. After discussions with stakeholders and regulators, the updated mine plan was developed to maximize the amount of lotic habitat that will be reconstructed. Approximately 77% of all disturbed lotic habitat will be reclaimed to channel; of note 98% of high quality habitat will now be reconstructed. By increasing the amount of reconstructed channel, overall fish habitat productive capacity is maintained (i.e. spawning, rearing, and feeding).

CVRI also proposes to construct end pit lakes to off-set habitat losses associated with the Project. In the original Project Application, 12 end pit lakes were proposed. The most recent mine plan includes 11 end pit lakes (Lake 4 was replaced with a reconstructed channel). The number of "off-channel" lakes has increased since the Project application. Six of the lakes will be "flow-through" lakes (7, 8, 9, 10, 11, and 12) that are constructed on streams and will have an inlet and an outlet. Five of the lakes will be constructed "off-channel" (1, 2, 3, 5, and 6) and will have no inlet but will have an outlet to adjacent streams. This allows for a greater degree of flow control and fish passage options. Other end pit lake changes include increased backfill in Lakes 1, 2, 3 and 12, which decreases the depth, volume and filling times of the lakes while increasing littoral areas and therefore overall fish habitat.

9.3 Buffer Zones

Riparian buffer zones adjacent to critical fish habitat have been proposed by CVRI in response to concerns raised by ESRD and DFO regarding potential impacts to fish habitat. CVRI has proposed to leave riparian buffer zones on Bryan Creek, Hay Creek, Erith River Tributary 1 (ERT1), Halpenny Creek and tributaries (HLT1 and HLT2), Lendrum Creek tributaries (LET1 and LET3), Pembina River Tributary 1 (PET1) and the Pembina River within or adjacent to the Mine Permit Boundary. The riparian buffer zones would reduce anywhere from approximately 17% to 100% of the impacts to fish habitat of the subject drainages, with the majority of the subject drainages seeing an approximate 50% reduction in fish impacts. The riparian buffer zone locations are presented in Figure 1 of the SIR#3.

Table 2 Fish Habitat Impacts for the Proposed Robb Trend Coal Mine Project.

Mine Area	Drainage	Waterbody	Sensitivity	Fish Habitat Impacts (m^2)				Comments
				Application	Level 1 Revision	Level 2 Revision	Level 3 Revision	
West	Bryan	Bryan Creek	Low	4,708	4,708	4,708	4,708	Bryan Creek was originally to be reclaimed as lake, now is being reclaimed as reconstructed channel, bypassing Lake 2. The proposed Robb West buffer may reduce fish habitat impacts by ~17%.
			High	9,500	9,500	9,500	7,880	
			Low	TBD	2,625	1,480	1,480	Habitat impacts on upper Bryan Creek. A 2013 habitat inventory revised impact numbers.
Main	Bacon	Bacon Creek	High	2,777	2,777	2,777	1,390	Bacon Creek was originally to be reclaimed as Lake 5, then as half reconstructed channel/half lake, now being reclaimed as all reconstructed channel. The proposed buffer on Bacon Creek may reduce fish habitat impacts by ~50%.
			High	10,000	10,000	0	0	Originally diverted into Lake 4/5, with lost downstream flows, now Bacon Creek flows will be maintained.
	Erith	Erith River	High	67,485	67,485	67,485	67,485	Originally reclaimed as Lakes 4 & 5. Alternatives considered: 1) reclaim as Lake 5 and reconstructed channel (impacts are presented for this alternative) 2) eliminate majority of mining through the Erith River, reclaim as Lake 5.
		ERT1	High	5,834	1,000	1,000	1,000	Originally reclaimed as Lake 4, now 600 m of Mynheer Pit will be eliminated, reducing majority of impacts. Reclaimed as reconstructed channel. The proposed buffer on ERT1 reduced fish habitat impacts to 1,000 m^2.
		ERT1A	Low	102	0	0	0	Originally reclaimed as Lake 4, now 600 m of Mynheer Pit will be eliminated, reducing all impacts

		ERT2	Low	406	406	406	406	No changes
		ERT3	Low	7,751	7,751	7,751	7,751	No changes
	Hay	Hay Creek	Low	1,804	2,325	2,325	1,163	Hay Creek reclaimed as Lake 3. The proposed Robb East buffer may reduce fish habitat impacts on Hay Creek by ~50%.
			Low	10,000	10,000	4,038	4,038	This represents potential habitat impacts (temporarily lost due to downstream flows being diverted away from Hay Creek while filling Lake 3). A 2013 habitat inventory revised impact numbers.
Centre	Halpenny	Halpenny Creek	Low	1,910	4,129	4,129	4,129	Originally reclaimed as Lake 6, now will be reclaimed channel, maintaining flows downstream.
			High	5,691	4,435	0	1,020	Originally reclaimed as lakes, now 1,000 m of Mynheer Pit will be eliminated, reducing majority of the impacts on Halpenny Creek. Revised analysis.
		HLT1	Mod	2,239	2,239	0	0	Originally reclaimed as small lake, now no mining expected through HLT1
		HLT2	Low	219	219	0	0	Originally reclaimed as lake/channel, now no mining expected through HLT2
	Lendrum	Lendrum Creek	Mod	17,468	17,468	17,468		Originally reclaimed as Lake 7, now will be reclaimed channel.
		LET1	Mod	1,923	3,282	3,282	1,641	Originally reclaimed as pond/channel/Lake 7. Now 1,000 m of Mynheer Pit will be eliminated, reducing impacts. Reclaimed as Lake 7. The proposed buffer on LET1 may reduce fish habitat impacts by ~50%.
		LET3	High	22,161	7,959	7,959	3,980	Originally reclaimed as channel/Lake 7. Now 1,000 m of Mynheer Pit will be eliminated, reducing impacts. Reclaimed as Lake 7. The proposed buffer on LET3 may reduce fish habitat impacts by ~50%.
East	Lund	Lund Creek	Mod	11,026	7,319	7,319	7,319	Lund Creek reclaimed as reconstructed channel and Lake 12.
			Mod	10,000	10,000	8,714	8,714	This represents potential habitat that will be lost due to

