Ivanhoe Energy

APPLICATION FOR APPROVAL OF THE TAMARACK INTEGRATED OIL SANDS PROJECT

VOLUME 6: SUPPLEMENTAL INFORMATION REQUEST #3

Submitted to:

Energy Resources Conservation Board

and

Alberta Environment

Submitted by:

Ivanhoe Energy Inc.
Calgary, Alberta

November 2012

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VIA COURIER

December 3, 2012

Mr. Salim Jagirdhar
Energy Resources Conservation Board
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Calgary, AB T2P 0R4

Ms. Jolene Shannon
Alberta Environment & Sustainable Resource Development
Room #111, 4999 – 98th Avenue
Edmonton, AB T6B 2X3

Dear Mr. Jagirdhar and Ms. Shannon:

Re: Supplemental Information Request for the Integrated Application for the Ivanhoe Tamarack Project, ERCB Application No. 1665921 and EPEA Application No. 001-267615

In support of the application filed with the Alberta Energy Resources Conservation Board (ERCB) and Alberta Environment (now Alberta Environment & Sustainable & Resource Development (ESRD)) on October 29, 2010, Volume 6 – Supplemental Information Request #3 (SIR #3) is hereby submitted to address the combined ERCB and ESRD Supplemental Information Request letter dated October 15, 2012.

Correspondence regarding the Integrated Application and the EIA should be directed to:

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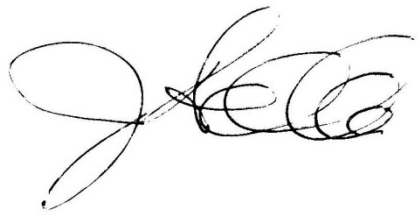
Yours truly,

Ivanhoe Energy Inc.



Jeremy Hrdlicka
Director, Regulatory, HS&E

Encl.

Preamble

This document, identified as *Volume 6 – Supplemental Information Request #3*, forms part of the application submitted by Ivanhoe Energy Inc. (Ivanhoe) to the Alberta Energy Resources Conservation Board (ERCB) and to Alberta Environment and Sustainable Resource Development (AENV) for approval of the Tamarack Integrated Oil Sands Project.

Pending approval, Ivanhoe plans to build and operate the Tamarack Integrated Oil Sands Project. ERCB Application No. 1665921 and *Environmental Protection and Enhancement Act* (EPEA) Application No. 001-267615 were submitted for approval on 29 October 2010. The application documents (in three volumes of hard copy and in CD format) were also made available for public review and commentary.

The ERCB and AENV completed a review of the Tamarack Integrated Oil Sands Project application and on 15 October 2012, the ERCB issued a third combined Supplemental Information Request (SIR) to Ivanhoe. The SIR contains 27 supplemental questions and included combined requests from the ERCB, AENV and interested Federal Regulators.

Volume 6 is organized as follows:

- Final ERCB/AENV SIR is the Supplemental Information Request issued on 15 October 2012;
- ERCB and AENV provide Ivanhoe responses to the 27 information requests; information is provided in the same numerical sequence as the questions posed in the SIR; and
- appendices provide additional information to support specific SIR responses as well as additional information requests from the ERCB.

Table of Contents

Table of Contents (cont)

PAGE

LIST OF TABLES

Table of Contents (cont)

PAGE

LIST OF FIGURES

Table of Contents (cont)

PAGE

LIST OF APPENDICES

Glossary, Acronyms and Abbreviations

%	Percent
µg	Microgram (one one-thousandth of a gram)
µg/g	Micrograms per gram
µg/m^3	Micrograms per cubic metre
<	Less than
>	More than
°C	Degrees Celsius
AAAQO	Alberta Ambient Air Quality Objectives
AAAQO	Ambient Air Quality Objective
AADT	Annual Average Daily Traffic
AAFRD	Alberta Agriculture Food and Rural Development
ACFN	Athabasca Chipewyan First Nation
ADMF	Acid Deposition Management Framework
Admixing	The mechanical mixing of discrete layers of soil during stripping and salvage operations.
Adverse effect	An undesirable or harmful effect to an organism (human or animal), indicated by some result such as mortality, altered food consumption, altered body and organ weights, altered enzyme concentrations or visible pathological changes.
AENV	Alberta Environment and Sustainable Resource Development
AGRASID	Agricultural Region of Alberta Soil Inventory Database
Al-Pac	Alberta-Pacific Forest Industries Inc.
ALSA	Aquatics Local Study Area
Ambient air	The air in the surrounding atmosphere.
Amendment, soil	An alteration of the properties of a soil by adding substances such as lime, gypsum and sawdust to make the soil more suitable for the growth of plants. Fertilizers constitute a special group of soil amendments.
Anthropogenic	Man-made
AOSERP	Alberta Oil Sands Environmental Research Program
API	American Petroleum Institute

AQ	Air Quality
AQLSA	Air Quality Local Study Area
AQRSA	Air Quality Regional Study Area
Aquifer	Any water-saturated body of geological material from which enough water can be drawn at a reasonable cost for the purpose required. A common usage of the term aquifer is to indicate the water-bearing material in any area from which water is most easily extracted.
Aquifer Test	A method of obtaining quantitative information on the hydraulic characteristics of an aquifer by removing water from the aquifer in a controlled manner and measuring the groundwater surface or piezometric response. Often referred to as a pump test or drawdown test.
Aquitard	A material of intermediate permeability between an aquifer and an aquiclude. An aquitard allows some measure of leakage between the aquifers it separates.
ARSA	Aquatics Regional Study Area
ASDT	Average Summer Daily Traffic
ASRD	Alberta Sustainable Resource Development
ASWQG	Surface Water Quality Guidelines for use in Alberta
AT	Alberta Transportation
ATSDR	Agency for Toxic Substances and Disease Registry
Attenuation	A reduction in sound level that occurs with sound propagation over distance by means of physical dissipation or absorption mechanisms, or a reduction in sound level that occurs by means of noise control measures applied to a sound source.
avg.	Average
A-Weighted Level or dBA	A measurement of overall sound pressure level that accounts for the frequency content of the measured sound assessed with a frequency response similar to that of the human ear.
Background	An area not influenced by chemicals or noise released from the site under evaluation.
Background Concentration (environmental)	The concentration of a chemical in a defined control area during a fixed period of time before, during or after a data-gathering operation.
BAF	Bio-accumulation Factors
Baseline	A surveyed condition, which serves as a reference point to which later surveys are coordinated or correlated.
Basic Sound Level	The allowable sound level at a residential location, as defined by the ERCB directive, with the inclusion of industrial presence based on dwelling unit density and proximity to transportation noise sources.
bbls	Barrels

bbls/d	Barrels per day
BC	Base cation
BCF	Bioconcentration Factor
Bedrock	The body of rock that underlies the gravel, soil or other superficial material.
Benthic invertebrates	Organisms that live at the bottom of lakes, ponds or streams.
Benzene	A colourless, liquid, flammable, aromatic hydrocarbon that boils at 80.1ºC and freezes at 5.4-5.5ºC. It is used to manufacture styrene and phenol.
BFW	Boiler feed water
Bioaccumulation	A general term, meaning that an organism stores within its body, a higher concentration of a substance than is found in the environment. This is not necessarily harmful. Many toxicants, such as arsenic, can be handled and excreted by aquatic organisms, so that they are not included among the dangerous bioaccumulative substances.
Bioconcentration	A process in which an organism receives a net accumulation of a chemical as a result of direct exposure to the chemical.
Bitumen	Extra heavy crude oil, generally more dense than 14ºAPI.
BMA	Basal McMurray Aquifer
BMR	Birch Mountain Resources Ltd.
BTEX	Benzene, Toluene, Ethylbenzene, Xylene
BTU	British Thermal Unit
C&R	Conservation and Reclamation
CAC	Criteria Air Contaminant
$CaCl_2$	Calcium chloride
$CaCO_3$	Calcium carbonate
CAESA	Canada-Alberta Environmentally Sustainable Agriculture Agreement
CALMET	California Meteorological Model. Used to process meteorological data for input into the CALPUFF model.
CALPUFF	California Puff model, used to estimate ambient concentrations of substances in air and deposition of those substances (e.g., acid deposition).
CAPP	Canadian Association of Petroleum Producers
CARB	California Air Resources Board
Carcinogen	An agent that is reactive or toxic enough to directly cause cancer.
CCME	Canadian Council of Ministers of the Environment

CCS	Carbon Capture and Storage
CCV	Critical Chemical Values
CDF	Commercial Demonstration Facility
CDWQ	Canadian Drinking Water Quality
CDWQG	Guidelines for Canadian Drinking Water Quality
CEA	Cumulative Effects Assessment
CEMA	Cumulative Environmental Management Association
CEPA	Canadian *Environmental Protection Act*
CEQG	Canadian Environmental Quality Guidelines
CHA	Cardiac Hospital Admission
Chronic exposure	A relatively long duration of time (Health Canada considers periods of human exposure greater than 3 months to be chronic while the U.S. EPA only considers human exposures that are greater than seven years to be chronic).
cm	Centimetre
cm/s	Centimetres per second
cm^2	Square centimetre
CMAR	Clearwater Multi-Use Access Road
$cmol(+)kg^{-1}$	Centimole of positive charge per kilogram of soil.
CNRL	Canadian Natural Resources Ltd.
CNS	Central Nervous System
CO	Carbon Monoxide
CO_2	Carbon Dioxide
Concentration (Conc.)	Quantifiable amount of a chemical in environmental media.
COP	Code of Practice
COPC	Chemical of Potential Concern
COS	Carbonyl sulphide
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CPDFN	Chipewyan Prairie Déne First Nation
CPF	Central Processing Facility

CS_2	Carbon disulphide
CWS	Canada-Wide Standard
dam^3	Cubic decametre
dB and dBA	Decibel
Development Area	The area of sufficient bitumen resource delineation to permit appropriate development.
Devonian	A period of the Paleozoic era thought to have covered the span of time between 400 and 345 million years ago; also, the corresponding system of rocks.
DFO	Department of Fisheries and Oceans
Dilbit	Diluted bitumen
Diluent	Fluids used to reduce the viscosity (thickness) of heavy oils, such as bitumen based-crude oil, in order to thin them enough to transport through pipelines.
DO	Dissolved oxygen
Dose	A measure of integral exposure. Examples include (1) the amount of chemical ingested, (2) the amount of a chemical taken up, and (3) the product of ambient exposure concentration and the duration of the exposure.
Dose Rate	Dose per unit time, for example in mg/day, sometimes also called dosage. Dose rates are often expressed on a per-unit-body-weight basis, yielding units such as mg/kg body weight/day expressed as averages over a specified time period (e.g., a lifetime).
Dose-Response	The quantitative relationship between exposure of an organism to a chemical and the extent of the adverse effect resulting from that exposure.
Drawdown	Lowering of water level caused by pumping. Drawdown is measured for a given quantity of water pumped during a specified period, or after the pumping level has become constant.
DRU	Diluent Recovery Unit
dS/m	Decisiemens per metre
DTS	Distributed temperature sensors
EC	Electrical Conductivity
Effective Porosity	The percentage of the total volume of a given mass of soil or rock that consists of interconnecting voids.
EIA	Environmental Impact Assessment
ELC	Ecological Land Classification
elev.	Elevation
Environmental Impact Assessment	A review of the effects a proposed development will have on the local environment and the regional environment.

EPA	Environmental Protection Agency
EPEA	*Environmental Protection and Enhancement Act* (Alberta)
ERCB	Energy Resources Conservation Board
Erosion	The process by which material, such as rock or soil, is worn away or removed by wind or water.
ERP	Emergency Response Plan
ESD	Emergency Shutdown
Evapotranspiration	Combined term for water lost as vapour from the soil/water surface (evaporation) and water lost through plants (transpiration).
Exceedance	An emission or ambient concentration with a measured value that is greater than that allowed by government regulations.
Exposure	The contact between a chemical and a biological system or organism.
Exposure Concentration	The concentration of a chemical in its transport or carrier medium at the point of contact.
Exposure Limit	An estimate of the daily dose of chemical allowed over an entire lifetime, without experiencing adverse health effects, or with an acceptable degree of risk (for non-threshold chemicals) associated with exposures. Exposure limits are expressed in mg/kg body weight/day.
Exposure Pathway	The route by which a receptor comes into contact with a chemical or physical agent. Examples of exposure pathways include the ingestion of water, food and soil, the inhalation of air and dust, and dermal absorption.
FGD	Flue Gas Desulphurization
Flare	A device for disposing of combustible gases from refining or chemical processes by burning in the open.
FMFN	Fort McMurray First Nation
Fresh water	Water with a total dissolved solids concentration below 1 000 g/m^3.
FTF	Feedstock Test Facility
FWMIS	Fisheries and Wildlife Management Information System
g	Gram
g/GJ	grams/Gigajoule
GHG	Greenhouse Gas – a substance in air that may trap radiated heat from Earth, thereby increasing ambient temperatures.
GIS	Geographic Information System
GJ or Gj	Gigajoule (10^9 Joules)

GJ/d or Gj/d	Gigajoule per day
GJ/hr or Gj/hr	Gigajoule per hour
Glaciofluvial	Sediments or landforms produced by meltwaters originating from a glacier or ice sheet.
Gleysolic Soil	A great group of soils in the Gleysolic order. A Gleysolic soil is characterized by the presence of a gleyed horizon (e.g., Bg, Btg) formed by intermittent contact with the water table.
GPS	Global Positioning System
Groundwater	Subsurface water that occurs beneath the water table in soils and geological formations (in the pores/voids within rocks both unconsolidated and consolidated) that are fully saturated. It is the water within the Earth that supplies water wells and springs.
Groundwater Flow Model	A simplified representation of one or more groundwater flow systems. In the present report, a numerical groundwater flow model is used to represent the groundwater flow systems in the regional study area.
H or hr	Hour
H^+	Hydrogen Ion
H_2S	Hydrogen sulphide
ha	Hectare
Habitat	The part of the physical environment in which a plant or animal lives.
Habitat Suitability Index	A model system that integrates the important ecological parameters (food availability, nesting/den requirements, responses to disturbances, etc.) for a wildlife species to allow for an evaluation of baseline conditions and project effects.
HC	Health Canada
HHRA	Human Health Risk Assessment
Historical Resource	A work of nature or by humans, valued for its palaeontological, archaeological, prehistoric, historic, cultural, natural, scientific or aesthetic interest.
Historical Resources Impact Assessment	A review of the effects a proposed development will have on the local and regional historic and prehistoric heritage of an area.
HP	High Pressure
HQ	Hazard Quotient
HRSA	Hydrogeology Regional Study Area
HTL™	Heavy-to-Light
Human Health Risk Assessment	The process of defining and quantifying risks and determining the acceptability of those risks to human life.

Hydraulic Conductivity	A coefficient "k" depends on the physical properties of geological formation and fluid. It describes the ease with which a fluid flows through a porous material. "k" is the rate of flow per unit cross-sectional area under the influence of a unit gradient and has the dimension of: $Length^3/Length^2$ x Time or Length/Time (e.g., m/s) but should not be confused with velocity.
Hydraulic Gradient	The change in groundwater elevation per unit of distance in a given direction. If not specified, the direction generally is understood to be that of the maximum rate of decrease in head. This coefficient is dimensionless.
Hydraulic Head	A measure of the potential energy of a fluid. For groundwater, the hydraulic head at a specific point is the level to which groundwater will rise above a fixed datum (usually sea level) in an observation well.
Hydrogeology	The science that relates to groundwater. Groundwater, as used here, includes all water in the zone of saturation beneath the earth's surface, except water chemically combined in minerals.
Hz	Hertz
IARC	International Agency for Research and Cancer
ID	Interim directive
IDA	Initial Development Area
ILCR	Incremental Lifetime Cancer Risk
Infiltration	The flow or movement of precipitation or surface water through the ground surface into the ground. Infiltration is the main factor in recharging groundwater reserves.
Invertebrate	An animal without a backbone and internal skeleton.
IOR	Imperial Oil Resources
IRC	Industry Relations Corporation
IRIS	Integrated Risk Information System
JSA	Job Safety Analysis
k	Thousand
KB	Kelly bushing
keq	Kilogram equivalent – equal to 1 kmol of hydrogen ion (H+)
keq/ha/yr	Kiloequivalent per hectares per year
kg	Kilogram
kg/d	Kilograms per day
kg/ha	Kilograms per hectare
kg/ha/yr	Kilograms per hectare per year

kg/hr	Kilograms per hour
kg/sd	Kilograms per stream day
kJ/kWh	Kilojoules per kilowatt hour
km	Kilometre
km^2	Square kilometre
kPa	Kilopascal
L or l	Litre
L/kg	Litres per kilogram
L/min	Litres per minute
Land Capability Classification	A system of classifying a soil's capability to sustain a commercial forest.
LARP	Lower Athabasca Regional Plan
LCCS	Land Capability Classification
L_{eq}	Energy Equivalent Sound Level
LFH	Leaf-Fibre-Humic Substances; a soil horizon
Lithology	A term usually used to describe the composition and texture of sediments and rocks.
LOAEL	Lowest Observed Adverse Effect Level
LOC	License of Occupation
LP	Low Pressure
LSA	Local Study Area
m	Metre
M	Mega (SI prefix)
m/m	Metres/metre
m/s	Metres per second
m/yr	Metres per year
m^2	Square metre
m^3	Cubic metre
m^3/d	Cubic metres per day
m^3/s	Cubic metres per second

masl	Metres Above Sea Level
max	Maximum
mbgs	Metres below ground surface
MCFN	Mikisew Cree First Nation
mD	MilliDarcies
MD	Measured depth
MDL	Method Detection Limit
mg	Milligrams
mg/d	Milligrams per day
mg/kg/d	Milligrams per kilograms body weight per day
mg/L	Milligrams per litre
mg/m^3	Milligrams per cubic metre
mg/Nm^3	Milligrams per normal cubic metre
min	Minimum
mm	Millimetre
MNA	Métis Nation of Alberta
Model Calibration	The trial-and-error process of matching the hydraulic heads and groundwater flows in a numerical groundwater flow model with observed values. An acceptable model calibration depends on the intended use of the numerical model.
Modelling	A simplified representation of a relationship or system of relationships. Modelling involves calculation techniques used to make quantitative estimates of an output parameter based on its relationship to input parameters. The input parameters influence the value of the output parameters.
MOP	Maximum Operating Pressure
MPOI	Maximum Point of Impingement
mS/cm	Millisiemens per centimetre
MSL	Mineral Surface Lease
MW	Megawatt
MWD	Measurement while drilling
N	Nitrogen
N.D.	No data

N/A (or n/a)	Not applicable
n/d	Not detected
NH_4	Ammonia (particle)
NIA	Noise Impact Assessment
NO	Nitric oxide (gas)
NO_2	Nitrogen dioxide (gas)
NO_3	Nitrate (particle)
NO_3/NO_2	Nitrate/nitrite
NOAEL	No-Observable-Adverse-Effect-Level
NOEC	No Observed Effect Concentration
Noncarcinogen	A chemical that does not cause cancer and has a threshold concentration.
NO_X	Gaseous oxides of nitrogen (NO, NO_2) or all nitrogen species (e.g., NO_X, N_2O, N_3O).
O_3	Ozone
OBIP	Original Bitumen in Place
Oil Sands (or Oilsands)	An unconsolidated, porous sand formation or sandstone containing or impregnated with petroleum or hydrocarbons.
OLM	Ozone Limiting Method
Organics	Chemical compounds, naturally occurring or otherwise, which contain carbon, with the exception of carbon dioxide (CO_2) and carbonates (e.g., $CaCO_3$).
OSDG	Oil Sands Developers Group
OSE	Oil Sands Exploration
Overburden	1. Any loose material that overlies bedrock (often used as a synonym for Quaternary sediments and/or surficial deposits). 2. Any barren material, consolidated or loose, that overlies an ore body.
PAHs	Polycyclic Aromatic Hydrocarbons
PAI	Potential Acid Input
Particulate Matter	May be relatively large and derived from crustal sources such as road dust (>10 μm), or relatively small and derived from combustion sources (both natural and anthropogenic; 2.5 to 10 μm), or may be derived through reactions in the atmosphere (secondary particulates; <2.5 μm).
PDA	Pre-disturbance Assessment
PDC	Planned Development Case

Permeability	A physical property of a porous medium. Permeability has dimensions of Length^2. When measured in cm^2, the value of permeability is very small, therefore, more practical units – darcy (D) or millidarcy (mD) – are commonly used.
Permissible Sound Level	The allowable overall A-weighted sound level of noise from energy industry sources, as specified by the ERCB Noise Control Directive, which may contribute to the sound environment of a residential location.
PFD	Process Flow Diagrams
pH	A measure of the acidity or alkalinity (based upon the concentration of the hydrogen ion) of a solution. The pH is expressed as the negative logarithm of hydrogen ion concentration.
Phie	Effective porosity
Phreatic Surface	Synonymous with unconfined groundwater surface.
Physiography	Synonymous with geomorphology.
Piezometer	An instrument for measuring fluid pressure.
Piezometric Surface	An imaginary surface that everywhere coincides with the static level of the water in the aquifer. The surface to which the water from a given aquifer will rise under its full head.
PM	Particulate Matter
PM_{10}	Particulate matter, with particles nominally smaller than 10 μm in diameter.
$PM_{2.5}$	Particulate matter, fine fraction (particles less than 2.5 μm in diameter).
Polycyclic Aromatic Hydrocarbons	Chemical by-products of petroleum. Aromatics are considered to be highly toxic components of petroleum products. PAHs are comprised of at least two fused benzene rings, many of which are potential carcinogens. Toxicity increases along with molecular size and degree of alkylation of the aromatic nucleus.
Potential Acid Input	A measure of the total deposition of acidifying substances (including sulphur dioxide, nitrogen oxides, ammonium and base cations).
ppb	Parts per billion
ppm	Parts per million
PSL	Permissible Sound Level
Q	Quarter (i.e., three months of a year)
QA/QC	Quality Assurance/Quality Control
RAMP	Regional Aquatics Monitoring Program
RCMP	Royal Canadian Mounted Police
Receptor	The person or organism subjected to chemical exposure.

Recharge	Water added to the saturated zone from any source. This term is commonly combined with other terms to indicate some specific mode of recharge, such as recharge well, recharge area or artificial recharge.
Reclamation	The process of stabilizing and returning disturbed land to a natural state of equivalent or better capability.
Reference Value	The maximum acceptable dose (per unit body weight and unit of time) of a chemical to which a specified receptor can be exposed, assuming a specified risk (e.g., one in one hundred thousand). May be expressed as a reference dose (RfD) for threshold-response chemicals or as a risk-specific dose (RsD) for non-threshold response chemicals.
Regional Langrangian Acid Deposition Model	A model used to estimate acid deposition (as PAI).
REL	Reference Exposure Level
RELAD	Regional Langrangian Acid Deposition Model
RfC	Reference Concentration
RfD	Reference Dose
RFMA	Registered Fur Management Area
RHA	Respiratory Hospital Admissions
RIC	Resource Inventory Committee
RID	Regional Integrated Decision
Risk	The likelihood or probability that the toxic effects associated with a chemical will be produced in populations of individuals under their actual conditions of exposure. Risk is usually expressed as the probability of occurrence of an adverse effect, i.e., the expected ratio between the number of individuals who would experience an adverse effect at a given time and the total number of individuals exposed to the factor. Risk is expressed as a fraction without units and takes values from 0 (absolute certainty that there is no risk, which can never be shown) to 1.0, where there is absolute certainty that a risk will occur.
Risk Assessment	The process whereby all available scientific information is brought together to produce a description of the nature and magnitude of the risk associated with exposure of human receptors to an environmental chemical.
Risk Specific Dose	The reference value determined for chemicals assumed to act as genotoxic (Risk Specific Dose), non-threshold carcinogens. An RsD is a function of carcinogenic potency (q1) and defined acceptable risk (i.e., q1 divide target level or risk, for example, the RsD for a lifetime cancer risk of one-in-one-million would be equal to q1 divided by $1x\ 10^6$).
Risk Specific Dose	The reference value determined for chemicals assumed to act as genotoxic, (risk-specific dose) non-threshold carcinogens. An RsD is a function of carcinogenic potency (q1) and defined acceptable risk (i.e., q1 divide target level or risk; for example, the RsD for a lifetime cancer risk of one-in-one-million would equal to q1 divided by $1x\ 10^6$).

Risk-Based Concentration	An exposure criterion that is based on the likelihood of an effect occurring.
RIVAD/ARM3	Regional Impact in Visibility and Acid Deposition/Acid Rain Mountain Mesocale Model
RIWG	Regional Issues Working Group
RMWB	Regional Municipality of Wood Buffalo
ROW	Right-of-way
RPD	Relative Percent Difference
RSA	Regional Study Area
RSC	Reduced Sulphur Compound
RsD	Risk Specific Dose
s	Second
SAGD	Steam Assisted Gravity Drainage
SAR	Species at Risk
SARA	*Species at Risk Act*
SCO	Synthetic Crude Oil
SD	Sustainability Department
Sec	Section
Seepage	1. Slow water movement in subsurface. 2. Flow of water from man-made retaining structures. 3. A spot or zone where water oozes from the ground, often forming the source of a small spring.
SEWG	Sustainable Ecosystems Working Group of the Cumulative Environmental Management Association (CEMA)
SIR	Supplementary Information Requests
SME	Surface Materials Exploration
SO_2	Sulphur dioxide
SOC	Statement of Concern
SOP	Standard Operating Procedure
SOR	Steam to Oil Ratio
Sound Power Level	A measurement of the acoustic energy of a sound source, which uses a logarithmic scale and which is normally calculated from sound pressure level measurements near the source.

SO_X	Oxides of sulphur
sp.	Species (singular)
spp.	Species (plural)
Stakeholder	People or organizations with an interest or share in an undertaking, such as a commercial venture.
STC	Sound Transmission Class
Steam Assisted Gravity Drainage	A process of extracting bitumen by injecting steam through a series of wells into a formation containing bitumen and recovering the released bitumen through a second set of wells.
STP	South Tailings Pond
Stratigraphy	The geological science concerned with the study of sedimentary rocks in terms of time and space.
t	Tonne
t/d	Tonne per day
t/e^3m^3	Tonnes per 1000 cubic metres
TC	Tolerable Concentration
TD	Total Depth
TDI	Tolerable Daily Intakes
TDS	Total Dissolved Solids, in water
TEF	Toxic Equivalency Factor
TEK	Traditional Ecological Knowledge
TKN	Total Kjeldahl Nitrogen
TLSA	Terrestrial Local Study Area
TLU	Traditional Land Use
TOC	Total Organic Carbon
Tonne	Metric ton (1 000 kg)
TOR	Terms of Reference
Total Suspended Solids	Particles suspended in water.
Toxic	A substance, dose, or a concentration that is harmful to a living organism.
Toxicity	The inherent potential or capacity of a material to cause adverse effects in a living organism.

TPH	Total Petroleum Hydrocarbon
TPM	Total Particulate Matter
Transmissivity	The product of the average coefficient of hydraulic conductivity (or permeability) and the thickness of the aquifer. Consequently, transmissivity is the rate of flow under a hydraulic gradient equal to unity through a cross section of unit width over the whole thickness of the aquifer. Transmissivity is designated by the symbol T and has the dimension of: Length^3/Time x Length or Length^2/Time (e.g., m^2/day)
TRSA	Terrestrial Regional Study Area
TRV	Toxicity Reference Value
TSS	Total Suspended Solids
TU	Traditional Use
TUS	Traditional Use Study
U.S.	United States of America
US EPA	United States Environmental Protection Agency
UN	Unnamed Creek
Uptake	The process by which a chemical crosses an absorption barrier and is absorbed into the body.
USGS	United States Geologic Survey
UWI	Unique Well Identifier
VEC	Valued Ecosystem Component
VOC	Volatile Organic Compound
Volatile Organic Compound	A class of organic chemicals that volatilize under ambient conditions. May be of natural or anthropogenic origin.
VRU	Vapour Recovery Unit
WBEA	Wood Buffalo Environmental Association
WHO	World Health Organization
WMU	Wildlife Management Unit
WCSS	Western Canadian Spill Service
WSC	Water Survey of Canada
yr	Year

Ivanhoe Energy

Final ERCB/AENV
Supplemental Information Request #3

Ivanhoe Energy Inc. (Ivanhoe)
Tamarack Integrated Oil Sands Project
Supplemental Information Request
EPEA Application No. 001-267615
ERCB Application No.1665921
October 15, 2012

Table of Contents

1. Acronyms used in this Supplemental Information Request

The following acronyms are used in this Supplemental Information Request.

AAAQO Alberta Ambient Air Quality Objectives
AQRSA Air Quality Regional Study Area
BATEA Best available technology economically achievable
CMAR Clearwater Multiuse Access Road
CO_2e Carbon Dioxide equivalents
CPF Central Processing Facility
FGD Flue Gas Desulphurization
GHG Greenhouse Gas
HTL Heavy-to-Light
NO_x Nitrogen oxides
PAH Polycyclic Aromatic Hydrocarbons
PDA Pre-disturbance Assessment
VOC Volatile Organic Compound

2. ERCB Commercial Application

The responses to questions in this ERCB section will not be considered as part of the EIA completeness decision made by Alberta Environment and Sustainable Resource Development.

2.1 General

1) Provide an update on the status of stakeholder (public and industry) notification and consultation respecting the subject application, including a discussion on any outstanding concerns or objections respecting the subject application and the efforts to resolve them. The stakeholder consultation update should address the outstanding objections from Suncor Energy Inc., Fort McMurray First Nation, Mikisew Cree First Nation, and the Regional Municipality of Wood Buffalo.

2.2 Geology

2) **Volume 5: Supplemental Information Request #2, Response # 6:** Ivanhoe has stated that it "*plans to postpone bitumen development within 100 m of faults affecting the Wabiskaw cap rock zones on the structural high.*" The faults shown in red in **Figure SIR2 F-18, Phase 1 Pattern, Pad, and SAGD Well Pairs Locations** illustrate Ivanhoe's interpretation of faults affecting the Wabiskaw caprock, the layout of the proposed subsurface drainage patterns, and the proposed well pairs.

a) Provide the rationale and supporting information for why a 100 metre stand-off distance from faulted areas is considered adequate to ensure fluid containment during the proposed SAGD operations. Considering the limitations of 2-D seismic data, the rationale should address how the extent of faulting can be accurately established based on available information.
b) Provide a discussion on the effect faulting may have on the ability of the Wabiskaw caprock to ensure fluid containment within the proposed pattern areas and any planned mitigations to address the potential increase in fluid containment risk due to the effects of faulting.
c) The proposed well pair placements shown in Figure SIR2 F-18 do not appear to have a 100 metre stand-off distance around fault features for Patterns B, G, and D. Provide the rationale for not including a stand-off distance around all proposed subsurface drainage patterns. Provide an updated map showing the proposed well placements which include a stand-off distance around fault features as necessary.
d) Provide a discussion on the resource recovery implications associated with utilizing a stand-off distance greater than 100 metres.
e) Provide a discussion on the impact postponing bitumen development in Pattern G until the end of Phase 1 will have on the risk to reservoir fluid containment compared to operating Pattern G concurrently with the offsetting patterns.

3) Provide the methodology used to determine the length and direction of faults seen in Figure SIR2 F-18. Considering the limitations of 2-D seismic, provide a discussion on the potential that the faults may be longer or may be orientated in different directions than interpreted.

4) Discuss the potential that additional faulting may exist within the proposed development area that was not identified by the 2-D seismic data.

5) **Volume 5: Supplemental Information Request #2, Response # 6; Figure SIR2 F-14, Devonian Structure Map; Figure SIR2 F-17, Depth Structure Map Top Wabiskaw B:** Ivanhoe has identified a geological feature in Pattern G. Ivanhoe states "*A structural high exists in the southern portion of Section 26 and northern portion of Section 23. This structural high formed after the Clearwater Formation was deposited in an approximately 25 ha-sized area centered near the 1AA/03-26-090-09W4/0 well. This structure contains 22 m of relief at the Wabiskaw B cap rock level (Appendix SIR2 F, Figure SIR2 F-17). This late forming feature may have been caused by rotational movement along a deep seated basement fault that branched upward into the Paleozoic and Cretaceous section as a flower structure, however, this cannot be confirmed with the existing well and seismic data. The Wabiskaw B cap rock is faulted in several places on this high, however, the faults at this level have minor offsets with shale on shale contact across the faults.*"

a) Considering that flower structures are related to strike-slip faulting, provide a discussion on the following:

i) Whether the geological feature is related to strike-slip faulting and the extent

of strike-slip faulting within the proposed project area.
ii) Whether strike-slip faulting of the Wabiskaw caprock has occurred within the proposed project area and, if so, the effect it has had on caprock integrity.
iii) The ability to identify the extent of fault offsets with 2-D seismic.

b) Considering that splay faults in a flower structure begin and end at the fault that stems them, provide a discussion on whether the faulting shown in Pattern G are splay faults and discuss the potential that the faults may extend further north and south into Patterns A and D.
c) Discuss how the uncertainty that the structural high in Section 26 is a flower structure impacts the caprock integrity assessment in Section 26.

2.2 Hydrogeology

6) **Volume 5: Supplemental Information Request #2, Response # 17 (d):** Ivanhoe stated the Basal McMurray aquifer is no longer being pursued as a water source and an off-lease water source will be investigated instead. The preferred and alternate water source(s) for the proposed project must be identified and discussed in the subject application to support an assessment of the proposed project.

a) Identify each water source Ivanhoe has investigated (including the Basal McMurray) and provide details on why each of these sources were, or were not, selected. Clearly identify the water source(s) Ivanhoe intends to use for the proposed project.
b) Identify if the investigated water source(s) are non-saline or saline (as defined by the Water Act), supported by a laboratory water analysis of the identified water source(s). If a groundwater source is pursued, provide the formation name, aquifer elevation (top and bottom), and location of source well(s).

2.3 Reservoir Engineering

7) **Volume 5: Supplemental Information Request #2, Appendix SIR2 A: Supplemental ERCB Question 4.** Ivanhoe stated that it "*plans to hold development of the Pattern G until the end of Phase 1*." Ivanhoe further stated that "*the approval for development of Pattern G is expected once information from the data monitoring in the area is available and reviewed with the Energy Resources Conservation Board (ERCB).*" Confirm that Ivanhoe is not requesting approval for the development of Pattern G as part of the subject application and that Ivanhoe will submit a subsequent application requesting approval to drill and operate Pattern G.

2.4 Geotechnical Analysis

8) **Volume 5: Supplemental Information Request# 2, Response # 27 a & b:** Ivanhoe discussed the stability assessment of profile sections K2-K2' and L-L' based on the original design and Suncor's 2011 South Tailings Pond Performance Report. Ivanhoe stated "*The design value of 0.6 corresponds with a 1.5 Factor of Safety. The 2011*

actual values ranged from 0.06 to 0.46. Based on our updated stability analysis, the value of 0.46 corresponds with a 1.7 factor of safety. The lowest (deepest) portion of the critical failure surface was at an elevation of 320 m., within the Clearwater formation."

a) Show on a map the location of the profile sections K2-K2' and L-L'.
b) Provide the slope stability analysis results. The analysis results should show the analysis method, geological models (profiles), strength and pore pressure parameters, critical slip surfaces, and factor of safety.
c) Provide the stability analysis results for the condition of maximum excess pore pressure in the Clearwater Formation that can trigger instability.

2.5 Facilities

9) **Volume 5: Supplemental Information Request# 2, Response # 17d:** In response to the request to provide an update on the selection of a water source for the proposed project, Ivanhoe stated that it is "*pursuing other off-lease water sources*" and that it "*is not in a position to provide any updates at this time.*" A viable water source is a critical component to the design of any thermal in situ facility which requires make-up water for steam generation.

   Provide details of the facility design associated with the water source(s) that will be used as make-up water for the proposed project. Details are to include:

   a) Any equipment that will be added to the central processing facility to accommodate the water source. Provide an updated process flow diagram(s) and plot plan detailing the additional equipment.
   b) Updated water balances based on the finalized water source(s).
   c) A discussion regarding the minimum produced water recycle rate that will be achieved at the proposed project. The discussion is to include the number of months, from start-up, required to achieve the minimum produced water recycle.

10) **Volume 5: Supplemental Information Request # 2, Response # 30c:** Ivanhoe stated that "*the produced gas to the Project is less than 1 t/d… therefore, Interim Directive 2001-03 does not apply to the Project.*" For Other Upstream Petroleum Industry Facilities, *ID 2001-03* states that sulphur recovery requirements are to be "determined based on the sulphur content of flared or incinerated gas streams." Until such time when the calendar quarter-year daily average sulphur rate of produced and sour gas streams flared and used as fuel at the central processing facility reaches one tonne per day, confirm that sulphur recovery at the proposed facility will not be less than set out in Table 1 of *ID 2001-03.*

2.6 Environment

11) **Volume 5: Supplemental Information Request# 2, Response # 32.** Ivanhoe indicated that aerial reconnaissance and ground investigations were completed in May 2012 to confirm separation distances between watercourses and proposed well pads. From these investigations Ivanhoe determined: a) no channel diversions were necessary for the project and b) watercourses were reclassified. The project update does not describe methods used for the ground investigations. Describe the site assessments, including ground investigations, that were completed in May 2012 to determine minimum setback distances used in Volume 5.

12) **Volume 5: Supplemental Information Request#2, SIR2Table PU-1 Minimum and Average Distances of Project from Watercourses.** For the most part, unnamed tributaries previously identified in the application have now been reclassified as watercourses with "no defined channel." Table SIR2 PU-1 lists the minimum distance from the high water mark of nearest watercourses to adjusted well pads.

a) Describe the measurement method used to calculate the minimum setback distances identified in Table SIR2 PU-1.

b) Describe how the high water mark recorded for water bodies referenced in Table SIR2 PU-1 (e.g. low gradient fens) was determined.

13) **Volume 5: Supplemental Information Request# 2, Response # 32.** For the unnamed tributary adjacent to the proposed surface well pads 1, 2, and 3, Ivanhoe determined the drainage to not be a water body because no defined channel was present. Other unnamed tributaries within the proposed development area were also reclassified on that basis. The definition of water body applicable to the ERCB's *Directive 056* and to the Water Act is not limited to features with a "defined channel."

Identify equivalent mitigations, including engineered controls and spill response plans, proposed where wellheads and facilities equipment are unable to maintain a 100 metre setback distance from water bodies as defined by *Directive 056*. In addition to spills, plans for pollution control mitigations should address the potential for accidental releases at wellheads and pipelines.

3. Water

3.1 Hydrology

14) **Volume 5, Supplemental Information Request #2, Response 53, Pages AENV-36**
Ivanhoe has not satisfied the information requirements to confirm that the predicted runoff amounts are accurate and that the resulting increase in runoff apparent in the Unnamed Creek 2 (UN2) catchment as a result of the project will have no adverse

effects. Ivanhoe indicates that the annual runoff volumes will increase by between 33 and 39 percent in UN2 (Table SIR2 53-1) due to project-related changes to the landscape. This will translate into an increase in peak flows by some amount and thus potentially change the regimes of the streams in the catchment. Ivanhoe suggests that effects on the upland portion of the catchment will be benign due to the mild slopes and numerous beaver dams (provided these are not removed). However, there remains significant concern regarding the steeply sloped channel that extends down the so-called escarpment leading to the Athabasca River.

Ivanhoe suggests that portion of the main stream channel is already armoured with relatively large bed material, as evident in Figure SIR2-53-1, and that this material should withstand the additional erosive power of the stream under the new hydrologic regime. The assumption that project impacts will be mitigated by beaver dams and self-armouring is not technically justified. This qualitative assessment is insufficient given the hydraulic techniques that are routinely applied to problems of this type. Given the lack of quantitative evidence, it is reasonable to believe that the channel has developed to some quasi-equilibrium condition and that the changes to the flow regime could cause either (i) degradation and thus promote bank instability or (ii) if the degradation is prevented by the existing armour layer bank erosion will accelerate thereby promoting instabilities as is evident in numerous case studies of similar situations.

a) Determine the potential increase in peak flows and assess the current and future stability of the bed along a salient typical reach of the outlet channel as it flows over the escarpment. This would require a profile and cross section survey, bed material sampling, and a hydraulic assessment of the stability of the bed material under the new hydrologic regime.

b) Develop and implement a monitoring plan that provides an ongoing assessment of the stability of the channel with the intent of mitigating instabilities should they occur. A reasonable approach would be to establish a number of cross sections at representative locations along the creek and monitor changes to these cross sections at two to three intervals. If it appears that the channel is stable after a period of say 10 years, discontinue the monitoring. If the channel appears to be changing, mitigate the changes using appropriate grade control or bank erosion techniques.

3.2 Aquatics

15) **Volume 5, Supplemental Information Request #2, Response # 33, Page AENV 1 :**

Ivanhoe states the majority of wellhead failures would be contained to the well pad but *There are conditions and events that could result in releases to the environment off-site, such as catastrophic failures or high pressure releases.* Ivanhoe revised the assessment of high pressure releases, downgrading the likelihood from possible to rare. However, in the response to a., Ivanhoe indicates that a rare event is one that is

highly unlikely but might occur under exceptional circumstances, where a possible event is described as *might occur at some time as there is a history of occurrence within industry.*

a) Clarify the distinction between wellhead failures, wellhead releases, well blowouts, catastrophic failures and high pressure releases.

b) Provide justification for the re-classification of high pressure releases given the criteria presented and history of occurrence of these releases in the in-situ industry.

