



















**CULTURAL HERITAGE ASSESSMENT
BASELINE
Appendix D**









Summary Tables









**Fort McKay
Industry Relations Corporation**

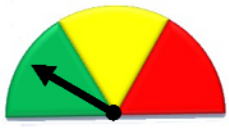


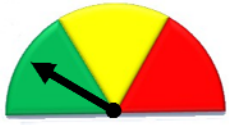









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Table 1 – Summary of Cultural Heritage Assessment - Environmental Indicators Gauges for Pre-development Scenario, Current Scenario and Base Case

Industry Stressors (3 rd level indicator)	Measuring Change in Stressors (4 th Level Indicator)	Green-Yellow-Red Gauge Rating ¹		
		Pre-Development Scenario	Current Scenario	Base Case
Stressor: Loss of Land	Land disturbance in Traditional Lands			
Stressor: Loss of Land	Land disturbance in Traplines			
Stressor: Loss of Land	Reclamation			
Stressor: Loss of Land	Protected areas			
Stressor: Loss of Land	Moose habitat and population	 (FTSA, Intense, Moderate, Low Use CSEs)	Note: no Current Scenario – see Base Case	 (FTSA)  (Intense Use CSE)  (Moderate and Low use CSE)

Industry Stressors (3 rd level indicator)	Measuring Change in Stressors (4 th Level Indicator)	Green-Yellow-Red Gauge Rating ¹		
		Pre-Development Scenario	Current Scenario	Base Case
Stressor: Loss of Land	Canada lynx habitat	 <p>(FTSA, Intense, Moderate, Low Use CSEs)</p>	<p>Note: no Current Scenario – see Base Case</p>	 <p>(FTSA)</p>  <p>(Intense Use CSE)</p>  <p>(Moderate and Low use CSE)</p>
Stressor: Loss of Land	Beaver habitat	 <p>(FTSA, Intense, Moderate, Low Use CSEs)</p>	<p>Note: no Current Scenario – see Base Case</p>	 <p>(FTSA, Intense Use CSE)</p>  <p>(Moderate Use CSE)</p>  <p>(Low Use CSE)</p>

Industry Stressors (3 rd level indicator)	Measuring Change in Stressors (4 th Level Indicator)	Green-Yellow-Red Gauge Rating ¹		
		Pre-Development Scenario	Current Scenario	Base Case
Stressor: Loss of Land	Fisher/marten habitat	 (FTSA, Intense, Moderate, Low Use CSEs)	Note: no Current Scenario – see Base Case	 (FTSA)  (Intense Use CSE)  (Moderate and Low Use CSE)
Stressor: Loss of Land	Upland Forest	 (upland forests, old growth, timber productive forest, riparian, rare plant potential – moderate and low)	Note: no Current Scenario – see Base Case	 (upland forests, old growth, timber productive forest, riparian, rare plant – moderate, rare plant –low)
Stressor: Loss of Land	Wetlands (Muskeg)	 (wetlands, peatlands, old growth associated wetlands, timber productive forest associated wetlands, riparian wetlands, rare plant potential – high and moderate)	Note: no Current Scenario – see Base Case	 (wetlands, peatlands, old growth associated wetlands, timber productive forest associated wetlands, riparian wetlands, rare plant potential – high and moderate)

Industry Stressors (3 rd level indicator)	Measuring Change in Stressors (4 th Level Indicator)	Green-Yellow-Red Gauge Rating ¹		
		Pre-Development Scenario	Current Scenario	Base Case
Stressor: Loss of Land	Traditional Plants	 (Traditional plant potential, Berry sites)	Note: no Current Scenario – see Base Case	 (traditional plant potential – moderate, berry sites)  (traditional plant potential – high)
Stressor: Loss of Land	Biodiversity		Note: no Current Scenario – see Base Case	 (high and moderate biodiversity potential)  (landscape heterogeneity - wetland cover class)  (landscape heterogeneity - terrestrial cover class)
Stressor: Pollution	Air quality parameters – SO ₂			
Stressor: Pollution	Air quality parameters – Nitrogen Oxides (NO _x)			