								downstream flows being diverted away from Lund Creek during Lake 12 filling.
		LDT1	Low	2,991	2,991	2,991	2,991	Reclaimed as channel and Lake 8 & 9.
		LDT1A	Low	1,091	1,091	1,091	1,091	Reclaimed as channel and Lake 8 & 9.
		LDT2	Low	TBD	209	209	209	Reclaimed as channel.
		LDT3	Low	2,507	3,831	3,831	3,831	Reclaimed as channel and Lake 10 &11.
		LDT4	Low	TBD	113	542	542	Reclaimed as channel and Lake 10 &11. A 2013 habitat inventory revised impact numbers.
		LDT5	Low	154	154	154	154	Reclaimed as Lake 12.
	Pembina	PET1	High	5,236	5,236	660	0	Originally the upper portion of PET1 was to be diverted into Lake 12 or diverted east into the Pembina River, now reclaimed as channel to the Pembina River. The proposed Pembina River buffer eliminates all impacts on PET1.
Total		**Original Report**		**204,983**				
		Level 1 Revision			**189,252**			
		Level 2 Revision				**159,819**		
		Level 3 Revision					**132,922**	

9.4 Alternative Means Rating System

Table 3 shows the rating system chosen to rate the alternative means effecting aquatic resources. For each alternative mean, a Preferred (P), Acceptable (A), or Unacceptable (U) rating was selected for each attribute: Economic Feasibility, Technical Feasibility, and Environmental Effects. After the attributes were rated, each alternative was then evaluated as a whole, receiving a final rating of Preferred (P), Acceptable (A), or Unacceptable (U) depending on how its attribute ratings compared against other alternatives.

Table3 Alternative means rating system for determining effects to aquatic resources.

	Preferred	Acceptable	Unacceptable
Economic Feasibility	Maximizes Coal Reserve Recovery within all economic pit shells.	Generally Maximizes Coal Reserve Recovery with recovery restrictions to reduce footprint and avoid significant impact on VEC's.	Reduction of Coal Reserves beyond economic feasibility.
Technical Feasibility	Utilizes existing equipment and infrastructure combined with technical expertise within known geotechnical, environmental and safety constraints. Maximum flexibility in terms of pit backfilling and staging of pits.	Utilize new equipment or technologies within acceptable economic constraints. Backfilling and pit staging constrained to meet optimal reclamation parameters.	Depend on unproven technologies, unacceptable safety risk or unrealistic scheduling constraints.
Environmental Effects	Least adverse effects to the natural environment with mitigation measures.	Minimizes adverse effects to the natural environment with mitigation measures.	Likely to cause significant adverse effects to the natural environment that cannot reasonably be mitigated.

The following tables show the assessment of the alternative means of carrying out the various project activities and the selection of the preferred alternative based on the performance objectives and the criteria.

- Table 4 shows the assessment of alternative means for the Robb West mining area;
- Table 5 shows the assessment of alternative means for the Robb Main mining area;

- Table 6 shows the assessment of alternative means for the Robb Centre mining area; and
- Table 7 shows the assessment of alternative means for the Robb East mining area.

Table 4 Assessment of Alternative Means for the Robb West Mining Area.						
Waterbody	**Activity**	**Alternative(s)**	**Technical Feasibility Rating**	**Economic Feasibility Rating**	**Environmental Effect Rating**	**Final Rating**
Bryan Creek	Reclamation	Route creek through End Pit Lake 2	Acceptable	Preferred	Acceptable	Acceptable
		Reconstruct channel, bypass End Pit Lake 2	Acceptable	Acceptable	Preferred, reduces increased fish habitat productive capacity	Preferred
		Small buffer zone between Robb West and the Hamlet of Robb	Acceptable	Acceptable	Acceptable	Acceptable
		Increased buffer zone between Robb West and the Hamlet of Robb	Preferred	Preferred	Preferred, reduced impacts on Bryan Creek	Preferred
		Limited backfilling in End Pit Lakes 1 & 2	Acceptable	Preferred	Acceptable	Acceptable
		Increased backfilling in End Pit Lakes 1 & 2	Preferred	Acceptable	Preferred, decreases lake size and volume while increasing littoral areas	Preferred

Table 5 Assessment of Alternative Means for the Robb Main Mining Area.

Waterbody	Activity	Alternative(s)	Technical Feasibility Rating	Economic Feasibility Rating	Environmental Effect Rating	Final Rating
Hay Creek	Reclamation	Small buffer zone between Robb Main and the Hamlet of Robb	Acceptable	Preferred	Acceptable	Acceptable
		Increased buffer zone between Robb Main and the Hamlet of Robb	Preferred	Preferred	Preferred, reduced impacts on Hay Creek	Preferred
		Limited backfilling in End Pit Lake 3	Acceptable	Preferred	Acceptable	Acceptable
		Increased backfilling in End Pit Lake 3	Preferred	Acceptable	Preferred, decreases lake size and volume while increasing littoral areas	Preferred
		Lake 3 filling via upper Hay Creek	Acceptable	Acceptable	Acceptable, lake filling time reduced, however, temporary fish habitat lost due to downstream flows being diverted away from Hay Creek while filling Lake 3	Acceptable
		Lake 3 filling via groundwater	Acceptable	Acceptable	Acceptable, increased lake filling time	Acceptable
		Lake 3 filling via groundwater with downstream flows maintained within Hay Creek via pumping	Preferred	Acceptable	Preferred, maintains flow downstream, maintains fish habitat	Preferred
Erith River	Diversion/ Reclamation	Multi-stage diversions of Erith River and tributaries with final reclamation including Lakes 4 & 5	Acceptable	Preferred	Acceptable, decreased fish habitat productive capacity, requires multiple diversions	Acceptable
		Multi-stage diversions of Erith River and tributaries with final reclamation including reconstructed channel and Lake 5	Preferred	Preferred	Acceptable, increased fish habitat productive capacity, requires multiple diversions	Preferred

Table 5 Assessment of Alternative Means for the Robb Main Mining Area.