16) **Volume 5, Supplemental Information Request #2, Response # 52, Page AENV-35 :**
Ivanhoe references the Project Update and ground investigations undertaken in May 2012. The Update describes a helicopter survey to assess permanence and channel development of the headwater streams located in proximity to proposed pad locations for the project; but, does not describe ground investigations.

a) Clarify whether these headwater channels were assessed on the ground or by helicopter.

b) Confirm how Ivanhoe will ground truth air survey information to ensure infrastructure is located away from local drainage with defined banks and channels.

17) **Volume 5, Supplemental Information Request #2, Response # 82 a and b, Page AENV-77**
Volume 5, Supplemental Information Request #2, Response # 59 b, Page AENV-48
Ivanhoe states based on the information available at this time *The proposed access road crosses the headwaters of Clarke Creek, a tributary to the Athabasca River.* Ivanhoe also states *Based on the analysis of aerial imagery the Clarke Creek crossings consist of ephemeral drainages with discontinuous channel development… Channels that are present are generally small (i.e., >5m).* Ivanhoe also states *All watercourses will be crossed using clear span bridge structures unless it is determined that there is no potential fish habitat present at the crossing location.*

a) Given data were not presented to characterize fish habitat and use in Clarke Creek provincial fisheries staff are challenged to understand the potential impacts of the project. Present all existing data and Traditional Ecological Knowledge available to characterize current and historical fish habitat and use.

b) Provide a data collection plan, schedule and target date to acquire and present the additional data required to assess fish habitat and use for submission to Alberta Environment and Sustainable Resource Development (ESRD) Fisheries and Lands staff in support of planned watercourse crossings. Clearly describe the criteria/methods Ivanhoe will use to determine that potential fish habitat is not present at crossing sites in preparation for meeting Schedule 4 1(1)(b)(i) & (e) of

the Code of Practice for Watercourse Crossings (2007) (note: beaver dams are not considered permanent or complete barriers to fish presence and use).

c) Discuss how forage fish presence and long-term maintenance and function of watercourse crossings will be considered for the lifetime of the crossing.

d) How will Ivanhoe ensure road grading and maintenance will not result in the deposit of road gravel and sediment into the channel?

18) **Volume 5, Supplemental Information Request #2, Response # 60, Page 49**
In response to the request for a discussion regarding long-term changes to aquatic biota in the watershed if bog and fen habitat cannot be reclaimed, Ivanhoe indicates *the watershed will be composed of more open water, marsh and swamp habitat in the long-term. In these modified habitats, the aquatic biota will be more diverse and abundant due to the wetter moisture regime and increased nutrients.*

a) Clarify the above statement discussing the different diversity levels and characteristics of aquatic flora and fauna in both a marsh and swamp habitat and a bog and fen habitat.

4. Terrestrial

4.1 Wildlife

19) **Volume 5, Supplemental Information Request #2, Response # 91a, Page AENV-113**
Ivanhoe indicates that seismic accounts for 89% of the regional linear disturbance (1.7 km^2 seismic/1.9 km of total disturbance). Despite the enormous contribution that seismic makes to linear disturbance in the region, Ivanhoe excludes their own project related seismic activities from their assessment of project effects stating they did not know at the time of submission that they were going to conduct seismic.

Ivanhoe also states they are not planning on conducting 3D or 4D seismic and will not assess the impacts of future seismic on wildlife.

Although it is reasonable that the precise location of seismic is unknown at this time, it is unreasonable to assume that the project could be carried out in full without the use of seismic or to suggest that potential wildlife impacts of any future seismic should not be assessed.

a) Provide an assessment of the likely effects of any future seismic activity on fish and wildlife. Base the assessment on a model developed from known seismic footprints from other in-situ projects in the region. Use these data to predict the seismic footprint expected at maximum build-out and complete the assessment of effects of fish and wildlife.

b) Provide the data used to support the assessment, including the seismic densities for each project, the length of time each project has been in operation, a description of the extent of development at each site, a map indicating the location of the various projects, the assumptions within the model and any other details needed to explain the data set and model used to make predictions for the Tamarack project.

20) **Volume 5, Supplemental Information Request #2, Response # 82, Page AENV-75**
Ivanhoe states *Impacts to fisheries, aquatic resources and wildlife associated with the access road from the CMAR to the Project were not considered.* Ivanhoe then describes how roads may affect wildlife in a general way, however no specifics on the vegetation, wildlife habitat, or wildlife along the proposed project access route from the Clearwater Multi Access Road (CMAR) were provided as was done for the rest of the Local Study Area (LSA).

a) Provide the rationale (highlighting the biological rationale) for treating the proposed project access road corridor from CMAR with less specificity than the project development area in the Environmental Impact Assessment (EIA).

b) Provide a summary of all available data describing the baseline terrestrial resources, including vegetation classification, wildlife habitat, and wildlife occurrences along the proposed project access route from CMAR.

c) Provide a plan as to how and when Ivanhoe will gather the additional data necessary to describe the terrestrial resources along the project access corridor to at least the same level of detail as was done for the rest of the LSA. Include a description of how and when these data will be provided to ESRD.

d) Describe what bio-physical constraints Ivanhoe will respect/avoid when selecting the final access route into the Project Area from CMAR. Include the biological rationale for each constraint selected.

5. Health

21) **Volume 5, Supplemental Information Request #2, Response # 98a, Tables SIR 98-2 and 98-3, Pages AENV-125 and 126**
In Table SIR 98-1 Nitrous dioxide (NO_2) and Sulphur dioxide (SO_2) were included in the screening. Alberta Health (AH) guidance states (footnote page 21) “Criteria pollutants, if being emitted by a proposed project, will automatically screen on to all assessments and, consequently, would not go through a screening process.”

a) For the non-carcinogenic Chemicals of Potential Concern (COPC) chronic inhalation screening, include the Criteria pollutants as COPC and re-screen remaining chemicals. Include all chemicals which contribute 99% Cumulated Toxicity Potency in the Human Health Risk Assessment (HHRA).

In Table SIR 98-2, arsenic contributes 74% of the Total Toxicity Potency. As it contributes the majority of the total toxic potency, it should have been removed and added directly to the COPC list and the carcinogens screened again.

b) For the carcinogenic COPC chronic inhalation screening, include arsenic as COPC and re-screen the remaining chemicals. Include all chemicals which contribute 99% Cumulated Toxicity Potency in the HHRA.

22) **Volume 5, Supplemental Information Request #2, Response # 100a, Page AENV-136**

Ivanhoe states *Based on discussions with AHW, the screening methods for bioaccumulation and persistence have been recalculated based solely on K_{ow} and chemicals-specific half life. Emissions rates were not considered in the screening process. As result, five new chemicals were added to the original COPC list…* The details and methods used for this selection are not provided, nor are the Optimal Water Partition Coefficient (K_{ow}) and half life data used.

a) Provide details of the methodology and assumptions used to identify COPC for the multi-media assessment including the thresholds for each parameter which indicated the selection of a COPC, the agency methods used (e.g. US EPA, Environment Canada) with supporting literature citations.

b) In a table, provide all the chemicals considered in the multi-media screening, the K_{ow} and half life data with literature references and indicate clearly which chemical screened on and off and why.

c) Explain how the heavier polycyclic aromatic hydrocarbons (PAHs) many with log K_{ow} greater than 3.5 and 5 and half lives from hours to days were not included as COPC in the multi-media assessment.

23) **Volume 5, Supplemental Information Request #2, Response # 102a, Page AENV-138**

Ivanhoe states *See response to SIR2 98a. When using the unit risk in the screening process, naphthalene is screened out of the COPC list*. Naphthalene was screened off using the methods described in SIR response 98; however, as arsenic contributed over 70% of the total toxicity potency, it is required that arsenic be added directly as a COPC and the carcinogens be re-screened.

a) Ensure naphthalene is included as a carcinogen in the chronic inhalation screening of the carcinogenic chemicals.

24) **Volume 5, Supplemental Information Request #2, Appendix SIR2 K, Tables SIR2 K-1 to K-8, Pages 1 to 19**

Results were provided for three scenarios (Tables SIR2 K-1 to SIR2 K-8); however, four scenarios are discussed in the text (Baseline Case, Project Only, Application Case and Planned Development Case (PDC)). The Tables do not indicate which case belongs to which results. Results for the non-carcinogenic COPCs should include Hazard Quotient (HQ) results for the Baseline Case, Application Case and PDC. For

carcinogens, Incremental Lifetime Cancer Risk (ILCR) results are required for the project emissions only.

a) Confirm that the three sets of location results provide in Tables SIR2 K-3 to K-6 are for Baseline Case (rows 1-21), Application Case (rows 22-42), and PDC (rows 43 – 63); if this is incorrect clearly indicate which results apply to which case scenario.

b) Confirm that rows 22-42 in Tables SIR2 K-1, K-2, K-7, and K-8 are the ILCR results for Project emissions only; if this is incorrect clearly indicate which results apply to which case scenario.

25) **Volume 5, Supplemental Information Request #2, Appendix SIR2 K, Table SIR2 K-8, Pages 17 and 18**
Ivanhoe discusses results described as ILCR-A. There are no results labeled ILCR-A in Table SIR K-8.

a) Clearly identify the ILCR results for the Project–Only emissions for this COPC.

6. Errata

26) **Volume 5, SIR 111, Page AENV-148**
Ivanhoe calculated pond sizing requirements. The use of the term "storage time" in the last step of the calculation suggests that there will be flow through the runoff pond during the event and that all the inflow will be stored for only 26.9 hours. In fact, the storage time could be very much longer since there should be no outlet and water would only be pumped from the pond upon its reaching a certain quality. A more appropriate description of the 26.9 hours is that the pond provides 12 percent more capacity than would be required for the adopted design standard.

27) **Volume 5, Supplemental Information Request #2, Appendix SIR2 K, Page 1**
Ivanhoe states *The Project alone had lower total ILCR values i.e., 3.8 x 10^{-6}, with the berries ingestion exposure pathway being the most significant source of risk.* There is no Total ILCR in Table SIR2 K-1 equal to 3.8 x 10^{-6}; however, the ILRC for Berries Ingestion for the second (Maximum Point of Impingement (MPOI) listed in Table SIR2 K-1 is 3.8 x 10^{-6}.

Ivanhoe Energy

ERCB Responses
ERCB Application No. 1665921

ERCB Responses
ERCB Application No. 1665921

GENERAL

1. Provide an update on the status of stakeholder (public and industry) notification and consultation respecting the subject application, including a discussion on any outstanding concerns or objections respecting the subject application and the efforts to resolve them. The stakeholder consultation update should address the outstanding objections from Suncor Energy Inc., Fort McMurray First Nation, Mikisew Cree First Nation, and the Regional Municipality of Wood Buffalo.

Volume 5, SIR2 provided an overview of consultation up to 31 May 2012. Since that time, Ivanhoe has continued to execute the consultation plan outlined in the application, as well as the Strategy and Plan for the Consultation of First Nations and Métis Communities (06 April 2010) approved by AENV (the Aboriginal Consultation Plan).

Volume 5 of the application was filed with the ERCB and AENV on 29 June 2012. Ivanhoe distributed copies of the documents in paper and/or electronic form directly to the stakeholders identified in Table SIR3 1-1.

AENV accepted seven Statement of Concerns (SOCs) during the public notification process from the following parties:

- Athabasca Chipewyan First Nation (ACFN);
- Fort McKay First Nation (Fort McKay FN);
- Fort McMurray First Nation #468 (FMFN);
- Mikisew Cree First Nation (MCFN);
- Regional Municipality of Wood Buffalo (RMWB);
- Suncor Energy Inc. (Suncor); and
- Northland Forest Products Ltd. (Northland).

Ivanhoe continues to work with stakeholders to address outstanding concerns with the ultimate goal of mitigating them, where feasible and possible. Formal SOC responses have been provided directly to ACFN, Fort McKay FN, FMFN, and MCFN and copied to the regulators (e.g., AENV and ERCB). Ivanhoe has also already met or is scheduled to meet with these parties in order to review the SOC responses and to address any remaining concerns.

Ivanhoe continues to work directly with RMWB, Suncor and Northland to address their concerns.

Through the formal responses to the SOCs and through further discussions with stakeholders, Ivanhoe hopes to have all SOCs formally withdrawn in the near future.

Table SIR3 1-1: SIR2 Stakeholder Notifications

Community or Stakeholder Group	Community or Stakeholder	Date of Notification	Contact Type
Local Communities	Anzac	July 13, 2012	Letter
	Fort Chipewyan Community	July 16, 2012	Letter
	Regional Municipality of Wood Buffalo	July 17, 2012	Letter
Environmental Organizations	Pembina Institute	July 16, 2012	Letter
	Fort McMurray Environmental Association	July 13, 2012	Letter
	Toxic Watch Society of Alberta	July 16, 2012	Letter
Aboriginal Organizations	Northeast Aboriginal Business Association	July 16, 2012	Letter
	Wood Buffalo First Nations Elder's Society	July 16, 2012	Letter
	Nistawoyou Association Friendship Centre	July 16, 2012	Letter
Métis Organizations	Métis Local 125	July 16, 2012	Letter
	Métis Local 2020	July 16, 2012	Letter
	Willow Lake Métis Local 780	July 23, 2012	Letter
	Métis Local 1935	July 10, 2012	Letter
	Métis Nation of Alberta	July 17, 2012	Letter
	Chard Métis Local 214	July 23, 2012	Letter
	Conklin Métis Local 193	July 16, 2012	Letter
	Métis Nation of Alberta	July 17, 2012	Letter
	Fort McKay Métis Community formally Métis Local 63	July 17, 2012	Letter
Athabasca Chipewyan First Nation	Athabasca Chipewyan First Nation IRC	July 10, 2012	Letter
Chipewyan Prairie Déne First Nation	Chipewyan Prairie Déne First Nation IRC	July 10, 2012	Letter
Fort McMurray #468 First Nation	Fort McMurray #468 First Nation IRC	July 12, 2012	In Person
Fort McKay First Nation	Fort McKay Sustainability Department	July 11, 2012	In Person
Mikisew Cree First Nation	Mikisew Cree First Nation GIR	July 10, 2012	Letter
Surface and Mineral Disposition Holders	Northland Forest Products Ltd.	July 17, 2012	Letter
	Alberta-Pacific Forest Industries Inc.	July 23, 2012	Letter
	Minus Nine	July 17, 2012	Letter
	ATCO	July 16, 2012	Letter
	Hammerstone Corporation	July 16, 2012	Letter
	Enbridge Pipelines Inc.	July 23, 2012	Letter
Trappers	Bernice Cree	July 23, 2012	Letter
	Richard Golosky (Individual - RLRU)	July 23, 2012	Letter
	Doug Golosky (Individual - RLRU)	July 23, 2012	Letter

Community or Stakeholder Group	Community or Stakeholder	Date of Notification	Contact Type
Regional Initiatives	Wood Buffalo Environmental Association	July 17, 2012	Letter
	Cumulative Environmental Management Association	July 17, 2012	Letter
	Regional Aquatics Monitoring Program	July 31, 2012	Letter
	Oil Sands Developers Group	July 16, 2012	Letter
	Northern Lights Health Region	July 13, 2012	Letter
Trade Organizations	Fort McMurray Chamber of Commerce	July 16, 2012	Letter
Oil Sand Operators	Grizzly Oil Sand	July 31, 2012	Letter
	Imperial Oil	July 23, 2012	Letter
	Joslyn Energy Development Inc.	July 31, 2012	Letter
	Nexen Inc.	July 31, 2012	Letter
	E-T Energy	July 23, 2012	Letter
	Suncor Energy Inc.	July 20, 2012	Letter
	Laricina Energy	July 31, 2012	Letter
Recreational Organizations	McMurray Sno-Drifters Association)	July 16, 2012	Letter
	Wood Buffalo ATV Riders Club	July 16, 2012	Letter

Public Stakeholders

Regional Municipality of Wood Buffalo

Ivanhoe continues to work with RMWB to address its concerns and issues identified in its SOC filed on 10 February 2011. Ivanhoe has had frequent communication with the RMWB regarding its SOCs. Ivanhoe met with the RMWB on 05 September 2012 to specifically discuss and review the most recent draft of a Memorandum of Understanding that will manage any outstanding issues identified in RMWB SOCs.

Suncor Energy Inc.

Ivanhoe continues to engage with Suncor to address its concerns and issues identified in its SOC filed on 16 February 2011. Ivanhoe has had frequent communication with Suncor regarding its SOCs. Ivanhoe met with the Suncor on 08 June 2012 to specifically discuss and review the SOCs and provide reference to information in the application and subsequent SIR response filings that it believes mitigate the concerns identified. In addition, Ivanhoe provided an overview of its proposed Reservoir Monitoring Plan, which it believes will allow for effective response to any potential subsurface issues. During that meeting, it was agreed that Suncor's SOC 1 and 6 were answered satisfactorily. For the remaining SOCs (2 to 5), Suncor agreed to review the information and get back to Ivanhoe with specific concerns. On 07 September 2012, Ivanhoe provided Suncor with draft responses to the SOCs and requested comments back by 19 September 2012. This was extended to 28 September 2012, on request from Suncor. Ivanhoe has yet to receive response or comment from Suncor to that request.

Northland Forest Products

Ivanhoe continues to work with Northland to address its concerns and issues identified in its SOC, filed on 09 February 2011. Ivanhoe met with Northland on 23 October 2012 to specifically discuss and review the most recent draft of a Memorandum of Understanding that will manage any outstanding issues identified in Northland's SOC.

Registered Fur Management Area 1582

Ivanhoe continues to consult with and provide regulatory updates to RFMA Holder 1582, located within the terrestrial local study area (TLSA) of the Project.

Registered Fur Management Area 273

Ivanhoe continues to consult with and provide regulatory updates to RFMA Holder 273, located within the terrestrial regional study area (TRSA) of the Project. Ivanhoe met with the trapper in August 2012.

Registered Fur Management Area 2422

Ivanhoe continues to consult with and provide regulatory updates to RFMA Holder 2422, located within the TRSA of the Project. Ivanhoe met with the trapper in September 2012.

Registered Fur Management Area 2453

Ivanhoe is continuing to engage with the Fort McKay Sustainability Department on behalf of RFMA Holder 2543, located within the TRSA for the Project.

Aboriginal Communities

A detailed record of consultation with Aboriginal communities from June 2012 to September 2012 is provided in Appendix SIR3 A.

Athabasca Chipewyan First Nation

Ivanhoe continues to provide funding to the ACFN Industry Relations Corporation (IRC) for Membership at an associate level and provides copies of all records of contact to ACFN through the AENV bi-monthly reporting process.

Ivanhoe has had dialogue with ACFN's leadership over the last several months in an effort to address ACFN's SOCs. Ivanhoe is also scheduled to meet with ACFN IRC on 03 December 2012 to review and discuss Ivanhoe's formal response to ACFN SOCs.

ACFN is in the process of finalizing a traditional ecological knowledge (TEK) study for the Project. Once Ivanhoe receives a final copy of this report Ivanhoe will file it with the regulators for consideration in the regulatory process.

Ivanhoe continues to consult with ACFN to address its concerns and identified issues.

Chipewyan Prairie Déne First Nation

Ivanhoe continues to provide funding to the CPDFN IRC for membership at an associate level and provides copies all records of contact to CPDFN, through the AENV bi-monthly reporting process.

Fort McMurray First Nation #468

Ivanhoe is a member of the FMFN #468 IRC and provides copies of all records of contact to FMFN #468, through the AENV bimonthly reporting process.

Ivanhoe's Senior Management met with the leadership of FMFN #468 on 14 June 2012 at the FMFN #468 reserve.

Ivanhoe and FMFN #468 have met on an almost weekly basis since August 2012 in an effort to address FMFN #468's SOCs. These meetings and this dialogue has been guided by a "workbook" process recommended by FMFN #468 and supported by Ivanhoe.

Ivanhoe and FMFN #468 are currently working on a process to collect TEK information, in addition to the information collected previously, at the request of the FMFN #468. Once Ivanhoe receives a final copy of this report, Ivanhoe will file it with the regulators for consideration in the regulatory process.

Ivanhoe is working with FMFN #468 to arrange a meeting to review and discuss the formal responses to FMFN #468's SOCs. Ivanhoe will continue to consult with FMFN #468 to address its concerns and identified issues.

Fort McKay First Nation (includes Fort McKay Métis Community)

Ivanhoe continues to provide funding to the Fort McKay Sustainability Department and provides copies of all records of contact to Fort McKay, through the AENV bi-monthly reporting process.

Ivanhoe met with Fort McKay on 17 September 2012, 16 October 2012 and on 15 November 2012. The meetings in September and October provided Fort McKay the opportunity to review and discuss Ivanhoe's formal responses to the SOCs.

The meeting on 15 November 2012 allowed Fort McKay and Ivanhoe to establish a process to address any outstanding SOCs. Ivanhoe continues to work with Fort McKay throughout the remainder of 2012 with the goal of addressing all SOCs where possible.

Ivanhoe provided funding for Fort McKay's Community Consultation sessions in 2012 and received a final copy of the report from these sessions on 28 September 2012. At the request of Fort McKay, Ivanhoe will not be filing this report with the regulators.

Ivanhoe continues to consult with Fort McKay to address its concerns and identified issues.

Mikisew Cree First Nation

Ivanhoe continues to provide funding to the MCFN Government & Industry Relations Department (GIR) for membership at an associate level. Ivanhoe provides copies of all records of contact to MCFN, through the AENV bi-monthly reporting process.

As mentioned, Ivanhoe provided formal responses to the MCFN SOCs on 29 June 2012. On 18 July 2012, MCFN filed a formal Letter of Objection with the ERCB, with respect to the Tamarack Project.

Ivanhoe met with MCFN in June 2012 and October 2012. The June 2012 meeting was held with an Advisory Committee consisting of MCFN members and staff from the MCFN GIR. This meeting provided MCFN members with an overview of the Tamarack Project and allowed the opportunity for MCFN members to ask questions and provide input.

The meeting in October 2012 provided an opportunity for the leadership and senior staff of MCFN to meet with Senior Management of Ivanhoe to discuss the Project and to establish a process to address MCFN's SOCs. A follow-up meeting between the leadership of MCFN and Senior Management of Ivanhoe is scheduled to happen in early 2013.

MCFN has provided Ivanhoe with additional TEK information in the form of the report, "*Mikisew Cree First Nation Indigenous Knowledge and Use Report and Assessment, October 31, 2012"*. This information was provided to Ivanhoe on 01 November 2012 and forwarded to the ERCB and AENV on 07 November 2012 and 14 November 2012, respectively, for consideration in the regulatory process.

Ivanhoe is scheduled to meet with MCFN on 03 December 2012 to review and discuss the formal responses to MCFN's SOCs. Ivanhoe will continue to consult with MCFN to address its concerns and identified issues.

Fort McMurray Métis Local 1935 (Local 1935)

Ivanhoe continues to provide regulatory and project updates to Local 1935. Ivanhoe has attended and supported Local 1935 community events in September 2012.

Ivanhoe met with staff from Métis Local 1935 on 15 November 2012 to provide an update on the Project and the regulatory process.

Ivanhoe has also provided funding to Local 1935 to complete their "Mark of the Métis" TEK project. Ivanhoe was provided with a final copy of this report at a ceremony on 28 September 2012.

Ivanhoe continues to work with Local 1935 to address its concerns and issues.

Fort Chipewyan Métis Local 125 (Local 125)

Ivanhoe received correspondence from Métis Local 125 on 16 August 2012 requesting that Ivanhoe undertake consultation and negotiations with Métis Local 125 with regard to the Tamarack Project, including a map of the "deemed 160 km' circle of traditional territory identified by Métis Local 125. Ivanhoe responded on 27 August 2012 by letter and informed Métis Local 125 that Ivanhoe had consulted with Métis Local 125 by notifying them of all regulatory filings. To date, Métis Local 125 have not provided any information that would establish that members of the Métis Local 125 have in the past exercised or continue to exercise traditional uses in the area of the Tamarack Project. It was noted that the Tamarack Project is well outside the "deemed 160 km" circle of traditional territory. Ivanhoe has requested additional information on traditional land use, if available.

Ivanhoe met with Leadership and advisors of Métis Local 125 on 09 October 2012 to provide an overview of the Tamarack Project and to discuss the earlier correspondence. Ivanhoe agreed that it would continue to provide Métis Local 125 with regular project updates as it has to date.

On 19 November 2012, Ivanhoe was included on a correspondence from Métis Local 125 addressed to the Minster(s) of Aboriginal Affairs and Environment and Sustainable Resource Development regarding consultation.

GEOLOGY

2. Volume 5: Supplemental Information Request #2, Response #6: Ivanhoe has stated that it "*plans to postpone bitumen development within 100 m of faults affecting the Wabiskaw cap rock zones on the structural high.*" The faults shown in red in Figure SIR2 F-18, Phase 1 Pattern, Pad, and SAGD Well Pairs Locations illustrate Ivanhoe's interpretation of faults affecting the Wabiskaw caprock, the layout of the proposed subsurface drainage patterns, and the proposed well pairs.

a. Provide the rationale and supporting information for why a 100 metre stand-off distance from faulted areas is considered adequate to ensure fluid containment during the proposed SAGD operations. Considering the limitations of 2-D seismic data, the rationale should address how the extent of faulting can be accurately established based on available information.

The proposed 100 m stand-off distance provides for an offset of 250% of the distance to the midpoint of the inter-well-pair spacing for the proposed pattern development (80 m well spacing) and is expected to exceed the well drainage area and allow an adequate buffer from operations. The stand-off distance as proposed has been demonstrated to be effective at limiting the extent of pressure and thermal communication from geologic features in a similar operational and monitoring environment (i.e., Nexen Long Lake).

Extensive coupled reservoir and geomechanical modelling has been completed in the original application and subsequent SIRs. The modelling, in general, has shown that horizontal stresses increase in and adjacent to, the steam chamber over the well-pair life. During the first few years of steam chamber development, it was observed that stress decreases above and beside the steam chamber and shear stresses develop on the shoulder of the steam chamber.

The existing models show the stand-off distance from the faults ensures that the steam chamber at the end of the well life will be 50 m from the fault with the proposed 100 m stand-off. Given that the effective permeability of the McMurray, sand-to-water is about 1 mD at original conditions (confirmed from minifrac interpretation), the pressure leaks-off ahead of the steam chamber, thereby increasing pressure at the fault and reducing the pressure gradient. The spread of pressure causes the magnitude of the shearing effect at the localized pressure front from the developing steam chamber to be greatly reduced. Thus, the shear loading remaining is that associated with the shoulder of the steam chamber, which remains sufficiently offset from the fault at the end of life.

In addition, the increased pressure at the fault causes the effective normal stress on the fault to decrease. Since the orientation of the fault is close to vertical, the normal stress on the fault will be a horizontal stress. The modelling has confirmed that the horizontal stress increase will increase the total normal stress. This change is expected to counter the stress associated with the pressure increase such that the effective normal stress on the fault will actually increase. An increase in effective normal stress will increase the shear strength of the fault.

The above conclusions suggest that the proposed offset will be sufficient to keep the steam chamber a safe distance from the fault and avoid significant shear loading close to the fault.

The 2D seismic results support excellent resolution of small-scale faults, where they exist. A targeted 3D seismic is planned to provide further definition of the extent and orientation of the faults identified by existing 2D seismic. The 3D seismic will be used to design final well trajectories with 100 m stand-off from Pattern G area faults.

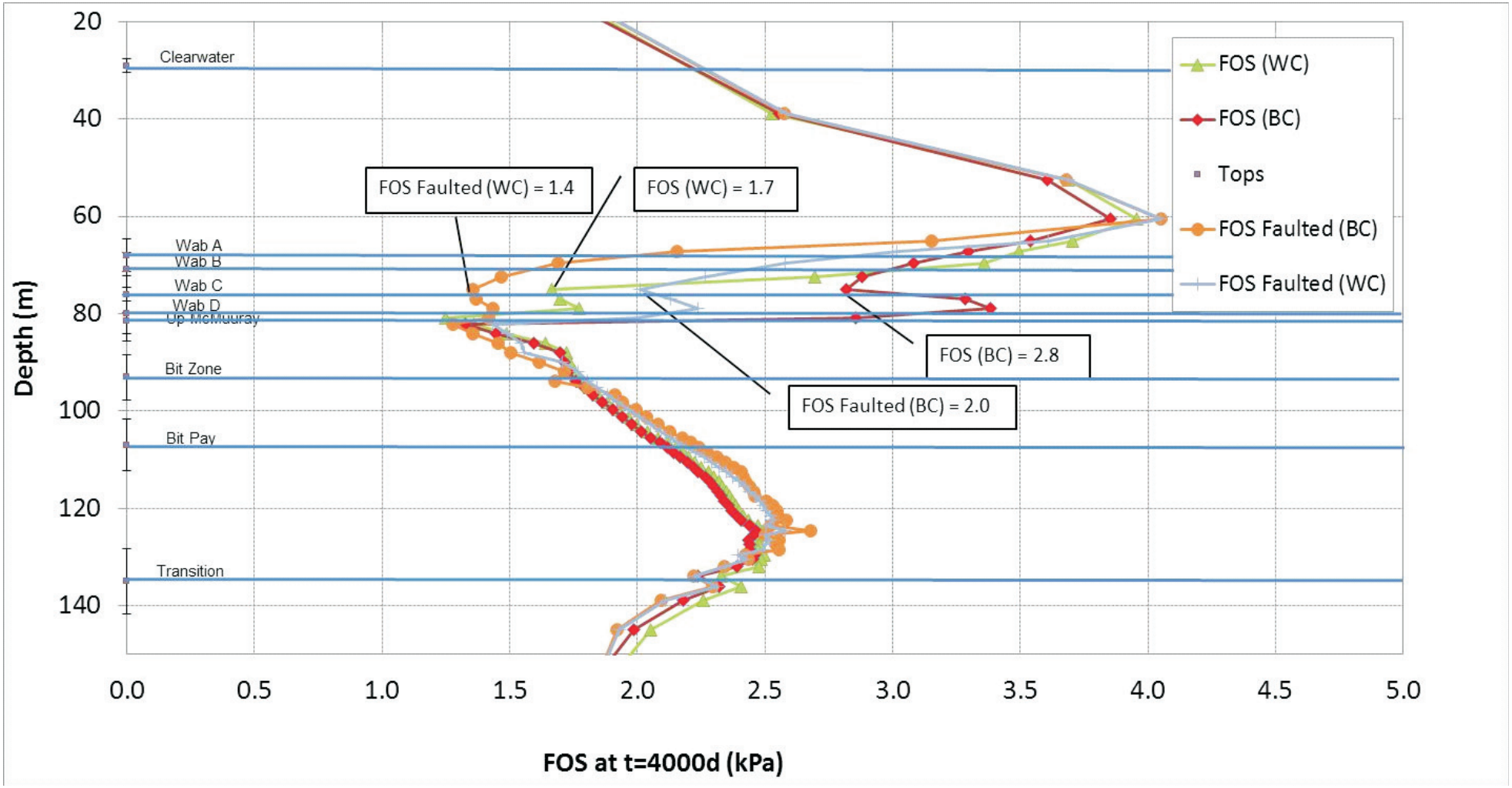
The Ivanhoe monitoring program described in Volume 5, Appendix SIR2 D will allow near-real time monitoring of changes within the reservoir and cap rock. Temperatures, pressures and micro-deformation changes will be tracked to manage operations to prevent excessive pressures or steam from reaching identified faults with development stand-offs. This information will be used to adjust pattern operating pressures, if necessary and in consultation with the ERCB, to minimize significant stress changes in the vicinity of faults.

b. Provide a discussion on the effect faulting may have on the ability of the Wabiskaw caprock to ensure fluid containment within the proposed pattern areas and any planned mitigations to address the potential increase in fluid containment risk due to the effects of faulting.

The fault offset observed on the 2D seismic profiles has been approximated in an updated Geosim model (Appendix SIR3 B). The two faulted cases are modifications that include faulting of models previously described in Volume 5, SIR2 24. The results in Figure SIR3 2-1 of the updated faulted models are denoted as FOS Faulted for Base Case (BC) and Worst Case (WC) results. The results of this modelling show that the fault may allow greater vertical pressure communication with the Wabiskaw C. The shear and tensile stress ratios used to evaluate cap rock integrity are increased (about 10% above the previous base cases and still less than 70% of the shear strength), but still far below critical values. The corresponding factor of safety as shown in Figure SIR3 2-1 drops from 2.8 to 2.0 at the base of the Wab B using the Base Case GeoSim model. If pressures at the base of the Wab B cap rock become a concern (i.e. factor of safety at the base of the cap rock approaches 1.2) then the suggested mitigation strategy, as discussed in SIR3 2a, is to adjust the pattern operating pressures in consultation with the ERCB.

c. The proposed well pair placements shown in Figure SIR2 F-18 do not appear to have a 100 metre stand-off distance around fault features for Patterns B, G, and D. Provide the rationale for not including a stand-off distance around all proposed subsurface drainage patterns. Provide an updated map showing the proposed well placements which include a stand-off distance around fault features as necessary.

Figure SIR2 F-18, provided in Volume 5, Appendix SIR2 F, illustrates well locations that are consistent with the proposed 100 m stand-off distance for the Pattern G area. Figure SIR3 2-2 illustrates the 100 m stand-off polygon surrounding these faults superimposed on the Figure SIR2 F-18. Ivanhoe has not recommended a stand-off distance in Pattern B and the rational for this is discussed below. Finalized well locations and design will be subject to future well applications to the ERCB.



Source: Ivanhoe.

Ivanhoe Energy
Tamarack Project

Safety Factor Versus Depth

DATE: November 2012		SIR3-Fig02-01 12-11-29	
PROJECT: CE0374601		DRAWN BY: AMEC	
ANALYST: KW	QA/QC: KW EH EH	PREPARED BY: EBA	

Figure SIR3 2-1

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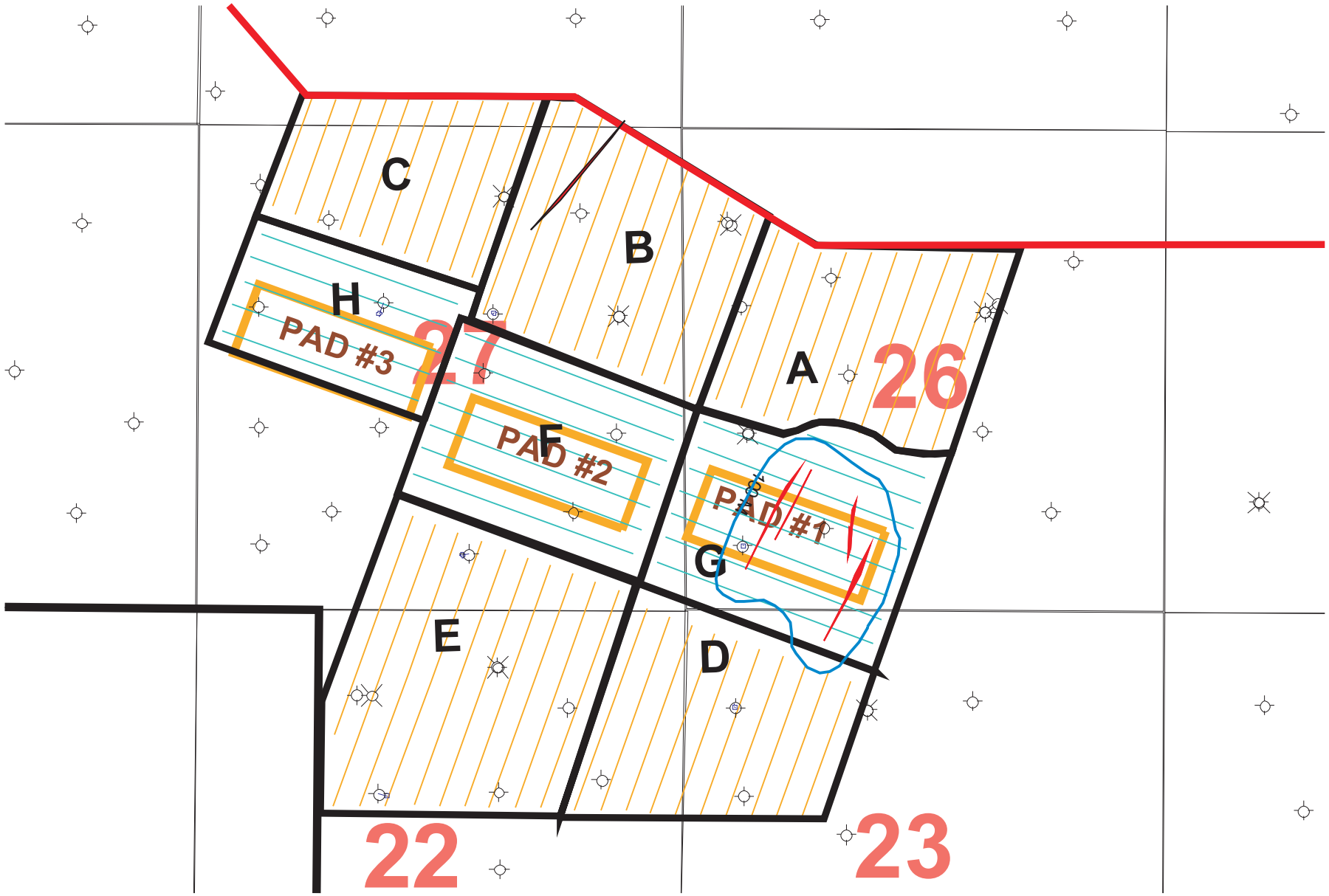

Source: Ivanhoe.

Ivanhoe Energy
Tamarack Project

Wabiskaw B 100 m Fault Stand-off Polygon with
Phase 1 SAGD Patterns and Well Pair Locations

DATE: November 2012			SIR3-Fig02-02 12-11-29
PROJECT: CE0374601		DRAWN BY:	AMEC
ANALYST: KW	QA/QC: KW EH EH	PREPARED BY:	EBA

Figure SIR3 2-2

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Potential faulting identified at Pattern B is considered to be very minor with minimal offset (2 m maximum above McMurray formation) and shale on shale contact. By developing the area concurrently (without stand-off), the expected stress changes will be more uniform across the area and bitumen resource recovery maximized. The minor extent of potential faulting is not expected to provide any significant risk to cap rock integrity and the proposed monitoring plan described in Volume 5, Appendix SIR2 D will provide information that would allow adjustments to operations (such as reducing operating pressures) should concerns over pressure or steam migration arise.

Ivanhoe suggests that development of Pattern G be subject to a future approval from the ERCB as development of this area is planned for late in the Phase 1 development and will be constrained by data collected from earlier Phase 1 operations, including extensive monitoring of the area. The Pattern G area is recognized to be more complex geologically than the rest of the Project Area and, as a result, Ivanhoe believes that operational experience in other areas of Phase 1 along with data collected from the monitoring program will allow for the optimal design for safe resource recovery of the Pattern G area.

As shown in SIR3 Figure 2-2, well-pairs in pattern D are planned at 100 m stand-off from faults and will have monitoring between the well pattern and faults. The planned 3D seismic will be used to establish the final well locations to provide the 100 m stand-off distance.

The length of the horizontal sections of some of the wells, as shown in Volume 4, Table SIR 25-1, could be adjusted by up to 100 m to maintain a 100 m stand-off distance from faults.

Based upon the discussion above, an updated map with adjusted well placements has not been provided.

d. Provide a discussion on the resource recovery implications associated with utilizing a stand-off distance greater than 100 metres.

Stand-off distances greater than 100 m from faulting around Pattern G would result in an increase in resource remaining undeveloped commensurate with the specific offset distance and the local reservoir characteristics. Project economics and well lengths would be negatively affected by stand-offs greater than 100 m. An increase to a 150 m stand-off would result in approximately 1 million m^3 original bitumen in place (OBIP) of additional resource being undeveloped. Based on the responses to SIR3 2a and SIR3 2b, the risks associated with the proposed 100 m stand-off are low.

e. Provide a discussion on the impact postponing bitumen development in Pattern G until the end of Phase 1 will have on the risk to reservoir fluid containment compared to operating Pattern G concurrently with the offsetting patterns.

Postponing development of Pattern G relative to patterns in the vicinity of the faults is proposed for the following reasons:

- Pattern G is proposed to operate at a pressure well below other patterns due to its shallower depth. Since maximum operating pressure (MOP) will be reduced to the lowest pattern operating pressure once steam chambers coalesce, the premature lowering of MOP in deeper patterns is expected to adversely impact the project economics and the expected ultimate recovery. By postponing Pattern G development, adjacent patterns will be able to be developed at a higher MOP, increasing bitumen recovery; and
- due to the complex nature of Pattern G, it is beneficial to gain experience and understanding of reservoir performance from historical operations and data from the monitoring program in order to develop the best depletion plan for Pattern G to maximize recovery and assess fluid containment. As described in SIR3 2c, Ivanhoe proposes that Pattern G development be subject to future ERCB approval within the Phase 1 scheme.

3. Provide the methodology used to determine the length and direction of faults seen in Figure SIR2 F-18. Considering the limitations of 2-D seismic, provide a discussion on the potential that the faults may be longer or may be orientated in different directions than interpreted.

Ivanhoe interprets one fault to occur in northeastern Section 27, about 600 m long and trending NNE-SSW. Its orientation and length are governed by:

- clear expression on Line L6000, indicating a high-angle intersection;
- does not occur on Line L4000 to the south, indicating it must terminate well north of that line;
- time structure contours on Wab B marker supports indicated orientation; and
- fracture studies in Devonian bedrock in the region show a common NE-SW orientation.

While it is possible to interpret slightly longer trends to the north and south and with a slightly different azimuth, Ivanhoe believes that the fault trace interpreted is conservative and reasonable, given the available data.