Industry Stressors (3 rd level indicator)	Measuring Change in Stressors (4 th Level Indicator)	Green-Yellow-Red Gauge Rating ¹		
		Pre-Development Scenario	Current Scenario	Base Case
Stressor: Pollution	Air Quality – Particulate Matter (PM _{2.5})			
Stressor: Pollution	Odours			
Stressor: Pollution	Air emission effects on vegetation		 (SO ₂ , Ozone, and PAI - minimal issues, effects very local in nature)	 (SO ₂ & PAI)
			 (ozone)	 (ozone)
			 (NOx)	 (NOx)
			 (nitrogen deposition)	 (nitrogen deposition)
			 (NH ₃)	 (NH ₃)
			 (SO ₂ & PAI)	 (ozone)
			 (NOx)	 (nitrogen deposition)
Stressor: Industrial Water Use	Athabasca River			

Industry Stressors (3 rd level indicator)	Measuring Change in Stressors (4 th Level Indicator)	Green-Yellow-Red Gauge Rating ¹		
		Pre-Development Scenario	Current Scenario	Base Case
Stressor: Industrial Water Use	Watershed Disturbance		 (Muskeg River)	 (Muskeg River)
			 (Pierre River)	 (Pierre River)
			 (McLean Creek Beaver, Tar and Calumet River watersheds)	 (McLean Creek Beaver, Tar and Calumet River watersheds)
Stressor: Industrial Water Use	Groundwater			
Stressor: Access to Land	Traditional Trails		Note: no Current Scenario – see Base Case	
Stressor: Access to Land	Linear disturbance			
Stressor: Increased Population	Regional Population Trends			

¹ The assessment of significance and the meanings of **green**, **yellow** and **red** varies slightly between components. In general: **green** = significant adverse effect unlikely, **yellow** = possible significant adverse effect and **red** = significant adverse effect. Substantial knowledge gaps or uncertainty regarding the assessment of specific indicator was rated in the **yellow** or **red** category depending on the situation. The assessment criteria that indicate when a rating moves from **green** to **yellow** to **red** are specific for each component. These are summarized in Table 2 of this Appendix and described in detail in each component section of the Fort McKay Environmental Specific Assessment [Fort McKay IRC 2010a; [Section 2 – Air Quality](#) (SO₂, NO_x, PM_{2.5}, odours, air emission effects on vegetation), [Section 3 – Groundwater](#), [Section 4 – Surface Water](#) (watershed disturbance, Athabasca River), [Section 5 – Water Quality and Fish Resources](#), [Section 6 – Wildlife](#) (moose, Canada lynx, fisher/marten, beaver), [Section 7 – Vegetation](#) (uplands, wetlands, traditional plants), [Section 8 – Biodiversity](#), [Section 9 – Disturbance and Access Implications for Traditional Use](#) (traditional lands disturbance, trapline disturbance, watershed disturbance, traditional trails, linear disturbance, regional population trends), [Section 10 – Reclamation](#)].

Table 2 – Summary of Assessment Criteria for Environmental Components

Component	Assessment Criteria	Green-Yellow-Red Rating ¹
Air Quality (Section 2.0)	Fort McKay’s Health and Odour Criteria (Appendix 2-1) <ul style="list-style-type: none"> • Health Canada’s Air Quality Health Index (AQHI) • World Health Organization (WHO) criteria or Alberta Environment (AENV) criteria, depending on the basis for the limit Fort McKay’s Keeping Clean Areas Clean (KCAC) Air Quality Targets (Appendix 2-1)	Green: <ul style="list-style-type: none"> • Parameter levels below KCAC targets Yellow: <ul style="list-style-type: none"> • exceedance of KCAC Targets • predicted increase of more than 5% in an air quality parameter as a result of the proposed Projects • knowledge gaps/uncertainties Red: <ul style="list-style-type: none"> • exceedance of health-based criteria • predicted increase of more than 10% in an air quality parameter as a result of the proposed Projects • knowledge gaps/uncertainties
Odours (Section 2.0)	Fort McKay’s Health and Odour Criteria <ul style="list-style-type: none"> • Health Canada’s Air Quality Health Index (AQHI) • World Health Organization (WHO) criteria or Alberta Environment (AENV) criteria, depending on the basis for the limit Fort McKay’s Keeping Clean Areas Clean Air Quality Targets	Green: <ul style="list-style-type: none"> • Parameter levels below KCAC targets Yellow: <ul style="list-style-type: none"> • exceedance of KCAC Targets • predicted increase of more than 5% in an air quality parameter as a result of the proposed Projects • substantial knowledge gaps/uncertainties Red: <ul style="list-style-type: none"> • Since odours are currently a major problem in the Community, any predicted increase in odours in the Community was considered
Air Emission Vegetation/ Ecosystem Effects (Section 2.0)	Fort McKay’s Vegetation\Ecosystem Protection Criteria <ul style="list-style-type: none"> • 95% protection level for vegetation on undisturbed portions of Fort McKay’s Traditional Lands Parameter-specific air/vegetation criteria: <ul style="list-style-type: none"> • SO₂ and NO₂: WHO criteria • NH₃: Economic Commission of Europe (ECE) criteria • O₃: Cumulative Environmental Management Association (CEMA) criteria • Nitrogen deposition: ECE and CEMA criteria • Potential Acid Input (PAI): CEMA criteria 	Green: <ul style="list-style-type: none"> • Any predicted exceedance of air/vegetation criteria on undisturbed land that are less than 5% of the project development area or 5% of total cumulative development areas • Parameter levels below air/vegetation criteria (except where the project has a predicted increase of more than 5% in any air quality parameter) Yellow: <ul style="list-style-type: none"> • Any predicted exceedance of air/vegetation criteria on undisturbed land that exceeds 5% of the project development area or 5% of total cumulative development areas • predicted increase of more than 5% in an air quality parameter as a result of the proposed Projects • Substantial knowledge gaps/uncertainties Red: <ul style="list-style-type: none"> • predicted increase of more than 10% in an air quality parameter as a result of the proposed Projects