Waterbody	Activity	Alternative(s)	Technical Feasibility Rating	Economic Feasibility Rating	Environmental Effect Rating	Final Rating
		Divert portions of the Erith River, eliminate mining of the Mynheer Pit along the Erith River, with final reclamation including Lake 5	Acceptable	Acceptable	Preferred, substantially reduced impacts on the Erith River	Acceptable
ERT1	Diversion/ Reclamation	Divert during mining and reclaimed as Lake 4	Acceptable	Preferred	Acceptable	Acceptable
		Mining buffer around majority of ERT1, reducing diversion length, reclaimed as reconstructed channel	Preferred	Acceptable	Preferred, reduced impacts on ERT1, increased fish habitat productive capacity	Preferred
Bacon Creek	Diversion/ Reclamation	Divert during mining, reclaimed to outlet to Lake 4/5	Acceptable	Preferred	Acceptable, reduces downstream flows	Acceptable
		Mining buffer around majority of Bacon Creek, reducing diversion length, reclaimed as reconstructed channel	Preferred	Acceptable	Preferred, reduced impacts on Bacon Creek, increased fish habitat productive capacity, maintains flows	Preferred

Table 6 Assessment of Alternative Means for the Robb Centre Mining Area.						
Waterbody	**Activity**	**Alternative(s)**	**Technical Feasibility Rating**	**Economic Feasibility Rating**	**Environmental Effect Rating**	**Final Rating**
Halpenny Creek	Diversion/ Reclamation	Divert during mining, reclaimed as Lake 6 and small pond	Acceptable	Acceptable	Acceptable, reduces downstream flows	Acceptable
		Mining buffer around majority of Halpenny Creek, reducing diversions, reclaimed as reconstructed channel	Preferred	Acceptable	Preferred, reduced impacts on Halpenny Creek, increased fish habitat productive capacity, maintains flows	Preferred
HLT1 & HLT2	Diversion/ Reclamation	Divert during mining, reclaimed as channel/lakes	Acceptable	Preferred	Acceptable	Acceptable
		Eliminate mining through HLT1 & HLT2	Preferred	Acceptable	Preferred, eliminates impacts on HLT1 & HLT2	Preferred
Lendrum Creek	Reclamation	Reclaimed as Lake 7	Acceptable	Preferred	Acceptable, reduces downstream flows	Acceptable
		Reclaimed as reconstructed channel	Preferred	Acceptable	Preferred, increased fish habitat productive capacity, maintains flows	Preferred
LET1 & LET3	Diversion/ Reclamation	Divert during mining, reclaimed as channel/lakes	Acceptable	Preferred	Acceptable	Acceptable
		Mining buffer around majority of LET1 & LET3, reducing diversions, reclaimed as Lake 7	Preferred	Acceptable	Preferred, reduced impacts on LET1 & LET3	Preferred

Table 7 Assessment of Alternative Means for the Robb East Mining Area.						
Waterbody	**Activity**	**Alternative(s)**	**Technical Feasibility Rating**	**Economic Feasibility Rating**	**Environmental Effect Rating**	**Final Rating**
Lund Creek	Reclamation	Lake 12 filling via upper Lund Creek	Acceptable	Preferred	Acceptable, lake filling time reduced, however, temporary fish habitat lost due to downstream flows being diverted away from Lund Creek while filling Lake 12	Acceptable
		Lake 12 filling via groundwater	Acceptable	Acceptable	Acceptable, increased lake filling time	Acceptable
		Lake 12 filling via groundwater with downstream flows maintained within Lund Creek via pumping	Preferred	Acceptable	Preferred, maintains flow downstream, maintains fish habitat	Preferred
PET1	Diversion/ Reclamation	Divert north or east into Pembina River during mining, reclaim as Lake 12	Acceptable	Preferred	Acceptable, reduced flows downstream	Acceptable
		Eliminate mining through PET1	Acceptable	Acceptable	Preferred, eliminates impacts on PET1	Preferred
		Limited backfilling in End Pit Lake 12	Acceptable	Preferred	Acceptable	Acceptable
		Increased backfilling in End Pit Lake 12	Preferred	Acceptable	Preferred, decreases lake size and volume while increasing littoral areas	Preferred

9.5 Changes in Flow Regimes

Although streams tend to exhibit considerable natural seasonal variation in volume of flow or discharge, changes in discharge can have an adverse effect on lotic communities. As a general rule, induced changes in volume of flow that do not exceed natural seasonal extremes have little effect. Further reductions in volume of flow during normal low flow periods adversely affect aquatic resources (fish and benthic invertebrate). Increases in discharge during the normal high flow periods tend to adversely affect habitat, principally due to the effects of erosion, resulting in higher sediment loads.

Decreases in base flow may threaten overwinter survival and successful incubation of eggs deposited in fall. Increases in peak flow increase habitat instability, erosion and sediment mobilization and may reduce spring spawning activity and successful egg incubation. In addition, the retention of surface waters in settling ponds, or in-pit lakes can result in an increase in average water temperatures.

The original Project application included a description of Project components that have the potential to affect surface flows and provided discussion of the potential for these surface flow impacts to affect fish habitat availability. Table 8 provides an updated description of the anticipated changes in flow regime and the corresponding impacts to fish habitat.