The faults associated with the structural high in SW-26-090-09W4 are well defined due to the density of the high resolution 2D seismic lines that were acquired in this area. These faults appear on multiple lines so the interpreted orientations are considered to be accurate and they are consistent with the regional trend. In addition, there is a strong degree of confidence (+/- 10 m) that they do not extend to the north beyond what is indicated. This interpretation is confirmed by line L4000, which does not show the presence of any faults. There is, however, limited seismic control to the south; therefore, uncertainty remains as to the southern extent of these faults. However, given the relatively small vertical offsets observed on all these faults, it does not appear reasonable to infer they have a significantly greater length. To better define this structure, define the extent of faults and to aid in optimizing well trajectories, Ivanhoe will acquire 3D seismic data over the identified faulted areas prior to final well licensing.

4. Discuss the potential that additional faulting may exist within the proposed development area that was not identified by the 2-D seismic data.

At the present time, Ivanhoe believes the interpretation of faults is consistent with the existing well and high-quality 2D data, and that there is sufficient data coverage (2D seismic and one delineation well per LSD) to preclude the possibility that significant faults have been missed. It is possible that minor low-throw faults (i.e., <1 m) may be present within the proposed development areas that were not identified but, if present, these would only extend a short distance and not be operationally significant.

5. Volume 5: Supplemental Information Request #2, Response #6; Figure SIR2 F-14, Devonian Structure Map; Figure SIR2 F-17, Depth Structure Map Top Wabiskaw B: Ivanhoe has identified a geological feature in Pattern G. Ivanhoe states "*A structural high exists in the southern portion of Section 26 and northern portion of Section 23. This structural high formed after the Clearwater Formation was deposited in an approximately 25 ha-sized area centered near the 1AA/03-26-090-09W4/0 well. This structure contains 22 m of relief at the Wabiskaw B cap rock level (Appendix SIR2 F, Figure SIR2 F-17). This late forming feature may have been caused by rotational movement along a deep seated basement fault that branched upward into the Paleozoic and Cretaceous section as a flower structure, however, this cannot be confirmed with the existing well and seismic data. The Wabiskaw B cap rock is faulted in several places on this high, however, the faults at this level have minor offsets with shale on shale contact across the faults.*"

a. Considering that flower structures are related to strike-slip faulting, provide a discussion on the following:

i. Whether the geological feature is related to strike-slip faulting and the extent of strike-slip faulting within the proposed project area.

While our seismic interpretation shows a pattern of faulting that could be interpreted as a flower structure in this particular location, the presence of such a structure is not sufficient to infer that a strike-slip structural regime exists. Regional stresses in this part of the Western Canada Sedimentary Basin make the existence of such a regime highly unlikely. On a very local scale, deep-seated salt solution or solution and karsting at the pre-Cretaceous unconformity may have produced a vector component of apparent strike-slip motion that produced these structures. We would not expect to see such faulting away from the very specific local stresses at this particular location, and in fact, our seismic does not show such structure to the north, south or west of Pattern G.

ii. Whether strike-slip faulting of the Wabiskaw caprock has occurred within the proposed project area and, if so, the effect it has had on caprock integrity.

As discussed in SIR3 5a.i, it is highly unlikely that strike-slip motion has occurred in the area except in the immediate vicinity of the local structure, as indicated by our seismic control. With the exception of a minor offset, with shale on shale contact in the Wabiskaw B and Clearwater intervals, no discernible effect on cap rock integrity can be predicted except as indicated on the seismic control. Where a local strike-slip motion can be inferred, as discussed above, we would expect very little to no effect on cap rock integrity due to sand-on-sand contacts or residual permeability in the fault zone. The existing seismic control confirms that the cap rock in this area has been sheared in its geological history, but there is no indication of significant vertical offsets. The relatively weak strength of the mudstone would not be expected to sustain any bridging or gaps in the fault. The geomechanical weakness of the cap rock in this area due to past shear failure has been accounted for in the existing cap rock integrity analysis. The shear strength

analyses performed for Tamarack Project cap rock have used residual shear strength parameters. This assumes pre-sheared planes are present and would be representative of the shear strength remaining in the strike-slip faulted region.

iii. The ability to identify the extent of fault offsets with 2-D seismic.

The 2D seismic acquired by Ivanhoe in the Phase 1 Development Area shows extremely high data quality and resolution and there is high confidence that faults intersected by one of these seismic lines has been detected and the vertical displacement of beds associated with faulting has been imaged as accurately as possible. It is important to note that some of the faults that have been interpreted may in fact not be as clearly visible on a 3D survey with normal resolution.

Given configuration of the acquired 2D lines does not completely blanket the area, it is possible that small faults exist that were not detected; also, where we can detect faulting on one line but not the next along trend, there is some uncertainty as to fault azimuth and the fault termination point between the two lines. With the existing spacing of the 2D array, these uncertainties are small, and it is unlikely that any fault of significant magnitude remains undetected between 2D lines in the Phase 1 Project Area. Refer to related discussion in SIR3 3.

b. Considering that splay faults in a flower structure begin and end at the fault that stems them, provide a discussion on whether the faulting shown in Pattern G are splay faults and discuss the potential that the faults may extend further north and south into Patterns A and D.

As discussed in SIR3 5a, the observed fault pattern is a very local response to movements associated with a very local stress, most likely deep-seated salt solution or a particular karst/solution feature on the pre-Cretaceous unconformity. While there may be a superficial resemblance to a flower structure on one seismic line, the regional stress regime does not support the creation of a true flower structure, and it is therefore not correct to speculate upon the presence of splay faults and other features associated with a strike-slip stress regime. Ivanhoe maintains that it is extremely unlikely that any faulting associated with the isolated structural feature will extend further north into Pattern A and south into Pattern D.

The uncertainties regarding the lateral extent of faults identified in Pattern G are discussed in SIR3 3.

c. Discuss how the uncertainty that the structural high in Section 26 is a flower structure impacts the caprock integrity assessment in Section 26.

The possibility that the structural anomaly is related to the existence of a flower structure in Section 26 is discussed in SIR3 5b. Cap rock integrity surrounding the structural high may have been impacted by faulting but there is no data to support that the remaining area of Section 26 (Pattern A) has been affected. The influence of the structural anomaly does not extend to the north or south beyond Pattern G. Ivanhoe plans to develop the Pattern G area at a later date and seek ERCB approval at that time as discussed in SIR3 2c and 2e.

HYDROGEOLOGY

6. Volume 5: Supplemental Information Request #2, Response #17 (d): Ivanhoe stated the Basal McMurray aquifer is no longer being pursued as a water source and an off-lease water source will be investigated instead. The preferred and alternate water source(s) for the proposed project must be identified and discussed in the subject application to support an assessment of the proposed project.

a. Identify each water source Ivanhoe has investigated (including the Basal McMurray) and provide details on why each of these sources were, or were not, selected. Clearly identify the water source(s) Ivanhoe intends to use for the proposed project.

The response to Volume 5, SIR2 17d represents a misunderstanding. Ivanhoe intends to use the Basal McMurray Aquifer (BMA) as the water source for the Project as described in Volume 1, Section 2.1.4.14 and Volume 2, Section 6. 5.1.1.

As identified in Volume 1, Section 2.1.4.14, Ivanhoe continues to investigate alternative water sources, such as tailings pond water. The suitability of any alternative water sources has not been determined. If an alternate source is determined to be feasible, Ivanhoe will apply for all necessary regulatory approvals.

b. Identify if the investigated water source(s) are non-saline or saline (as defined by the *Water Act*), supported by a laboratory water analysis of the identified water source(s). If a groundwater source is pursued, provide the formation name, aquifer elevation (top and bottom), and location of source well(s).

The proposed BMA source water is described as saline, with TDS ranging from 12 000 to 15 000 ppm (Volume 1, Section 2.1.4.14 and Volume 2, Section 6.4.3.4). Laboratory analysis was provided in Volume 3, Appendix C3. Elevation detail is provided in Volume 2, Figure 6.4.6 (BMA top elevation) and Volume 2, Figure 6.4-3 (bottom elevation, BMA contact with the Devonian). Potential source well locations are provided in Volume 2, Figure 6.5-2.

RESERVOIR ENGINEERING

7. Volume 5: Supplemental Information Request #2, Appendix SIR2 A: Supplemental ERCB Question 4. Ivanhoe stated that it "*plans to hold development of the Pattern G until the end of Phase 1.*" Ivanhoe further stated that "*the approval for development of Pattern G is expected once information from the data monitoring in the area is available and reviewed with the Energy Resources Conservation Board (ERCB).*" Confirm that Ivanhoe is not requesting approval for the development of Pattern G as part of the subject application and that Ivanhoe will submit a subsequent application requesting approval to drill and operate Pattern G.

Ivanhoe is requesting scheme approval for the Project, as currently proposed, and approval to proceed with development of all well patterns within Phase 1 with the exception of Pattern G. Ivanhoe is not requesting approval for the development of Pattern G as part of this application and Ivanhoe will submit a subsequent application requesting approval to drill and operate Pattern G at the latter stages of Phase 1 development, and when additional seismic and operational data are available.

GEOTECHNICAL ANALYSIS

8. Volume 5: Supplemental Information Request #2, Response #27 a & b: Ivanhoe discussed the stability assessment of profile sections K2-K2' and L-L' based on the original design and Suncor's 2011 South Tailings Pond Performance Report. Ivanhoe stated "*The design value of 0.6 corresponds with a 1.5 Factor of Safety. The 2011 actual values ranged from 0.06 to 0.46. Based on our updated stability analysis, the value of 0.46 corresponds with a 1.7 factor of safety. The lowest (deepest) portion of the critical failure surface was at an elevation of 320 m., within the Clearwater formation.*"

a. Show on a map the location of the profile sections K2-K2' and L-L'.

The location of the Suncor profile sections K2-K2' and L-L' are shown on Figure SIR3 8-1. These two section lines (locations and lengths) are taken from Figure 2.10 of the Suncor South Tailings Pond El. 390 m Design Update Report, January 2010 (Suncor 2010).

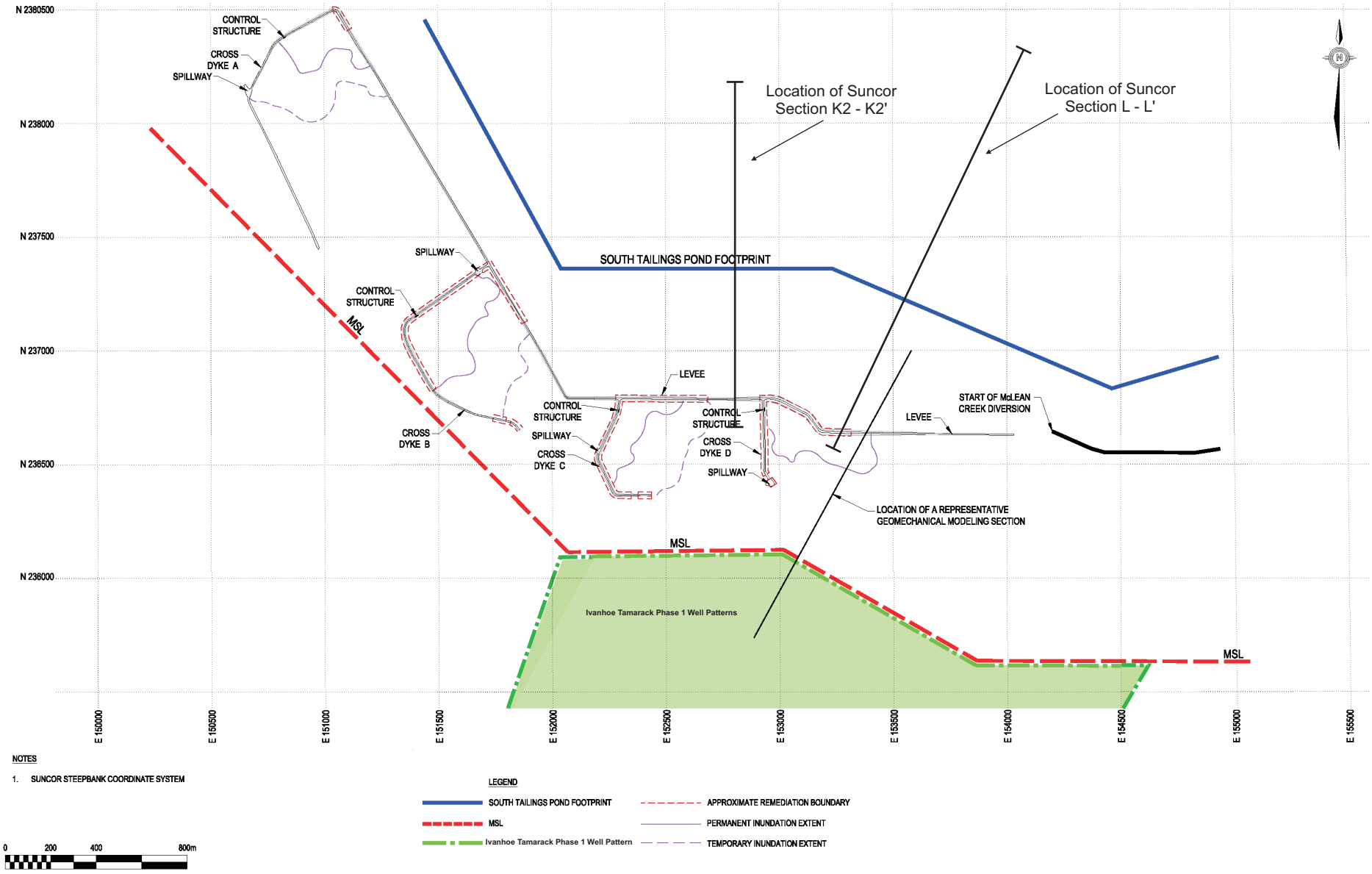
b. Provide the slope stability analysis results. The analysis results should show the analysis method, geological models (profiles), strength and pore pressure parameters, critical slip surfaces, and factor of safety.

The geologic profiles, strength parameters and pore pressure parameters are taken from Suncor (2010).Our geologic profile for sections K2-K2' and L-L' are based on Figure II-21 and Figure II-22, respectively, from Suncor (2010).

The Clearwater Formation extends down to the McMurray Formation at an approximate elevation of 280 m. Because the primary issue of concern is the potential impact of elevated pore pressure from SAGD in the underlying McMurray Formation, Ivanhoe conducted stability analyses considering slip surfaces in the Clearwater at elevation 320 m (near Suncor's critical slip surface), and also at elevation 305 m (25 m above the McMurray Formation) and elevation 285 m (5 m above the McMurray Formation).

The three slip surfaces analyzed for profile section K2-K2' are shown on Figures SIR3 8-2 (slip surface at elev. 320 m), SIR3 8-3 (slip surface at elev. 305 m) and SIR3 8-4 (slip surface at elev. 285 m).

The three slip surfaces analyzed for profile section L-L' are shown on Figures SIR3 8-5 (slip surface at elev. 320 m), SIR3 8-6 (slip surface at elev. 305 m) and SIR3 8-7 (slip surface at elev. 285 m).



Source: Ivanhoe.

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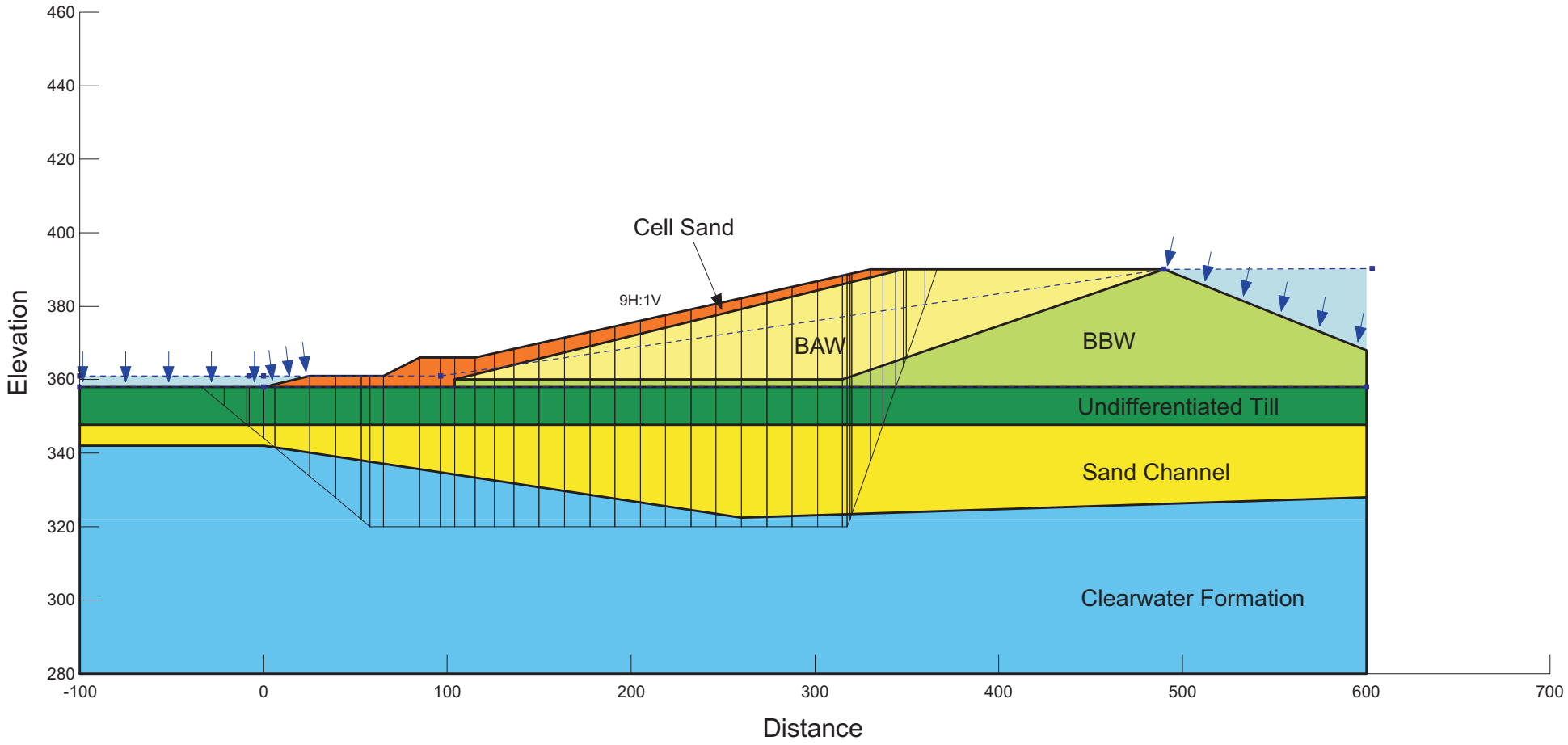
Ivanhoe Energy
Tamarack Project

Location of the Suncor Profile Sections K2-K2' and L-L'

DATE: November 2012		SIR2-Fig08-01 12-11-28	**Figure SIR3 8-1**
PROJECT: CE0374601		DRAWN BY: AMEC	
ANALYST: KW	QA/QC: KW EH EH	PREPARED BY: EBA	



Source: Ivanhoe.

Ivanhoe Energy
Tamarack Project

Failure Surface at Elevation 320.0 m
Section K2-K2'

DATE: November 2012			SIR2-Fig08-02 12-11-14
PROJECT: CE0374601			DRAWN BY: AMEC
ANALYST: KW	QA/QC: KW EH EH		PREPARED BY: EBA

Figure SIR3 8-2

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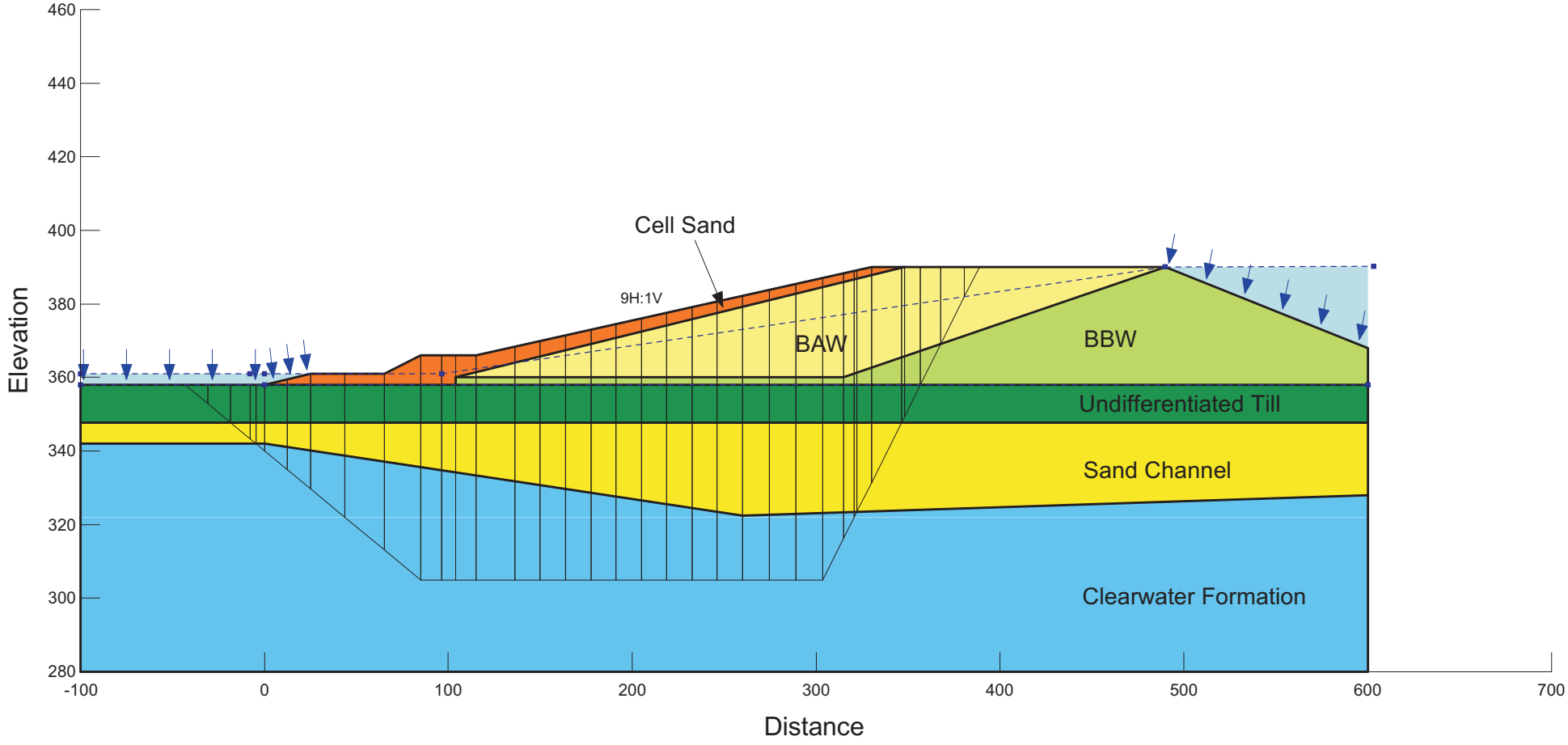

Source: Ivanhoe.

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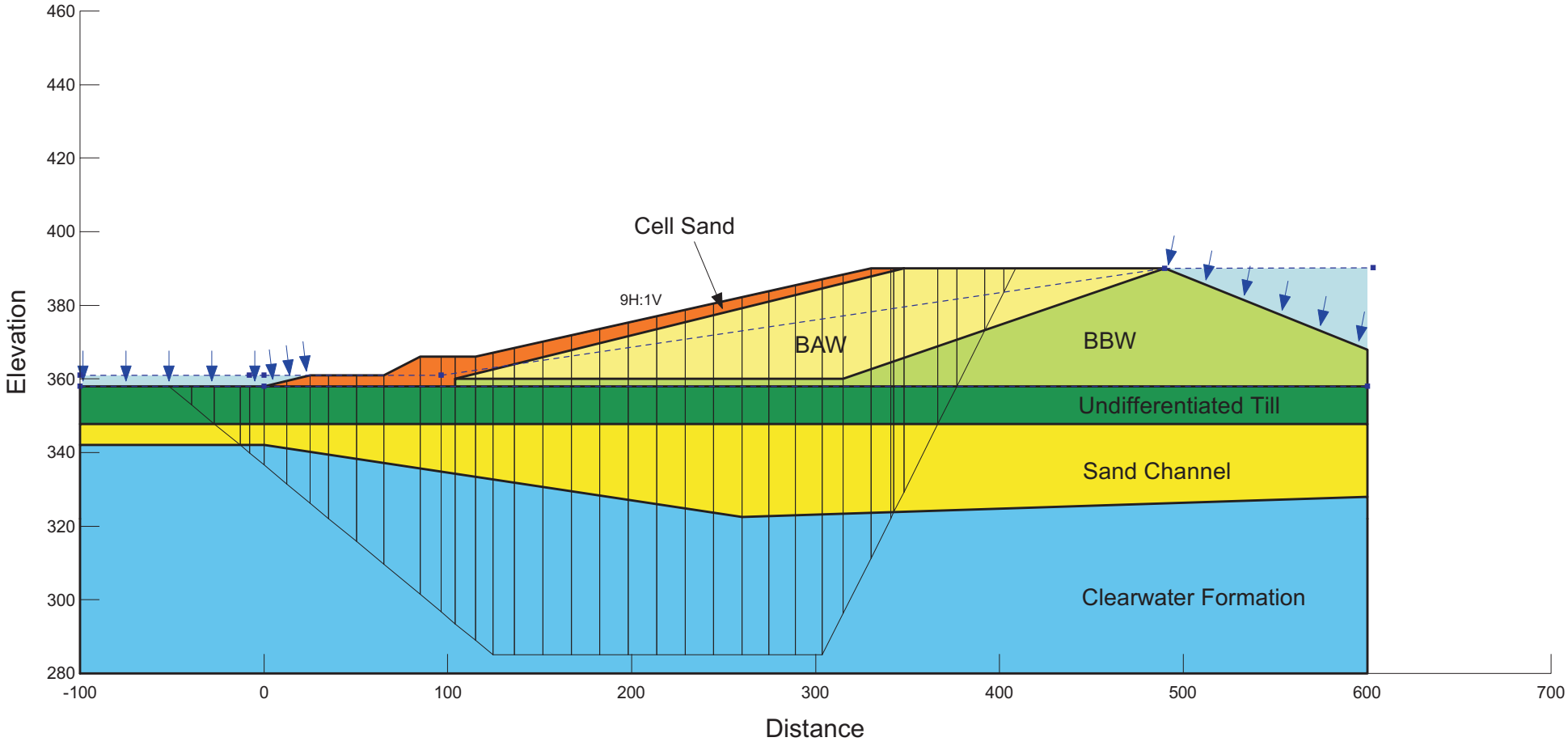
Ivanhoe Energy
Tamarack Project

Failure Surface at Elevation 305.0 m
Section K2-K2'

DATE: November 2012			SIR2-Fig08-03 12-11-14
PROJECT: CE0374601			DRAWN BY: AMEC
ANALYST: KW	QA/QC: KW EH	EH	PREPARED BY: EBA

Figure SIR3 8-3



Source: Ivanhoe.

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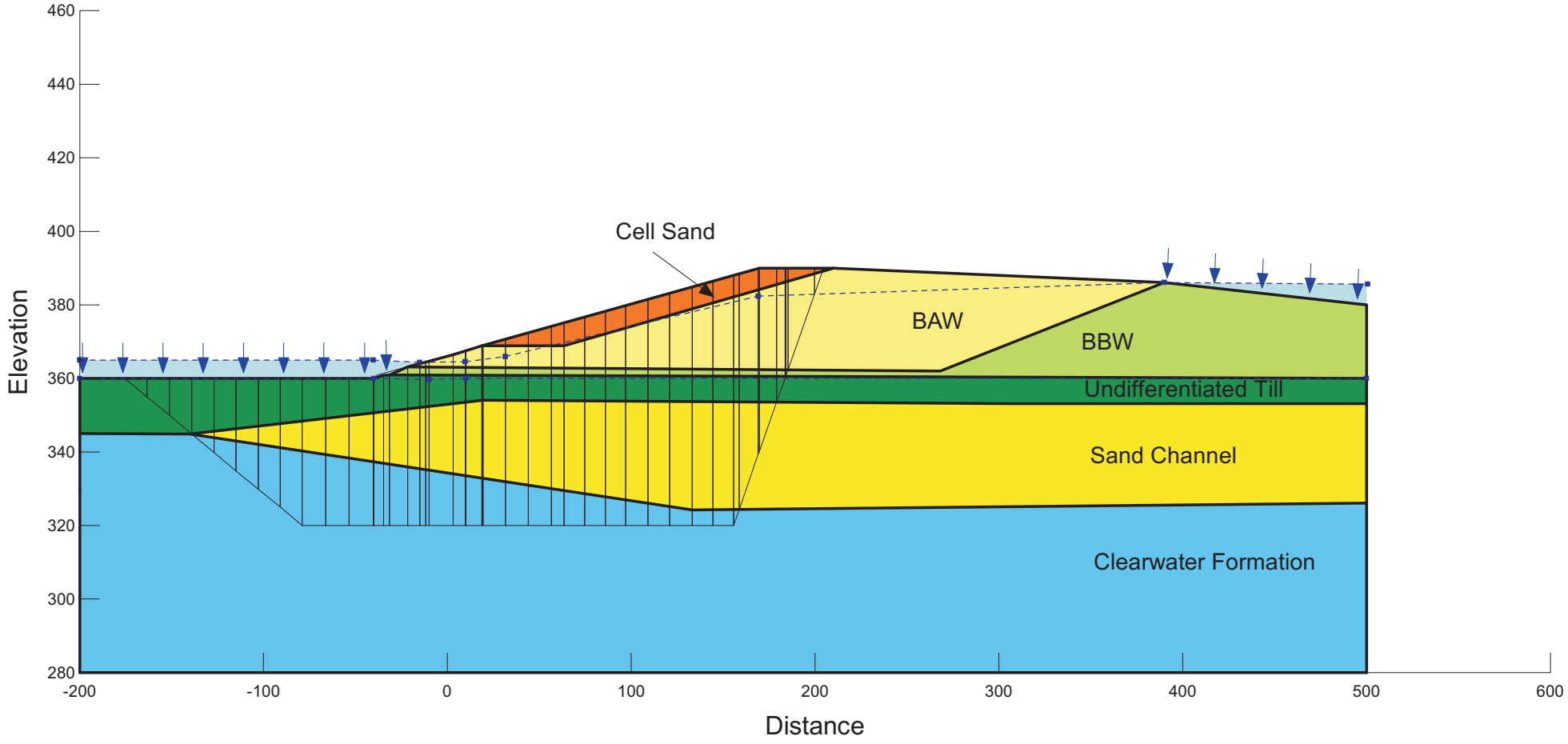
Ivanhoe Energy
Tamarack Project

Failure Surface at Elevation 285.0 m
Section K2-K2'

DATE: November 2012			SIR2-Fig08-04 12-11-14
PROJECT: CE0374601			DRAWN BY: AMEC
ANALYST: KW	QA/QC: KW EH EH		PREPARED BY: EBA

Figure SIR3 8-4



Source: Ivanhoe.

Ivanhoe Energy
Tamarack Project

Failure Surface at Elevation 320.0 m
Section L-L'

DATE: November 2012			SIR2-Fig08-05 12-11-14
PROJECT: CE0374601			DRAWN BY: AMEC
ANALYST: KW	QA/QC: KW EH EH		PREPARED BY: EBA

Figure SIR3 8-5

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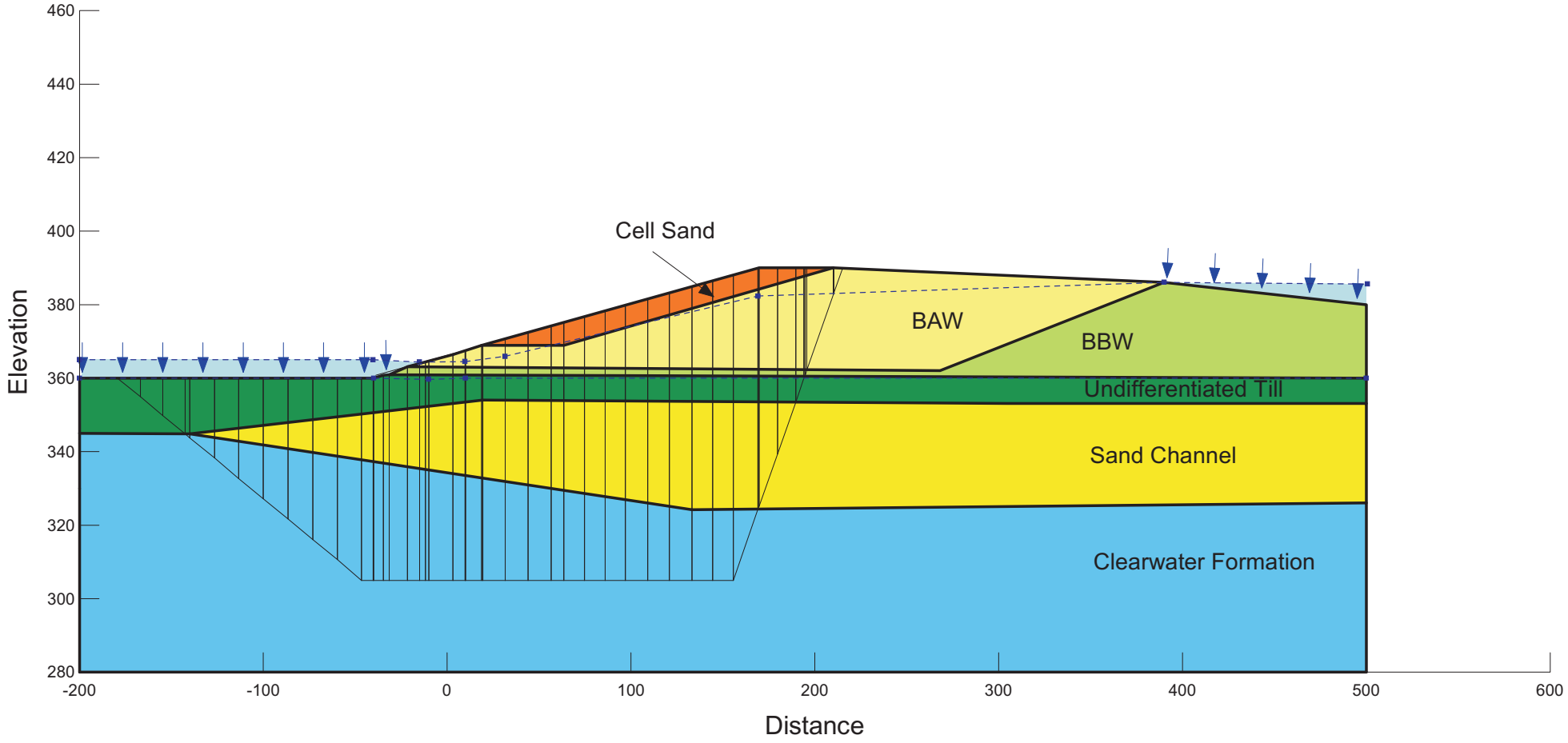

Source: Ivanhoe.

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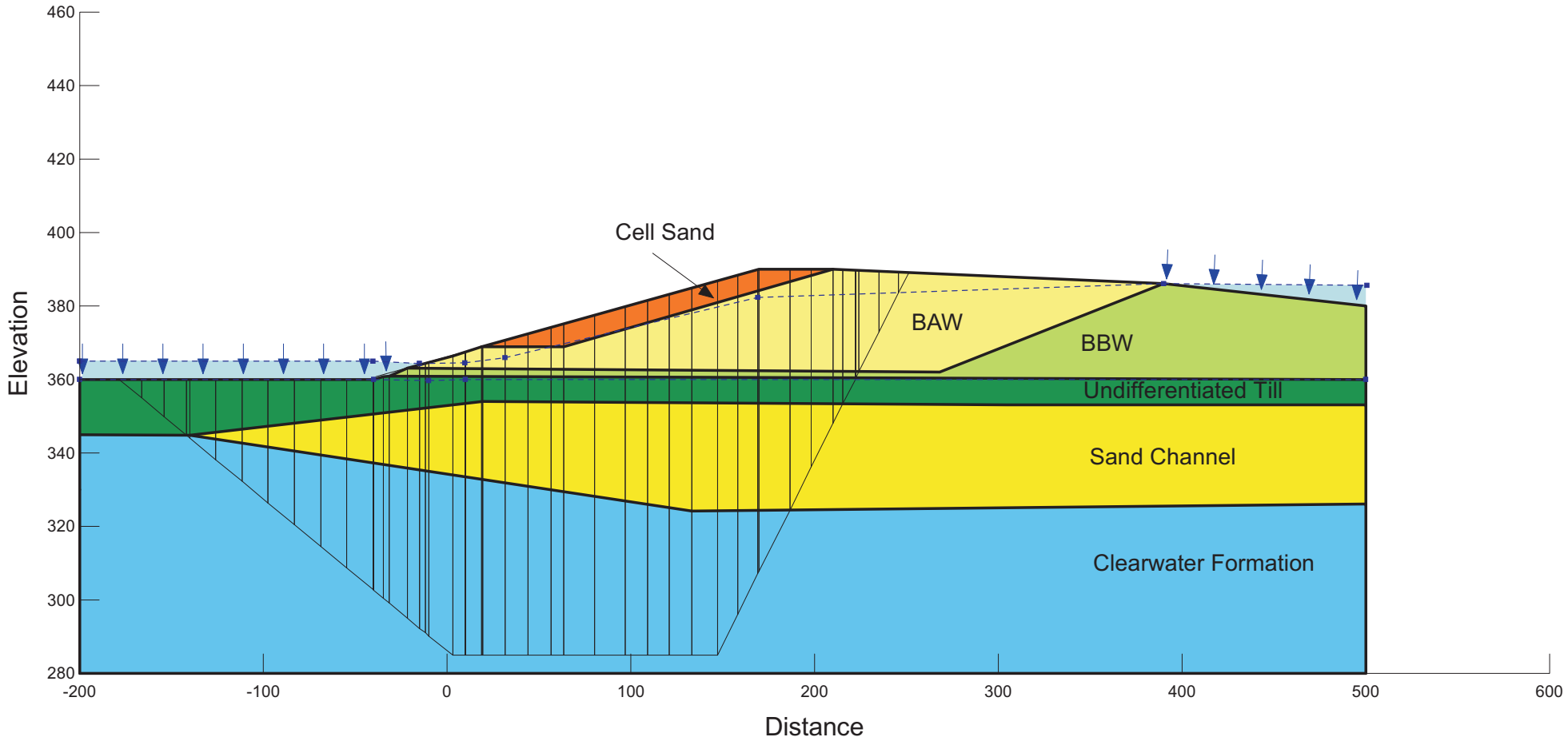
Ivanhoe Energy
Tamarack Project

Failure Surface at Elevation 305.0 m
Section L-L'

DATE: November 2012			SIR2-Fig08-06 12-11-14
PROJECT: CE0374601		DRAWN BY: AMEC	
ANALYST: KW	QA/QC: KW EH EH	PREPARED BY: EBA	

Figure SIR3 8-6



Source: Ivanhoe.

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Ivanhoe Energy
Tamarack Project

Failure Surface at Elevation 285.0 m
Section L-L'

DATE: November 2012			SIR2-Fig08-07 12-11-14
PROJECT: CE0374601		DRAWN BY: AMEC	
ANALYST: KW	QA/QC: KW EH EH	PREPARED BY: EBA	

Figure SIR3 8-7

The soil strength parameters used in our stability analyses, the same values as used by Suncor, are as follows:

BAW Tailings Dyke Sand

Unit weight: 19.5 kN/m^3
Cohesion: 0 kPa
Friction angle Phi: 32 degrees
Pore pressure: Piezometric line

BBW Tailings Dyke Sand

Unit weight: 18.5 kN/m^3
Cohesion: 0 kPa
Friction angle Phi: 28 degrees
Pore pressure: Piezometric line

Undifferentiated Till

Unit weight: 21 kN/m^3
Cohesion: 0 kPa
Friction angle Phi: 30 degrees
B-Bar: 0.5

Sand Channel

Unit weight: 21 kN/m^3
Cohesion: 0 kPa
Friction angle Phi- Horizontal: 33 degrees
Friction angle Phi- Vertical (non-horizontal): 36 degrees
Pore pressure: Piezometric line

Clearwater Formation

Unit weight: 21 kN/m^3
Cohesion: 0 kPa
Friction angle Phi- Horizontal: 7.5 degrees (also a 10 degrees case for K2-K2')
Friction angle Phi- Vertical (non-horizontal, cross bedding): 17 degrees
Pore pressure: Piezometric line
B-Bar: 0.8

Increased pore pressures, primarily resulting from the tailings dyke fill surcharge load (computed using pore pressure parameter B-Bar), decrease the effective soil shear strength mobilized along the stability slip surface. The most critical portion of the slip surface is the weak

horizontal bands within the Clearwater formation. The excess hydrostatic pore pressure along the horizontal portion of the slip surface is proportional to the surcharge load imposed by the fill. It is lowest beneath the dyke toe and greatest beneath the dyke crest.

The slope stability analyses were carried out using Morgernstern-Price method available in the computer program "GeoStudio 2007" (Version 7.19).

Tables SIR3 8-1 through SIR3 8-3, provides the results of the slope stability analyses, for the soil strength and pore pressure parameters used by Suncor (presented above) for slip surface along horizontal low-strength bands within the Clearwater at elevations 320 m, 305 m and 285 m.