Component	Assessment Criteria	Green-Yellow-Red Rating ¹
Groundwater (Section 3.0)	<p>Groundwater quantity: drawdown in fens and/or at cabins sites</p> <ul style="list-style-type: none"> • < 0.1 m – negligible effect • >0.1 and <1.0 m – potential effect • > 1.0 m – significant effect <p>Groundwater quality:</p> <ul style="list-style-type: none"> • No seepage of process-affected water predicted – negligible effects • Uncertainty as to whether these will be seepage – potential effect • Predicted seepage of process-affected water – significant effect 	<p>Green:</p> <ul style="list-style-type: none"> • Any groundwater quantity or quality changes that will not or are unlikely to have a negative effect on a community member’s direct or indirect use of groundwater on Traditional Lands. May require some ongoing monitoring to validate the predictions of little or no impact. <p>Yellow:</p> <ul style="list-style-type: none"> • Any groundwater quantity or quality impacts that might affect a community member’s direct or indirect use of groundwater on Traditional Lands was considered as an adverse effect. Might require ongoing monitoring (the greater the uncertainty, the more extensive the monitoring will be) and potentially additional mitigation or suitable offset. <p>Red:</p> <ul style="list-style-type: none"> • Any groundwater quantity or quality changes that will affect a community member’s direct or indirect use of groundwater on Traditional Lands is considered a significant adverse effect that would require further mitigation and/or accommodation.
Surface Water Hydrology (Section 4.0)	<p>State of the Surface Water in the Watershed:</p> <ul style="list-style-type: none"> • Maximum change in seasonal stream flow • Watershed area disturbed 	<p>State of Surface Water in the Watershed</p> <p>Green – Sustainable:</p> <ul style="list-style-type: none"> • less than 10% change in stream flow in any given season and/or less than 20% of the watershed area affected by development and related land-use changes. No water management plan is needed at this time. <p>Yellow – Threatened:</p> <ul style="list-style-type: none"> • more than 10% change but less than 25% change in stream flow in any season, and/or between 20% and 40% of the watershed area affected by development and related land-use changes. A water management plan should be developed to establish impact limits and provide direction to development. <p>Red – Endangered:</p> <ul style="list-style-type: none"> • more than 25% change in stream flow in any given season and/or more than 40% of the watershed area affected by development and related land-use changes. A water management plan is urgently needed to establish impact limits and provide direction to development.