Table 8	Summary of surface flow impacts and corresponding effects on fish habitat in major watercourses.			
Mine Area	**Watercourse**	**Potential Change to Flow Regime**		**Potential Impacts to Fish Habitat**
		Application	**Revisions[1]**	
Robb West	Bryan Creek	• Moderation of peak flows • Increase in low flows • Mean annual runoff may temporarily increase by as much as 20% during pit, groundwater dewatering	• Revised mine plan will allow for natural flow regime through the Project area as Bryan Creek will now be reclaimed channel bypassing Lake 2	• No significant impact to fish habitat expected • Impacted habitat has high and low potential/utilization ranking
Robb Main	Bacon Creek	• Approximately 70% of lower basin lost due to diversion • 2.4 km long channel remaining with ~30% of flow	• Revised mine plan will allow for natural flow regime through the Project area as Bacon Creek will now be reclaimed channel bypassing Lakes 5 & 6	• No significant impact to fish habitat expected • Impacted habitat has high potential/utilization ranking
	Embarras River	• Small footprint upstream of Robb, impacts during mining expected to be negligible • Maximum estimated impacts downstream of Robb equate to: 3% decrease in high flows, 10% increase in low flows, and negligible change in mean annual flows	• No change to original impact scenario expected	• No significant impact to fish habitat expected • Impacted habitat has high potential/utilization ranking
	Erith River	• Flow regulation via settling ponds • 10% reduction in peak flows • Maintenance or slight increase in low flows • Overall modest change in annual runoff	• Revised mine plan will allow for natural flow regime through the Project area via a reclaimed channel (preferred) or leaving the existing channel undisturbed • ERT1 flows maintained via reclaimed channel	• No significant impact to fish habitat expected • Impacted habitat has high potential/utilization ranking
	Hay Creek	• Up to 50% reduction in peak flows • Up to 200% increase in low flows • Mean annual runoff may	• Temporary reduction in flows during end pit lake filling • No change to original impact scenario	• Reduced habitat availability for 2.25 km downstream of pit during end pit lake filling (4,038 m^2) • Impacted habitat has low

Table 8	Summary of surface flow impacts and corresponding effects on fish habitat in major watercourses.			
Mine Area	**Watercourse**	**Potential Change to Flow Regime**		**Potential Impacts to Fish Habitat**
		Application	**Revisions[1]**	
		temporarily increase by as much as 25% during pit, groundwater dewatering	expected once the end pit lake has been filled	potential/utilization ranking
Robb Centre	Halpenny Creek	• Approximately 20% of flows altered depending on various diversions. • Impacts expected to be short term (temporary diversions) • Flow regulation due to settling ponds • Increased total annual runoff due to road runoff	• Revised mine plan will allow for natural flow regime through the Project area as Halpenny Creek will now be reclaimed channel bypassing Lake 6 and no mining expected on HLT1 and HLT2	• No significant impact to fish habitat expected • Impacted habitat has high potential/utilization ranking
	Lendrum Creek	• Moderation of peak flows • Increase in low flows • Mean annual runoff may temporarily increase by as much as 20% during pit, groundwater dewatering	• Revised mine plan will allow for natural flow regime through the Project area as Lendrum Creek will now be reclaimed channel and mining has been reduced on LET1 and LET2	• No significant impact to fish habitat expected • Impacted habitat has moderate potential/utilization ranking
Robb East	Lund Creek	• Moderation of peak flows • Increase in low flows • Mean annual runoff may temporarily increase by as much as 25% during pit, groundwater dewatering • Reduced flows and habitat availability downstream of pit (potential loss of upper portion of creek if flows are diverted through lakes permanently)	• No change to original impact scenario expected • Temporary reduction in flows during end pit lake filling	• Reduced habitat availability for 2.66 km (8,714 m^2) due to flows being diverted through lakes • Impacted habitat has moderate potential/utilization ranking
	PET1	• Small portion of watershed may be re-directed into Lund Creek	• Revised mine plan will allow for natural flow regime through the Project area as mining	• No impacts expected • PET1 habitat has high potential/utilization ranking

Table 8	Summary of surface flow impacts and corresponding effects on fish habitat in major watercourses.			
Mine Area	**Watercourse**	**Potential Change to Flow Regime**		**Potential Impacts to Fish Habitat**
		Application	**Revisions[1]**	
			has been eliminated around PET1	
	Pembina River	• Minor influence, <2% decrease in flows in Pembina River due to permanent diversion of PET1	• With revised mine plan there is no expectation for measurable changes in flows in the Pembina River	• No impacts expected

[1] Conclusions subject to review by Matrix as mine plans progress during License phase.

10. Potential Effects on Aquatic Valued Ecosystem Components (VECs)

Table 9 shows the VECs selected for the Project, including the selection rationale.

Table 9	VECs and selection rationale for the Robb Trend Coal Mine Project.
VEC	**Rationale**
Arctic Grayling (*Thymallus arcticus*)	• Baseline investigations found this species to be present in the RSA • Possibly also occupies small portion of the LSA (historically found in LSA in Erith River) • Classified as *Sensitive* in the *General Status of Alberta Wild Species* report (ESRD 2010) • Classified as *Species of Special Concern* by Alberta's Endangered Species Conservation Committee (ESCC) (ESRD 2014) • Popular sport fish species
Bull Trout (*Salvelinus confluentus*)	• Baseline investigations found this species to be present in the RSA • Baseline investigations found this species to occasionally occupy small portion of the LSA (specifically upper Erith River) • Classified as *Sensitive* in the *General Status of Alberta Wild Species* report (ESRD 2010) • Classified as *Threatened* under Alberta's *Wildlife Act* (ESRD 2014) • Classified as *Special Concern* (Western Arctic Population) by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) (2014) • Popular sport fish species
Athabasca Rainbow Trout (*Oncorhynchus mykiss*)	• Most wide-spread species found throughout the LSA and RSA during baseline investigations • Classified as *Threatened* under Alberta's *Wildlife Act* (ESRD 2014) • Classified as *Endangered* (Athabasca River Population) by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) (2014) • Popular sport fish species
Benthic Invertebrates	• Important food source for fish • Potentially sensitive to aquatic ecological changes • Effective biomonitoring indicator

The impacts potentially affecting fish habitat potential, the abundance, health and survival of fish populations (in general) and the abundance, health and survival of VECs are principally related to:

- Changes to physical habitat components;
- Changes to flow regime;
- Changes to water quality (sediment and other chemical contaminants); and
- Changes to the fisheries resource access and utilization.

Measures to reduce or mitigate potential effects were identified using proven strategies and combined expertise of professionals. A summary of effects and proposed mitigation is presented in Table 10.