Table SIR3 8-1: Profile Section K2-K2': Clearwater Phi-Horizontal of 7.5 Degrees and B-Bar of 0.8

Horizontal Slip Surface Elevation (m)	Figure No.	Factor of Safety	Average Excess Hydrostatic Pore Pressure[1] (kPa)
320	SIR3 8-2	1.31	247
305	SIR3 8-3	1.31	247
285	SIR3 8-4	1.37	247

[1] Average excess hydrostatic pore pressure along horizontal slip surface.

Table SIR3 8-2: Profile Section K2-K2': Clearwater Phi-Horizontal of 10 Degrees and B-Bar of 0.8

Horizontal Slip Surface Elevation (m)	Figure No.	Factor of Safety	Average Excess Hydrostatic Pore Pressure[1] (kPa)
320	SIR3 8-2	1.49	247
305	SIR3 8-3	1.53	247
285	SIR3 8-4	1.62	247

[1] Average excess hydrostatic pore pressure along horizontal slip surface.

Table SIR3 8-3: Profile Section L-L': Clearwater Phi-Horizontal of 7.5 Degrees and B-Bar of 0.8

Horizontal Slip Surface Elevation (m)	Figure No.	Factor of Safety	Average Excess Hydrostatic Pore Pressure[1] (kPa)
320	SIR3 8-5	1.42	230
305	SIR3 8-6	1.40	230
285	SIR3 8-7	1.43	230

[1] Average excess hydrostatic pore pressure along horizontal slip surface.

These slope stability analyses are based on the soil strength parameters and the pore pressure parameter used by Suncor in their design report submissions. A pore pressure parameter (B-Bar) value of 0.8 was used. The Suncor South Tailings Pond 2011 Annual Performance Report (Suncor 2011) stated that for the pore pressures measured below the West Dyke and

South Dyke, “the B-Bar values range between 0.06 and 0.46,which are below the design value of 0.8”. Based on that finding, the slope stability analyses which were carried out using a B-Bar value of 0.8 are considered to be conservative, and the actual factors of safety would likely be higher.

c. Provide the stability analysis results for the condition of maximum excess pore pressure in the Clearwater Formation that can trigger instability.

Excess pore pressures resulting from the proposed Ivanhoe SAGD operations will not impair the stability of the Suncor South Tailings Pond South Dyke since instability conditions cannot be achieved from Ivanhoe’s proposed operations based on the conservative modelling performed. The proposed operating conditions are expected to result in less than 1 kPa increase in pore pressure at the base of the Clearwater Shale. The results of stability analysis for the conditions that would trigger instability, indicate 345 kPa excess pore pressure would be required.

The stability analysis results for the condition of maximum excess pore pressure in the Clearwater Formation that can trigger instability are presented in Tables SIR3 8-4 through SIR3 8-6. The method used was to determine the pore pressure parameter B-Bar value which would result in an approximate 1.05 Factor of Safety (i.e., instability condition), and then to compute the average excess hydrostatic pore pressure along the horizontal sliding surface for that B-Bar value. The results of these analyses are as follows:

Table SIR3 8-4: Profile Section K2-K2’: Clearwater Phi-Horizontal of 7.5 Degrees and Factor of Safety approximately 1.05

Horizontal Slip Surface Elevation (masl)	Figure No.	B-Bar	Average Excess Hydrostatic Pore Pressure[1] (kPa)
320	SIR3 8-2	1.05	325
305	SIR3 8-3	1.05	325
285	SIR3 8-4	1.12	346

[1] Average excess hydrostatic pore pressure along horizontal slip surface.

Table SIR3 8-5: Profile Section K2-K2’: Clearwater Phi-Horizontal of 10 Degrees and Factor of Safety approximately 1.05

Horizontal Slip Surface Elevation (m)	Figure No.	B-Bar	Average Excess Hydrostatic Pore Pressure[1] (kPa)
320	SIR3 8-2	1.12	337
305	SIR3 8-3	1.17	362
285	SIR3 8-4	1.28	396

[1] Average excess hydrostatic pore pressure along horizontal slip surface.

Table SIR3 8-6: Profile Section L-L': Clearwater Phi-Horizontal of 7.5 Degrees and Factor of Safety approximately 1.05

Horizontal Slip Surface Elevation (m)	Figure No.	B-Bar	Average Excess Hydrostatic Pore Pressure[1] (kPa)
320	SIR3 8-5	1.20	345
305	SIR3 8-6	1.20	345
285	SIR3 8-7	1.25	360

[1] Average excess hydrostatic pore pressure along horizontal slip surface.

Comparison of the Slope Stability Analysis Results to the Geomechanical Simulation Results

In Volume 4, SIR 295, the geomechanical simulations for two cases were extended to 32 years.

- for Case 20-C, at 32 years the increased pore pressure near the toe of the Suncor dyke was 72 kPa in the McMurray sand just below the Wabiskaw; however, the increased pore pressure in the first Clearwater shale layer above the Wabiskaw was less than 1.0 kPa; and
- for Case 19-C, at 32 years the increased pore pressure near the toe of the Suncor dyke was 152 kPa in the McMurray sand just below the Wabiskaw; however, the increased pore pressure in the first Clearwater shale layer above the Wabiskaw was also less than 1.0 kPa.

Cases are described in Volume 1, Attachment 2, Assessment of the Effects of SAGD Phase 1 on Suncor South Tailings Pond Works.

The most recent slope stability analysis results presented in SIR3 8b, demonstrate that if there was a very weak (Phi of 7.5 degrees) layer in Clearwater clay at elevation 285 m (approximately 5 m above the McMurray):

- for profile section K2-K2' an average excess hydrostatic pore pressure of 247 kPa would provide a 1.37 factor of safety; and
- for profile section L-L' an average excess hydrostatic pore pressure of 230 kPa would provide a 1.43 factor of safety;

The slope stability analysis results presented above, demonstrate that if there was a very weak (Phi of 7.5 degrees) layer in Clearwater clay at elevation 285 m (approximately 5 m above the McMurray):

- for profile section K2-K2' an average excess hydrostatic pore pressure of 346 kPa would provide a 1.05 factor of safety; and
- for profile section L-L' an average excess hydrostatic pore pressure of 360 kPa would provide a 1.05 factor of safety.

Literature Cited

Suncor Energy Inc. (Suncor). 2010. *Depressurization Well Network*. In: Klohn-Crippen Berger Ltd., South Tailings Pond El. 390 m Design Updated, dated January 2010.

Suncor Energy Inc. (Suncor). 2011. *South Tailings Pond 2011 Annual Performance Report.*

FACILITIES

9. Volume 5: Supplemental Information Request #2, Response #17d: In response to the request to provide an update on the selection of a water source for the proposed project, Ivanhoe stated that it is "*pursuing other off-lease water sources*" and that it "*is not in a position to provide any updates at this time.*" A viable water source is a critical component to the design of any thermal in situ facility which requires make-up water for steam generation.

Provide details of the facility design associated with the water source(s) that will be used as make-up water for the proposed project. Details are to include:

a. Any equipment that will be added to the central processing facility to accommodate the water source. Provide an updated process flow diagram(s) and plot plan detailing the additional equipment.

As noted in SIR3 6a, the response to Volume 5, SIR2 17d was the result of a misunderstanding. Ivanhoe intends to use the BMA as the water source for the Project. This is consistent with the information presented within Volume 1, Section 2.0. Additional equipment will not be added to the central processing facility (CPF), therefore, updated process flow diagrams or plot plans are not required. The original CPF flow diagram is provided in Volume 1, Figure 2.3-1 and the CPF plot plan is provided in Volume 1, Figure 2.3-2. Detailed Phase 1 process flow diagrams are provided in Volume 4, Appendix H.

b. Updated water balances based on the finalized water source(s).

See response to SIR3 9a. The water source has not changed; therefore, updated water balances are not required. The original water balance is presented in Volume 1, Section 2.3.6.4.

c. A discussion regarding the minimum produced water recycle rate that will be achieved at the proposed project. The discussion is to include the number of months, from start-up, required to achieve the minimum produced water recycle.

See response to SIR3 9a. The water source remains the BMA and water recycle rates have not changed. Water recycle information is provided in Volume 1, Section 2.5.2.2 and expected source water flow rates are provided in Volume 4, SIR 48. Ivanhoe is aware of the recent approval of ERCB Directive 081: *Water Disposal Limits and Reporting Requirements for Thermal In Situ Oil Sands Schemes* on 21 November 2012 and confirms that the current Tamarack Project application will comply with the directive.

10. Volume 5: Supplemental Information Request #2, Response #30c: Ivanhoe stated that "*the produced gas to the Project is less than 1 t/d… therefore, Interim Directive 2001-03 does not apply to the Project.*" For Other Upstream Petroleum Industry Facilities, *ID 2001-03* states that sulphur recovery requirements are to be "determined based on the sulphur content of flared or incinerated gas streams." Until such time when the calendar quarter-year daily average sulphur rate of produced and sour gas streams flared and used as fuel at the central processing facility reaches one tonne per day, confirm that sulphur recovery at the proposed facility will not be less than set out in Table 1 of *ID 2001-03.*

After reviewing this SIR question with the ERCB, Ivanhoe accepts that in reference to ID2001-03, any sour gas received from the HTL™ and burned in the steam generator and co-generation units within the SAGD facility boundaries would be considered to be "…flared or incinerated gas streams…" within the SAGD facility under Section 2.2 of ID2001-03.

In this case, the total sulphur mass included in gas streams received at the SAGD facility would be 2.80 tonne per day (tpd) as shown in Table SIR3 10-1. This would require a sulphur recovery of 70%, according to Table 1 in ID2001-03. Table SIR3 10-1 shows the effective recovery % of sulphur is 70.6% because of the flue gas from the SAGD steam generator (which contains 2.20 tpd of sulphur) being routed to the flue gas desulphurization (FGD) within the HTL™. In the FGD, 90% of this sulphur is recovered and hence only 0.22 tpd are emitted per Table SIR3 10-1.

Table SIR3 10-1: Gas Stream Incinerated with SAGD Facility

Gas Streams IN	Sulphur (tpd)	Non-Recovered Sulphur	Sulphur (tpd)
SAGD Assoc. Gas	0.12	Co-Gen Flue to Atm.	0.43
HTL™ Cracked Gas	2.03	Steam Gen 2&3 Flue	0.00
HTL™ Product Gas	0.62	HTL™ Heater Flue	0.17
Gas From HTL™ Sour Water	0.02	FGD Exhaust Steam Gen Portion	0.22
Total	**2.79**	**Total**	**0.82**
		Recovered in FGD Ash	**1.97**
Recovery Required ID2001-03	**70.0%**	**Recovery Fraction**	**70.6%**

As stated in Volume 2, Page 4-48 and again in Volume 4, SIR 47b, in the case of an unplanned FGD upset, the HTL™ will go into a controlled shutdown. Because of this, there will be no difficulty meeting the 69.7% calendar quarter-year sulphur recovery requirement in ID2001-03.

When Phase 2 is installed, the estimated sulphur quantity would double to 5.6 tpd, which would increase the required sulphur recovery fraction to 90%. However, this sulphur quantity is a conservative estimate and actual quantities are expected to be lower. Should operating data from Phase 1 indicate that total sulphur will be over 5 tpd once Phase 2 is operating, Ivanhoe will undertake process efficiencies or install additional equipment to ensure that the Project meets all of the requirements of ID2001-03.

ENVIRONMENT

11. Volume 5: Supplemental Information Request #2, Response #32. Ivanhoe indicated that aerial reconnaissance and ground investigations were completed in May 2012 to confirm separation distances between watercourses and proposed well pads. From these investigations Ivanhoe determined: a) no channel diversions were necessary for the project and b) watercourses were reclassified. The project update does not describe methods used for the ground investigations. Describe the site assessments, including ground investigations, that were completed in May 2012 to determine minimum setback distances used in Volume 5.

There is an error in the response to Volume 5, SIR2 32a. Ground investigations were not conducted because protocol conditions were not met (see below), therefore, the second sentence should read:

> *"However, investigations of the subject watercourse undertaken in May 2012, as discussed in the SIR2 Project Update reveal that there is no defined channel in the areas near Pads 1, 2 and 3"*

The standard protocol used during the May 2012 survey was developed through experience with Fisheries and Oceans Canada and AENV and was conducted as follows:

- the crew proceeded to area/site to be investigated via helicopter using GPS coordinates and refined with known landmarks (i.e., Suncor South Tailings Pond, Athabasca River);
- once at each specific site, the helicopter pilot flew at an altitude that allowed overview photos to be taken;
- photos were taken in all directions and directions were noted accordingly;
- after the view of the general area was established, the pilot flew closer to the ground, as close as necessary (and safe) to identify any watercourses or water bodies;
- the potential for watercourses or water bodies was identified by a qualified aquatic environment specialist with over 15 years of experience. Watercourses were identified where channel development (bed and bank development) and evidence of scour and deposition were present;
- when a watercourse (defined channel as above) or water body was not observed, the sites was identified as "no defined channel" and the survey is complete;
- water bodies and large, isolated beaver impoundments that were able to be characterized from the air did not require a landing. Edges of these features were recorded with GPS to assist with setback distance determination;

- if a watercourse (defined channel) or water body was observed near an area of interest (i.e., well pad location), the pilot was to land in a safe area; and
- where a “no defined channel” was observed adjacent to a potential well pad location, the “no defined channel” was followed downstream to document the location where channel development does exist. The location where channel development did exist was GPS referenced to assist setback distance determination.

Because only “no defined channels” were located adjacent to the well pads, or the well pads were located adjacent to beaver impoundments that could be characterized from the air, ground investigations were not necessary.

12. Volume 5: Supplemental Information Request#2, SIR2Table PU-1 Minimum and Average Distances of Project from Watercourses. For the most part, unnamed tributaries previously identified in the application have now been reclassified as watercourses with "no defined channel." Table SIR2 PU-1 lists the minimum distance from the high water mark of nearest watercourses to adjusted well pads.

a) Describe the measurement method used to calculate the minimum setback distances identified in Table SIR2 PU-1.

The 100 m buffer of watercourses was created using watercourses from 1:20 000 AltaLIS base features as the High Water Mark. The data was then modified through information provided through site assessments to differentiate between watercourses with defined channels and those with no defined channel. The watercourses with defined channels were then buffered by 100 m.

b) Describe how the high water mark recorded for water bodies referenced in Table SIR2 PU-1 (e.g., low gradient fens) was determined.

Volume 5, Table SIR2 PU-1 is specific to watercourses with channels with defined bed and banks and evidence of deposition and scour (i.e., defined channels). The ordinary high water marks for the defined channels were field observed and GPS referenced. Water bodies with subsurface flow or "no defined channels" (e.g., low gradient fens) were not included within the table. These water bodies are addressed in SIR3 13.

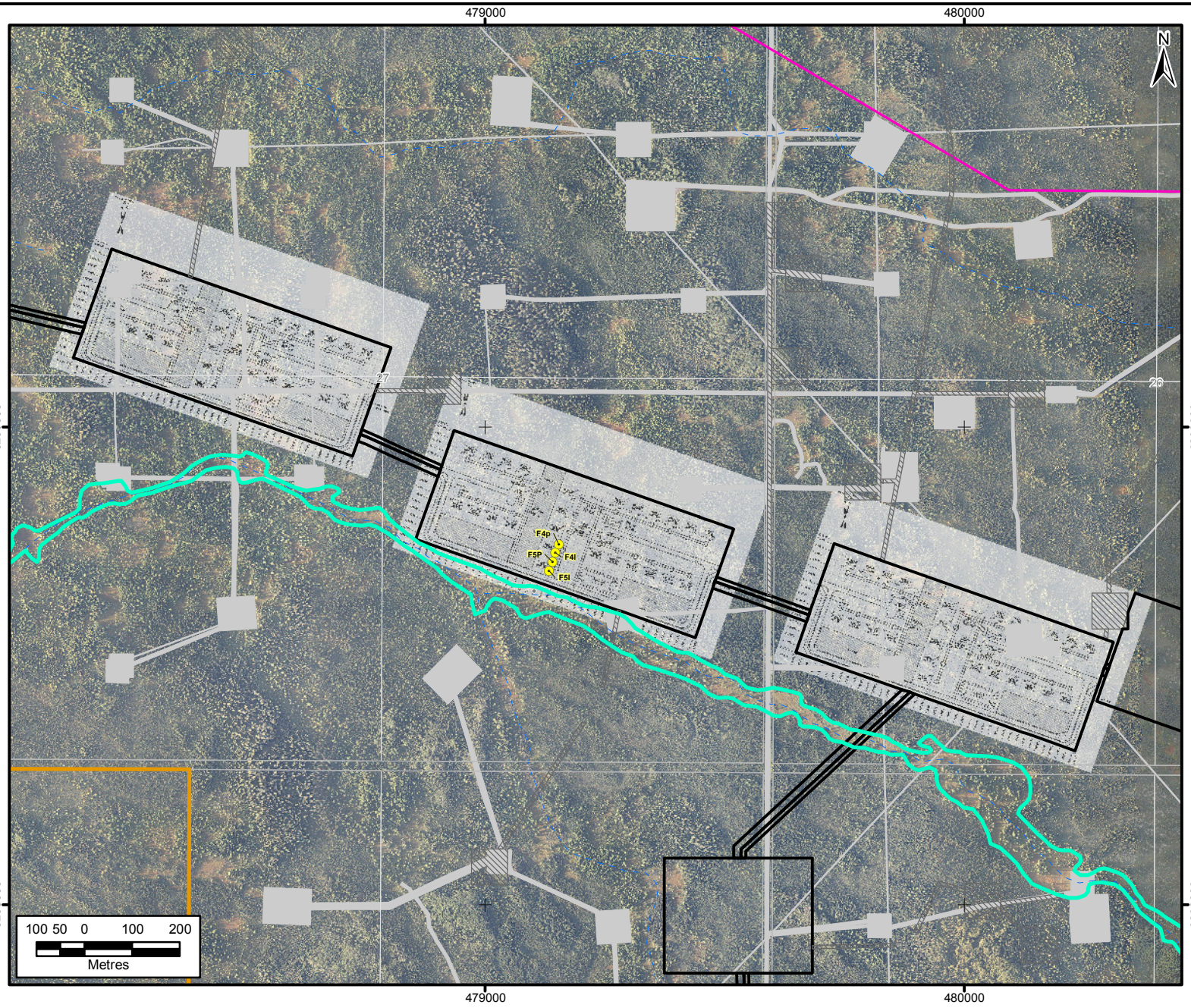
13. Volume 5: Supplemental Information Request #2, Response #32. For the unnamed tributary adjacent to the proposed surface well pads 1, 2, and 3, Ivanhoe determined the drainage to not be a water body because no defined channel was present. Other unnamed tributaries within the proposed development area were also reclassified on that basis. The definition of water body applicable to the ERCB's *Directive 056* and to the *Water Act* is not limited to features with a "defined channel."

Identify equivalent mitigations, including engineered controls and spill response plans, proposed where wellheads and facilities equipment are unable to maintain a 100 metre setback distance from water bodies as defined by *Directive 056*. In addition to spills, plans for pollution control mitigations should address the potential for accidental releases at wellheads and pipelines.

Figure SIR3 13-1 identifies all wellheads within 100 m of the water body. Three wells on Well Pad 2 are within 100 m and one well is 100 m away from the water body.

For the wellheads within the 100 m setback distance from water bodies as defined by Directive 056: *Energy Development Applications and Schedules*, Ivanhoe will implement a number of measures to comply with the setback requirements from Directive 056 to address the potential for accidental releases at wellheads and pipelines. These measures may include:

- all well pads will be designed to provide a surface runoff collection pond (with impermeable liner) by way of a surrounding berm or ditch;
- all well pads will be designed to prevent runoff from off-site drainage reaching the site by way of a surrounding berm or ditch and elevated pads;
- well heads and pipelines will be equipped with automatic controls and emergency shutdown valves to shutdown automatically in case of an event;
- routine well maintenance and pipeline integrity inspection to identify potential deficiencies for correction and to clean up leaks and spills in a timely manner;
- as outlined in Volume 5, SIR2 34, Ivanhoe will implement a Spill Response Plan and plans to become a member Area Y of the Western Canadian Spill Services Ltd. to provide timely, coordinated and efficient spill response;
- well pads will have spill response stations, including booms, absorbents, containers and other spill response equipment to provide timely access during a spill event;
- use of vacuum trucks or other applicable equipment, as necessary, to clean up any spilled bitumen, produced water or other liquids;
- obtaining a Crown disposition if the well centre is located on Crown land; and
- maintaining natural drainage if there is intermittent drainage or a spring/artesian flow across the well site.



Legend

- Terrestrial LSA
- Tamarack Project Footprint
- Tamarack Other Disturbance
- Current Baseline Disturbance
- Open Water
- Watercourse
- No Defined Channel
- Suncor MSL044435 Boundary
- Fen
- Well

Well Pad	Well ID	Distance (m)
2	F4I	80
2	F5P	60
2	F5I	40
2	F4p	100

Sources: Al-Pac, Ivanhoe, Spatial Data Warehouse Ltd.

Path: S:\Gis\Projects\CE\IvanhoeEnergy\CE0374601_Tamarack_SIRs3\ArcGIS\Question13\SIR3-Fig13-01.mxd

Ivanhoe Energy
Tamarack Project

Well Pad Plot Plan and Water Body Set Backs

DATE: November-2012				SIR3-Fig13-01 12-11-28	**Figure SIR3 13-1**
PROJECT: CE0374601				PROJECTION/DATUM: UTM Zone 12 NAD83	
ANALYST: KW	QA/QC: KW	EH	EH	DRAWN BY: AMEC	PREPARED BY: AMEC

Ivanhoe Energy

AENV Responses
EPEA Application No. 001-267615

AENV Responses
EPEA Application No. 001-267615

WATER

HYDROLOGY

14. Volume 5, Supplemental Information Request #2, Response 53, Pages AENV-36
Ivanhoe has not satisfied the information requirements to confirm that the predicted runoff amounts are accurate and that the resulting increase in runoff apparent in the Unnamed Creek 2 (UN2) catchment as a result of the project will have no adverse effects. Ivanhoe indicates that the annual runoff volumes will increase by between 33 and 39 percent in UN2 (Table SIR2 53-1) due to project-related changes to the landscape. This will translate into an increase in peak flows by some amount and thus potentially change the regimes of the streams in the catchment. Ivanhoe suggests that effects on the upland portion of the catchment will be benign due to the mild slopes and numerous beaver dams (provided these are not removed). However, there remains significant concern regarding the steeply sloped channel that extends down the so-called escarpment leading to the Athabasca River.

Ivanhoe suggests that portion of the main stream channel is already armoured with relatively large bed material, as evident in Figure SIR2-53-1, and that this material should withstand the additional erosive power of the stream under the new hydrologic regime. The assumption that project impacts will be mitigated by beaver dams and self-armouring is not technically justified. This qualitative assessment is insufficient given the hydraulic techniques that are routinely applied to problems of this type. Given the lack of quantitative evidence, it is reasonable to believe that the channel has developed to some quasi-equilibrium condition and that the changes to the flow regime could cause either (i) degradation and thus promote bank instability or (ii) if the degradation is prevented by the existing armour layer bank erosion will accelerate thereby promoting instabilities as is evident in numerous case studies of similar situations.

a. Determine the potential increase in peak flows and assess the current and future stability of the bed along a salient typical reach of the outlet channel as it flows over the escarpment. This would require a profile and cross section survey, bed material sampling, and a hydraulic assessment of the stability of the bed material under the new hydrologic regime.

Application Case peak flow impacts are discussed in Volume 2, Section 7.5, Table 7.5-3 and analysis concluded that in Unnamed Creek 2 (UN2), an increase of 31.7% was expected during the 1:100 year flood event.

Using cross section data collected as part of manual stream flow measurements and photos to estimate a representative cross section, a comparative hydraulic analysis was conducted. A channel with a 0.5 m bottom width, 0.5 m high banks, 1:1 sideslopes, a channel Manning's n of 0.05 and a floodplain Manning's n of 0.06 were used in a hydraulic analysis of both water depths and velocities for full range of slopes expected within the reach (Tables SIR3 14-1 and SIR3 14-2).

Table SIR3 14-1: Project Related Water Levels Effects on UN2

Channel Slope	Baseline Mean Annual Discharge Depth (m)	Project Mean Annual Discharge Depth (m)	Mean Annual Discharge Depth Increase (m)	Baseline 1:100 Year Discharge Depth (m)	Project 1:100 Year Discharge Depth (m)	1:100 Year Discharge Depth Increase (m)
1%	0.14	0.17	**0.03**	0.83	0.89	**0.06**
2%	0.12	0.14	**0.02**	0.76	0.81	**0.05**
3%	0.10	0.13	**0.03**	0.73	0.77	**0.04**
4%	0.10	0.12	**0.02**	0.71	0.75	**0.04**
5%	0.09	0.11	**0.02**	0.69	0.73	**0.04**
6%	0.08	0.10	**0.02**	0.68	0.72	**0.04**
7%	0.08	0.10	**0.02**	0.67	0.71	**0.04**
8%	0.08	0.10	**0.02**	0.66	0.70	**0.04**
9%	0.08	0.09	**0.01**	0.66	0.69	**0.03**
10%	0.07	0.09	**0.02**	0.65	0.68	**0.03**
11%	0.07	0.09	**0.02**	0.65	0.68	**0.03**
12%	0.07	0.09	**0.02**	0.64	0.67	**0.03**
13%	0.07	0.08	**0.01**	0.64	0.67	**0.03**
14%	0.07	0.08	**0.01**	0.64	0.66	**0.02**
15%	0.06	0.08	**0.02**	0.63	0.66	**0.03**
16%	0.06	0.08	**0.02**	0.63	0.66	**0.03**
17%	0.06	0.08	**0.02**	0.63	0.65	**0.02**
18%	0.06	0.08	**0.02**	0.62	0.65	**0.03**
19%	0.06	0.07	**0.01**	0.62	0.65	**0.03**
20%	0.06	0.07	**0.01**	0.62	0.65	**0.03**

Table SIR3 14-2: Project Related Velocity Effects on UN2

Channel Slope	Baseline Mean Annual Discharge Velocity (m/s)	Project Mean Annual Discharge Velocity (m/s)	Mean Annual Discharge Velocity Increase (m/s)	Baseline 1:100 Year Discharge Velocity (m/s)	Project 1:100 Year Discharge Velocity (m/s)	1:100 Year Discharge Velocity Increase (m/s)
1%	0.44	0.48	**0.04**	0.81	0.91	**0.10**
2%	0.55	0.62	**0.07**	1.01	1.12	**0.11**
3%	0.64	0.71	**0.07**	1.14	1.27	**0.13**
4%	0.70	0.79	**0.09**	1.24	1.38	**0.14**
5%	0.76	0.85	**0.09**	1.33	1.48	**0.15**
6%	0.81	0.90	**0.09**	1.40	1.56	**0.16**
7%	0.85	0.95	**0.10**	1.47	1.64	**0.17**
8%	0.89	1.00	**0.11**	1.53	1.71	**0.18**
9%	0.93	1.04	**0.11**	1.58	1.77	**0.19**
10%	0.96	1.08	**0.12**	1.64	1.82	**0.18**
11%	0.99	1.11	**0.12**	1.68	1.88	**0.20**
12%	1.02	1.15	**0.13**	1.73	1.93	**0.20**
13%	1.05	1.18	**0.13**	1.77	1.97	**0.20**
14%	1.07	1.21	**0.14**	1.81	2.02	**0.21**
15%	1.10	1.23	**0.13**	1.85	2.06	**0.21**
16%	1.12	1.26	**0.14**	1.88	2.10	**0.22**
17%	1.15	1.29	**0.14**	1.92	2.14	**0.22**
18%	1.17	1.31	**0.14**	1.95	2.18	**0.23**
19%	1.19	1.34	**0.15**	1.99	2.22	**0.23**
20%	1.21	1.36	**0.15**	2.02	2.25	**0.23**

Project-related increases to depth for the chosen cross section and slopes from 1 to 20% are anticipated to be 0.01 to 0.06 m. Project related increases to velocity for the chosen cross section and slopes from 1 to 20% are anticipated to be 0.04 to 0.23 m/s.

Ivanhoe concludes (Volume 2, Table 7.5-4) that effects to UN2 annual total discharge will be high in magnitude, negative in direction, long-term in duration, local in extent, high in likelihood, and reversible. Impacts due to the 1:100 year peak discharge will be high in magnitude, negative in direction, long-term in duration, local in extent, low in likelihood, and reversible. Ivanhoe concludes only that the final impact in UN2 due to annual total discharge and 1:100 year peak discharge will be low because of factors including the lack of fish habitat in UN2, mitigation due to wetlands, beaver ponds and self armouring, and the extremely local nature of the impact due to the proximity of the Athabasca River. This conclusion is supported by the information provided in Tables SIR3 14-1 and SIR3 14-2.

b. Develop and implement a monitoring plan that provides an ongoing assessment of the stability of the channel with the intent of mitigating instabilities should they occur. A reasonable approach would be to establish a number of cross sections at representative locations along the creek and monitor changes to these cross sections at two to three intervals. If it appears that the channel is stable after a period of say 10 years, discontinue the monitoring. If the channel appears to be changing, mitigate the changes using appropriate grade control or bank erosion techniques.

As per Volume 2, Section 7.5.5, Ivanhoe is committed to "Monitoring along the watercourses in UN1 and UN2 between the Project Area and the Athabasca River valley, particularly along the reaches between the crest of the east Athabasca River valley wall and the mouths of the channels. This program will include peak flow monitoring, periodic discharge measurements, as well as visual inspection for signs of increased erosion. If areas of increased erosion are identified, site-specific corrective measures will be developed and implemented."

EPEA approvals typically provide detailed specifics on required monitoring programs. A conceptual plan, as summarized below would be acceptable to Ivanhoe:

- establishing continuous hydrometric monitoring stations on both UN1 and UN2;
- selection of three sites on UN2, two sites on UN1, and two sites on a nearby stream un-affected by the Project to be monitored annually during the open water season for the first three years, and every three years thereafter for signs of erosion and downcutting. Representative cross sections at each of these sites will be marked, and benchmarks will be established from which to measure relative channel width and bed elevation. Photo records will be maintained for each site; and
- if areas of increased erosion are identified, site-specific corrective measures will be developed and implemented, in consultation with AENV.

AQUATICS

15. Volume 5, Supplemental Information Request #2, Response 33, Page AENV 1 Ivanhoe states the majority of wellhead failures would be contained to the well pad but *There are conditions and events that could result in releases to the environment off-site, such as catastrophic failures or high pressure releases.* Ivanhoe revised the assessment of high pressure releases, downgrading the likelihood from possible to rare. However, in the response to a., Ivanhoe indicates that a rare event is one that is *highly unlikely but might occur under exceptional circumstances,* where a possible event is described as *might occur at some time as there is a history of occurrence within industry.*

a. Clarify the distinction between wellhead failures, wellhead releases, well blowouts, catastrophic failures and high pressure releases.

The requested distinctions of these different terms are:

- *Wellhead release:* Is the release of well fluids and gas (production or injection) to the atmosphere in a controlled or uncontrolled manner.
- *Wellhead failure:* Is the failure of a wellhead component that release of well fluids (production or injection) to the atmosphere. This terminology is used to define a wellhead failure above the master valve so that the well can be controlled by shutting in this valve.
- *Well blowout:* Is the uncontrolled release of well fluids and gas (production or injection) to the atmosphere that cannot be controlled without a major intervention. These conditions can occur during drilling and production/injection operations. For this to occur during production/injection operations a complete failure of the wellhead or casing is necessary.
- *Catastrophic failures:* This term is used to define a complete failure of a component due to defects in material or construction, accidents, sabotage, and extreme weather events.
- *High pressure release:* Is a controlled or uncontrolled release of high pressure well fluids (oil water and gas). In SAGD operation this would also include steam. These high pressure releases could also occur within the facility and associated pipelines.

b. Provide justification for the re-classification of high pressure releases given the criteria presented and history of occurrence of these releases in the in-situ industry.

In answering Volume 5, SIR2 33b, Ivanhoe reclassified well blowouts (a form of high pressure release) but has not classified high pressure release as a separate item. The high pressure release contemplated within the response to SIR2 33b deals with well releases and well blowouts (both of which may result in a high pressure release although the magnitude between these two types of releases are significantly different). The classification of a well blowout as a

rare event is justified since this type of accident occurs very infrequently within the oil sands and within the general Alberta petroleum industry. The potential magnitude of high is justified since a well blowout is a significant event and normally requires a period of time to correct.

A well release is not of the same magnitude as a well blowout. A well release can be controlled by shutting in the wellbore at the master valve. This type of high pressure release is classified as possible because there is some history of it occurring within oil sands SAGD operations. The magnitude of this type of release would generally be low because of the ability to terminate the release within a short time frame limiting the size of the release.

16. Volume 5, Supplemental Information Request #2, Response 52, Page AENV-35 Ivanhoe references the Project Update and ground investigations undertaken in May 2012. The Update describes a helicopter survey to assess permanence and channel development of the headwater streams located in proximity to proposed pad locations for the project; but, does not describe ground investigations.

a. Clarify whether these headwater channels were assessed on the ground or by helicopter.

See response to SIR3 11.

b. Confirm how Ivanhoe will ground truth air survey information to ensure infrastructure is located away from local drainage with defined banks and channels.

Ivanhoe will ground truth the well pad and CPF locations and the potential for defined channels within 100 m of these facilities during the following activities:

- pre-disturbance assessments (PDAs) for each Project component; and
- ground surveys associated with detailed engineering design.

17. Volume 5, Supplemental Information Request #2, Response 82 a and b, Page AENV-77, Volume 5, Supplemental Information Request #2, Response 59 b, Page AENV-48

Ivanhoe states based on the information available at this time *The proposed access road crosses the headwaters of Clarke Creek, a tributary to the Athabasca River.* Ivanhoe also states *Based on the analysis of aerial imagery the Clarke Creek crossings consist of ephemeral drainages with discontinuous channel development… Channels that are present are generally small (i.e., >5m).* Ivanhoe also states *All watercourses will be crossed using clear span bridge structures unless it is determined that there is no potential fish habitat present at the crossing location.*

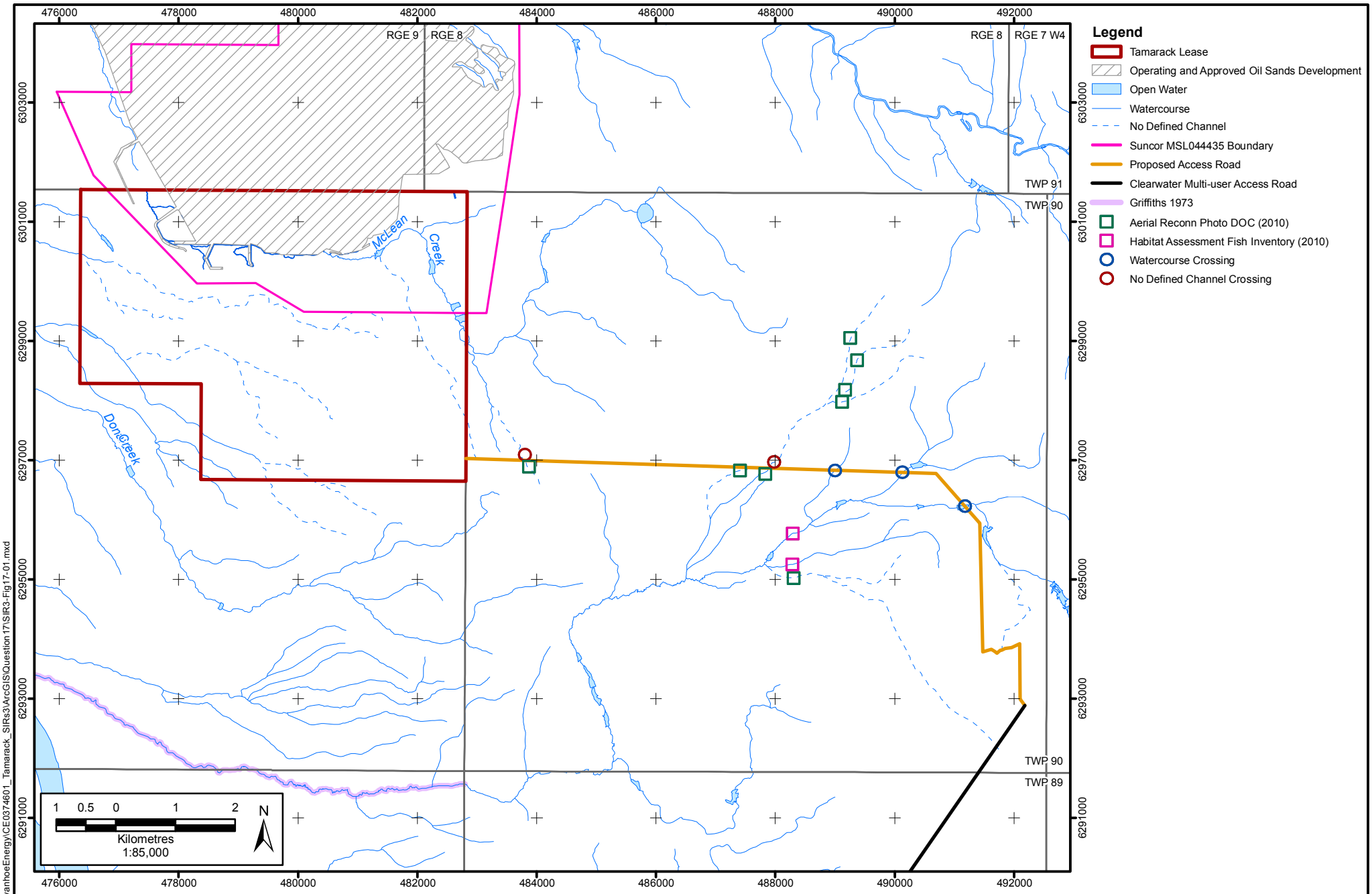
a. Given data were not presented to characterize fish habitat and use in Clarke Creek provincial fisheries staff are challenged to understand the potential impacts of the project. Present all existing data and Traditional Ecological Knowledge available to characterize current and historical fish habitat and use.

Available fisheries data on Clarke Creek is limited to two sampling events. The first occurred in 1972 along the lower section of Clarke Creek (Griffiths 1973). The surveyed reach was approximately 4.8 km long located near the confluence of the Athabasca River (Figure SIR3 17-1). The average width of the creek was 2.4 m and was considered intermittent having an average depth of 0.3 m or less (Griffiths 1973). Available cover was primarily overhanging vegetation with limited instream woody debris and depth limited. The creek was rated as having poor to moderate habitat for sport fish because of its small size. One pool was sampled and a few juvenile Arctic grayling were captured (Griffiths 1973).

The second event occurred in 2010 in the upper reaches of the drainage basin near the proposed crossing location (Figure SIR3 17-1). This survey was conducted by Ivanhoe as a part of initial route selection. The survey included a reconnaissance to identify areas with defined channels and fish habitat assessments and inventories at two sites on Clarke Creek with defined channels. During the survey, four species of forage fish were captured and included brook stickleback, finescale dace, fathead minnows, and pearl dace (ESRD 2012).

The surveyed reach of Clarke Creek flowed through a low lying drainage occasionally confined by dry upland glacial deposits with a mature stand of white spruce and aspen. The surveyed reach is characterized by a series of abandoned beaver dams and drained impoundments connected by a straight incised channel. The creek has good flow. The incised channel had an average width of 2.2 m while the remains of the largest impoundment had a channel width of 83.0 m.

Substrate within the creek was predominately fines with a small amount of large cobble and boulders noted. Stream flow was good and depths ranging from 0.3 to 1.0 m. The majority of the banks were vertical in shape ranging in height from 0.2 and 0.6 m. Riparian vegetation along the creek was predominately willow and alder with some areas of white spruce and aspen.



Sources: Ivanhoe, Spatial Data Warehouse Ltd.

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Ivanhoe Energy
Tamarack Project

Proposed Access Road Watercourse Crossings and Available Fisheries Information

DATE: November 2012		SIR3-Fig17-01 12-11-26	**Figure SIR3 17-1**
PROJECT: CE0374601		PROJECTION/DATUM: UTM Zone 12 NAD83	
ANALYST: KW	QA/QC: KW RF EH	DRAWN BY: AMEC	PREPARED BY: AMEC

Available fish cover was 40% and primarily made up of water depth (30%) and instream vegetation (30%), followed by small woody debris (20%), overhanging cover (8%), undercut banks (5%), boulder (5%), and surface turbulence (2%).

This section of Clarke Creek was rated as having good quality habitat for forage fish species but poor habitat quality for Arctic grayling because of the lack of preferred habitat (i.e., clear, cold water; riffle-run sections with gravel substrates that are free of fines; and fast flows) (Nelson and Paetz 1992; Stewart and Watkinson 2007). Species that require rocky substrates to complete one or more life stages would have limited success.

TEK provided to Ivanhoe in connection with the Project does not provide any specific information relative to characterization of current and historical fish habitat and use.

b. Provide a data collection plan, schedule and target date to acquire and present the additional data required to assess fish habitat and use for submission to Alberta Environment and Sustainable Resource Development (ESRD) Fisheries and Lands staff in support of planned watercourse crossings. Clearly describe the criteria/methods Ivanhoe will use to determine that potential fish habitat is not present at crossing sites in preparation for meeting Schedule 4 1(1)(b)(i) & (e) of the Code of Practice for Watercourse Crossings (2007) (note: beaver dams are not considered permanent or complete barriers to fish presence and use).