Component	Assessment Criteria	Green-Yellow-Red Rating ¹
<p>Water Quality and Fisheries Resources (Section 5.0)</p>	<p>Water quality criteria</p> <ul style="list-style-type: none"> Canadian Council of Ministers of the Environment (CCME) <p>Aquatic Change Index (water quality and fish health):</p> <ul style="list-style-type: none"> an abbreviated version of the CCME Water Quality Index: pre-development median values are compared against future time snapshots and the number of times change in predicted median water quality concentrations is calculated <p>Fish Health</p> <ul style="list-style-type: none"> Aquatic Change Index Change in State of Watershed (% flow and % watershed disturbance) as assessed in the Hydrology assessment of this Fort McKay Specific Assessment (Section 4) and <p>Fishing Opportunities:</p> <ul style="list-style-type: none"> Fish health (as described above) Consideration of the impacts to fish habitat described by Shell and the preliminary fish habitat compensation plan 	<p>Aquatic Change Index</p> <p>Green – Low:</p> <ul style="list-style-type: none"> less than 10 times change in predicted median water quality concentrations compared to pre-development to the given time snapshot in any given season and/or few guideline exceedances expected. If all variables are assessed as low, no water quality or fishing opportunities management plan is needed at this time and is assessed by Fort McKay as no adverse impact. <p>Yellow - Moderate:</p> <ul style="list-style-type: none"> between 10 and 25 times change in predicted median mean water quality concentrations expected and/or aquatic life guideline exceedances at certain times of the year. Where aquatic life may be at risk, a watershed management and fishing opportunities management plan should be developed to establish impact limits and provide direction to development. Professional judgment is required to assess whether the impact is significant. <p>Red – High:</p> <ul style="list-style-type: none"> more than 25 times change in predicted median water quality concentrations and/or with guideline exceedances expected frequently; potential toxic effects related to mixtures of chemicals. Fishing opportunities are lost. A watershed management and fishing opportunities management plan is needed to establish impact limits, and provide direction to development. A significant adverse impact is likely to be the result. <p>Fish Health</p> <p>Professional judgment based on Aquatic Change Index and State of Surface Water as described above, plus other relevant factors</p> <p>Fishing Opportunities</p> <p>Professional judgment based on Fish health as described above, loss of fish habitat as described in Shell’s compensation plan, Community perspectives on effects to fishing opportunities, plus other relevant factors</p>

Component	Assessment Criteria	Green-Yellow-Red Rating ¹
Wildlife (Section 6.0)	Criteria and Numerical Scores Direction	Environmental Consequence
Upland Vegetation (Section 7.0)	<ul style="list-style-type: none"> • Positive • Neutral • Negative 	<ul style="list-style-type: none"> • Negligible — 0 to 5 (a green situation): generally associated with effects that are of negligible magnitude; or effects of low magnitude, local in extent and reversible. • Low — 6 to 10 (a green situation): associated with effects of low magnitude that is reversible. • Moderate—11 to 15 (a yellow situation): associated with effects of moderate magnitude that are irreversible; or effects of low magnitude, that are local extent, irreversible and far future in duration; or effects of low magnitude, regional extent, irreversible, far future in duration. • High—>15 (a red situation); associated with effects of moderate magnitude, local in extent, far future in duration and irreversible; moderate magnitude, regional in extent, far future duration, irreversible and of medium frequency; high magnitude, local in extent, irreversible or partially reversible and long-term or far future in duration; high magnitude and regional in extent.
Wetland Vegetation (Section 7.0)	Magnitude	
Traditional Plants (Section 7.0)	<ul style="list-style-type: none"> • Negligible (<1% change): score = 0 • Low (<10% change): score = +5 • Moderate (10 to 20% change): score = +10 • High (>20% change): score = +15 	
Biodiversity (Section 8.0)	Geographic Extent <ul style="list-style-type: none"> • Local (within LSA): score = 0 • Regional (beyond LSA into FTSA): score = +1 • Beyond Regional (beyond FTSA): score = +2 Frequency <ul style="list-style-type: none"> • Low (occurs once): score = 0 • Medium (intermittent): score = +1 • High (continuous): score = +2 Duration <ul style="list-style-type: none"> • Short-term (< 3 years): score = 0 • Medium-term (3 to 10 years): score = +1 • Long-term (10-20 years): score = +2 • Far-future (one to several generations): score +3 Reversibility <ul style="list-style-type: none"> • Irreversible (occurs once): score = +3 • Reversible (intermittent): score = -3 • Partially reversible (continuous): score = 0 	
Disturbance and Access (Section 9.0)	<ul style="list-style-type: none"> • Qualitative assessment 	Professional judgment assessment based on location and magnitude of disturbance in relation to Fort McKay’s key traditional use areas and resources, effects on access and Community concerns.
Reclamation (Section 10.0)	<ul style="list-style-type: none"> • Area disturbed and reclaimed over time 	Professional judgment assessment based on scientific\technical uncertainties associated with reclamation, specific Community concerns and loss of traditional use opportunities, and project-specific data.

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