Table 10 Summary of Project specific effects and mitigation on selected VECs

VEC	Presence in LSA	Direct Habitat Loss/Alteration		Changes in Surface WQ		Changes in Flow Regime		Changes in Resource Access		Significance of Effect
		Potential Impact	Mitigation	Potential Impact	Mitigation	Potential Impact	Mitigation	Potential Impact	Mitigation	
Athabasca Rainbow Trout	• Widespread, present throughout LSA	• All major stream diversions and some minor diversions • Haulroad crossings • Rock dumps	• Implementation of NNLP • Stream flow management to protect habitat integrity • Construction timing • Open channel diversions • Habitat enhancement of reclaimed channels • Implementation of standard BMPs for watercourse crossing construction • Provision for fish passage where required • Fish salvage	• Sedimentation (runoff from haulroads and rock dumps, diversions) • Chemical contaminants	• Implementation of surface water management plan • Sediment/erosion controls • Water quality monitoring • Turbidity monitoring • Revegetation • Watercourse buffers • Adaptive management	• Potential reduction in flows during filling of pit lakes • Reduction of peak flows • Moderation of peak flows • Increase in low flows	• Management of flows to meet instream flow needs (IFN) • Implementation of NNLP • Fish salvage • Provision for fish passage	• Increased access and harvest of fisheries resource	• Restricting access to mine property • Current fisheries regulation	• Insignificant, effect(s) can be mitigated
Bull Trout	• Erith River and ERT1 (baseline) • Embarras River, Erith River, ERT6, ERT10, Bacon Creek, Halpenny Creek, LDT1 (historical reference)	• Robb Main stream diversions (limited potential in Robb Centre and Robb East) • Haulroad crossings	• Implementation of NNLP • Stream flow management to protect habitat integrity • Construction timing • Open channel diversions • Habitat enhancement of reclaimed channels • Implementation of standard BMPs for watercourse crossing construction • Provision for fish passage where required • Fish salvage	• Sedimentation (runoff from haulroads and rock dumps, diversions) • Chemical contaminants	• Implementation of surface water management plan • Sediment/erosion controls • Water quality monitoring • Turbidity monitoring • Revegetation • Watercourse buffers • Adaptive management	• Potential reduction in flows during filling of pit lakes • Reduction of peak flows • Moderation of peak flows • Increase in low flows	• Management of flows to meet IFN • Implementation of NNLP • Fish salvage • Provision for fish passage	• Increased access and harvest of fisheries resource	• Restricting access to mine property • Current fisheries regulation	• Insignificant, effect(s) can be mitigated
Arctic Grayling	• Embarras River (baseline) • Embarras River, Erith River (historical reference)	• Robb Main stream diversions • Haulroad crossings	• Implementation of NNLP • Stream flow management to protect habitat integrity • Construction timing • Open channel diversions • Habitat enhancement of reclaimed channels • Implementation of standard BMPs for watercourse crossing construction • Provision for fish passage where required • Fish salvage	• Sedimentation (runoff from haulroads and rock dumps, diversions) • Chemical contaminants	• Implementation of surface water management plan • Sediment/erosion controls • Water quality monitoring • Turbidity monitoring • Revegetation • Watercourse buffers • Adaptive management	• Potential reduction in flows during filling of pit lakes • Reduction of peak flows • Moderation of peak flows • Increase in low flows	• Management of flows to meet IFN • Implementation of NNLP • Fish salvage • Provision for fish passage	• Increased access and harvest of fisheries resource	• Restricting access to mine property • Current fisheries regulation	• Insignificant, effect(s) can be mitigated
Benthic Invertebrates	• All	• Stream diversions	• Implementation of NNLP • Stream flow management to	• Sedimentation (runoff from	• Implementation of surface water	• Potential reduction in flows during filling	• Management of flows to meet	• No harvest	• None required	• Insignificant, effect(s) can be

		• Haulroad crossings • Rock dumps	protect habitat integrity • Open channel diversions • Habitat enhancement of reclaimed channels	haulroads and rock dumps, diversions) • Chemical contaminants	management plan • Sediment/erosion controls • Water quality monitoring • Turbidity monitoring • Revegetation • Watercourse buffers • Adaptive management	of pit lakes • Reduction of peak flows • Moderation of peak flows • Increase in low flows	IFN • Implementation of NNLP			mitigated

Potential impacts to the selected VECs relate primarily to direct physical habitat alteration/loss, changes in surface water hydrology, and surface water quality issues. The potential mine plan revisions would limit the amount of alteration/loss or changes in surface water hydrology by maintaining watercourses in their current positions and state. Habitat effects primarily impact Rainbow Trout which were most abundant and widespread in the streams directly affected by the proposed diversions. With mitigation measures, it is anticipated that there will be an insignificant impact on the VEC's identified. Table 11 summarizes the potential impacts on aquatic resource VEC's.

Table 11 Summary of impact significance on VECs.

Nature of Potential Impact or Effect	Mitigation/ Protection Plan	Type of Impact or Effect	Geographical Extent of Impact or Effect[1]	Duration of Impact or Effect[2]	Frequency of Impact or Effect[3]	Ability for Recovery from Impact or Effect[4]	Magnitude of Impact or Effect[5]	Project Contribution[6]	Confidence Rating[7]	Probability of Impact or Effect Occurrence[8]	Significance[9]
Rainbow Trout											
Habitat alteration, changes in surface hydrology, sedimentation and other changes in water quality	NNLP, Flow management, Surface water management plan, Construction timing, Fish salvage	Project	Local	Long	Occasional	Reversible	Moderate	Negative	Moderate	Medium	Insignificant
		Residual	Local	Long	Occasional	Reversible	Moderate	Negative	Moderate	Medium	Insignificant
Bull Trout											
Habitat alteration,	NNLP, Flow	Project	Local	Long	Occasional	Reversible	Moderate	Negative	Moderate	Medium	Insignificant

Table 11 Summary of impact significance on VECs.