Ivanhoe considers Clarke Creek fish-bearing. When final crossing locations have been determined, fish habitat assessments will be conducted at the crossing locations in accordance to the Code of Practice for Watercourse Crossing (AENV 2007). Information will be collected and made available as part of the Code of Practice notification process. All watercourses will be crossed using clear span bridge structures unless it is determined that there is no potential fish habitat present at the crossing location. A defined channel with evidence of deposition and scour will be used to indicate that potential fish habitat is present. Ivanhoe is committed to installing clear span bridges to minimize impacts to fish habitat. Where a defined channel does not exist, Ivanhoe will install culverts to maintain surface drainage.

c. Discuss how forage fish presence and long-term maintenance and function of watercourse crossings will be considered for the lifetime of the crossing.

Monitoring to ensure watercourse crossings are functioning as intended will be conducted during the life of the Project. Monitoring will include:

- routine inspection of bridge crossings to ensure that bridge openings are not affected by debris accumulations, ice scour, or beaver activity;
- bank/abutment erosion at the crossings will require prompt remediation, should it occur; and

- routine inspection of water levels on both sides of the road in wetlands/muskeg areas to ensure that ponding, indicating drainage obstruction, does not occur or that mitigative measures can be implemented in a timely fashion if cross-drainage is demonstrated to be impeded.

Monitoring will occur, regardless of the presence of forage fish.

d. How will Ivanhoe ensure road grading and maintenance will not result in the deposit of road gravel and sediment into the channel?

Road grading will not be permitted across the bridge or culvert crossing. Ivanhoe will use qualified environmental inspectors during the construction phase and implement a post-construction monitoring program. This program will include inspection and maintenance of erosion control measures and the re-establishment of vegetation around stream crossings.

The following standard mitigation measures will be implemented to minimize impacts to the aquatic environment.

- minimize the clearing of vegetation to provide access to the work area. The removal of stumps, roots and downed (non-merchantable) or buried logs will not be undertaken in any areas not required for road construction, ditchlines or culvert or bridge installation;
- stabilize all disturbed areas by:
  - immediately installing temporary erosion control measures, at the crossing site and the developed road allowance sloping to the water body, that remain in place until vegetation or other long-term erosion control methods are fully established and functioning;
  - installing and placing long-term erosion control measures at the crossing site and the developed road allowance sloping to the water body, including, but not limited to, slope stabilization, revegetation, soil coverings, riprap and armouring, silt fences, check dams, sediment traps, brush barriers and vegetation filters; and
- divert runoff or water from the work site or area disturbed by the crossing construction that contains sediment to a setting pond, sediment trap, or through a vegetated area to minimize erosion and sedimentation of the water body.

Literature Cited

Alberta Environment (AENV). 2007. *Code of Practice for Watercourse Crossings*. Alberta Environment, Edmonton, Alberta.

Alberta Environment Sustainable Resource Development (ESRD). 2012. *FWMIS Internet Mapping tool*. Website: http://xnet.env.gov.ab.ca/imf/imf.jsp?site=fw_mis_pub. Accessed 15 October 2012.

Griffiths, E.W. 1973. *Preliminary Fisheries Survey of the Fort McMurray Tar Sands Area*. Department of Lands and Forest. Fish and Wildlife Division.

Nelson, J.S. and M.J. Paetz. 1992. *The Fishes of Alberta*. The University of Calgary Press. Calgary, Alberta. 437 pp.

Stewart, K.W. and D.A. Watkinson. 2007. *The Freshwater Fishes of Manitoba*. The University of Manitoba Press. Winnipeg, Manitoba. pp 278.

18. Volume 5, Supplemental Information Request #2, Response 60, Page 49
In response to the request for a discussion regarding long-term changes to aquatic biota in the watershed if bog and fen habitat cannot be reclaimed, Ivanhoe indicates *the watershed will be composed of more open water, marsh and swamp habitat in the long-term. In these modified habitats, the aquatic biota will be more diverse and abundant due to the wetter moisture regime and increased nutrients.*

a. Clarify the above statement discussing the different diversity levels and characteristics of aquatic flora and fauna in both a marsh and swamp habitat and a bog and fen habitat.

Wetland habitats that have more open water interspersed with areas of emergent vegetation have been documented to have higher biodiversity than those wetlands with homogenous stands of vegetation (Schummer *et al.* 2012). In addition, Smith *et al.* (2007) observed that bogs are typically species poor compared to other wetland types. Locky and Bayley (2006) observed that wooded moderate-rich fens and black spruce swamps had the highest mean plant diversity, whereas wooded bogs and open extreme-rich fens had the lowest mean plant diversity. High plant diversity appeared to be related to high habitat heterogeneity and moderate environmental variables, e.g., pH and alkalinity.

This was also documented in Volume 2, Section 13.4.3 (Tables 13.4-14, 13.4-16, 13.4-21 and 13.4-22). Habitats associated with water (emergent wetlands, graminoid wetlands, open water, riparian communities and shrubby wetlands) were determined to overall to have higher biodiversity ranks then bogs and fens (lowland coniferous habitats).

Therefore, it was concluded that habitats with open water and greater habitat heterogeneity (e.g., marshes and swamps) would have a higher biodiversity of aquatic flora and fauna.

Literature Cited

Locky, D.A. and S.E. Bayley. 2006. *Plant Diversity, Composition and Rarity in the Southern Boreal Peatlands of Manitoba, Canada*. Can. J. Bot. 84(6): 940-955.

Schummer, M.L., J. Palframan, E. McNaughton, T. Barney and S.A. Petrie. 2012. *Comparisons of Bird, Aquatic Macroinvertebrate and Plant Communities Among Dredged Ponds and Natural Wetland Habitats at Long Point, Lake Erie, Ontario*. Wetlands 32:945-953.

Smith, K.B., C.E. Smith, S.F. Forest and A.J. Richard. 2007. *A Field Guide to the Wetlands of the Boreal Plains Ecozone of Canada*. Ducks Unlimited Canada, Western Boreal Office: Edmonton, Alberta. 98pp.

TERRESTRIAL

WILDLIFE

19. Volume 5, Supplemental Information Request #2, Response 91a, Page AENV-113 Ivanhoe indicates that seismic accounts for 89% of the regional linear disturbance (1.7 km^2 seismic/1.9 km of total disturbance). Despite the enormous contribution that seismic makes to linear disturbance in the region, Ivanhoe excludes their own project related seismic activities from their assessment of project effects stating they did not know at the time of submission that they were going to conduct seismic.

Ivanhoe also states they are not planning on conducting 3D or 4D seismic and will not assess the impacts of future seismic on wildlife.

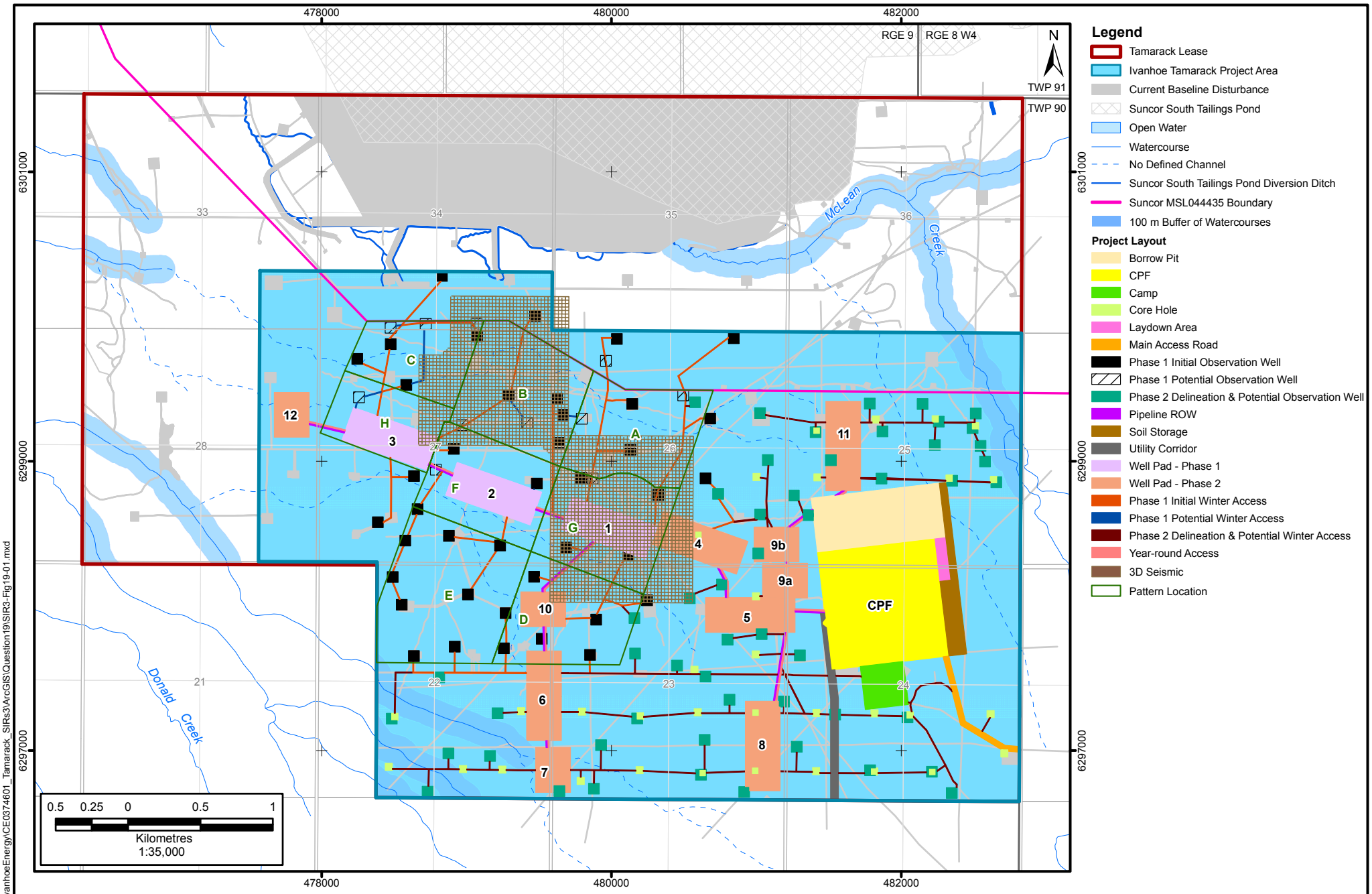
Although it is reasonable that the precise location of seismic is unknown at this time, it is unreasonable to assume that the project could be carried out in full without the use of seismic or to suggest that potential wildlife impacts of any future seismic should not be assessed.

a. Provide an assessment of the likely effects of any future seismic activity on fish and wildlife. Base the assessment on a model developed from known seismic footprints from other in-situ projects in the region. Use these data to predict the seismic footprint expected at maximum build-out and complete the assessment of effects of fish and wildlife.

Planned Phase 1 3D Seismic Program

Ivanhoe plans to conduct a limited 3D seismic program to gather additional information on localized subsurface faults, identified in the 2012 2D Seismic Program.

The Planned Phase 1 3D Seismic Program will focus on two areas within the Project Area (Figure SIR3 19-1). The first area, in SW 26-90-09 W4, is anticipated to have a line spacing of 24 m x 24 m, resulting in 78 north-south lines and 78 east-west lines. The second area, in NE 27-90-09 W4, is anticipated to have a line spacing of 24 m x 24 m, resulting in 44 north-south lines and 38 east-west lines. For both areas, low impact seismic techniques will be employed and the line widths will be 2.75 m wide for east-west lines and 1.75 m for north-south lines. The predicted seismic program for Phase 1 of the Project is anticipated to result in approximately 38.4 ha of disturbance. Of this, 10.2 ha will overlap with proposed and existing developments such as well pads, observation wells, winter access, and existing seismic. Therefore, the Planned Phase 1 3D Seismic Program would result in 28.2 ha of incremental disturbance.



Sources: Ivanhoe, Spatial Data Warehouse Ltd.

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Ivanhoe Energy
Tamarack Project

Planned Phase 1 3D Seismic Program

DATE: November 2012		SIR3-Fig19-01 12-11-29	**Figure SIR3 19-1**
PROJECT: CE0374601		PROJECTION/DATUM: UTM Zone 12 NAD83	
ANALYST: KW	QA/QC: KW EH EH	DRAWN BY: AMEC	PREPARED BY: AMEC

This is the only 3D seismic program currently planned for the Project. Although not anticipated, there is potential for future programs in Phase 2. Any future seismic requirements would be determined based on the identification of complex geological conditions, such as faulting, that would warrant additional characterization. No structural anomalies beyond what has been imaged to date have been identified, even with comprehensive 2D seismic information.

Modelled 3D Seismic Program

To provide the reviewer with the information and assessment requested on the effects of any future seismic activity on fish and wildlife, Ivanhoe has collected seismic activity information for other operating SAGD projects within Alberta and determined the average percentage of each project development area cleared for 3D seismic activities (see SIR3 19b). Based on the extrapolation of the average 3D seismic use in existing projects (Table SIR3 19-1), an additional 45.1 ha of incremental disturbance associated with the Tamarack Project would be required to match the 3D seismic density of other SAGD projects (Table SIR3 19-2). This new disturbance is inclusive of an approximate 120 m buffer zone, as required to properly image the Tamarack reservoir. Based on the shallow nature of the Tamarack resource, the use of a smaller buffer is appropriate, as the buffer zone size is a function of reservoir depth, e.g., as the reservoir gets deeper, the buffer zone gets larger.

Table SIR3 19-1: *In Situ* Projects Used for the Determination of Modelled Future Seismic Activity Associated with the Project

Project	3D Seismic Disturbance (ha)			Project Development Area (ha)	% of Project Development Area		
	Incremental	Overlapping	Total		Incremental	Overlapping	Total
Suncor Firebag	102.4	63.1	165.5	2 617.4	3.9	2.4	6.3
Devon Jackfish	227.0	54.8	281.8	3 179.8	7.1	1.7	8.9
Cenovus Christina Lake	107.5	27.0	134.5	2 212.4	4.9	1.2	6.1
Suncor MacKay River	5.0	1.2	6.2	4 179.9	0.1	0.0	0.1
Statoil Kai Kos Dehseh Leismer	133.2	16.7	149.9	2 077.5	6.4	0.8	7.2
Husky Sunrise	648.5	162.8	811.3	16 970.9	3.8	1.0	4.8
MEG Christina Lake	356.0	50.7	406.8	7 387.1	4.8	0.7	5.5
Average	**225.7**	**53.7**	**279.4**	**5 517.9**	**4.4**	**1.1**	**5.6**

Table SIR3 19-2: Planned and Modelled Future Seismic Activity for the Project

Project	3D Seismic Disturbance (ha)			Project Development Area (ha)	% of Project Development Area		
	Incremental	Overlapping	Total		Incremental	Overlapping	Total
Phase 1 Planned	28.2	10.2	38.4		1.7	0.6	2.3
Phase 2 Modelled	45.1	8.3	53.3		2.7	0.5	3.3
Ivanhoe Tamarack Total	**73.3**	**18.5**	**91.7**	**1650.1**	**4.4**	**1.1**	**5.6**

The analysis provided in this response provides a conservative assessment of potential impacts that could be expected due to the acquisition of additional 3D seismic data. The hypothetical additional 45.1 ha of incremental seismic disturbance calculated for the Project Area is approximately 1.6 times more disturbance than identified in the Planned Phase 1 3D Seismic Program. Based on current information, this is a conservative assumption.

Ivanhoe has based the potential for seismic on the Project Area, identified in Figure SIR3 19-1. This is a reasonable boundary because it is consistent with the development outlined in the current application.

The assessment provided in this response does not consider any potential impacts associated with 4D seismic because Ivanhoe does not plan to undertake 4D seismic programs at any time for steam chamber monitoring. Ivanhoe has proposed the Reservoir Monitoring Plan provided in Volume 5, Appendix SIR2 D, which includes the use of an extensive tiltmeter system to monitor near real-time steam chamber development. The implementation of this monitoring technology replaces any need to consider 4D seismic. This plan is considered best in class and does not require recurring disturbance. Information regarding the implementation of this monitoring plan was provided as a part of Ivanhoe's responses to Volume 5, SIR2 13 and Appendix SIR2 D.

The effects of future seismic activity on fish and wildlife based upon the information requested by AENV are presented below. Specific locations and habitat loss estimates have been quantitatively determined for Phase 1 of the Project and qualitatively assessed for potential future seismic programs.

Potential Effects of any Future Seismic Activity on Fish

Fish have not been documented within the Project Area and only poor quality fish habitat is present therefore direct effects to fish are not expected as a result of any future seismic programs. Seismic programs do result in additional cleared areas which can increase runoff and impact fish and fish habitat in downstream areas. Therefore, impacts to mean annual flow and the 1:100 year flood event were analyzed using the same methods outlined in the environmental impact assessment.

The Planned Phase 1 3D Seismic Program disturbances occur within the UN1, UN2 and UN3 watersheds (Table SIR3 19-3). Impacts due to the seismic program result in watersheds UN1 and UN2, with small 1:100 year flood event increases of 0.1 m^3/s and 0.2 m^3/s, respectively. Mean annual flow will not change measurably in any of the watersheds.

Table SIR3 19-3: Flow Changes due to Phase 1 3D Seismic Program

Watershed	1:100 Year Flood Event (m^3/s)	Mean Annual Flow (m^3/s)
UN1	0.10	<0.01
UN2	0.20	<0.01
UN3	0.00	0.00

The additional 45.1 ha of disturbance associated with potential future seismic programs cannot be specifically placed within the Project Area; therefore, impacts to each watershed cannot be determined. Assuming that the 45.1 ha required to be cleared for the future seismic investigations is distributed evenly over the Project Area; the area of additional disturbance would be approximately 9 ha in Watershed UN1, 27 ha in Watershed UN2 and 9 ha in the McLean Creek watershed. Given that an increase in cleared area is directly related to an increase in runoff and peak flows, both the 1:100 year flood peak discharge and the mean annual discharge could be expected to increase in the affected watersheds. Using the increases computed for the Planned Phase 1 3D Seismic Program as a guide, it is estimated that the 1:100 year flow in Watershed UN 2 could increase by approximately 0.48 m^3/s as a result of the additional clearing. The increase in 1:100 year peak flows in the UN1 and McLean Creek watersheds is similarly estimated to be less than 0.1 m^3/s. Increases in mean annual flows in all watersheds is estimated to remain less than 0.01 m^3/s.

The final impact in watersheds within the Project Area due to annual total discharge and 1:100 year peak discharge will be low because of the lack of fish habitat, mitigation due to fens, wetlands, beaver ponds and self armouring, and the extremely local nature of the impact due to the proximity of the Athabasca River. Changes in flow will not be detected within the Athabasca River and therefore impacts to fish within the Athabasca River will not occur due to the addition of future seismic programs.

The monitoring program proposed for the Project in Volume 2, Section 7.5.5, and described further in the response to SIR3 14b will monitor changes in watersheds due to increased flows. If areas of increased erosion are identified, site-specific corrective measures will be developed and implemented, in consultation with AENV, to limit any effects on fish and fish habitat in the Athabasca River.

Potential Effects of any Future Seismic Activity on Wildlife

Vegetation clearing associated with the Planned Phase 1 3D Seismic Program represents new vegetation clearing that may impact wildlife habitat. Black spruce represents the majority of habitat to be cleared for 3D seismic. Small amounts of fen, white spruce, mixedwood and Jackpine habitats will also be cleared (Table SIR3 19-4).

Table SIR3 19-4: Predicted Incremental 3D Seismic Disturbance and Wildlife Habitat

Broad Habitat Type	Ecosite Phase	Ecosite (ha)	Ecosite (%)	Habitat (ha)	Habitat (%)
Black spruce	g1	0.5	1.9	23.2	82.3
	j1	16.6	58.7		
	j2	6.1	21.7		
Fen	k1	1.8	6.2	1.8	6.2
Jackpine	c1	0.5	1.8	0.5	1.8
Mixedwood	b3	0.9	3.0	0.9	3.0
White spruce	h1	1.9	6.6	1.9	6.6
Total	**-**	**28.2**	**100.0**	**28.2**	**100.0**

As mentioned above, potential disturbance associated with Modelled 3D Seismic Program cannot be specifically placed within the Project Area; therefore, direct impacts to wildlife and wildlife habitat cannot be determined. The 45.1 ha represents a 160% increase over the incremental disturbance of 28.2 ha expected to be cleared for Planned Phase 1 3D Seismic Program. This increase represents an additional loss of vegetation and potential wildlife habitat. During baseline field studies, evidence of habitat use by two wildlife species of concern was found within the area of the Planned Phase 1 3D Seismic Program blocks: foraging sign of a pileated woodpecker (*Dryocopus pileatus*) and two Cape May warblers (*Dendroica tigrina*), were heard calling. Additionally, one Canadian toad (*Anaxyrus hemiophrys*) was heard calling just north of the proposed SW 26-90-09 W4 block. As such, breeding and foraging habitat for these species of concern may be directly impacted by the 3D seismic activities. Mitigation measures such as restrictions on clearing periods, winter clearing, low impact clearing, preserving large diameters trees, and utilizing vehicles with low ground pressure will reduce the effects of the 3D seismic activity for these species of concern.

Short-term impacts to wildlife may include altered behaviour and avoidance of preferred habitats from blasting, machinery noise and human presence while the 3D seismic lines are being cut. In the long-term, large mammals may be more susceptible to increased mortality as a result of altered predator-prey interactions (James and Stuart-Smith 2007), and the new access may lead to increased hunting pressure. Some scavenging species, such as bears, foxes and martens, may also be attracted via cutlines into camps, potentially leading to increased human-wildlife interactions (YEMR 2006) and wildlife habituation.

Seismic lines do not appear to have a large impact on songbird communities, though responses differ by species. For some species, seismic lines may act as territorial boundaries. This was observed with ovenbirds, who would cross seismic lines at some point during the breeding season but showed distinct use of one side of the line (Machtans 2006; Bayne *et al.* 2005a). Some ground and shrub nesting birds have been observed to increase their territory size in response to seismic disturbance. A study by Leonard *et al.* 2008 found that some species increased the size of their territories by about 30% when direct habitat loss by seismic was only 8% of an area. Seismic lines may also increase the foraging efficiency of avian predators such as gray jays (Thompson *et al.* 2008). However, birds will readily incorporate low impact seismic lines (i.e., 6 m or less) into their territories (Bayne *et al.* 2005b), and most canopy nesting species do not appear to be affected by seismic lines. Many bat and owl species will use clearings and linear features as movement corridors and for foraging.

Impacts to amphibians are anticipated to be short-term and negligible as the 3D seismic lines will be cut in the winter months while amphibians are hibernating, and vegetation in wetland habitats rebounds quickly after low impact seismic has been cut.

Though linear disturbance thresholds have not been determined for most wildlife species, studies have shown that linear disturbances and corridors can affect the distribution, movement, and population dynamics of many wildlife species (James and Stuart-Smith 2007; Jalkotzy *et al.* 1997).

Low impact seismic lines represent best management practices for reducing the footprint of seismic exploration. Ivanhoe will implement this technique which includes mitigation to lessen the potential impacts of 3D seismic on wildlife, such as:

- cutting lines at a minimal width with smaller equipment;
- meandering the lines and creating doglegs at intersections to break line-of-sight effects;
- preserving larger trees;
- winter access for seismic programs;
- surface cutting which minimizes disturbance to soil and root systems through seasonal timing, and the use of vehicles with low ground pressure and blade covers; and
- clean cuts near to or at ground level to ensure wildlife are not injured by long splintered stumps.

These low impact seismic techniques represent current standard best practices for 3D seismic activities (ASRD 2010; YEMR 2006). Schneider and Dyer (2006) indicate that the lines appear to be visibly reintegrated into the forest within five years without additional reclamation. Due to the implementation of these techniques and mitigation, the effects of the Project's 3D seismic activities on wildlife are predicted to be low.

b. Provide the data used to support the assessment, including the seismic densities for each project, the length of time each project has been in operation, a description of the extent of development at each site, a map indicating the location of the various projects, the assumptions within the model and any other details needed to explain the data set and model used to make predictions for the Tamarack project.

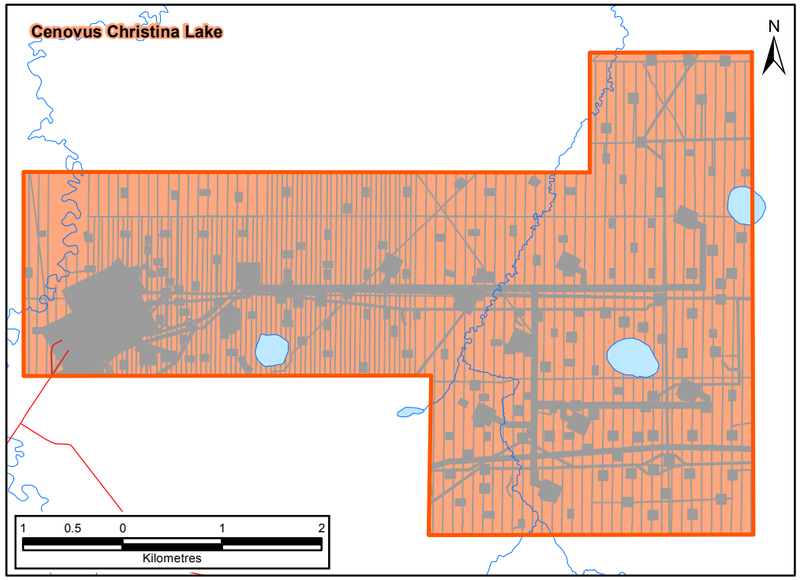
As indicated in SIR3 19a, Ivanhoe has identified a Planned Phase 1 3D Seismic Program for the Project. In order determine additional potential future seismic activity, Ivanhoe identified *in situ* operations within Athabasca Oil Sands Region currently in operation or where projects have been approved. Of the projects, a search was conducted to determine the availability of data to complete GIS analysis to establish impacts due to seismic activities. For the operating projects which had data available to Ivanhoe, respective project areas were identified and the amount of incremental and overlapping 3D seismic disturbance within each of the respective project areas was quantified. The results for each project were averaged and applied to the Tamarack Project Area.

The project screening is provided in Table SIR3 19-5. The seismic and project development areas used to support the assessment are provided in Table SIR3 19-1 and Figure SIR3 19-2. The planned and modelled future seismic activity associated with the Project is presented in Table SIR3 19-2.

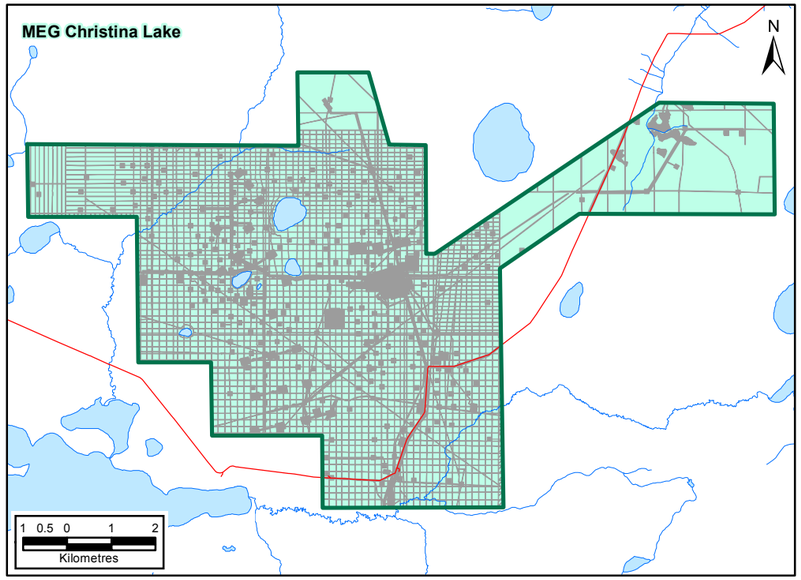
Table SIR3 19-5: *In Situ* Project Screening

Operator	Project	Type	Total Vertical Depth	Data Available	Used in Assessment	Notes
BP	Terre de Grace	SAGD	160	No	No	
Cenovus	Brintnell	SAGD	244	No	No	
Cenovus	Christina Lake	SAGD		Yes	Yes	Operating since 2008 Footprint used was updated in 2007 Baseline disturbance was updated in 2008
Conacher	Divide	SAGD	520	No	No	
Conoco Philips	Resdeln	SAGD	440	No	No	
Devon	Jackfish	SAGD		Yes	Yes	Operating since 2008 Footprint used was updated in 2007 Baseline disturbance was updated in 2008
Husky	Sunrise	SAGD		Yes	Yes	Under Construction Footprint used was updated in 2007 Baseline disturbance was updated in 2012
JACOS	Hanging Stone	SAGD	300	No	No	
Laricina	Saleski	SAGD	380	No	No	
Meg Energy	Hardy	SAGD	390	No	No	
Meg Energy	Christina Lake	SAGD		Yes	Yes	Under Construction Footprint used was updated in 2008 Baseline disturbance was updated in 2008
Nexen	Newby	SAGD	245	No	No	
Southern Pacific	MacKay	SAGD	190	No	No	
Statoil	Kai Kos Dehseh Leismer	SAGD	430	Yes	Yes	Demonstrator Project Operating since 2010, rest approved 2010 Footprint used was updated in 2008 Baseline disturbance was updated in 2008
Suncor	MacKay	SAGD	130	Yes	Yes	Operating since 2002 Footprint used was updated in 2010 Baseline disturbance was updated in 2010
Suncor	Firebag	SAGD	330	Yes	Yes	Operating since 2004 Footprint used was updated in 2011 Baseline disturbance was updated in 2012
Total	Joslyn	SAGD	95	Yes	No	Project has been suspended and limited seismic has been conducted

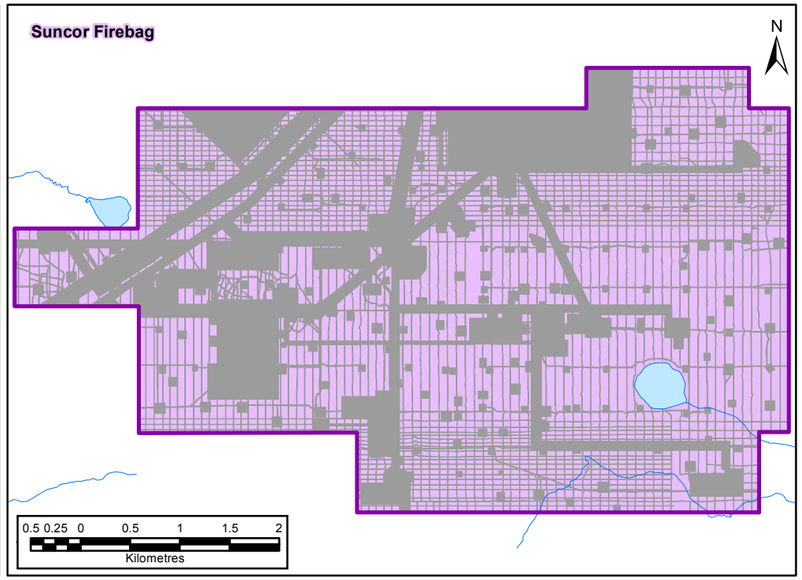
Cenovus Christina Lake



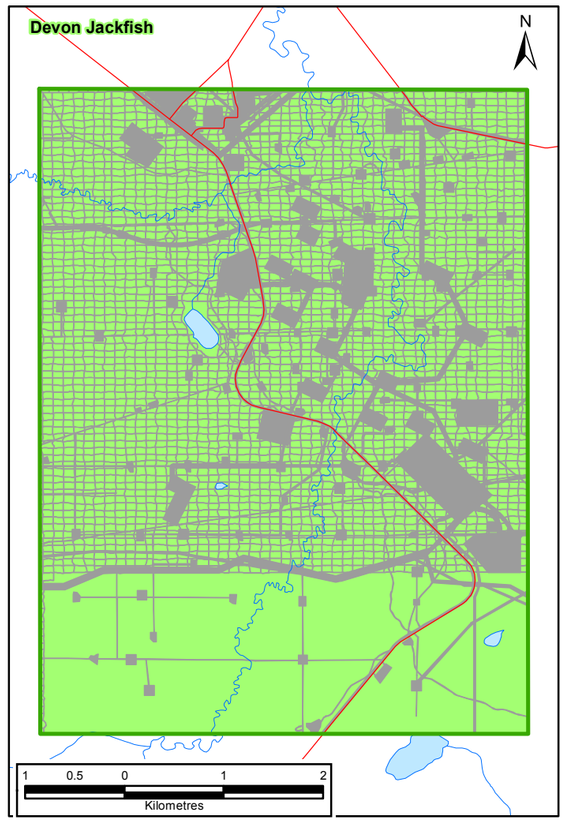
MEG Christina Lake



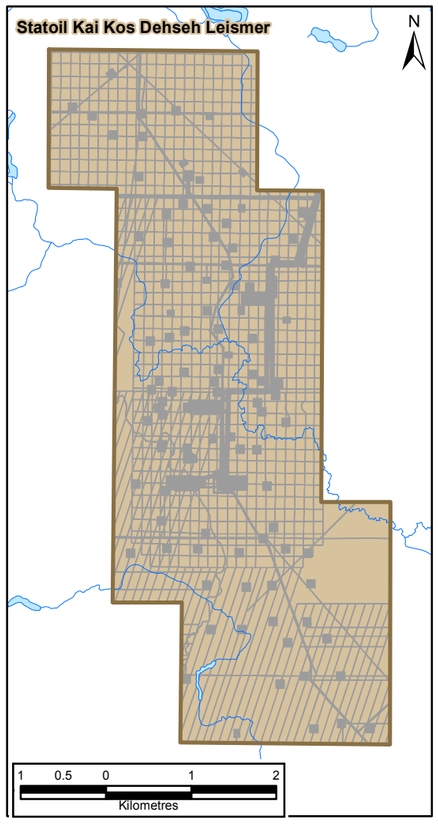
Suncor Firebag



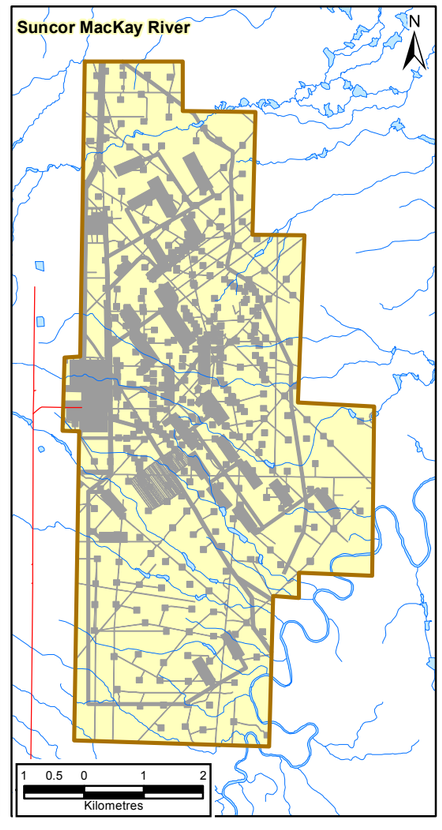
Devon Jackfish



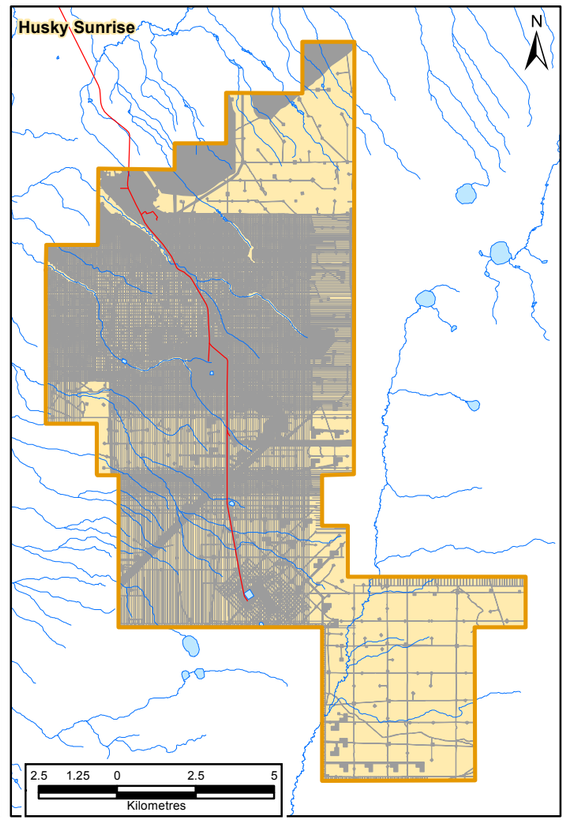
Statoil Kai Kos Dehseh Leismer

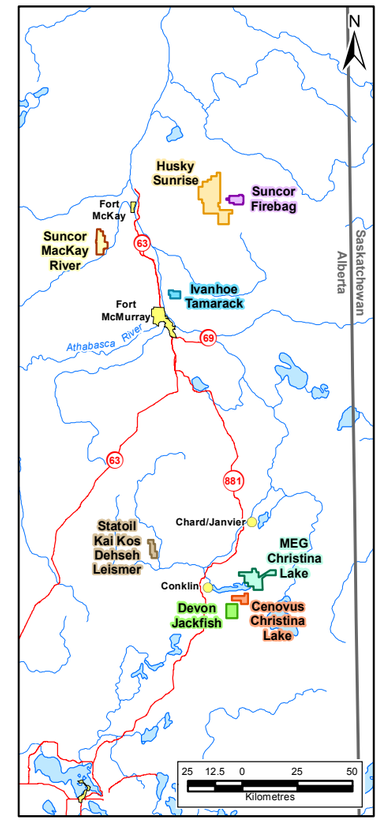


Suncor MacKay River



Husky Sunrise





Legend

- Cenovus Christina Lake Project Area
- Devon Jackfish Project Area
- Husky Sunrise Project Area
- Ivanhoe Tamarack Project Area
- MEG Christina Lake Project Area
- Statoil Kai Kos Dehseh Leismer Project Area
- Suncor Firebag Project Area
- Suncor MacKay River Project Area
- Baseline Disturbance

Sources: GeoBase®, Ivanhoe, Spatial Data Warehouse Ltd.

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Ivanhoe Energy
Tamarack Project

3D Seismic Programs

DATE: November 2012				SIR3-Fig19-02 12-11-29	**Figure SIR3 19-2**
PROJECT: CE0374601				PROJECTION/DATUM: UTM Zone 12 NAD83	
ANALYST: KW	QA/QC: KW	EH	EH	DRAWN BY: AMEC	PREPARED BY: AMEC

The analysis provided in this response provides a conservative assessment of potential impacts that could be expected due to the acquisition of additional 3D seismic data. The hypothetical additional 45.1 ha of incremental seismic disturbance calculated for the Project Area is approximately 1.6 times more disturbance than identified in the Planned Phase 1 3D Seismic Program. Based on current information, this is a conservative assumption.

The analysis did not include seismic outside of the Project Area as described in SIR3 19a. The analysis did not include 4D seismic as described in SIR3 19a.

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20. Volume 5, Supplemental Information Request #2, Response 82, Page AENV-75
Ivanhoe states *Impacts to fisheries, aquatic resources and wildlife associated with the access road from the CMAR to the Project were not considered.* Ivanhoe then describes how roads may affect wildlife in a general way, however no specifics on the vegetation, wildlife habitat, or wildlife along the proposed project access route from the Clearwater Multi Access Road (CMAR) were provided as was done for the rest of the Local Study Area (LSA).

a. Provide the rationale (highlighting the biological rationale) for treating the proposed project access road corridor from CMAR with less specificity than the project development area in the Environmental Impact Assessment (EIA).

At the time the Project application was submitted, the proposed access route was not determined. The final access route is dependent on the approval of the Ledcor Clearwater Multi-user Access Road (CMAR) and, therefore, the proposed access route cannot be finalized until that time. The Ledcor CMAR route has been altered throughout the CMAR approval process and, therefore, data collected by Ivanhoe for earlier access route options has limited applicability.

The current access route follows existing disturbance associated with winter road access, therefore, environmental disturbance will be an incremental increase, rather than new disturbance within the proposed right-of-way (ROW).

b. Provide a summary of all available data describing the baseline terrestrial resources, including vegetation classification, wildlife habitat, and wildlife occurrences along the proposed project access route from CMAR.

The proposed access road for the Project is situated within the Central Mixedwood Subregion of the Boreal Forest Natural Region of Alberta (NRC 2006). Overall, 47.29 ha of vegetation and currently available habitat for wildlife will be cleared for the proposed access road (Tables SIR3 20-1 and SIR3 20-2). A winter road is currently present along the proposed access road. This existing access, along with previous industrial and exploration disturbances, constitute 8.72 ha of the proposed 45 m wide access corridor.

Table SIR3 20-1: Ecosite Phases Along the Proposed Access Route

Ecosite Phase	Area (ha)
b3	1.05
c1	0.19
d1	10.48
d2	3.60
d3	1.25
g1	2.72
h1	2.97
i1	14.34
i2	6.71
j1	0.33
j2	1.68
k1	1.42
k3	0.30
Open Water	0.25
Total Undisturbed	*47.29*
Industrial/Clearing	0.29
ROW	0.85
Seismic/Trail	0.77
Wellsite	0.35
Winter Access	6.47
Total	**56.01**

Table SIR3 20-2: Habitat Types along the Proposed Access Road

Broad Habitat Type	Ecosite Phase	Ecosite (ha)	Ecosite (%)	Habitat (ha)	Habitat (%)
Jack pine	c1	0.19	0.3	0.19	0.3
White spruce	d3	1.25	2.2	4.22	7.5
	h1	2.97	5.3		
Mixedwood	b3	1.05	1.9	4.64	8.3
	d2	3.60	6.4		
Deciduous	d1	10.48	18.7	10.48	18.7
Black spruce	g1	2.72	4.8	25.78	46.0
	i1	14.34	25.6		
	i2	6.71	12.0		
	j1	0.33	0.6		
	j2	1.68	3.0		
Fen	k1	1.42	2.5	1.72	3.1
	k3	0.30	0.6		
Open water	-	0.25	0.5	0.25	0.5
Disturbed	-	8.72	15.6	8.72	15.6
Total	**-**	**56.01**	**100.0**	**56.01**	**100.0**

The township within which the access road is located has been mapped using the Alberta Vegetation Inventory methodology and converted to Ecological Land Classification units. The summary of areas of the ecosite phases (Beckingham and Archibald 1996) occurring along the access road ROW are provided in Table SIR3 20-1 and mapped on Figure SIR3 20-1. The last five categories in the table (Industrial/Clearing, ROW, Seismic/Trail, Wellsite, and Winter Access) represent existing clearings or disturbances on the landscape, while the remaining categories represent areas of native or undisturbed vegetation cover or open water.