Nature of Potential Impact or Effect	Mitigation/ Protection Plan	Type of Impact or Effect	Geographical Extent of Impact or Effect[1]	Duration of Impact or Effect[2]	Frequency of Impact or Effect[3]	Ability for Recovery from Impact or Effect[4]	Magnitude of Impact or Effect[5]	Project Contribution[6]	Confidence Rating[7]	Probability of Impact or Effect Occurrence[8]	Significance[9]
changes in surface hydrology, sedimentation and other changes in water quality	management, Surface water management plan, Construction timing, Fish salvage	Residual	Local	Long	Occasional	Reversible	Moderate	Negative	Moderate	Medium	Insignificant
Artic Grayling											
Sedimentation and other changes in water quality habitat alteration, changes in surface hydrology	NNLP, Flow management, Surface water management plan, Construction timing, Fish salvage	Project	Local	Long	Occasional	Reversible	Moderate	Negative	Moderate	Medium	Insignificant
		Residual	Local	Long	Occasional	Reversible	Moderate	Negative	Moderate	Medium	Insignificant
Benthic Invertebrates											
Habitat alteration, changes in surface hydrology, sedimentation and other changes in water quality	NNLP, Flow management, Surface water management plan	Project	Local	Long	Occasional	Reversible	Moderate	Negative	Moderate	Medium	Insignificant
		Residual	Local	Long	Occasional	Reversible	Moderate	Negative	Moderate	Medium	Insignificant

[1] Local, Regional, Provincial, National, Global
[2] Short, Long, Extended, Residual
[3] Continuous, Isolated, Periodic, Occasional, Accidental, Seasonal
[4] Reversible in short term, Reversible in long term, Irreversible – rare
[5] Nil, Low, Moderate, High
[6] Neutral, Positive, Negative
[7] Low, Moderate, High
[8] Low, Medium, High
[9] Insignificant, Significant

11. Potential Effects on Wildlife Valued Ecosystem Components (VECs)

Within Tables 4 to 7 all of the selected "Preferred" options relating to aquatics are also preferred options for wildlife as these proposed alternative mine plans reduce the overall footprint of the Project. These buffer areas' surrounding watercourses within the Project area provide watercourse protection, reduction in habitat losses and access for wildlife species.

Table 12 and 13 summarizes ratings for impact types and wildlife VECs. Ratings were based on predicted post-mitigation (residual) conditions and successful implementation of mitigation. Potential impacts to the selected VECs relate primarily to direct physical habitat alteration/loss, human interaction (wildlife mortality) and wildlife movement. The potential mine plan revisions would limit the amount of habitat alteration/loss. With mitigation measures, it is anticipated that there will be an overall insignificant impact on the VEC's identified.

Table 12 Summary of Impact Significance on Mammalian Carnivore Valued Environmental Components

VEC	Nature of Potential Impact or Effect	Mitigation/ Protection Plan	Type of Effect	Geographic Extent[1]	Duration[2]	Frequency[3]	Reversibility[4]	Magnitude[5]	Project Contribution (Direction)[6]	Confidence Rating[7]	Probability of Occurrence[8]	Impact Rating[9]
1. Marten												
	Increased Mortality	Section E.7.5	Application	Local	Extended	Occasional	Reversible-LT	Low	Negative	High	Medium	Insignificant
			Cumulative	Regional	Extended	Occasional	Reversible-LT	Low	Negative	High	Medium	Insignificant
	Habitat Alteration		Application	Local	Extended	Continuous	Reversible-LT	Moderate	Negative	High	High	Insignificant
			Cumulative	Regional	Extended	Continuous	Reversible-LT	High	Negative	High	High	Insignificant
	Sensory Disturbance		Application	Regional	Long	Isolated	Reversible-ST	Low	Negative	Moderate	High	Insignificant
			Cumulative	Regional	Extended	Periodic	Reversible-ST	Low	Negative	Moderate	High	Insignificant
	Habitat Fragmentation		Application	Local	Extended	Continuous	Reversible-LT	Moderate	Negative	High	High	Insignificant
			Cumulative	Regional	Extended	Continuous	Reversible-LT	High	Negative	High	High	Insignificant
	Barriers to Movement		Application	Local	Extended	Continuous	Reversible-LT	Moderate	Negative	High	High	Insignificant
			Cumulative	Regional	Extended	Continuous	Reversible-LT	Moderate	Negative	High	High	Insignificant
2. Fisher												
	Increased Mortality	Section E.7.5	Application	Local	Extended	Occasional	Reversible-LT	Low	Negative	High	Medium	Insignificant
			Cumulative	Regional	Extended	Occasional	Reversible-LT	Low	Negative	High	Medium	Insignificant
	Habitat Alteration		Application	Local	Extended	Continuous	Reversible-LT	Moderate	Negative	High	High	Insignificant
			Cumulative	Regional	Extended	Continuous	Reversible-LT	Low	Negative	High	High	Insignificant
	Sensory Disturbance		Application	Regional	Long	Isolated	Reversible-ST	Moderate	Negative	Low	High	Insignificant
			Cumulative	Regional	Extended	Periodic	Reversible-ST	Low	Negative	Moderate	High	Insignificant
	Habitat Fragmentation		Application	Local	Extended	Continuous	Reversible-LT	Moderate	Negative	Moderate	High	Insignificant
			Cumulative	Regional	Extended	Continuous	Reversible-LT	Moderate	Negative	Low	High	Insignificant
	Barriers to		Application	Local	Extended	Continuous	Reversible-LT	Moderate	Negative	Moderate	High	Insignificant