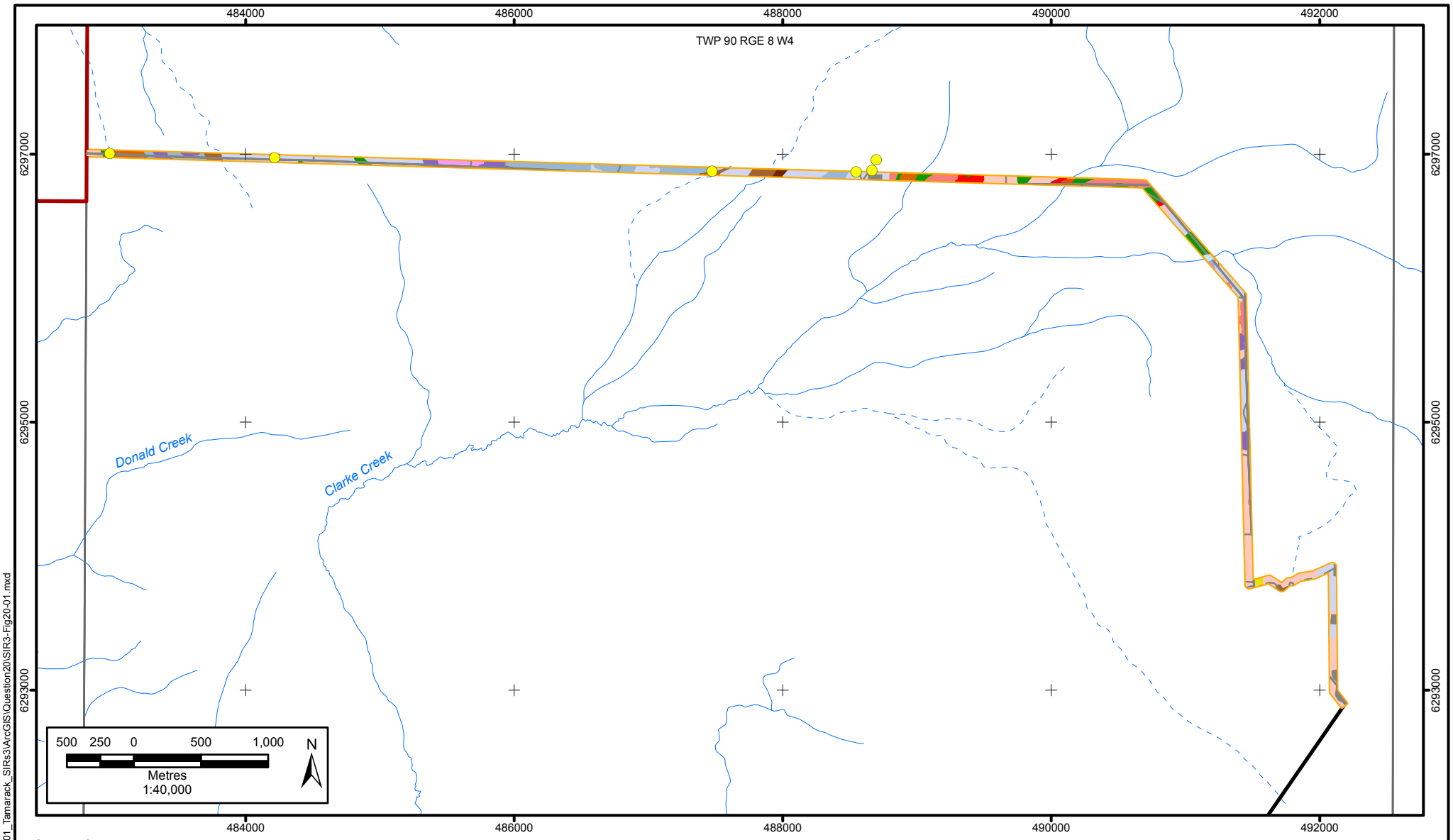
A late season rare plant survey was conducted in 2010 at six sites in the vicinity of the proposed access road (Figure SIR3 20-1). No rare plants were found at those sites. During the rare plant surveys, the ecosite phase mapping was also confirmed and the phase designation corrected if an error was noted. Any weed species observed was also noted, however, none were found at the sites visited in 2010 along the access road.

Of the 47.29 ha of currently available habitat for wildlife cleared for the proposed access road, the most common habitat type is black spruce, which comprises 46.0% (25.78 ha) of the access road (Table SIR3 20-2; Figure SIR3 20-2). Deciduous forest is also relatively common.

A Fisheries and Wildlife Management Information System (FWMIS) database search was conducted using the online Internet Mapping Framework tool developed by ASRD (ASRD 2011). Four records of wildlife species of concern were previously detected within 1 km of the proposed road, in Section 19-90-08 W4M (Figure SIR3 20-2): sandhill crane (*Grus canadensis*), Canada lynx (*Lynx canadensis*), fisher (*Martes pennanti*), and wolverine (*Gulo gulo*). FWMIS loadform data also detected two western tanagers (*Piranga ludoviciana*) in the southeast portion of the proposed access road (Skilnick *pers. comm.* 2012). No federally or provincially designated sensitive areas or wildlife zones are located along, or in the vicinity of, the proposed access road (ABADATA 2012).

c. Provide a plan as to how and when Ivanhoe will gather the additional data necessary to describe the terrestrial resources along the project access corridor to at least the same level of detail as was done for the rest of the LSA. Include a description of how and when these data will be provided to ESRD.

Ivanhoe will collect additional data along the access route during summer of 2013 after the access route to the Project has been finalized. This data will be used to support the Enhanced Approval Process for the access road Licence of Occupation which will be submitted to AENV. Additional data will be collected at watercourse crossings to satisfy the AENV *Water Act* Code of Practice for Watercourse Crossings and Fisheries and Oceans Canada Operational Statement for Clear-Span Bridges.



Legend

- Tamarack Lease
- Proposed Access Road ROW
- Baseline Disturbance
- Suncor MSL044435 Boundary
- Clearwater Multi-user Access Road
- Open Water
- Watercourse
- No Defined Channel
- Rare Plant Survey Location

Ecological Land Class (ELC)

b3	d2	h1	j1	k3	
c1	d3	i1	j2	Clearing	
d1	g1	i2	k1		

Note: AVI 2.1
Sources: Al-Pac, Ivanhoe, Spatial Data Warehouse Ltd.

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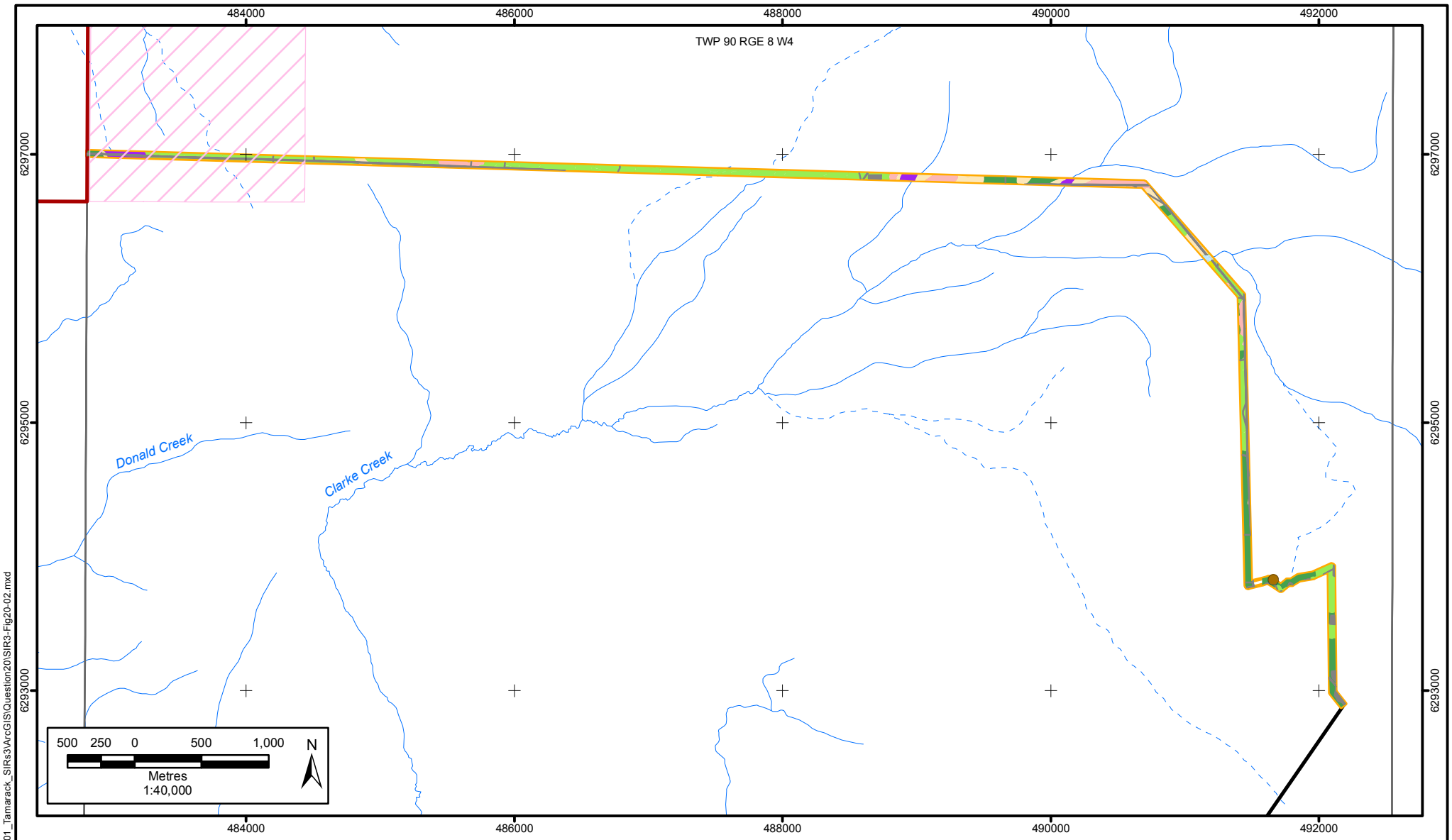
Ivanhoe Energy
Tamarack Project

Ecological Land Classes and Rare Plant Survey Locations Along the Proposed Access Road

DATE: November 2012				SIR3-Fig20-01 12-11-24	**Figure SIR3 20-1**
PROJECT: CE0374601				PROJECTION/DATUM: UTM Zone 12 NAD83	
ANALYST: KW	QA/QC: KW	LR	EH	DRAWN BY: AMEC	PREPARED BY: AMEC



Legend

- Tamarack Lease
- Proposed Access Road ROW
- Baseline Disturbance
- Suncor MSL044435 Boundary
- Clearwater Multi-user Access Road
- Open Water
- Watercourse
- No Defined Channel

Broad Habitat Type

- Jack Pine
- White Spruce
- Mixedwood
- Deciduous
- Black Spruce
- Fen

FWMIS Detections

- Canada Lynx, Fisher, Sandhill Crane, Wolverine
- Western Tanager (Species Count 2)

Note: AVI 2.1
Sources: Al-Pac, Ivanhoe, Spatial Data Warehouse Ltd.

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Ivanhoe Energy
Tamarack Project

Broad Habitat Types Along the Proposed Access Road

DATE: November 2012		SIR3-Fig20-02 12-11-26	**Figure SIR3 20-2**
PROJECT: CE0374601		PROJECTION/DATUM: UTM Zone 12 NAD83	
ANALYST: TR	QA/QC: KW CT EH	DRAWN BY: AMEC	PREPARED BY: AMEC

d. Describe what bio-physical constraints Ivanhoe will respect/avoid when selecting the final access route into the Project Area from CMAR. Include the biological rationale for each constraint selected.

Ivanhoe has selected the proposed access route based on:

- *following existing disturbance:* the access road follows existing winter road access therefore the access road will not contribute to new linear effects in the area and the amount of area to be cleared for the road is reduced. This will minimize the effects to vegetation, wildlife and biodiversity;
- *watercourse crossings:* the access road will be routed to minimize required watercourse crossings. Where watercourse crossings are required over defined channels (i.e., potential fish habitat), Ivanhoe will use clearspan bridges to minimize the effects to the aquatic environment; and
- *watercourses and riparian areas:* access road routing avoids running parallel to watercourses and riparian areas to minimized impacts to the aquatic environment, riparian vegetation, and wildlife movement corridors.

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HEALTH

21. Volume 5, Supplemental Information Request #2, Response 98a, Tables SIR 98-2 and 98-3, Pages AENV-125 and 126

In Table SIR 98-1 Nitrous dioxide (NO_2) and Sulphur dioxide (SO_2) were included in the screening. Alberta Health (AH) guidance states (footnote page 21) "Criteria pollutants, if being emitted by a proposed project, will automatically screen on to all assessments and, consequently, would not go through a screening process."

a. For the non-carcinogenic Chemicals of Potential Concern (COPC) chronic inhalation screening, include the Criteria pollutants as COPC and re-screen remaining chemicals. Include all chemicals which contribute 99% Cumulated Toxicity Potency in the Human Health Risk Assessment (HHRA).

Table SIR3 21-1 summarizes the non-carcinogenic chemical of potential concern (COPCs) chronic air inhalation screening, not including the criteria air contaminants. As a result, the following chemicals were added to the original list of COPC: manganese, aluminum, aliphatics C_5-C_8, hydrogen sulphide (H_2S), and lead.

The chronic air inhalation health risks for manganese are presented as hazard quotients in Table SIR3 21-2. None of the air inhalation hazard quotients exceed 1.0 at any of the receptor locations for the four assessment cases. As such, it is unlikely that chronic air inhalation of manganese will result in adverse health effects in the air quality regional study area (AQRSA).

The chronic air inhalation health risks for aluminum are presented as hazard quotients in Table SIR3 21-3. None of the air inhalation hazard quotients exceed 1.0 at any of the receptor locations for the four assessment cases. As such, it is unlikely that chronic air inhalation of aluminum will result in adverse health effects in the AQRSA.

The chronic air inhalation health risks for the aliphatic C_5-C_8 group are presented as hazard quotients in Table SIR3 21-4. None of the air inhalation hazard quotients exceed 1.0 at any of the receptor locations for the four assessment cases. As such, it is unlikely that chronic air inhalation of the aliphatic C_5-C_8 group will result in adverse health effects in the AQRSA.

The chronic air inhalation health risks for H_2S are presented as hazard quotients in Table SIR3 21-5. With the exception of the maximum point of impingement (MPOI; HQ=2.1), none of the air inhalation hazard quotients exceed 1.0 at any of the receptor locations for the four assessment cases. At the MPOI, the hazard quotient associated with the Project is 0.0000055, suggesting that the Project is not expected to materially increase the Baseline H_2S-related health risks at the MPOI. Air inhalation hazard quotients for people living at any of the cabins or within any of the communities were all less than 1.0, indicating that predicted H_2S air concentrations are not anticipated to adversely affect health of people at these locations.

The chronic air inhalation health risks for lead are presented as hazard quotients in Table SIR3 21-6. None of the air inhalation hazard quotients exceed 1.0 at any of the receptor locations for the four assessment cases. As such, it is unlikely that chronic air inhalation of lead will result in adverse health effects in the AQRSA.

Table SIR3 21-1: Non-carcinogenic COPC Chronic Inhalation Screening

Chemicals	Total Emission	RfC (mg/m^3)	Toxicity Potency	Weighting	Cumulative Toxic Potency
Manganese	0.009	0.00004	225.00	0.727	73%
Arsenic	0.00044	0.000015	29.33	0.095	82%
Aluminum	0.074	0.005	14.80	0.048	87%
Formaldehyde	0.0383	0.003	12.77	0.041	91%
Mercury	0.00022	0.00003	7.33	0.024	93%
Aliphatic C_5-C_8	0.863	0.2	4.32	0.014	95%
Aliphatic C_9-C_{16}	0.509	0.2	2.55	0.008	96%
Benzene	0.0435	0.02	2.18	0.007	96%
H_2S	0.0043	0.002	2.15	0.007	97%
Lead	0.0026	0.0015	1.73	0.006	98%
n-Hexane	0.92	0.67	1.37	0.004	98%
n-Pentane	1.33	1.0	1.33	0.004	98%
Benzo(a)pyrene	0.000000613	0.0000005	1.23	0.004	99%
COS	0.000607	0.0005	1.21	0.004	99%
Aromatic	0.238	0.2	1.19	0.004	100%
Xylenes	0.0477	0.1	0.48	0.002	100%
Toluene	0.123	0.3	0.41	0.001	100%
Naphthalene	0.000312	0.003	0.10	0.000	100%
Phenanthrene	0.00000869	0.0001	0.09	0.000	100%
Dichlorobenzene	0.000613	0.008	0.08	0.000	100%
Ethylbenzene	0.0201	1.0	0.020	0.000	100%
2-Methylnaphthalene	0.0000123	0.006	0.0021	0.000	100%
CS2	0.000556	0.7	0.00079	0.000	100%
Benzo(g,h,i)perylene	0.000000613	0.012	0.000051	0.000	100%
Acenaphthylene	0.000000919	0.035	0.0000263	0.000	100%
Pyrene	0.00000256	0.1	0.0000256	0.000	100%
Fluoranthene	0.00000153	0.14	0.000011	0.000	100%
Fluorene	0.00000143	0.14	0.000010	0.000	100%
Acenaphthene	0.000000919	0.21	0.000004	0.000	100%
Anthracene	0.00000123	1.0	0.000001	0.000	100%

Shaded cells represent the COPCs carried forward in the health assessment.

Table SIR3 21-2: Noncarcinogenic Risk Estimates for Chronic Manganese Exposures

HQ	Receptor Location	Hazard Quotient (EDI/TDI)										Total HQ
		Soil Ingestion	Soil Dermal	Soil Inhalation	Air Inhalation	Surface Water Ingestion	Lab Tea Ingestion	Cattail Ingestion	Berries Ingestion	Fish Ingestion	Wild Game Ingestion	
BASELINE	MPOI	2.17E-02	1.87E-03	8.50E-03	1.24E-02	3.02E-01	1.02E+00	4.85E-01	1.53E-02	1.1E+00	5.14E-04	2.96E+00
	AC	2.17E-02	1.87E-03	8.50E-03	1.53E-04	3.02E-01	1.02E+00	4.85E-01	1.53E-02	1.1E+00	5.14E-04	2.95E+00
	AR	2.17E-02	1.87E-03	8.50E-03	9.52E-04	3.02E-01	1.02E+00	4.85E-01	1.53E-02	1.1E+00	5.14E-04	2.95E+00
	BC	2.17E-02	1.87E-03	8.50E-03	1.34E-03	3.02E-01	1.02E+00	4.85E-01	1.53E-02	1.1E+00	5.14E-04	2.95E+00
	BL	2.17E-02	1.87E-03	8.50E-03	6.69E-04	3.02E-01	1.02E+00	4.85E-01	1.53E-02	1.1E+00	5.14E-04	2.95E+00
	DC	2.17E-02	1.87E-03	8.50E-03	4.42E-04	3.02E-01	1.02E+00	4.85E-01	1.53E-02	1.1E+00	5.14E-04	2.95E+00
	DSC	2.17E-02	1.87E-03	8.50E-03	4.97E-04	3.02E-01	1.02E+00	4.85E-01	1.53E-02	1.1E+00	5.14E-04	2.95E+00
	FC	2.17E-02	1.87E-03	8.50E-03	6.16E-04	3.02E-01	1.02E+00	4.85E-01	1.53E-02	1.1E+00	5.14E-04	2.95E+00
	FMK	2.17E-02	1.87E-03	8.50E-03	1.09E-03	3.02E-01	1.02E+00	4.85E-01	1.53E-02	1.1E+00	5.14E-04	2.95E+00
	FMM	2.17E-02	1.87E-03	8.50E-03	8.20E-04	3.02E-01	1.02E+00	4.85E-01	1.53E-02	1.1E+00	5.14E-04	2.95E+00
	FMT	2.17E-02	1.87E-03	8.50E-03	2.37E-04	3.02E-01	1.02E+00	4.85E-01	1.53E-02	1.1E+00	5.14E-04	2.95E+00
	FMT1	2.17E-02	1.87E-03	8.50E-03	5.77E-05	3.02E-01	1.02E+00	4.85E-01	1.53E-02	1.1E+00	5.14E-04	2.95E+00
	FMT2	2.17E-02	1.87E-03	8.50E-03	1.06E-03	3.02E-01	1.02E+00	4.85E-01	1.53E-02	1.1E+00	5.14E-04	2.95E+00
	GEC	2.17E-02	1.87E-03	8.50E-03	7.60E-04	3.02E-01	1.02E+00	4.85E-01	1.53E-02	1.1E+00	5.14E-04	2.95E+00
	GWC	2.17E-02	1.87E-03	8.50E-03	9.57E-04	3.02E-01	1.02E+00	4.85E-01	1.53E-02	1.1E+00	5.14E-04	2.95E+00
	KL	2.17E-02	1.87E-03	8.50E-03	9.01E-04	3.02E-01	1.02E+00	4.85E-01	1.53E-02	1.1E+00	5.14E-04	2.95E+00
	LEC	2.17E-02	1.87E-03	8.50E-03	6.28E-04	3.02E-01	1.02E+00	4.85E-01	1.53E-02	1.1E+00	5.14E-04	2.95E+00
	LWC	2.17E-02	1.87E-03	8.50E-03	8.57E-04	3.02E-01	1.02E+00	4.85E-01	1.53E-02	1.1E+00	5.14E-04	2.95E+00
	MC	2.17E-02	1.87E-03	8.50E-03	5.87E-04	3.02E-01	1.02E+00	4.85E-01	1.53E-02	1.1E+00	5.14E-04	2.95E+00
	TC	2.17E-02	1.87E-03	8.50E-03	1.03E-03	3.02E-01	1.02E+00	4.85E-01	1.53E-02	1.1E+00	5.14E-04	2.95E+00
	WC	2.17E-02	1.87E-03	8.50E-03	9.21E-04	3.02E-01	1.02E+00	4.85E-01	1.53E-02	1.1E+00	5.14E-04	2.95E+00
PROJECT ALONE	MPOI	8.29E-13	7.13E-14	3.25E-13	4.98E-05	7.40E-09	2.48E-08	7.78E-14	1.24E-07	2.69E-08	1.26E-08	5.00E-05
	AC	3.99E-15	3.43E-16	1.56E-15	6.05E-07	3.56E-11	2.48E-08	3.74E-16	1.24E-07	1.30E-10	1.26E-08	7.66E-07
	AR	1.17E-14	1.00E-15	4.57E-15	2.41E-06	1.04E-10	2.48E-08	1.09E-15	1.24E-07	3.79E-10	1.26E-08	2.58E-06
	BC	9.46E-15	8.14E-16	3.71E-15	1.88E-06	8.44E-11	2.48E-08	8.87E-16	1.24E-07	3.07E-10	1.26E-08	2.04E-06
	BL	2.14E-14	1.84E-15	8.39E-15	3.17E-06	1.91E-10	2.48E-08	2.01E-15	1.24E-07	6.96E-10	1.26E-08	3.33E-06
	DC	2.23E-14	1.92E-15	8.75E-15	2.99E-06	1.99E-10	2.48E-08	2.09E-15	1.24E-07	7.25E-10	1.26E-08	3.15E-06
	DSC	3.93E-14	3.38E-15	1.54E-14	2.72E-06	3.51E-10	2.48E-08	3.69E-15	1.24E-07	1.28E-09	1.26E-08	2.88E-06
	FC	3.81E-14	3.28E-15	1.49E-14	3.68E-06	3.40E-10	2.48E-08	3.57E-15	1.24E-07	1.24E-09	1.26E-08	3.85E-06
	FMK	9.49E-15	8.16E-16	3.72E-15	2.06E-06	8.46E-11	2.48E-08	8.90E-16	1.24E-07	3.08E-10	1.26E-08	2.23E-06
	FMM	4.22E-14	3.63E-15	1.65E-14	2.18E-06	3.76E-10	2.48E-08	3.95E-15	1.24E-07	1.37E-09	1.26E-08	2.34E-06
	FMT	1.40E-14	1.21E-15	5.50E-15	2.35E-06	1.25E-10	2.48E-08	1.32E-15	1.24E-07	4.56E-10	1.26E-08	2.51E-06
	FMT1	2.96E-15	2.55E-16	1.16E-15	3.90E-07	2.64E-11	2.48E-08	2.78E-16	1.24E-07	9.63E-11	1.26E-08	5.52E-07
	FMT2	1.01E-14	8.67E-16	3.95E-15	2.16E-06	8.99E-11	2.48E-08	9.45E-16	1.24E-07	3.28E-10	1.26E-08	2.32E-06
	GEC	1.39E-13	1.20E-14	5.45E-14	1.24E-05	1.24E-09	2.48E-08	1.30E-14	1.24E-07	4.52E-09	1.26E-08	1.26E-05
	GWC	1.27E-13	1.09E-14	4.99E-14	6.95E-06	1.13E-09	2.48E-08	1.19E-14	1.24E-07	4.13E-09	1.26E-08	7.12E-06
	KL	7.46E-15	6.42E-16	2.92E-15	1.25E-06	6.66E-11	2.48E-08	7.00E-16	1.24E-07	2.42E-10	1.26E-08	1.41E-06
	LEC	7.54E-15	6.49E-16	2.96E-15	1.23E-06	6.73E-11	2.48E-08	7.07E-16	1.24E-07	2.45E-10	1.26E-08	1.39E-06
	LWC	6.70E-15	5.76E-16	2.62E-15	1.05E-06	5.97E-11	2.48E-08	6.28E-16	1.24E-07	2.18E-10	1.26E-08	1.21E-06
	MC	8.91E-15	7.66E-16	3.49E-15	1.78E-06	7.95E-11	2.48E-08	8.36E-16	1.24E-07	2.90E-10	1.26E-08	1.94E-06
	TC	7.52E-15	6.47E-16	2.95E-15	1.27E-06	6.71E-11	2.48E-08	7.05E-16	1.24E-07	2.44E-10	1.26E-08	1.43E-06
	WC	1.40E-14	1.20E-15	5.48E-15	2.48E-06	1.25E-10	2.48E-08	1.31E-15	1.24E-07	4.54E-10	1.26E-08	2.64E-06

HQ	Receptor Location	Hazard Quotient (EDI/TDI)										Total HQ
		Soil Ingestion	Soil Dermal	Soil Inhalation	Air Inhalation	Surface Water Ingestion	Lab Tea Ingestion	Cattail Ingestion	Berries Ingestion	Fish Ingestion	Wild Game Ingestion	
APPLICATION	MPOI	2.17E-02	1.87E-03	8.50E-03	1.24E-02	3.02E-01	1.02E+00	4.85E-01	1.53E-02	1.10E+00	5.14E-04	2.96E+00
	AC	2.17E-02	1.87E-03	8.50E-03	1.53E-04	3.02E-01	1.02E+00	4.85E-01	1.53E-02	1.10E+00	5.14E-04	2.95E+00
	AR	2.17E-02	1.87E-03	8.50E-03	9.54E-04	3.02E-01	1.02E+00	4.85E-01	1.53E-02	1.10E+00	5.14E-04	2.95E+00
	BC	2.17E-02	1.87E-03	8.50E-03	1.34E-03	3.02E-01	1.02E+00	4.85E-01	1.53E-02	1.10E+00	5.14E-04	2.95E+00
	BL	2.17E-02	1.87E-03	8.50E-03	6.72E-04	3.02E-01	1.02E+00	4.85E-01	1.53E-02	1.10E+00	5.14E-04	2.95E+00
	DC	2.17E-02	1.87E-03	8.50E-03	4.45E-04	3.02E-01	1.02E+00	4.85E-01	1.53E-02	1.10E+00	5.14E-04	2.95E+00
	DSC	2.17E-02	1.87E-03	8.50E-03	5.00E-04	3.02E-01	1.02E+00	4.85E-01	1.53E-02	1.10E+00	5.14E-04	2.95E+00
	FC	2.17E-02	1.87E-03	8.50E-03	6.20E-04	3.02E-01	1.02E+00	4.85E-01	1.53E-02	1.10E+00	5.14E-04	2.95E+00
	FMK	2.17E-02	1.87E-03	8.50E-03	1.09E-03	3.02E-01	1.02E+00	4.85E-01	1.53E-02	1.10E+00	5.14E-04	2.95E+00
	FMM	2.17E-02	1.87E-03	8.50E-03	8.23E-04	3.02E-01	1.02E+00	4.85E-01	1.53E-02	1.10E+00	5.14E-04	2.95E+00
	FMT	2.17E-02	1.87E-03	8.50E-03	2.40E-04	3.02E-01	1.02E+00	4.85E-01	1.53E-02	1.10E+00	5.14E-04	2.95E+00
	FMT1	2.17E-02	1.87E-03	8.50E-03	5.81E-05	3.02E-01	1.02E+00	4.85E-01	1.53E-02	1.10E+00	5.14E-04	2.95E+00
	FMT2	2.17E-02	1.87E-03	8.50E-03	1.06E-03	3.02E-01	1.02E+00	4.85E-01	1.53E-02	1.10E+00	5.14E-04	2.95E+00
	GEC	2.17E-02	1.87E-03	8.50E-03	7.73E-04	3.02E-01	1.02E+00	4.85E-01	1.53E-02	1.10E+00	5.14E-04	2.95E+00
	GWC	2.17E-02	1.87E-03	8.50E-03	9.64E-04	3.02E-01	1.02E+00	4.85E-01	1.53E-02	1.10E+00	5.14E-04	2.95E+00
	KL	2.17E-02	1.87E-03	8.50E-03	9.03E-04	3.02E-01	1.02E+00	4.85E-01	1.53E-02	1.10E+00	5.14E-04	2.95E+00
	LEC	2.17E-02	1.87E-03	8.50E-03	6.29E-04	3.02E-01	1.02E+00	4.85E-01	1.53E-02	1.10E+00	5.14E-04	2.95E+00
	LWC	2.17E-02	1.87E-03	8.50E-03	8.58E-04	3.02E-01	1.02E+00	4.85E-01	1.53E-02	1.10E+00	5.14E-04	2.95E+00
	MC	2.17E-02	1.87E-03	8.50E-03	5.88E-04	3.02E-01	1.02E+00	4.85E-01	1.53E-02	1.10E+00	5.14E-04	2.95E+00
	TC	2.17E-02	1.87E-03	8.50E-03	1.03E-03	3.02E-01	1.02E+00	4.85E-01	1.53E-02	1.10E+00	5.14E-04	2.95E+00
	WC	2.17E-02	1.87E-03	8.50E-03	9.23E-04	3.02E-01	1.02E+00	4.85E-01	1.53E-02	1.10E+00	5.14E-04	2.95E+00
CEA	MPOI	2.17E-02	1.87E-03	8.50E-03	2.39E-02	3.04E-01	1.02E+00	4.85E-01	3.05E-02	1.11E+00	5.15E-04	3.00E+00
	AC	2.17E-02	1.87E-03	8.50E-03	1.80E-04	3.04E-01	1.02E+00	4.85E-01	3.05E-02	1.11E+00	5.15E-04	2.98E+00
	AR	2.17E-02	1.87E-03	8.50E-03	1.09E-03	3.04E-01	1.02E+00	4.85E-01	3.05E-02	1.11E+00	5.15E-04	2.98E+00
	BC	2.17E-02	1.87E-03	8.50E-03	1.50E-03	3.04E-01	1.02E+00	4.85E-01	3.05E-02	1.11E+00	5.15E-04	2.98E+00
	BL	2.17E-02	1.87E-03	8.50E-03	7.67E-04	3.04E-01	1.02E+00	4.85E-01	3.05E-02	1.11E+00	5.15E-04	2.98E+00
	DC	2.17E-02	1.87E-03	8.50E-03	5.46E-04	3.04E-01	1.02E+00	4.85E-01	3.05E-02	1.11E+00	5.15E-04	2.98E+00
	DSC	2.17E-02	1.87E-03	8.50E-03	6.24E-04	3.04E-01	1.02E+00	4.85E-01	3.05E-02	1.11E+00	5.15E-04	2.98E+00
	FC	2.17E-02	1.87E-03	8.50E-03	7.35E-04	3.04E-01	1.02E+00	4.85E-01	3.05E-02	1.11E+00	5.15E-04	2.98E+00
	FMK	2.17E-02	1.87E-03	8.50E-03	1.24E-03	3.04E-01	1.02E+00	4.85E-01	3.05E-02	1.11E+00	5.15E-04	2.98E+00
	FMM	2.17E-02	1.87E-03	8.50E-03	1.38E-03	3.04E-01	1.02E+00	4.85E-01	3.05E-02	1.11E+00	5.15E-04	2.98E+00
	FMT	2.17E-02	1.87E-03	8.50E-03	3.94E-04	3.04E-01	1.02E+00	4.85E-01	3.05E-02	1.11E+00	5.15E-04	2.98E+00
	FMT1	2.17E-02	1.87E-03	8.50E-03	7.20E-05	3.04E-01	1.02E+00	4.85E-01	3.05E-02	1.11E+00	5.15E-04	2.98E+00
	FMT2	2.17E-02	1.87E-03	8.50E-03	1.21E-03	3.04E-01	1.02E+00	4.85E-01	3.05E-02	1.11E+00	5.15E-04	2.98E+00
	GEC	2.17E-02	1.87E-03	8.50E-03	1.23E-03	3.04E-01	1.02E+00	4.85E-01	3.05E-02	1.11E+00	5.15E-04	2.98E+00
	GWC	2.17E-02	1.87E-03	8.50E-03	1.57E-03	3.04E-01	1.02E+00	4.85E-01	3.05E-02	1.11E+00	5.15E-04	2.98E+00
	KL	2.17E-02	1.87E-03	8.50E-03	9.76E-04	3.04E-01	1.02E+00	4.85E-01	3.05E-02	1.11E+00	5.15E-04	2.98E+00
	LEC	2.17E-02	1.87E-03	8.50E-03	6.79E-04	3.04E-01	1.02E+00	4.85E-01	3.05E-02	1.11E+00	5.15E-04	2.98E+00
	LWC	2.17E-02	1.87E-03	8.50E-03	9.12E-04	3.04E-01	1.02E+00	4.85E-01	3.05E-02	1.11E+00	5.15E-04	2.98E+00
	MC	2.17E-02	1.87E-03	8.50E-03	7.08E-04	3.04E-01	1.02E+00	4.85E-01	3.05E-02	1.11E+00	5.15E-04	2.98E+00
	TC	2.17E-02	1.87E-03	8.50E-03	1.10E-03	3.04E-01	1.02E+00	4.85E-01	3.05E-02	1.11E+00	5.15E-04	2.98E+00
	WC	2.17E-02	1.87E-03	8.50E-03	1.04E-03	3.04E-01	1.02E+00	4.85E-01	3.05E-02	1.11E+00	5.15E-04	2.98E+00

Table SIR3 21-3: Noncarcinogenic Risk Estimates for Chronic Aluminum Exposures

HQ	Receptor Location	Hazard Quotient (EDI/TDI)										Total HQ
		Soil Ingestion	Soil Dermal	Soil Inhalation	Air Inhalation	Surface Water Ingestion	Lab Tea Ingestion	Cattail Ingestion	Berries Ingestion	Fish Ingestion	Wild Game Ingestion	
BASELINE	MPOI	3.83E-02	3.30E-04	2.42E-03	7.96E-03	6.50E-03	3.47E-02	5.21E-03	3.95E-04	8.6E-02	7.80E-05	1.82E-01
	AC	3.83E-02	3.30E-04	2.42E-03	9.84E-05	6.50E-03	3.47E-02	5.21E-03	3.95E-04	8.6E-02	7.80E-05	1.74E-01
	AR	3.83E-02	3.30E-04	2.42E-03	6.13E-04	6.50E-03	3.47E-02	5.21E-03	3.95E-04	8.6E-02	7.80E-05	1.75E-01
	BC	3.83E-02	3.30E-04	2.42E-03	8.64E-04	6.50E-03	3.47E-02	5.21E-03	3.95E-04	8.6E-02	7.80E-05	1.75E-01
	BL	3.83E-02	3.30E-04	2.42E-03	4.31E-04	6.50E-03	3.47E-02	5.21E-03	3.95E-04	8.6E-02	7.80E-05	1.75E-01
	DC	3.83E-02	3.30E-04	2.42E-03	2.85E-04	6.50E-03	3.47E-02	5.21E-03	3.95E-04	8.6E-02	7.80E-05	1.74E-01
	DSC	3.83E-02	3.30E-04	2.42E-03	3.20E-04	6.50E-03	3.47E-02	5.21E-03	3.95E-04	8.6E-02	7.80E-05	1.74E-01
	FC	3.83E-02	3.30E-04	2.42E-03	3.97E-04	6.50E-03	3.47E-02	5.21E-03	3.95E-04	8.6E-02	7.80E-05	1.75E-01
	FMK	3.83E-02	3.30E-04	2.42E-03	7.02E-04	6.50E-03	3.47E-02	5.21E-03	3.95E-04	8.6E-02	7.80E-05	1.75E-01
	FMM	3.83E-02	3.30E-04	2.42E-03	5.28E-04	6.50E-03	3.47E-02	5.21E-03	3.95E-04	8.6E-02	7.80E-05	1.75E-01
	FMT	3.83E-02	3.30E-04	2.42E-03	1.53E-04	6.50E-03	3.47E-02	5.21E-03	3.95E-04	8.6E-02	7.80E-05	1.74E-01
	FMT1	3.83E-02	3.30E-04	2.42E-03	3.72E-05	6.50E-03	3.47E-02	5.21E-03	3.95E-04	8.6E-02	7.80E-05	1.74E-01
	FMT2	3.83E-02	3.30E-04	2.42E-03	6.80E-04	6.50E-03	3.47E-02	5.21E-03	3.95E-04	8.6E-02	7.80E-05	1.75E-01
	GEC	3.83E-02	3.30E-04	2.42E-03	4.90E-04	6.50E-03	3.47E-02	5.21E-03	3.95E-04	8.6E-02	7.80E-05	1.75E-01
	GWC	3.83E-02	3.30E-04	2.42E-03	6.16E-04	6.50E-03	3.47E-02	5.21E-03	3.95E-04	8.6E-02	7.80E-05	1.75E-01
	KL	3.83E-02	3.30E-04	2.42E-03	5.81E-04	6.50E-03	3.47E-02	5.21E-03	3.95E-04	8.6E-02	7.80E-05	1.75E-01
	LEC	3.83E-02	3.30E-04	2.42E-03	4.04E-04	6.50E-03	3.47E-02	5.21E-03	3.95E-04	8.6E-02	7.80E-05	1.75E-01
	LWC	3.83E-02	3.30E-04	2.42E-03	5.52E-04	6.50E-03	3.47E-02	5.21E-03	3.95E-04	8.6E-02	7.80E-05	1.75E-01
	MC	3.83E-02	3.30E-04	2.42E-03	3.78E-04	6.50E-03	3.47E-02	5.21E-03	3.95E-04	8.6E-02	7.80E-05	1.75E-01
	TC	3.83E-02	3.30E-04	2.42E-03	6.62E-04	6.50E-03	3.47E-02	5.21E-03	3.95E-04	8.6E-02	7.80E-05	1.75E-01
	WC	3.83E-02	3.30E-04	2.42E-03	5.93E-04	6.50E-03	3.47E-02	5.21E-03	3.95E-04	8.6E-02	7.80E-05	1.75E-01
PROJECT ALONE	MPOI	4.36E-09	3.75E-11	2.75E-10	3.21E-05	6.02E-07	2.98E-08	5.31E-12	1.49E-07	7.98E-06	4.41E-09	4.08E-05
	AC	2.10E-11	1.80E-13	1.32E-12	3.90E-07	2.90E-09	2.98E-08	2.56E-14	1.49E-07	3.84E-08	4.35E-09	6.14E-07
	AR	6.13E-11	5.27E-13	3.87E-12	1.55E-06	8.47E-09	2.98E-08	7.47E-14	1.49E-07	1.12E-07	4.35E-09	1.86E-06
	BC	4.97E-11	4.27E-13	3.14E-12	1.21E-06	6.86E-09	2.98E-08	6.05E-14	1.49E-07	9.10E-08	4.35E-09	1.49E-06
	BL	1.12E-10	9.67E-13	7.10E-12	2.04E-06	1.55E-08	2.98E-08	1.37E-13	1.49E-07	2.06E-07	4.35E-09	2.45E-06
	DC	1.17E-10	1.01E-12	7.40E-12	1.93E-06	1.62E-08	2.98E-08	1.43E-13	1.49E-07	2.15E-07	4.35E-09	2.34E-06
	DSC	2.07E-10	1.78E-12	1.30E-11	1.75E-06	2.86E-08	2.98E-08	2.52E-13	1.49E-07	3.78E-07	4.35E-09	2.34E-06
	FC	2.00E-10	1.72E-12	1.26E-11	2.37E-06	2.77E-08	2.98E-08	2.44E-13	1.49E-07	3.67E-07	4.35E-09	2.95E-06
	FMK	4.98E-11	4.29E-13	3.15E-12	1.33E-06	6.89E-09	2.98E-08	6.07E-14	1.49E-07	9.12E-08	4.35E-09	1.61E-06
	FMM	2.21E-10	1.90E-12	1.40E-11	1.41E-06	3.06E-08	2.98E-08	2.70E-13	1.49E-07	4.05E-07	4.35E-09	2.02E-06
	FMT	7.37E-11	6.34E-13	4.65E-12	1.51E-06	1.02E-08	2.98E-08	8.98E-14	1.49E-07	1.35E-07	4.35E-09	1.84E-06
	FMT1	1.56E-11	1.34E-13	9.82E-13	2.51E-07	2.15E-09	2.98E-08	1.90E-14	1.49E-07	2.85E-08	4.35E-09	4.65E-07
	FMT2	5.30E-11	4.55E-13	3.34E-12	1.39E-06	7.32E-09	2.98E-08	6.45E-14	1.49E-07	9.70E-08	4.35E-09	1.68E-06
	GEC	7.30E-10	6.28E-12	4.61E-11	8.00E-06	1.01E-07	2.98E-08	8.90E-13	1.49E-07	1.34E-06	4.36E-09	9.62E-06
	GWC	6.68E-10	5.75E-12	4.22E-11	4.48E-06	9.23E-08	2.98E-08	8.14E-13	1.49E-07	1.22E-06	4.36E-09	5.98E-06
	KL	3.92E-11	3.37E-13	2.47E-12	8.04E-07	5.42E-09	2.98E-08	4.78E-14	1.49E-07	7.18E-08	4.35E-09	1.06E-06
	LEC	3.96E-11	3.41E-13	2.50E-12	7.91E-07	5.47E-09	2.98E-08	4.83E-14	1.49E-07	7.25E-08	4.35E-09	1.05E-06
	LWC	3.52E-11	3.02E-13	2.22E-12	6.74E-07	4.86E-09	2.98E-08	4.29E-14	1.49E-07	6.44E-08	4.35E-09	9.26E-07
	MC	4.68E-11	4.03E-13	2.95E-12	1.15E-06	6.47E-09	2.98E-08	5.70E-14	1.49E-07	8.57E-08	4.35E-09	1.42E-06
	TC	3.95E-11	3.40E-13	2.49E-12	8.18E-07	5.46E-09	2.98E-08	4.81E-14	1.49E-07	7.23E-08	4.35E-09	1.08E-06
	WC	7.34E-11	6.32E-13	4.63E-12	1.60E-06	1.01E-08	2.98E-08	8.95E-14	1.49E-07	1.34E-07	4.35E-09	1.93E-06

HQ	Receptor Location	Hazard Quotient (EDI/TDI)										Total HQ
		Soil Ingestion	Soil Dermal	Soil Inhalation	Air Inhalation	Surface Water Ingestion	Lab Tea Ingestion	Cattail Ingestion	Berries Ingestion	Fish Ingestion	Wild Game Ingestion	
APPLICATION	MPOI	3.83E-02	3.30E-04	2.42E-03	7.99E-03	6.50E-03	3.47E-02	5.21E-03	3.96E-04	8.62E-02	7.80E-05	1.82E-01
	AC	3.83E-02	3.30E-04	2.42E-03	9.87E-05	6.50E-03	3.47E-02	5.21E-03	3.96E-04	8.61E-02	7.80E-05	1.74E-01
	AR	3.83E-02	3.30E-04	2.42E-03	6.15E-04	6.50E-03	3.47E-02	5.21E-03	3.96E-04	8.61E-02	7.80E-05	1.75E-01
	BC	3.83E-02	3.30E-04	2.42E-03	8.65E-04	6.50E-03	3.47E-02	5.21E-03	3.96E-04	8.61E-02	7.80E-05	1.75E-01
	BL	3.83E-02	3.30E-04	2.42E-03	4.33E-04	6.50E-03	3.47E-02	5.21E-03	3.96E-04	8.61E-02	7.80E-05	1.75E-01
	DC	3.83E-02	3.30E-04	2.42E-03	2.87E-04	6.50E-03	3.47E-02	5.21E-03	3.96E-04	8.61E-02	7.80E-05	1.74E-01
	DSC	3.83E-02	3.30E-04	2.42E-03	3.22E-04	6.50E-03	3.47E-02	5.21E-03	3.96E-04	8.61E-02	7.80E-05	1.74E-01
	FC	3.83E-02	3.30E-04	2.42E-03	3.99E-04	6.50E-03	3.47E-02	5.21E-03	3.96E-04	8.61E-02	7.80E-05	1.75E-01
	FMK	3.83E-02	3.30E-04	2.42E-03	7.03E-04	6.50E-03	3.47E-02	5.21E-03	3.96E-04	8.61E-02	7.80E-05	1.75E-01
	FMM	3.83E-02	3.30E-04	2.42E-03	5.30E-04	6.50E-03	3.47E-02	5.21E-03	3.96E-04	8.61E-02	7.80E-05	1.75E-01
	FMT	3.83E-02	3.30E-04	2.42E-03	1.54E-04	6.50E-03	3.47E-02	5.21E-03	3.96E-04	8.61E-02	7.80E-05	1.74E-01
	FMT1	3.83E-02	3.30E-04	2.42E-03	3.74E-05	6.50E-03	3.47E-02	5.21E-03	3.96E-04	8.61E-02	7.80E-05	1.74E-01
	FMT2	3.83E-02	3.30E-04	2.42E-03	6.81E-04	6.50E-03	3.47E-02	5.21E-03	3.96E-04	8.61E-02	7.80E-05	1.75E-01
	GEC	3.83E-02	3.30E-04	2.42E-03	4.98E-04	6.50E-03	3.47E-02	5.21E-03	3.96E-04	8.61E-02	7.80E-05	1.75E-01
	GWC	3.83E-02	3.30E-04	2.42E-03	6.21E-04	6.50E-03	3.47E-02	5.21E-03	3.96E-04	8.61E-02	7.80E-05	1.75E-01
	KL	3.83E-02	3.30E-04	2.42E-03	5.81E-04	6.50E-03	3.47E-02	5.21E-03	3.96E-04	8.61E-02	7.80E-05	1.75E-01
	LEC	3.83E-02	3.30E-04	2.42E-03	4.05E-04	6.50E-03	3.47E-02	5.21E-03	3.96E-04	8.61E-02	7.80E-05	1.75E-01
	LWC	3.83E-02	3.30E-04	2.42E-03	5.53E-04	6.50E-03	3.47E-02	5.21E-03	3.96E-04	8.61E-02	7.80E-05	1.75E-01
	MC	3.83E-02	3.30E-04	2.42E-03	3.79E-04	6.50E-03	3.47E-02	5.21E-03	3.96E-04	8.61E-02	7.80E-05	1.75E-01
	TC	3.83E-02	3.30E-04	2.42E-03	6.63E-04	6.50E-03	3.47E-02	5.21E-03	3.96E-04	8.61E-02	7.80E-05	1.75E-01
	WC	3.83E-02	3.30E-04	2.42E-03	5.95E-04	6.50E-03	3.47E-02	5.21E-03	3.96E-04	8.61E-02	7.80E-05	1.75E-01
PDC	MPOI	3.83E-02	3.30E-04	2.42E-03	1.54E-02	2.00E-01	3.47E-02	5.21E-03	7.91E-04	2.65E+00	9.44E-05	2.94E+00
	AC	3.83E-02	3.30E-04	2.42E-03	1.16E-04	2.00E-01	3.47E-02	5.21E-03	7.91E-04	2.65E+00	9.44E-05	2.93E+00
	AR	3.83E-02	3.30E-04	2.42E-03	7.03E-04	2.00E-01	3.47E-02	5.21E-03	7.91E-04	2.65E+00	9.44E-05	2.93E+00
	BC	3.83E-02	3.30E-04	2.42E-03	9.68E-04	2.00E-01	3.47E-02	5.21E-03	7.91E-04	2.65E+00	9.44E-05	2.93E+00
	BL	3.83E-02	3.30E-04	2.42E-03	4.94E-04	2.00E-01	3.47E-02	5.21E-03	7.91E-04	2.65E+00	9.44E-05	2.93E+00
	DC	3.83E-02	3.30E-04	2.42E-03	3.52E-04	2.00E-01	3.47E-02	5.21E-03	7.91E-04	2.65E+00	9.44E-05	2.93E+00
	DSC	3.83E-02	3.30E-04	2.42E-03	4.02E-04	2.00E-01	3.47E-02	5.21E-03	7.91E-04	2.65E+00	9.44E-05	2.93E+00
	FC	3.83E-02	3.30E-04	2.42E-03	4.74E-04	2.00E-01	3.47E-02	5.21E-03	7.91E-04	2.65E+00	9.44E-05	2.93E+00
	FMK	3.83E-02	3.30E-04	2.42E-03	7.96E-04	2.00E-01	3.47E-02	5.21E-03	7.91E-04	2.65E+00	9.44E-05	2.93E+00
	FMM	3.83E-02	3.30E-04	2.42E-03	8.88E-04	2.00E-01	3.47E-02	5.21E-03	7.91E-04	2.65E+00	9.44E-05	2.93E+00
	FMT	3.83E-02	3.30E-04	2.42E-03	2.54E-04	2.00E-01	3.47E-02	5.21E-03	7.91E-04	2.65E+00	9.44E-05	2.93E+00
	FMT1	3.83E-02	3.30E-04	2.42E-03	4.64E-05	2.00E-01	3.47E-02	5.21E-03	7.91E-04	2.65E+00	9.44E-05	2.93E+00
	FMT2	3.83E-02	3.30E-04	2.42E-03	7.81E-04	2.00E-01	3.47E-02	5.21E-03	7.91E-04	2.65E+00	9.44E-05	2.93E+00
	GEC	3.83E-02	3.30E-04	2.42E-03	7.89E-04	2.00E-01	3.47E-02	5.21E-03	7.91E-04	2.65E+00	9.44E-05	2.93E+00
	GWC	3.83E-02	3.30E-04	2.42E-03	1.01E-03	2.00E-01	3.47E-02	5.21E-03	7.91E-04	2.65E+00	9.44E-05	2.93E+00
	KL	3.83E-02	3.30E-04	2.42E-03	6.29E-04	2.00E-01	3.47E-02	5.21E-03	7.91E-04	2.65E+00	9.44E-05	2.93E+00
	LEC	3.83E-02	3.30E-04	2.42E-03	4.37E-04	2.00E-01	3.47E-02	5.21E-03	7.91E-04	2.65E+00	9.44E-05	2.93E+00
	LWC	3.83E-02	3.30E-04	2.42E-03	5.87E-04	2.00E-01	3.47E-02	5.21E-03	7.91E-04	2.65E+00	9.44E-05	2.93E+00
	MC	3.83E-02	3.30E-04	2.42E-03	4.56E-04	2.00E-01	3.47E-02	5.21E-03	7.91E-04	2.65E+00	9.44E-05	2.93E+00
	TC	3.83E-02	3.30E-04	2.42E-03	7.11E-04	2.00E-01	3.47E-02	5.21E-03	7.91E-04	2.65E+00	9.44E-05	2.93E+00
	WC	3.83E-02	3.30E-04	2.42E-03	6.71E-04	2.00E-01	3.47E-02	5.21E-03	7.91E-04	2.65E+00	9.44E-05	2.93E+00

Table SIR3 21-4: Noncarcinogenic Risk Estimates for Chronic Aliphatics C_5-C_8 Exposures

HQ	Receptor Location	Hazard Quotient (EDI/TDI)										Total HQ
		Soil Ingestion	Soil Dermal	Soil Inhalation	Air Inhalation	Surface Water Ingestion	Lab Tea Ingestion	Cattail Ingestion	Berries Ingestion	Fish Ingestion	Wild Game Ingestion	
BASELINE	MPOI	9.70E-06	1.67E-06	4.13E-10	1.14E-01	1.45E-04	2.42E-04	2.42E-04	1.85E-04	1.2E-02	1.83E-04	1.27E-01
	AC	9.70E-06	1.67E-06	4.13E-10	3.52E-04	1.45E-04	2.42E-04	2.42E-04	1.00E-05	1.2E-02	2.63E-05	1.32E-02
	AR	9.70E-06	1.67E-06	4.13E-10	3.00E-03	1.45E-04	2.42E-04	2.42E-04	1.41E-05	1.2E-02	2.99E-05	1.59E-02
	BC	9.70E-06	1.67E-06	4.13E-10	6.16E-02	1.45E-04	2.42E-04	2.42E-04	1.04E-04	1.2E-02	1.11E-04	7.47E-02
	BL	9.70E-06	1.67E-06	4.13E-10	1.91E-03	1.45E-04	2.42E-04	2.42E-04	1.24E-05	1.2E-02	2.84E-05	1.48E-02
	DC	9.70E-06	1.67E-06	4.13E-10	7.15E-04	1.45E-04	2.42E-04	2.42E-04	1.06E-05	1.2E-02	2.68E-05	1.36E-02
	DSC	9.70E-06	1.67E-06	4.13E-10	8.41E-04	1.45E-04	2.42E-04	2.42E-04	1.08E-05	1.2E-02	2.70E-05	1.37E-02
	FC	9.70E-06	1.67E-06	4.13E-10	1.13E-03	1.45E-04	2.42E-04	2.42E-04	1.12E-05	1.2E-02	2.73E-05	1.40E-02
	FMK	9.70E-06	1.67E-06	4.13E-10	3.64E-03	1.45E-04	2.42E-04	2.42E-04	1.51E-05	1.2E-02	3.08E-05	1.65E-02
	FMM	9.70E-06	1.67E-06	4.13E-10	5.15E-04	1.45E-04	2.42E-04	2.42E-04	1.03E-05	1.2E-02	2.65E-05	1.34E-02
	FMT	9.70E-06	1.67E-06	4.13E-10	1.51E-04	1.45E-04	2.42E-04	2.42E-04	9.70E-06	1.2E-02	2.60E-05	1.30E-02
	FMT1	9.70E-06	1.67E-06	4.13E-10	8.75E-05	1.45E-04	2.42E-04	2.42E-04	9.60E-06	1.2E-02	2.59E-05	1.30E-02
	FMT2	9.70E-06	1.67E-06	4.13E-10	1.28E-02	1.45E-04	2.42E-04	2.42E-04	2.92E-05	1.2E-02	4.35E-05	2.57E-02
	GEC	9.70E-06	1.67E-06	4.13E-10	4.05E-04	1.45E-04	2.42E-04	2.42E-04	1.01E-05	1.2E-02	2.63E-05	1.33E-02
	GWC	9.70E-06	1.67E-06	4.13E-10	4.35E-04	1.45E-04	2.42E-04	2.42E-04	1.01E-05	1.2E-02	2.64E-05	1.33E-02
	KL	9.70E-06	1.67E-06	4.13E-10	3.39E-03	1.45E-04	2.42E-04	2.42E-04	1.47E-05	1.2E-02	3.05E-05	1.63E-02
	LEC	9.70E-06	1.67E-06	4.13E-10	2.81E-03	1.45E-04	2.42E-04	2.42E-04	1.38E-05	1.2E-02	2.97E-05	1.57E-02
	LWC	9.70E-06	1.67E-06	4.13E-10	2.45E-03	1.45E-04	2.42E-04	2.42E-04	1.32E-05	1.2E-02	2.92E-05	1.53E-02
	MC	9.70E-06	1.67E-06	4.13E-10	1.02E-03	1.45E-04	2.42E-04	2.42E-04	1.10E-05	1.2E-02	2.72E-05	1.39E-02
	TC	9.70E-06	1.67E-06	4.13E-10	3.79E-03	1.45E-04	2.42E-04	2.42E-04	1.53E-05	1.2E-02	3.10E-05	1.67E-02
	WC	9.70E-06	1.67E-06	4.13E-10	2.08E-03	1.45E-04	2.42E-04	2.42E-04	1.27E-05	1.2E-02	2.87E-05	1.50E-02
PROJECT ALONE	MPOI	8.56E-14	1.47E-14	3.65E-18	1.09E-07	3.83E-08	5.01E-14	1.62E-14	2.51E-13	3.21E-06	9.33E-10	3.36E-06
	AC	2.16E-14	3.72E-15	9.21E-19	2.74E-08	9.67E-09	1.27E-14	4.09E-15	6.33E-14	8.12E-07	2.36E-10	8.49E-07
	AR	6.00E-14	1.03E-14	2.55E-18	7.61E-08	2.68E-08	3.51E-14	1.14E-14	1.75E-13	2.25E-06	6.53E-10	2.35E-06
	BC	8.56E-14	1.47E-14	3.65E-18	1.09E-07	3.83E-08	5.01E-14	1.62E-14	2.51E-13	3.21E-06	9.33E-10	3.36E-06
	BL	8.31E-14	1.43E-14	3.54E-18	1.05E-07	3.72E-08	4.86E-14	1.57E-14	2.43E-13	3.12E-06	9.05E-10	3.26E-06
	DC	8.22E-14	1.41E-14	3.50E-18	1.04E-07	3.68E-08	4.81E-14	1.56E-14	2.40E-13	3.09E-06	8.96E-10	3.23E-06
	DSC	8.31E-14	1.43E-14	3.54E-18	1.05E-07	3.72E-08	4.86E-14	1.57E-14	2.43E-13	3.12E-06	9.05E-10	3.26E-06
	FC	9.12E-14	1.57E-14	3.89E-18	1.16E-07	4.08E-08	5.34E-14	1.73E-14	2.67E-13	3.42E-06	9.94E-10	3.58E-06
	FMK	5.35E-14	9.21E-15	2.28E-18	6.79E-08	2.39E-08	3.13E-14	1.01E-14	1.57E-13	2.01E-06	5.83E-10	2.10E-06
	FMM	7.07E-14	1.22E-14	3.01E-18	8.97E-08	3.16E-08	4.14E-14	1.34E-14	2.07E-13	2.65E-06	7.70E-10	2.78E-06
	FMT	7.82E-14	1.35E-14	3.33E-18	9.93E-08	3.50E-08	4.58E-14	1.48E-14	2.29E-13	2.94E-06	8.52E-10	3.07E-06
	FMT1	1.68E-14	2.89E-15	7.15E-19	2.13E-08	7.51E-09	9.82E-15	3.18E-15	4.91E-14	6.30E-07	1.83E-10	6.59E-07
	FMT2	6.00E-14	1.03E-14	2.55E-18	7.61E-08	2.68E-08	3.51E-14	1.14E-14	1.75E-13	2.25E-06	6.53E-10	2.35E-06
	GEC	3.42E-13	5.88E-14	1.46E-17	4.34E-07	1.53E-07	2.00E-13	6.47E-14	1.00E-12	1.28E-05	3.72E-09	1.34E-05
	GWC	2.11E-13	3.63E-14	8.98E-18	2.68E-07	9.43E-08	1.23E-13	3.99E-14	6.17E-13	7.91E-06	2.30E-09	8.28E-06
	KL	4.20E-14	7.22E-15	1.79E-18	5.33E-08	1.88E-08	2.46E-14	7.95E-15	1.23E-13	1.57E-06	4.57E-10	1.65E-06
	LEC	3.08E-14	5.30E-15	1.31E-18	3.91E-08	1.38E-08	1.80E-14	5.84E-15	9.02E-14	1.16E-06	3.36E-10	1.21E-06
	LWC	3.30E-14	5.67E-15	1.40E-18	4.18E-08	1.47E-08	1.93E-14	6.24E-15	9.64E-14	1.24E-06	3.59E-10	1.29E-06
	MC	4.45E-14	7.66E-15	1.90E-18	5.65E-08	1.99E-08	2.61E-14	8.43E-15	1.30E-13	1.67E-06	4.85E-10	1.75E-06
	TC	4.28E-14	7.37E-15	1.82E-18	5.43E-08	1.92E-08	2.51E-14	8.11E-15	1.25E-13	1.61E-06	4.67E-10	1.68E-06
	WC	6.51E-14	1.12E-14	2.77E-18	8.26E-08	2.91E-08	3.81E-14	1.23E-14	1.90E-13	2.44E-06	7.09E-10	2.56E-06

HQ	Receptor Location	Hazard Quotient (EDI/TDI)										Total HQ
		Soil Ingestion	Soil Dermal	Soil Inhalation	Air Inhalation	Surface Water Ingestion	Lab Tea Ingestion	Cattail Ingestion	Berries Ingestion	Fish Ingestion	Wild Game Ingestion	
APPLICATION	MPOI	9.70E-06	1.67E-06	4.13E-10	1.14E-01	1.45E-04	2.42E-04	2.42E-04	1.85E-04	1.22E-02	1.83E-04	1.27E-01
	AC	9.70E-06	1.67E-06	4.13E-10	3.52E-04	1.45E-04	2.42E-04	2.42E-04	1.00E-05	1.22E-02	2.63E-05	1.32E-02
	AR	9.70E-06	1.67E-06	4.13E-10	3.00E-03	1.45E-04	2.42E-04	2.42E-04	1.41E-05	1.22E-02	2.99E-05	1.59E-02
	BC	9.70E-06	1.67E-06	4.13E-10	6.16E-02	1.45E-04	2.42E-04	2.42E-04	1.04E-04	1.22E-02	1.11E-04	7.47E-02
	BL	9.70E-06	1.67E-06	4.13E-10	1.91E-03	1.45E-04	2.42E-04	2.42E-04	1.24E-05	1.22E-02	2.84E-05	1.48E-02
	DC	9.70E-06	1.67E-06	4.13E-10	7.15E-04	1.45E-04	2.42E-04	2.42E-04	1.06E-05	1.22E-02	2.68E-05	1.36E-02
	DSC	9.70E-06	1.67E-06	4.13E-10	8.42E-04	1.45E-04	2.42E-04	2.42E-04	1.08E-05	1.22E-02	2.70E-05	1.37E-02
	FC	9.70E-06	1.67E-06	4.13E-10	1.13E-03	1.45E-04	2.42E-04	2.42E-04	1.12E-05	1.22E-02	2.73E-05	1.40E-02
	FMK	9.70E-06	1.67E-06	4.13E-10	3.64E-03	1.45E-04	2.42E-04	2.42E-04	1.51E-05	1.22E-02	3.08E-05	1.65E-02
	FMM	9.70E-06	1.67E-06	4.13E-10	5.15E-04	1.45E-04	2.42E-04	2.42E-04	1.03E-05	1.22E-02	2.65E-05	1.34E-02
	FMT	9.70E-06	1.67E-06	4.13E-10	1.51E-04	1.45E-04	2.42E-04	2.42E-04	9.70E-06	1.22E-02	2.60E-05	1.30E-02
	FMT1	9.70E-06	1.67E-06	4.13E-10	8.76E-05	1.45E-04	2.42E-04	2.42E-04	9.60E-06	1.22E-02	2.59E-05	1.30E-02
	FMT2	9.70E-06	1.67E-06	4.13E-10	1.28E-02	1.45E-04	2.42E-04	2.42E-04	2.92E-05	1.22E-02	4.35E-05	2.57E-02
	GEC	9.70E-06	1.67E-06	4.13E-10	4.05E-04	1.46E-04	2.42E-04	2.42E-04	1.01E-05	1.22E-02	2.64E-05	1.33E-02
	GWC	9.70E-06	1.67E-06	4.13E-10	4.35E-04	1.46E-04	2.42E-04	2.42E-04	1.01E-05	1.22E-02	2.64E-05	1.33E-02
	KL	9.70E-06	1.67E-06	4.13E-10	3.39E-03	1.45E-04	2.42E-04	2.42E-04	1.47E-05	1.22E-02	3.05E-05	1.63E-02
	LEC	9.70E-06	1.67E-06	4.13E-10	2.81E-03	1.45E-04	2.42E-04	2.42E-04	1.38E-05	1.22E-02	2.97E-05	1.57E-02
	LWC	9.70E-06	1.67E-06	4.13E-10	2.45E-03	1.45E-04	2.42E-04	2.42E-04	1.32E-05	1.22E-02	2.92E-05	1.53E-02
	MC	9.70E-06	1.67E-06	4.13E-10	1.02E-03	1.45E-04	2.42E-04	2.42E-04	1.10E-05	1.22E-02	2.72E-05	1.39E-02
	TC	9.70E-06	1.67E-06	4.13E-10	3.79E-03	1.45E-04	2.42E-04	2.42E-04	1.53E-05	1.22E-02	3.10E-05	1.67E-02
	WC	9.70E-06	1.67E-06	4.13E-10	2.08E-03	1.45E-04	2.42E-04	2.42E-04	1.27E-05	1.22E-02	2.87E-05	1.50E-02
PDC	MPOI	9.70E-06	1.67E-06	4.13E-10	1.14E-01	2.61E-04	2.43E-04	2.42E-04	1.94E-04	2.19E-02	1.86E-04	1.37E-01
	AC	9.70E-06	1.67E-06	4.13E-10	3.82E-04	1.80E-04	2.42E-04	2.42E-04	1.95E-05	1.51E-02	2.72E-05	1.62E-02
	AR	9.70E-06	1.67E-06	4.13E-10	3.08E-03	1.97E-04	2.42E-04	2.42E-04	2.37E-05	1.65E-02	3.13E-05	2.03E-02
	BC	9.70E-06	1.67E-06	4.13E-10	6.19E-02	2.60E-04	2.43E-04	2.42E-04	1.14E-04	2.18E-02	1.14E-04	8.47E-02
	BL	9.70E-06	1.67E-06	4.13E-10	1.96E-03	1.87E-04	2.42E-04	2.42E-04	2.20E-05	1.57E-02	2.95E-05	1.84E-02
	DC	9.70E-06	1.67E-06	4.13E-10	7.50E-04	1.82E-04	2.42E-04	2.42E-04	2.01E-05	1.53E-02	2.77E-05	1.68E-02
	DSC	9.70E-06	1.67E-06	4.13E-10	8.66E-04	1.78E-04	2.42E-04	2.42E-04	2.03E-05	1.50E-02	2.78E-05	1.65E-02
	FC	9.70E-06	1.67E-06	4.13E-10	1.15E-03	1.80E-04	2.42E-04	2.42E-04	2.07E-05	1.51E-02	2.82E-05	1.70E-02
	FMK	9.70E-06	1.67E-06	4.13E-10	3.92E-03	2.68E-04	2.43E-04	2.42E-04	2.49E-05	2.25E-02	3.42E-05	2.73E-02
	FMM	9.70E-06	1.67E-06	4.13E-10	5.31E-04	1.75E-04	2.42E-04	2.42E-04	1.97E-05	1.47E-02	2.72E-05	1.59E-02
	FMT	9.70E-06	1.67E-06	4.13E-10	1.59E-04	1.73E-04	2.42E-04	2.42E-04	1.92E-05	1.45E-02	2.67E-05	1.54E-02
	FMT1	9.70E-06	1.67E-06	4.13E-10	9.85E-05	1.73E-04	2.42E-04	2.42E-04	1.91E-05	1.46E-02	2.66E-05	1.54E-02
	FMT2	9.70E-06	1.67E-06	4.13E-10	1.30E-02	2.17E-04	2.42E-04	2.42E-04	3.88E-05	1.82E-02	4.54E-05	3.20E-02
	GEC	9.70E-06	1.67E-06	4.13E-10	4.18E-04	1.74E-04	2.42E-04	2.42E-04	1.96E-05	1.46E-02	2.71E-05	1.58E-02
	GWC	9.70E-06	1.67E-06	4.13E-10	4.49E-04	1.75E-04	2.42E-04	2.42E-04	1.96E-05	1.46E-02	2.71E-05	1.58E-02
	KL	9.70E-06	1.67E-06	4.13E-10	3.48E-03	2.01E-04	2.42E-04	2.42E-04	2.43E-05	1.69E-02	3.19E-05	2.11E-02
	LEC	9.70E-06	1.67E-06	4.13E-10	2.85E-03	1.82E-04	2.42E-04	2.42E-04	2.33E-05	1.52E-02	3.06E-05	1.88E-02
	LWC	9.70E-06	1.67E-06	4.13E-10	2.53E-03	1.96E-04	2.42E-04	2.42E-04	2.28E-05	1.64E-02	3.05E-05	1.97E-02
	MC	9.70E-06	1.67E-06	4.13E-10	1.80E-03	4.45E-04	2.43E-04	2.42E-04	2.17E-05	3.73E-02	3.56E-05	4.01E-02
	TC	9.70E-06	1.67E-06	4.13E-10	3.88E-03	2.02E-04	2.42E-04	2.42E-04	2.49E-05	1.69E-02	3.25E-05	2.16E-02
	WC	9.70E-06	1.67E-06	4.13E-10	2.14E-03	1.92E-04	2.42E-04	2.42E-04	2.22E-05	1.61E-02	2.99E-05	1.90E-02

Table SIR3 21-5: Noncarcinogenic Risk Estimates for Chronic Hydrogen Sulphide Exposures

HQ	Receptor Location	Hazard Quotient (EDI/TDI)										Total HQ
		Soil Ingestion	Soil Dermal	Soil Inhalation	Air Inhalation	Surface Water Ingestion	Lab Tea Ingestion	Cattail Ingestion	Berries Ingestion	Fish Ingestion	Wild Game Ingestion	
BASELINE	MPOI	0.00E+00	0.00E+00	0.00E+00	2.07E+00	0.00E+00	0.00E+00	0.00E+00	0.0E+00	0.00E+00	0.00E+00	2.07E+00
	AC	0.00E+00	0.00E+00	0.00E+00	1.64E-03	0.00E+00	0.00E+00	0.00E+00	0.0E+00	0.00E+00	0.00E+00	1.64E-03
	AR	0.00E+00	0.00E+00	0.00E+00	2.55E-02	0.00E+00	0.00E+00	0.00E+00	0.0E+00	0.00E+00	0.00E+00	2.55E-02
	BC	0.00E+00	0.00E+00	0.00E+00	1.44E-01	0.00E+00	0.00E+00	0.00E+00	0.0E+00	0.00E+00	0.00E+00	1.44E-01
	BL	0.00E+00	0.00E+00	0.00E+00	4.73E-02	0.00E+00	0.00E+00	0.00E+00	0.0E+00	0.00E+00	0.00E+00	4.73E-02
	DC	0.00E+00	0.00E+00	0.00E+00	7.48E-03	0.00E+00	0.00E+00	0.00E+00	0.0E+00	0.00E+00	0.00E+00	7.48E-03
	DSC	0.00E+00	0.00E+00	0.00E+00	9.00E-03	0.00E+00	0.00E+00	0.00E+00	0.0E+00	0.00E+00	0.00E+00	9.00E-03
	FC	0.00E+00	0.00E+00	0.00E+00	1.55E-02	0.00E+00	0.00E+00	0.00E+00	0.0E+00	0.00E+00	0.00E+00	1.55E-02
	FMK	0.00E+00	0.00E+00	0.00E+00	1.60E-02	0.00E+00	0.00E+00	0.00E+00	0.0E+00	0.00E+00	0.00E+00	1.60E-02
	FMM	0.00E+00	0.00E+00	0.00E+00	4.25E-03	0.00E+00	0.00E+00	0.00E+00	0.0E+00	0.00E+00	0.00E+00	4.25E-03
	FMT	0.00E+00	0.00E+00	0.00E+00	1.01E-03	0.00E+00	0.00E+00	0.00E+00	0.0E+00	0.00E+00	0.00E+00	1.01E-03
	FMT1	0.00E+00	0.00E+00	0.00E+00	4.93E-04	0.00E+00	0.00E+00	0.00E+00	0.0E+00	0.00E+00	0.00E+00	4.93E-04
	FMT2	0.00E+00	0.00E+00	0.00E+00	3.82E-02	0.00E+00	0.00E+00	0.00E+00	0.0E+00	0.00E+00	0.00E+00	3.82E-02
	GEC	0.00E+00	0.00E+00	0.00E+00	3.04E-03	0.00E+00	0.00E+00	0.00E+00	0.0E+00	0.00E+00	0.00E+00	3.04E-03
	GWC	0.00E+00	0.00E+00	0.00E+00	3.18E-03	0.00E+00	0.00E+00	0.00E+00	0.0E+00	0.00E+00	0.00E+00	3.18E-03
	KL	0.00E+00	0.00E+00	0.00E+00	1.42E-02	0.00E+00	0.00E+00	0.00E+00	0.0E+00	0.00E+00	0.00E+00	1.42E-02
	LEC	0.00E+00	0.00E+00	0.00E+00	8.63E-03	0.00E+00	0.00E+00	0.00E+00	0.0E+00	0.00E+00	0.00E+00	8.63E-03
	LWC	0.00E+00	0.00E+00	0.00E+00	9.55E-03	0.00E+00	0.00E+00	0.00E+00	0.0E+00	0.00E+00	0.00E+00	9.55E-03
	MC	0.00E+00	0.00E+00	0.00E+00	6.24E-03	0.00E+00	0.00E+00	0.00E+00	0.0E+00	0.00E+00	0.00E+00	6.24E-03
	TC	0.00E+00	0.00E+00	0.00E+00	1.62E-02	0.00E+00	0.00E+00	0.00E+00	0.0E+00	0.00E+00	0.00E+00	1.62E-02
	WC	0.00E+00	0.00E+00	0.00E+00	2.31E-02	0.00E+00	0.00E+00	0.00E+00	0.0E+00	0.00E+00	0.00E+00	2.31E-02
PROJECT ALONE	MPOI	0.00E+00	0.00E+00	0.00E+00	5.50E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.50E-06
	AC	0.00E+00	0.00E+00	0.00E+00	1.26E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.26E-06
	AR	0.00E+00	0.00E+00	0.00E+00	3.87E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.87E-06
	BC	0.00E+00	0.00E+00	0.00E+00	3.25E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.25E-06
	BL	0.00E+00	0.00E+00	0.00E+00	4.81E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.81E-06
	DC	0.00E+00	0.00E+00	0.00E+00	4.81E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.81E-06
	DSC	0.00E+00	0.00E+00	0.00E+00	4.86E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.86E-06
	FC	0.00E+00	0.00E+00	0.00E+00	5.31E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.31E-06
	FMK	0.00E+00	0.00E+00	0.00E+00	3.15E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.15E-06
	FMM	0.00E+00	0.00E+00	0.00E+00	4.12E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.12E-06
	FMT	0.00E+00	0.00E+00	0.00E+00	4.62E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.62E-06
	FMT1	0.00E+00	0.00E+00	0.00E+00	9.77E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.77E-07
	FMT2	0.00E+00	0.00E+00	0.00E+00	3.29E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.29E-06
	GEC	0.00E+00	0.00E+00	0.00E+00	1.77E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.77E-05
	GWC	0.00E+00	0.00E+00	0.00E+00	1.07E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.07E-05
	KL	0.00E+00	0.00E+00	0.00E+00	2.41E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.41E-06
	LEC	0.00E+00	0.00E+00	0.00E+00	2.22E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.22E-06
	LWC	0.00E+00	0.00E+00	0.00E+00	2.01E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.01E-06
	MC	0.00E+00	0.00E+00	0.00E+00	3.37E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.37E-06
	TC	0.00E+00	0.00E+00	0.00E+00	2.47E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.47E-06
	WC	0.00E+00	0.00E+00	0.00E+00	4.29E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.29E-06

HQ	Receptor Location	Hazard Quotient (EDI/TDI)										Total HQ
		Soil Ingestion	Soil Dermal	Soil Inhalation	Air Inhalation	Surface Water Ingestion	Lab Tea Ingestion	Cattail Ingestion	Berries Ingestion	Fish Ingestion	Wild Game Ingestion	
APPLICATION	MPOI	0.00E+00	0.00E+00	0.00E+00	2.07E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.07E+00
	AC	0.00E+00	0.00E+00	0.00E+00	1.65E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.65E-03
	AR	0.00E+00	0.00E+00	0.00E+00	2.55E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.55E-02
	BC	0.00E+00	0.00E+00	0.00E+00	1.44E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.44E-01
	BL	0.00E+00	0.00E+00	0.00E+00	4.73E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.73E-02
	DC	0.00E+00	0.00E+00	0.00E+00	7.49E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.49E-03
	DSC	0.00E+00	0.00E+00	0.00E+00	9.01E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.01E-03
	FC	0.00E+00	0.00E+00	0.00E+00	1.55E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.55E-02
	FMK	0.00E+00	0.00E+00	0.00E+00	1.60E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.60E-02
	FMM	0.00E+00	0.00E+00	0.00E+00	4.25E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.25E-03
	FMT	0.00E+00	0.00E+00	0.00E+00	1.02E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.02E-03
	FMT1	0.00E+00	0.00E+00	0.00E+00	4.94E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.94E-04
	FMT2	0.00E+00	0.00E+00	0.00E+00	3.82E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.82E-02
	GEC	0.00E+00	0.00E+00	0.00E+00	3.06E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.06E-03
	GWC	0.00E+00	0.00E+00	0.00E+00	3.19E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.19E-03
	KL	0.00E+00	0.00E+00	0.00E+00	1.42E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.42E-02
	LEC	0.00E+00	0.00E+00	0.00E+00	8.63E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.63E-03
	LWC	0.00E+00	0.00E+00	0.00E+00	9.55E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.55E-03
	MC	0.00E+00	0.00E+00	0.00E+00	6.25E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.25E-03
	TC	0.00E+00	0.00E+00	0.00E+00	1.62E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.62E-02
	WC	0.00E+00	0.00E+00	0.00E+00	2.31E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.31E-02
PDC	MPOI	0.00E+00	0.00E+00	0.00E+00	2.07E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.07E+00
	AC	0.00E+00	0.00E+00	0.00E+00	1.92E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.92E-03
	AR	0.00E+00	0.00E+00	0.00E+00	2.61E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.61E-02
	BC	0.00E+00	0.00E+00	0.00E+00	1.45E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.45E-01
	BL	0.00E+00	0.00E+00	0.00E+00	4.77E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.77E-02
	DC	0.00E+00	0.00E+00	0.00E+00	7.85E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.85E-03
	DSC	0.00E+00	0.00E+00	0.00E+00	9.34E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.34E-03
	FC	0.00E+00	0.00E+00	0.00E+00	1.60E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.60E-02
	FMK	0.00E+00	0.00E+00	0.00E+00	1.72E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.72E-02
	FMM	0.00E+00	0.00E+00	0.00E+00	4.45E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.45E-03
	FMT	0.00E+00	0.00E+00	0.00E+00	1.16E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.16E-03
	FMT1	0.00E+00	0.00E+00	0.00E+00	5.92E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.92E-04
	FMT2	0.00E+00	0.00E+00	0.00E+00	3.89E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.89E-02
	GEC	0.00E+00	0.00E+00	0.00E+00	3.30E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.30E-03
	GWC	0.00E+00	0.00E+00	0.00E+00	3.43E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.43E-03
	KL	0.00E+00	0.00E+00	0.00E+00	1.47E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.47E-02
	LEC	0.00E+00	0.00E+00	0.00E+00	8.97E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.97E-03
	LWC	0.00E+00	0.00E+00	0.00E+00	1.01E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.01E-02
	MC	0.00E+00	0.00E+00	0.00E+00	8.96E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.96E-03
	TC	0.00E+00	0.00E+00	0.00E+00	1.68E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.68E-02
	WC	0.00E+00	0.00E+00	0.00E+00	2.36E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.36E-02