	Movement		Cumulative	Regional	Extended	Continuous	Reversible-LT	Moderate	Negative	Moderate	High	Insignificant
3. Lynx												
	Increased Mortality	Section E.7.5	Application	Local	Extended	Occasional	Reversible-LT	Low	Negative	High	Medium	Insignificant
			Cumulative	Regional	Extended	Occasional	Reversible-LT	Low	Negative	High	Medium	Insignificant
	Habitat Alteration		Application	Local	Extended	Continuous	Reversible-LT	Low	Positive	High	High	Insignificant
			Cumulative	Regional	Extended	Continuous	Reversible-LT	Low	Positive	High	High	Insignificant
	Sensory Disturbance		Application	Regional	Long	Isolated	Reversible-ST	Low	Negative	Moderate	High	Insignificant
			Cumulative	Regional	Extended	Periodic	Reversible-ST	Low	Negative	Moderate	High	Insignificant
	Habitat Fragmentation		Application	Local	Extended	Continuous	Reversible-LT	Moderate	Negative	High	High	Insignificant
			Cumulative	Regional	Extended	Continuous	Reversible-LT	Moderate	Positive	High	High	Insignificant
	Barriers to Movement		Application	Local	Extended	Continuous	Reversible-LT	Moderate	Negative	High	High	Insignificant
			Cumulative	Regional	Extended	Continuous	Reversible-LT	Moderate	Negative	High	High	Insignificant
4. Wolf												
	Increased Mortality	Section E.7.5	Application	Local	Extended	Occasional	Reversible-LT	Low	Negative	High	Medium	Insignificant
			Cumulative	Regional	Extended	Occasional	Reversible-LT	Low	Negative	Moderate	High	Insignificant
	Habitat Alteration		Application	Local	Extended	Continuous	Reversible-LT	High	Negative	High	High	Insignificant
			Cumulative	Regional	Extended	Continuous	Reversible-LT	High	Negative	High	High	Insignificant
	Sensory Disturbance		Application	Regional	Long	Isolated	Reversible-ST	Low	Negative	Moderate	High	Insignificant
			Cumulative	Regional	Extended	Periodic	Reversible-ST	Low	Negative	Moderate	High	Insignificant
	Habitat Fragmentation		Application	Local	Extended	Continuous	Reversible-LT	Low	Negative	High	Medium	Insignificant
			Cumulative	Regional	Extended	Continuous	Reversible-LT	Low	Positive	Moderate	Medium	Insignificant
	Barriers to Movement		Application	Local	Extended	Continuous	Reversible-LT	Low	Negative	High	Medium	Insignificant
			Cumulative	Regional	Extended	Continuous	Reversible-LT	Low	Negative	High	Medium	Insignificant

5. Grizzly Bear												
	Increased Mortality	Section E.7.5	Application	Local	Extended	Occasional	Reversible-LT	Low	Negative	High	Low	Insignificant
			Cumulative	Regional	Extended	Occasional	Reversible-LT	High	Negative	High	Medium	Significant
	Habitat Alteration		Application	Local	Extended	Continuous	Reversible-LT	Moderate	Positive	High	High	Insignificant
			Cumulative	Regional	Extended	Continuous	Reversible-LT	Moderate	Negative	High	High	Insignificant
	Sensory Disturbance		Application	Regional	Long	Isolated	Reversible-ST	Low	Negative	High	Medium	Insignificant
			Cumulative	Regional	Extended	Periodic	Reversible-ST	Low	Negative	High	Medium	Insignificant
	Habitat Fragmentation		Application	Local	Extended	Continuous	Reversible-LT	Low	Negative	High	Low	Insignificant
			Cumulative	Regional	Extended	Continuous	Reversible-LT	Low	Negative	High	Low	Insignificant
	Barriers to Movement		Application	Local	Long	Isolated	Reversible-LT	Low	Negative	High	Medium	Insignificant
			Cumulative	Regional	Extended	Continuous	Reversible-LT	Low	Negative	High	Medium	Insignificant

(1) Local, Regional, Provincial, National, Global
(2) Short, Long, Extended, Residual
(3) Continuous, Isolated, Periodic, Occasional (Accidental, Seasonal)
(4) Reversible in short term, Reversible in long term, Irreversible – rare
(5) Nil, Low, Moderate, High
(6) Neutral, Positive, Negative
(7) Low, Moderate, High
(8) Low, Medium, High
(9) Insignificant, Significant

Table 13 Determination of the Significance of Potential Effects of the Proposed Project on Wildlife Resources (Ungulates, Small Mammals, Breeding Birds, Raptors, and Amphibians).

VEC	Nature of Potential Impact	Mitigation/ Protection Plan	Type of Effect	Criteria for Determining Significance						Significance	Project Contribution	Confidence Rating
				Extent	Duration	Frequency	Recovery	Magnitude	Probability			
UNGULATES (Moose, Deer, Elk)												
Elk	Loss of Foraging Habitat	Minimize Loss (2) Reclamation (1, 9,10,12,17,18)	Project	Local	Grassland Development (Extended) Shrub	Continuous	Reversible in Short-Term	Moderate	High	Significant	Positive	High
	Loss of Forest Cover	Minimize Loss (2) Reclamation (9,10)	Residual	Local	Development (Long) Forest Development (Long)	Continuous	Reversible in Long-Term	Low	High	Insignificant	Neutral	High
Moose	Loss of Foraging Habitat	Minimize Loss (2) Reclamation (1, 7, 8, 10, 11, 16)	Project	Local	Shrub Development (Long)	Continuous	Reversible Long-Term	Low	High	Insignificant	Neutral	Moderate
	Loss of Forest Cover	Minimize Loss (2) Reclamation (1, 7, 8, 11,)	Residual	Local	Forest Development (Long)	Continuous	Reversible in Long-Term	Low	High	Insignificant	Neutral	High
Deer	Loss of Foraging Habitat	Minimize Loss (2) Reclamation (1, 7, 8, 9,10,11,12,16)	Project	Local	Grassland Development (Extended) Shrub	Continuous	Reversible in Short-Term	Moderate	High	Significant	Positive	High
	Loss of Forest Cover	Minimize Loss (2) Reclamation (9,10)	Residual	Local	Development (Long) Forest Development (Long)	Continuous	Reversible in Long-Term	Low	High	Insignificant	Neutral	High

Elk Moose Deer	Disruption of Movement Patterns	Minimize Loss (2) Reclamation (15) Management (18)	Project Project	Local Local	Short Short	Continuous Continuous	Reversible in Short-Term Reversible in Short-Term	Low Moderate	High High	Insignificant Insignificant	Neutral Neutral	High Moderate
Elk Moose Deer	Displacement	Management (17,18)	Project	Regional	Long	Continuous	Reversible in Long-Term	Moderate	Medium	Insignificant	Neutral	Moderate
Elk Moose Deer	Direct Mortality	Training (5)	Project	Local	Short	Continuous	Irreversible	Low	High	Insignificant	Neutral	High
SMALL MAMMALS												
	Loss of Habitat	Minimize Loss (2) Reclamation (1,7,8, 9, 10, 11, 15,16)	Project	Local	Grassland Development (Extended) Shrub Development (Long) Forest Development (Long)	Continuous Continuous	Reversible in Short-Term Reversible in Long-Term	Low Low	High High	Insignificant Insignificant	Neutral Neutral	High Moderate
BREEDING BIRDS and RAPTORS												
	Loss of Habitat	Minimize Loss (2) Reclamation (1, 7, 8, 9, 10, 11, 12, 13, 16) Management (18)	Project and Residual Project	Local Local	Grassland Development (Extended) Shrub Development (Long) Forest Development (Long) Short	Continuous Continuous Continuous	Reversible in Short-Term Reversible in Long-Term Reversible in Short-Term	Low Low Low	High High High	Insignificant Insignificant Insignificant	Neutral Neutral Neutral	High Moderate High

	Direct Mortality	Timing & Training (3, 4, 6)	Project	Local	Short	Continuous	Irreversible	Low	High	Insignificant	Neutral	High
	Displacement	Minimize Loss (2) Reclamation (1, 7, 8, 9, 10, 11, 12, 13, 16) Management (18)	Project and Residual Project	Local Local	Grassland Development (Extended) Shrub Development (Long) Forest Development (Long) Short	Continuous Continuous Continuous	Reversible in Short-Term Reversible in Long-Term Reversible in Short-Term	Low Low Low	High High High	Insignificant Insignificant Insignificant	Neutral Neutral Neutral	High Moderate High
AMPHIBIANS												
	Loss of Habitat	Minimize Loss (2) Reclamation (1, 13)	Project	Local	Short	Continuous	Reversible in Short-Term	Low	High	Insignificant	Neutral	High

12. Summary of concerns expressed by Aboriginal groups or the public

Discussions, communication and consultation with aboriginal groups to ascertain Traditional Land Use (TLU) and Traditional Ecological Knowledge (TEK) for the Project are ongoing. CVRI has consulted with various Aboriginal groups as well as the general public/stakeholders and has committed to having an ongoing dialogue with regards to specific impacts and mitigation measures that may occur as mine plans progress. Concerns provided during consultation relating to aquatic and wildlife resources included:

- Access restrictions during mining;
- Environmental impacts/destruction;
- Water quality;
- Impacts on local waterbodies;
- Impacts on local fish species;
- Development of a suitable fish habitat compensation plan;
- Consumption of fish in the local area;
- Impacts on local wildlife species;
- Reclamation backlog;
- Health and abundance of local wildlife; and
- Restrictions on hunting.

CVRI acknowledges that the Project will occupy Crown land otherwise available for the exercise of Treaty Rights and traditional uses as well as and including hunting, fishing, camping and hiking for a period of time during mine development, operation and reclamation. As mining will be completed in stages, access restrictions will be in place during mining which will lead to a short term decrease in access. Access to the lease area will be restricted in advance of active mining operations. Following Project completion and reclamation, lands will be reclaimed and upon review and certification by the provincial government access will no longer be restricted by CVRI.

CVRI is working with Fisheries and Oceans Canada (DFO), and other stakeholders and regulators, in creating a conceptual compensation plan that will ensure “no net loss” of fish habitat. CVRI has presented a response relating to environmental impacts and mine plan changes have taken these concerns into consideration. Currently, there are no consumption advisories for fish in the Project area or adjacent to existing CVM operations (Government of Alberta 2014). Additionally, fish resources within the lease area were not identified as an

important First Nations food source during baseline studies. End pit lake fisheries and a projected net increase in fisheries habitat area following mining should result in no long term negative impact to the use of aquatic resources in the area.

An increase in mine buffer areas and reduction of impacts to stream channel areas has been included in revised mine plans. These reductions in the overall footprint have a positive effect on both aquatic and wildlife habitat.

CVRI will implement a surface water management plan throughout the life of the Project.

CVM has recently completed an update to their onsite surface water management strategy and the updated management plan will be applied to the Project. The surface water management plan targets continuous improvement during active monitoring, sampling and inspection throughout the life of the Project to ensure a healthy aquatic environment. Monitoring programs provide real time data that allows, CVM to identify, avoid, and minimize any potentially adverse impacts on water quality in the region.

Consultation with Aboriginal Groups and public stakeholders is ongoing and will continue throughout the life of the Project. All interested parties are encouraged to voice concerns and opinions on future mine plans, current operations and reclamation practices.

REFERENCE LIST

Alberta Environment and Sustainable Resource Development (ESRD). 2010. Status of Alberta Fish. Accessed February 9, 2015 from: http://esrd.alberta.ca/fish-wildlife/species-at-risk/wild-species-status-search.aspx

Alberta Environment and Sustainable Resource Development (ESRD). 2014. Species Assessed by Alberta's Endangered Species Conservation Committee. Accessed February 9, 2015 from: http://esrd.alberta.ca/fish-wildlife/species-at-risk/documents/SpeciesAssessed-EndangeredSpecies-Jul18-2014.pdf

Committee on the Status of Endangered Wildlife in Canada (COSEWIC). 2014. Wildlife Species Search. Accessed February 9, 2015 from: http://www.cosewic.gc.ca/eng/sct1/SearchResult_e.cfm?commonName=&scienceName=&boxStatus=1&boxStatus=2&boxStatus=3&boxStatus=4&boxStatus=5&boxStatus=6&boxStatus=7&boxTaxonomic=3&location=2&Submit=Submit

Government of Alberta. 2014. Fish Consumption Advisory. Accessed February 9, 2015 from: http://mywildalberta.com/fishing/SafetyProcedures/FishConsumptionAdvisory.aspx.