Table SIR3 21-6: Noncarcinogenic Risk Estimates for Chronic Lead Exposures

HQ	Receptor Location	Hazard Quotient (EDI/TDI)										Total HQ
		Soil Ingestion	Soil Dermal	Soil Inhalation	Air Inhalation	Surface Water Ingestion	Lab Tea Ingestion	Cattail Ingestion	Berries Ingestion	Fish Ingestion	Wild Game Ingestion	
BASELINE	MPOI	1.04E-03	5.94E-04	2.60E-06	1.10E-03	6.48E-04	3.79E-03	3.79E-03	1.04E-02	2.5E-03	1.60E-01	1.83E-01
	AC	1.04E-03	5.94E-04	2.60E-06	1.36E-05	6.48E-04	3.79E-03	3.79E-03	1.04E-02	2.5E-03	1.60E-01	1.82E-01
	AR	1.04E-03	5.94E-04	2.60E-06	8.45E-05	6.48E-04	3.79E-03	3.79E-03	1.04E-02	2.5E-03	1.60E-01	1.82E-01
	BC	1.04E-03	5.94E-04	2.60E-06	1.19E-04	6.48E-04	3.79E-03	3.79E-03	1.04E-02	2.5E-03	1.60E-01	1.82E-01
	BL	1.04E-03	5.94E-04	2.60E-06	5.94E-05	6.48E-04	3.79E-03	3.79E-03	1.04E-02	2.5E-03	1.60E-01	1.82E-01
	DC	1.04E-03	5.94E-04	2.60E-06	3.93E-05	6.48E-04	3.79E-03	3.79E-03	1.04E-02	2.5E-03	1.60E-01	1.82E-01
	DSC	1.04E-03	5.94E-04	2.60E-06	4.41E-05	6.48E-04	3.79E-03	3.79E-03	1.04E-02	2.5E-03	1.60E-01	1.82E-01
	FC	1.04E-03	5.94E-04	2.60E-06	5.47E-05	6.48E-04	3.79E-03	3.79E-03	1.04E-02	2.5E-03	1.60E-01	1.82E-01
	FMK	1.04E-03	5.94E-04	2.60E-06	9.67E-05	6.48E-04	3.79E-03	3.79E-03	1.04E-02	2.5E-03	1.60E-01	1.82E-01
	FMM	1.04E-03	5.94E-04	2.60E-06	7.28E-05	6.48E-04	3.79E-03	3.79E-03	1.04E-02	2.5E-03	1.60E-01	1.82E-01
	FMT	1.04E-03	5.94E-04	2.60E-06	2.11E-05	6.48E-04	3.79E-03	3.79E-03	1.04E-02	2.5E-03	1.60E-01	1.82E-01
	FMT1	1.04E-03	5.94E-04	2.60E-06	5.12E-06	6.48E-04	3.79E-03	3.79E-03	1.04E-02	2.5E-03	1.60E-01	1.82E-01
	FMT2	1.04E-03	5.94E-04	2.60E-06	9.37E-05	6.48E-04	3.79E-03	3.79E-03	1.04E-02	2.5E-03	1.60E-01	1.82E-01
	GEC	1.04E-03	5.94E-04	2.60E-06	6.75E-05	6.48E-04	3.79E-03	3.79E-03	1.04E-02	2.5E-03	1.60E-01	1.82E-01
	GWC	1.04E-03	5.94E-04	2.60E-06	8.49E-05	6.48E-04	3.79E-03	3.79E-03	1.04E-02	2.5E-03	1.60E-01	1.82E-01
	KL	1.04E-03	5.94E-04	2.60E-06	8.00E-05	6.48E-04	3.79E-03	3.79E-03	1.04E-02	2.5E-03	1.60E-01	1.82E-01
	LEC	1.04E-03	5.94E-04	2.60E-06	5.57E-05	6.48E-04	3.79E-03	3.79E-03	1.04E-02	2.5E-03	1.60E-01	1.82E-01
	LWC	1.04E-03	5.94E-04	2.60E-06	7.60E-05	6.48E-04	3.79E-03	3.79E-03	1.04E-02	2.5E-03	1.60E-01	1.82E-01
	MC	1.04E-03	5.94E-04	2.60E-06	5.21E-05	6.48E-04	3.79E-03	3.79E-03	1.04E-02	2.5E-03	1.60E-01	1.82E-01
	TC	1.04E-03	5.94E-04	2.60E-06	9.13E-05	6.48E-04	3.79E-03	3.79E-03	1.04E-02	2.5E-03	1.60E-01	1.82E-01
	WC	1.04E-03	5.94E-04	2.60E-06	8.17E-05	6.48E-04	3.79E-03	3.79E-03	1.04E-02	2.5E-03	1.60E-01	1.82E-01
PROJECT ALONE	MPOI	1.89E-14	1.09E-14	4.75E-17	4.42E-06	1.04E-08	5.13E-14	2.75E-12	2.57E-13	3.93E-08	6.18E-11	4.47E-06
	AC	9.12E-17	5.23E-17	2.29E-19	5.37E-08	5.03E-11	3.45E-16	1.32E-14	1.72E-15	1.90E-10	2.99E-13	5.39E-08
	AR	2.67E-16	1.53E-16	6.68E-19	2.14E-07	1.48E-10	1.18E-15	3.87E-14	5.90E-15	5.58E-10	8.78E-13	2.15E-07
	BC	2.16E-16	1.24E-16	5.42E-19	1.67E-07	1.20E-10	9.36E-16	3.13E-14	4.68E-15	4.52E-10	7.11E-13	1.68E-07
	BL	4.89E-16	2.80E-16	1.23E-18	2.81E-07	2.70E-10	1.83E-15	7.10E-14	9.14E-15	1.02E-09	1.60E-12	2.83E-07
	DC	5.10E-16	2.92E-16	1.28E-18	2.65E-07	2.81E-10	1.82E-15	7.40E-14	9.11E-15	1.06E-09	1.67E-12	2.67E-07
	DSC	8.98E-16	5.15E-16	2.25E-18	2.41E-07	4.93E-10	2.53E-15	1.30E-13	1.26E-14	1.87E-09	2.93E-12	2.44E-07
	FC	8.71E-16	4.99E-16	2.18E-18	3.27E-07	4.79E-10	2.73E-15	1.26E-13	1.37E-14	1.81E-09	2.85E-12	3.29E-07
	FMK	2.17E-16	1.24E-16	5.43E-19	1.83E-07	1.20E-10	9.87E-16	3.14E-14	4.93E-15	4.54E-10	7.14E-13	1.84E-07
	FMM	9.63E-16	5.52E-16	2.41E-18	1.94E-07	5.28E-10	2.51E-15	1.40E-13	1.26E-14	2.00E-09	3.14E-12	1.96E-07
	FMT	3.21E-16	1.84E-16	8.04E-19	2.08E-07	1.77E-10	1.27E-15	4.65E-14	6.35E-15	6.70E-10	1.05E-12	2.09E-07
	FMT1	6.77E-17	3.88E-17	1.70E-19	3.46E-08	3.73E-11	2.40E-16	9.82E-15	1.20E-15	1.41E-10	2.22E-13	3.48E-08
	FMT2	2.30E-16	1.32E-16	5.77E-19	1.91E-07	1.28E-10	1.04E-15	3.34E-14	5.19E-15	4.82E-10	7.59E-13	1.92E-07
	GEC	3.18E-15	1.82E-15	7.96E-18	1.10E-06	1.75E-09	9.69E-15	4.61E-13	4.85E-14	6.60E-09	1.04E-11	1.11E-06
	GWC	2.91E-15	1.67E-15	7.29E-18	6.17E-07	1.59E-09	7.69E-15	4.22E-13	3.84E-14	6.03E-09	9.48E-12	6.25E-07
	KL	1.70E-16	9.77E-17	4.27E-19	1.11E-07	9.41E-11	6.76E-16	2.47E-14	3.38E-15	3.56E-10	5.60E-13	1.11E-07
	LEC	1.72E-16	9.87E-17	4.32E-19	1.09E-07	9.51E-11	6.74E-16	2.50E-14	3.37E-15	3.60E-10	5.66E-13	1.10E-07
	LWC	1.53E-16	8.77E-17	3.83E-19	9.29E-08	8.44E-11	5.87E-16	2.22E-14	2.93E-15	3.19E-10	5.02E-13	9.33E-08
	MC	2.04E-16	1.17E-16	5.10E-19	1.58E-07	1.13E-10	8.84E-16	2.95E-14	4.42E-15	4.26E-10	6.70E-13	1.59E-07
	TC	1.72E-16	9.85E-17	4.31E-19	1.13E-07	9.48E-11	6.84E-16	2.49E-14	3.42E-15	3.59E-10	5.64E-13	1.13E-07
	WC	3.19E-16	1.83E-16	8.01E-19	2.20E-07	1.76E-10	1.30E-15	4.63E-14	6.52E-15	6.68E-10	1.05E-12	2.21E-07

HQ	Receptor Location	Hazard Quotient (EDI/TDI)										Total HQ
		Soil Ingestion	Soil Dermal	Soil Inhalation	Air Inhalation	Surface Water Ingestion	Lab Tea Ingestion	Cattail Ingestion	Berries Ingestion	Fish Ingestion	Wild Game Ingestion	
APPLICATION	MPOI	1.04E-03	5.94E-04	2.60E-06	1.10E-03	6.48E-04	3.79E-03	3.79E-03	1.04E-02	2.45E-03	1.60E-01	1.83E-01
	AC	1.04E-03	5.94E-04	2.60E-06	1.36E-05	6.48E-04	3.79E-03	3.79E-03	1.04E-02	2.45E-03	1.60E-01	1.82E-01
	AR	1.04E-03	5.94E-04	2.60E-06	8.47E-05	6.48E-04	3.79E-03	3.79E-03	1.04E-02	2.45E-03	1.60E-01	1.82E-01
	BC	1.04E-03	5.94E-04	2.60E-06	1.19E-04	6.48E-04	3.79E-03	3.79E-03	1.04E-02	2.45E-03	1.60E-01	1.82E-01
	BL	1.04E-03	5.94E-04	2.60E-06	5.97E-05	6.48E-04	3.79E-03	3.79E-03	1.04E-02	2.45E-03	1.60E-01	1.82E-01
	DC	1.04E-03	5.94E-04	2.60E-06	3.95E-05	6.48E-04	3.79E-03	3.79E-03	1.04E-02	2.45E-03	1.60E-01	1.82E-01
	DSC	1.04E-03	5.94E-04	2.60E-06	4.44E-05	6.48E-04	3.79E-03	3.79E-03	1.04E-02	2.45E-03	1.60E-01	1.82E-01
	FC	1.04E-03	5.94E-04	2.60E-06	5.50E-05	6.48E-04	3.79E-03	3.79E-03	1.04E-02	2.45E-03	1.60E-01	1.82E-01
	FMK	1.04E-03	5.94E-04	2.60E-06	9.68E-05	6.48E-04	3.79E-03	3.79E-03	1.04E-02	2.45E-03	1.60E-01	1.82E-01
	FMM	1.04E-03	5.94E-04	2.60E-06	7.30E-05	6.48E-04	3.79E-03	3.79E-03	1.04E-02	2.45E-03	1.60E-01	1.82E-01
	FMT	1.04E-03	5.94E-04	2.60E-06	2.13E-05	6.48E-04	3.79E-03	3.79E-03	1.04E-02	2.45E-03	1.60E-01	1.82E-01
	FMT1	1.04E-03	5.94E-04	2.60E-06	5.16E-06	6.48E-04	3.79E-03	3.79E-03	1.04E-02	2.45E-03	1.60E-01	1.82E-01
	FMT2	1.04E-03	5.94E-04	2.60E-06	9.39E-05	6.48E-04	3.79E-03	3.79E-03	1.04E-02	2.45E-03	1.60E-01	1.82E-01
	GEC	1.04E-03	5.94E-04	2.60E-06	6.86E-05	6.48E-04	3.79E-03	3.79E-03	1.04E-02	2.45E-03	1.60E-01	1.82E-01
	GWC	1.04E-03	5.94E-04	2.60E-06	8.56E-05	6.48E-04	3.79E-03	3.79E-03	1.04E-02	2.45E-03	1.60E-01	1.82E-01
	KL	1.04E-03	5.94E-04	2.60E-06	8.01E-05	6.48E-04	3.79E-03	3.79E-03	1.04E-02	2.45E-03	1.60E-01	1.82E-01
	LEC	1.04E-03	5.94E-04	2.60E-06	5.58E-05	6.48E-04	3.79E-03	3.79E-03	1.04E-02	2.45E-03	1.60E-01	1.82E-01
	LWC	1.04E-03	5.94E-04	2.60E-06	7.61E-05	6.48E-04	3.79E-03	3.79E-03	1.04E-02	2.45E-03	1.60E-01	1.82E-01
	MC	1.04E-03	5.94E-04	2.60E-06	5.22E-05	6.48E-04	3.79E-03	3.79E-03	1.04E-02	2.45E-03	1.60E-01	1.82E-01
	TC	1.04E-03	5.94E-04	2.60E-06	9.14E-05	6.48E-04	3.79E-03	3.79E-03	1.04E-02	2.45E-03	1.60E-01	1.82E-01
	WC	1.04E-03	5.94E-04	2.60E-06	8.20E-05	6.48E-04	3.79E-03	3.79E-03	1.04E-02	2.45E-03	1.60E-01	1.82E-01
PDC	MPOI	1.04E-03	5.94E-04	2.60E-06	2.12E-03	7.21E-04	3.79E-03	3.79E-03	2.08E-02	2.73E-03	1.60E-01	1.95E-01
	AC	1.04E-03	5.94E-04	2.60E-06	1.60E-05	7.21E-04	3.79E-03	3.79E-03	2.08E-02	2.73E-03	1.60E-01	1.93E-01
	AR	1.04E-03	5.94E-04	2.60E-06	9.69E-05	7.21E-04	3.79E-03	3.79E-03	2.08E-02	2.73E-03	1.60E-01	1.93E-01
	BC	1.04E-03	5.94E-04	2.60E-06	1.33E-04	7.21E-04	3.79E-03	3.79E-03	2.08E-02	2.73E-03	1.60E-01	1.93E-01
	BL	1.04E-03	5.94E-04	2.60E-06	6.81E-05	7.21E-04	3.79E-03	3.79E-03	2.08E-02	2.73E-03	1.60E-01	1.93E-01
	DC	1.04E-03	5.94E-04	2.60E-06	4.85E-05	7.21E-04	3.79E-03	3.79E-03	2.08E-02	2.73E-03	1.60E-01	1.93E-01
	DSC	1.04E-03	5.94E-04	2.60E-06	5.54E-05	7.21E-04	3.79E-03	3.79E-03	2.08E-02	2.73E-03	1.60E-01	1.93E-01
	FC	1.04E-03	5.94E-04	2.60E-06	6.53E-05	7.21E-04	3.79E-03	3.79E-03	2.08E-02	2.73E-03	1.60E-01	1.93E-01
	FMK	1.04E-03	5.94E-04	2.60E-06	1.10E-04	7.21E-04	3.79E-03	3.79E-03	2.08E-02	2.73E-03	1.60E-01	1.93E-01
	FMM	1.04E-03	5.94E-04	2.60E-06	1.22E-04	7.21E-04	3.79E-03	3.79E-03	2.08E-02	2.73E-03	1.60E-01	1.93E-01
	FMT	1.04E-03	5.94E-04	2.60E-06	3.50E-05	7.21E-04	3.79E-03	3.79E-03	2.08E-02	2.73E-03	1.60E-01	1.93E-01
	FMT1	1.04E-03	5.94E-04	2.60E-06	6.39E-06	7.21E-04	3.79E-03	3.79E-03	2.08E-02	2.73E-03	1.60E-01	1.93E-01
	FMT2	1.04E-03	5.94E-04	2.60E-06	1.08E-04	7.21E-04	3.79E-03	3.79E-03	2.08E-02	2.73E-03	1.60E-01	1.93E-01
	GEC	1.04E-03	5.94E-04	2.60E-06	1.09E-04	7.21E-04	3.79E-03	3.79E-03	2.08E-02	2.73E-03	1.60E-01	1.93E-01
	GWC	1.04E-03	5.94E-04	2.60E-06	1.40E-04	7.21E-04	3.79E-03	3.79E-03	2.08E-02	2.73E-03	1.60E-01	1.93E-01
	KL	1.04E-03	5.94E-04	2.60E-06	8.67E-05	7.21E-04	3.79E-03	3.79E-03	2.08E-02	2.73E-03	1.60E-01	1.93E-01
	LEC	1.04E-03	5.94E-04	2.60E-06	6.02E-05	7.21E-04	3.79E-03	3.79E-03	2.08E-02	2.73E-03	1.60E-01	1.93E-01
	LWC	1.04E-03	5.94E-04	2.60E-06	8.09E-05	7.21E-04	3.79E-03	3.79E-03	2.08E-02	2.73E-03	1.60E-01	1.93E-01
	MC	1.04E-03	5.94E-04	2.60E-06	6.28E-05	7.21E-04	3.79E-03	3.79E-03	2.08E-02	2.73E-03	1.60E-01	1.93E-01
	TC	1.04E-03	5.94E-04	2.60E-06	9.80E-05	7.21E-04	3.79E-03	3.79E-03	2.08E-02	2.73E-03	1.60E-01	1.93E-01
	WC	1.04E-03	5.94E-04	2.60E-06	9.24E-05	7.21E-04	3.79E-03	3.79E-03	2.08E-02	2.73E-03	1.60E-01	1.93E-01

The reference concentration (RfC) used to assess the chronic health risks associated with long-term air inhalation of H_2S is considered a conservative benchmark. Sufficient human data were not available to provide basis for the derivation of an RfC by the US EPA. Thus, this RfC was based on a no-observable-adverse-effect-level (NOAEL) of 13.9 mg/m^3 for olfactory loss in adult male rats following air inhalation exposure to H_2S for six hours per day, seven days per week for 10 weeks. Various adjustments were made to the NOAEL to account for intermittent exposure and calculate a human equivalent concentration (HEC). The US EPA (2003) applied an uncertainty factor of 300 to the adjusted NOAEL to account for interspecies variability (3-fold), intra-species variability (10-fold), and for subchronic exposure (10-fold). In the absence of human data, use of data from animal studies is common practice in the development of an RfC (US EPA 2002). Typically, the uncertainty associated with the use of animal data is accommodated through the calculation of a HEC and/or the application of an uncertainty factor. However, if there are data supporting the conclusion that the test species is more or equally as susceptible to the pollutant as humans, then a default uncertainty factor of 3 (in conjunction with the derivation of a human equivalent concentration) or 10 is not required (US EPA 2002). Rodent species may be more susceptible to nasal lesions than humans. This suggests that the US EPA RfC, with the calculation of a human equivalent concentration and the application of an uncertainty factor, might be overly conservative and the associated RQ values might overestimate the potential long-term health risks (nasal lesions) associated with H_2S emissions in the area. The maximum long-term H_2S air concentration of 4.14 µg/m^3 at the MPOI is 3 000-fold less than the NOAEL which formed the basis of the US EPA RfC.

Despite the predicted exceedance of the USEPA RfC at the MPOI, the weight-of-evidence indicates that there is low potential for adverse health effects associated with long-term exposure to H_2S in the region.

In Table SIR 98-2, arsenic contributes 74% of the Total Toxicity Potency. As it contributes the majority of the total toxic potency, it should have been removed and added directly to the COPC list and the carcinogens screened again.

b. For the carcinogenic COPC chronic inhalation screening, include arsenic as COPC and re-screen the remaining chemicals. Include all chemicals which contribute 99% Cumulated Toxicity Potency in the HHRA.

Table SIR3 21-7 summarizes the results of the carcinogenic COPCs chronic air inhalation re-screen following the exclusion of arsenic. As shown, benzene, benzo(a)pyrene, dibenzo(a,h)anthracene, and benzo(k)fluoranthene contribute more than 99.9% of the cumulative toxic potency. All four of these chemicals were assessed in the original human health risk assessment (HHRA). As such, no changes were made to the HHRA.

Table SIR3 21-7: Carcinogenic COPC Chronic Inhalation Screening

Chemicals	Total Emission	Unit Risk	Risk Specific Dose	Toxic Potency	Weighting	Cumulative Toxic Potency
Benzene	4.35E-02	1.00E-01	1.00E-04	4.35E+02	0.9992	0.9992
Benzo(a)pyrene	6.13E-07	3.08E+00	3.25E-06	1.89E-01	4.34E-04	0.9997
Dibenzo(a,h)anthracene	6.13E-07	1.20E+00	8.33E-06	7.36E-02	1.69E-04	0.9998
Benzo(k)fluoranthene	9.19E-07	3.90E-01	2.56E-05	3.58E-02	8.23E-05	0.9999
Benzo(a)anthracene	9.19E-07	1.10E-01	9.09E-05	1.01E-02	2.32E-05	0.9999
Benzo(b)fluoranthene	9.19E-07	1.10E-01	9.09E-05	1.01E-02	2.32E-05	1.0000
Indeno(1,2,3-cd)pyrene	9.19E-07	1.10E-01	9.09E-05	1.01E-02	2.32E-05	1.0000
Chrysene	9.19E-07	1.10E-02	9.09E-04	1.01E-03	2.32E-06	1.0000
7,12-Dimethylbenz(a)anthracene	8.18E-06	7.10E-04	1.41E-02	5.81E-04	1.33E-06	1.0000
Naphthalene	3.12E-04	3.40E-08	2.94E+02	1.06E-06	2.44E-09	1.0000
3-Methylcholanthrene	9.19E-07	6.30E-06	1.59E+00	5.79E-07	1.33E-09	1.0000

Shaded cells represent the COPCs carried forward in the health assessment.

Literature Cited

United States Environmental Protection Agency (US EPA) 2002. *A Review of the Reference Dose and Reference Concentration Process: Risk Assessment Forum*. December 2002. Washington DC.

United States Environmental Protection Agency (US EPA). 2003. *Toxicological review of Hydrogen Sulphide*. In Support of Summary Information on the Integrated Risk Information System (IRIS). Washington DC. EPA/635/R-03/3005.

22. Volume 5, Supplemental Information Request #2, Response 100a, Page AENV-136 Ivanhoe states *Based on discussions with AHW, the screening methods for bioaccumulation and persistence have been recalculated based solely on K_{ow} and chemicals-specific half life. Emissions rates were not considered in the screening process. As result, five new chemicals were added to the original COPC list…*The details and methods used for this selection are not provided, nor are the Optimal Water Partition Coefficient (K_{ow}) and half life data used.

a. Provide details of the methodology and assumptions used to identify COPC for the multi-media assessment including the thresholds for each parameter which indicated the selection of a COPC, the agency methods used (e.g., US EPA, Environment Canada) with supporting literature citations.

Based on further discussions with Alberta Health, COPC for the multi-media were identified using a step-wise approach, as described in the response to SIR3 22b.

b. In a table, provide all the chemicals considered in the multi-media screening, the K_{ow} and half life data with literature references and indicate clearly which chemical screened on and off and why.

Table SIR3 22-1 summarizes the multi-media screening for persistence and bioaccumulation for all emitted COPC. The COPC were identified using a tiered or step-wise approach as described below.

In Step 1, the physical-chemical properties of the COPC were compared against established criteria for volatility. The purpose of this step is to identify those emitted COPC that are non-volatile and may have the potential to accumulate in media other than air, in accordance with the following criteria from the US EPA (2003a):

- molecular weight ≥200 g/mol;
- Henry's Law Constant ≤0.00001 atm-m³/mol (or 1.0E-05 atm-m³/mol); and
- vapour pressure ≤0.001 mmHg (or 1.0E-03 mmHg).

Table SIR3 22-1: Multi-media Screening for Persistence and Bioaccumulation for all Emitted COPCs

Emitted Chemical	CAS #	Step 1			Step 2	Step 3	Included in Multi-media Assessment?
		Molecular Weight (g/mol)	Henry's Law Constant (atm-m³/mol)	Vapour Pressure (mm Hg)	Log K_{ow}	Fugacity	
	Criteria	**200**	**0.00001**	**0.001**	**3.5**	**95%**	
2-Methyl Naphthalene	000091-57-6	142	0.000518	0.055	**3.86**	94%	Yes
3-Methylcholanthrene	000056-49-5	**268**	**0.00000526**	**0.000000043**	-	-	Yes
7,12-Dimethylbenz(a)anthracene	000057-97-6	**256.35**	**0.00000376**	**0.00000068**	-	-	Yes
Acenaphthene	000083-32-9	154.21	0.000184	0.00215	**3.92**	81%	Yes
Acenaphthylene	000208-96-8	152.2	0.000114	0.00668	**3.94**	87%	Yes
Aliphatic C_{19}-C_{34}	No value	**270**	120.0	**0.00084**	-	-	Yes
Aliphatic C_5-C_8	No value	100	1.2	47.88	**3.8**	100%	No
Aliphatic C_9-C_{18}	No value	200	12.0	0.03648	**5.6**	100%	No
Anthracene	000120-12-7	178.24	0.0000556	**0.00000653**	-	-	Yes
Aromatic C_9-C_{16}	No value	150	0.0013	0.03648	**3.6**	90%	Yes
Aromatics C_7-C_8	No value	120	0.011428571	4.788	3.2	-	No
Benzene	000071-43-2	78.12	0.00555	94.8	2.13	-	No
Benzo(a)anthracene	000056-55-3	**228.3**	0.000012	**0.00000021**	-	-	Yes
Benzo(a)pyrene	000050-32-8	**252.32**	**0.000000457**	**0.00000000549**	-	-	Yes
Benzo(b)fluoranthene	000205-99-2	**252.32**	**0.000000657**	**0.0000005**	-	-	Yes
Benzo(g,h,i)perylene	000191-24-2	**276.34**	**0.000000331**	**0.0000000001**	-	-	Yes
Benzo(k)fluoranthene	000207-08-9	**252.32**	**0.000000584**	**0.000000000965**	-	-	Yes
Carbon Disulphide	000075-15-0	76.14	0.0144	359	1.94	-	No
Carbonyl Sulphide	000463-58-1	60.08	0.61	9410	-1.33	-	No
Chrysene	000218-01-9	**228.3**	**0.00000523**	**0.00000000623**	-	-	Yes
Dibenzo(a,h)anthracene	000053-70-3	**278.36**	**0.000000141**	**0.000000000955**	-	-	Yes
Dichlorobenzene	025321-22-6	147	0.00355	1.47	3.28	-	No
Ethyl Benzene	000100-41-4	106.17	0.00788	9.6	3.15	-	No
Fluoranthene	000206-44-0	**202.26**	**0.00000886**	**0.00000922**	-	-	Yes
Fluorene	000086-73-7	166	0.0000962	**0.0006**	**4.18**	83%	Yes
Formaldehyde	000050-00-0	30.03	**0.000000337**	3 890	-	-	Yes
Hydrogen Sulphide (H_2S)	007783-06-4	34.08	0.00856	15 600	0.23	-	No
Indeno(1,2,3-cd)pyrene	000193-39-5	**276.34**	**0.000000348**	**0.000000000125**	-	-	Yes
Mercaptans		104.22	0.00312	13.8	2.75	99%	No
Naphthalene	000091-20-3	128.18	0.00044	0.085	3.3	-	No
n-Hexane	000110-54-3	86.18	1.8	151	**3.9**	100%	No
n-Pentane	000109-66-0	72.15	1.25	514	3.39	-	No
Phenanthrene	000085-01-8	178.24	0.0000423	**0.000121**	-	-	Yes
Pyrene	000129-00-0	**202.26**	0.0000119	**0.0000045**	-	-	Yes
Thiophenes		112.19	0.00227	5.91	2.91	99%	No
Toluene	000108-88-3	92.14	0.00664	28.4	2.73	-	No
Xylenes	000463-58-1	106.17	0.00642	7.913333333	3.16	-	No

In Step 2, the Octanol-Water Partition Coefficients (K_{ow}) for the COPC are considered. In the event that the Log K_{ow} for a COPC exceeded 3.5, indicating a potential to bioaccumulate, the COPC was carried forward to Step 3.

Finally, Step 3 involves fugacity modelling of the COPC. For COPCs from Step 2 that had Log K_{ow} values greater than 3.5, fugacity modelling is completed to determine the potential relative apportionment of the chemical within environmental compartments other than air. Fugacity model results were based on the "Level III" fugacity model developed by US EPA (2011) that adheres to methods developed by Mackay *et al.* (1992; 1993). If a COPC is found to be less than 95% in air, or more than 5% in environmental compartments other than air (i.e., water, soil or sediment), the COPC is included in the multi-media assessment since there may be the potential for persistence and accumulation within soils, plants or other biota (Boethling *et al.* 2009).

Physical-chemical properties were adopted from Syracuse Research Corp. (SRC 2011), or, if a property was not available from SRC 2011, the EPI Suite program developed by US EPA (2011) was searched. However, for the petroleum hydrocarbon fractions, physical-chemical properties were sourced from CCME (2008). Table SIR3 22-1 summarizes the relevant physical-chemical properties for each of the chemicals emitted from the Project and identifies those COPCs that were included in the multi-media assessment.

The premise of this exercise is that if a chemical that is emitted to the air does not meet any of the criteria, the potential for the chemical to deposit near the Project and persist or accumulate in the environment is negligible and only limited opportunity exists for exposure via secondary pathways. However, if a chemical meets any one of the criteria, sufficient opportunity could be presented for exposure via secondary pathways and the chemical was retained in the multi-media assessment.

The results of the revised physical-chemical screen revealed that, in addition to the metals automatically included (i.e., manganese, aluminum and lead), the following "new" COPCs "screened on" to the multi-media assessment:

- 2-methylnaphthalene;
- 7,12-dimethylbenz(a)anthracene;
- acenaphthene;
- acenaphthylene;
- aliphatic C_{17}-C_{34};
- anthracene;
- benzo(a)anthracene;
- benzo(a)pyrene;
- benzo(b)fluoranthene;

- benzo(g,h,i)perylene;
- benzo(k)fluoranthene;
- chrysene;
- dibenzo(a,h)anthracene;
- fluoranthene;
- fluorene;
- indeno(1,2,3-cd)pyrene; and
- phenanthrene.

With the exception of the carcinogenic polycyclic aromatic hydrocarbons (PAHs), the health risks associated with multiple routes of exposure to these COPC are described below. The carcinogenic PAHs were assessed in the original HHRA and include: 7,12-dimethylbenz(a)anthracene; benzo(a)pyrene; benzo(b)fluoranthene; benzo(g,h,i)perylene; benzo(k)fluoranthene; chrysene; dibenzo(a,h)anthracene; and, indeno(1,2,3-cd)pyrene. It should be noted that three chemicals, aromatic hydrocarbons C_9-C_{16}, pyrene and 3-methylcholantrene were assessed in Volume 5, SIR2 100a and the results are not re-produced below.

The health risks associated with the new PAHs, along with the metals not originally assessed in the HHRA (aluminum, lead and manganese), are described below.

The chronic multi-media health risks for 2-methylnaphthalene are presented as hazard quotients in Table SIR3 22-2. None of the hazard quotients exceed 1.0 at any of the receptor locations for the four assessment cases. As such, it is unlikely that chronic multi-media exposure to 2-methylnapthalene will result in adverse health effects.

The chronic multi-media health risks for acenaphthene are presented as hazard quotients in Table SIR3 22-3. None of the hazard quotients exceed 1.0 at any of the receptor locations for the four assessment cases. As such, it is unlikely that chronic multi-media exposure to acenaphthene will result in adverse health effects.

The chronic multi-media health risks for acenaphthylene are presented as hazard quotients in Table SIR3 22-4. None of the hazard quotients exceed 1.0 at any of the receptor locations for the four assessment cases. As such, it is unlikely that chronic multi-media exposure to acenaphthylene will result in adverse health effects.

The chronic multi-media health risks for the aliphatic C_{17}-C_{34} group are presented as hazard quotients in Table SIR3 22-5. None of the hazard quotients exceed 1.0 at any of the receptor locations for the four assessment cases. As such, it is unlikely that chronic multi-media exposure to the aliphatic C_{17}-C_{34} group will result in adverse health effects.

Table SIR3 22-2: Noncarcinogenic Risk Estimates for Chronic Methylnaphthalene Exposures

HQ	Receptor Location	Hazard Quotient (EDI/TDI)										Total HQ
		Soil Ingestion	Soil Dermal	Soil Inhalation	Air Inhalation	Surface Water Ingestion	Lab Tea Ingestion	Cattail Ingestion	Berries Ingestion	Fish Ingestion	Wild Game Ingestion	
BASELINE	MPOI	3.03E-04	3.39E-05	3.17E-08	3.27E-05	1.27E-04	1.89E-02	2.27E-02	6.14E-04	4.0E-03	9.96E-04	4.78E-02
	AC	3.03E-04	3.39E-05	3.17E-08	1.92E-07	1.17E-04	1.89E-02	2.27E-02	6.14E-04	3.7E-03	9.96E-04	4.74E-02
	AR	3.03E-04	3.39E-05	3.17E-08	3.83E-07	1.17E-04	1.89E-02	2.27E-02	6.14E-04	3.7E-03	9.96E-04	4.75E-02
	BC	3.03E-04	3.39E-05	3.17E-08	4.23E-07	1.17E-04	1.89E-02	2.27E-02	6.14E-04	3.7E-03	9.96E-04	4.75E-02
	BL	3.03E-04	3.39E-05	3.17E-08	3.97E-07	1.17E-04	1.89E-02	2.27E-02	6.14E-04	3.7E-03	9.96E-04	4.75E-02
	DC	3.03E-04	3.39E-05	3.17E-08	4.53E-07	1.17E-04	1.89E-02	2.27E-02	6.14E-04	3.7E-03	9.96E-04	4.75E-02
	DSC	3.03E-04	3.39E-05	3.17E-08	5.25E-07	1.17E-04	1.89E-02	2.27E-02	6.14E-04	3.7E-03	9.96E-04	4.75E-02
	FC	3.03E-04	3.39E-05	3.17E-08	4.57E-07	1.17E-04	1.89E-02	2.27E-02	6.14E-04	3.7E-03	9.96E-04	4.75E-02
	FMK	3.03E-04	3.39E-05	3.17E-08	4.15E-07	1.17E-04	1.89E-02	2.27E-02	6.14E-04	3.7E-03	9.96E-04	4.75E-02
	FMM	3.03E-04	3.39E-05	3.17E-08	1.67E-06	1.17E-04	1.89E-02	2.27E-02	6.14E-04	3.7E-03	9.96E-04	4.75E-02
	FMT	3.03E-04	3.39E-05	3.17E-08	3.90E-07	1.17E-04	1.89E-02	2.27E-02	6.14E-04	3.7E-03	9.96E-04	4.75E-02
	FMT1	3.03E-04	3.39E-05	3.17E-08	7.90E-08	1.17E-04	1.89E-02	2.27E-02	6.14E-04	3.7E-03	9.96E-04	4.74E-02
	FMT2	3.03E-04	3.39E-05	3.17E-08	4.16E-07	1.17E-04	1.89E-02	2.27E-02	6.14E-04	3.7E-03	9.96E-04	4.75E-02
	GEC	3.03E-04	3.39E-05	3.17E-08	1.45E-06	1.17E-04	1.89E-02	2.27E-02	6.14E-04	3.7E-03	9.96E-04	4.75E-02
	GWC	3.03E-04	3.39E-05	3.17E-08	1.84E-06	1.17E-04	1.89E-02	2.27E-02	6.14E-04	3.7E-03	9.96E-04	4.75E-02
	KL	3.03E-04	3.39E-05	3.17E-08	5.37E-07	1.17E-04	1.89E-02	2.27E-02	6.14E-04	3.7E-03	9.96E-04	4.75E-02
	LEC	3.03E-04	3.39E-05	3.17E-08	1.20E-06	1.17E-04	1.89E-02	2.27E-02	6.14E-04	3.7E-03	9.96E-04	4.75E-02
	LWC	3.03E-04	3.39E-05	3.17E-08	5.82E-07	1.17E-04	1.89E-02	2.27E-02	6.14E-04	3.7E-03	9.96E-04	4.75E-02
	MC	3.03E-04	3.39E-05	3.17E-08	3.13E-07	1.17E-04	1.89E-02	2.27E-02	6.14E-04	3.7E-03	9.96E-04	4.74E-02
	TC	3.03E-04	3.39E-05	3.17E-08	5.36E-07	1.17E-04	1.89E-02	2.27E-02	6.14E-04	3.7E-03	9.96E-04	4.75E-02
	WC	3.03E-04	3.39E-05	3.17E-08	4.12E-07	1.17E-04	1.89E-02	2.27E-02	6.14E-04	3.7E-03	9.96E-04	4.75E-02
PROJECT ALONE	MPOI	8.51E-10	9.51E-11	8.89E-14	4.95E-08	9.61E-08	9.13E-10	3.92E-10	4.57E-09	3.06E-06	6.39E-09	3.22E-06
	AC	1.32E-10	1.47E-11	1.38E-14	7.68E-09	2.96E-09	5.69E-11	6.08E-11	2.84E-10	9.41E-08	4.97E-10	1.06E-07
	AR	5.17E-10	5.77E-11	5.40E-14	3.01E-08	1.07E-08	2.16E-10	2.38E-10	1.08E-09	3.40E-07	1.91E-09	3.85E-07
	BC	3.41E-10	3.82E-11	3.57E-14	1.99E-08	7.47E-09	1.46E-10	1.57E-10	7.29E-10	2.38E-07	1.28E-09	2.68E-07
	BL	6.99E-10	7.81E-11	7.30E-14	4.07E-08	1.41E-08	2.91E-10	3.22E-10	1.45E-09	4.50E-07	2.57E-09	5.10E-07
	DC	7.06E-10	7.89E-11	7.38E-14	4.11E-08	1.44E-08	2.94E-10	3.26E-10	1.47E-09	4.59E-07	2.60E-09	5.20E-07
	DSC	5.92E-10	6.62E-11	6.18E-14	3.45E-08	1.24E-08	2.49E-10	2.73E-10	1.25E-09	3.96E-07	2.20E-09	4.48E-07
	FC	8.43E-10	9.42E-11	8.81E-14	4.91E-08	1.70E-08	3.50E-10	3.89E-10	1.75E-09	5.41E-07	3.10E-09	6.14E-07
	FMK	3.91E-10	4.37E-11	4.08E-14	2.27E-08	8.38E-09	1.66E-10	1.80E-10	8.29E-10	2.67E-07	1.46E-09	3.01E-07
	FMM	5.13E-10	5.74E-11	5.36E-14	2.99E-08	1.38E-08	2.38E-10	2.37E-10	1.19E-09	4.38E-07	2.03E-09	4.86E-07
	FMT	5.81E-10	6.49E-11	6.07E-14	3.38E-08	1.19E-08	2.43E-10	2.68E-10	1.21E-09	3.79E-07	2.14E-09	4.29E-07
	FMT1	7.90E-11	8.84E-12	8.26E-15	4.60E-09	1.68E-09	3.35E-11	3.65E-11	1.67E-10	5.36E-08	2.94E-10	6.05E-08
	FMT2	4.10E-10	4.58E-11	4.28E-14	2.39E-08	8.75E-09	1.74E-10	1.89E-10	8.68E-10	2.78E-07	1.53E-09	3.14E-07
	GEC	2.99E-09	3.34E-10	3.13E-13	1.74E-07	5.99E-08	1.24E-09	1.38E-09	6.20E-09	1.91E-06	1.10E-08	2.16E-06
	GWC	1.60E-09	1.79E-10	1.67E-13	9.30E-08	3.46E-08	6.80E-10	7.37E-10	3.40E-09	1.10E-06	5.97E-09	1.24E-06
	KL	2.48E-10	2.78E-11	2.60E-14	1.45E-08	6.00E-09	1.10E-10	1.15E-10	5.51E-10	1.91E-07	9.53E-10	2.13E-07
	LEC	1.97E-10	2.20E-11	2.06E-14	1.15E-08	6.64E-09	1.01E-10	9.08E-11	5.04E-10	2.11E-07	8.34E-10	2.31E-07
	LWC	2.17E-10	2.43E-11	2.27E-14	1.26E-08	5.52E-09	9.83E-11	1.00E-10	4.91E-10	1.76E-07	8.45E-10	1.96E-07
	MC	3.59E-10	4.01E-11	3.75E-14	2.09E-08	7.53E-09	1.51E-10	1.66E-10	7.56E-10	2.40E-07	1.33E-09	2.71E-07
	TC	2.52E-10	2.82E-11	2.63E-14	1.47E-08	6.06E-09	1.12E-10	1.16E-10	5.58E-10	1.93E-07	9.66E-10	2.16E-07
	WC	4.68E-10	5.23E-11	4.89E-14	2.72E-08	9.82E-09	1.97E-10	2.16E-10	9.85E-10	3.13E-07	1.73E-09	3.53E-07

HQ	Receptor Location	Hazard Quotient (EDI/TDI)										Total HQ
		Soil Ingestion	Soil Dermal	Soil Inhalation	Air Inhalation	Surface Water Ingestion	Lab Tea Ingestion	Cattail Ingestion	Berries Ingestion	Fish Ingestion	Wild Game Ingestion	
APPLICATION	MPOI	3.03E-04	3.39E-05	3.17E-08	3.27E-05	1.27E-04	1.89E-02	2.27E-02	6.14E-04	4.05E-03	9.96E-04	4.78E-02
	AC	3.03E-04	3.39E-05	3.17E-08	2.00E-07	1.17E-04	1.89E-02	2.27E-02	6.14E-04	3.72E-03	9.96E-04	4.74E-02
	AR	3.03E-04	3.39E-05	3.17E-08	4.13E-07	1.17E-04	1.89E-02	2.27E-02	6.14E-04	3.72E-03	9.96E-04	4.75E-02
	BC	3.03E-04	3.39E-05	3.17E-08	4.42E-07	1.17E-04	1.89E-02	2.27E-02	6.14E-04	3.72E-03	9.96E-04	4.75E-02
	BL	3.03E-04	3.39E-05	3.17E-08	4.38E-07	1.17E-04	1.89E-02	2.27E-02	6.14E-04	3.72E-03	9.96E-04	4.75E-02
	DC	3.03E-04	3.39E-05	3.17E-08	4.94E-07	1.17E-04	1.89E-02	2.27E-02	6.14E-04	3.72E-03	9.96E-04	4.75E-02
	DSC	3.03E-04	3.39E-05	3.17E-08	5.59E-07	1.17E-04	1.89E-02	2.27E-02	6.14E-04	3.72E-03	9.96E-04	4.75E-02
	FC	3.03E-04	3.39E-05	3.17E-08	5.06E-07	1.17E-04	1.89E-02	2.27E-02	6.14E-04	3.72E-03	9.96E-04	4.75E-02
	FMK	3.03E-04	3.39E-05	3.17E-08	4.38E-07	1.17E-04	1.89E-02	2.27E-02	6.14E-04	3.72E-03	9.96E-04	4.75E-02
	FMM	3.03E-04	3.39E-05	3.17E-08	1.70E-06	1.17E-04	1.89E-02	2.27E-02	6.14E-04	3.73E-03	9.96E-04	4.75E-02
	FMT	3.03E-04	3.39E-05	3.17E-08	4.24E-07	1.17E-04	1.89E-02	2.27E-02	6.14E-04	3.72E-03	9.96E-04	4.75E-02
	FMT1	3.03E-04	3.39E-05	3.17E-08	8.36E-08	1.17E-04	1.89E-02	2.27E-02	6.14E-04	3.72E-03	9.96E-04	4.74E-02
	FMT2	3.03E-04	3.39E-05	3.17E-08	4.40E-07	1.17E-04	1.89E-02	2.27E-02	6.14E-04	3.72E-03	9.96E-04	4.75E-02
	GEC	3.03E-04	3.39E-05	3.17E-08	1.62E-06	1.17E-04	1.89E-02	2.27E-02	6.14E-04	3.73E-03	9.96E-04	4.75E-02
	GWC	3.03E-04	3.39E-05	3.17E-08	1.93E-06	1.17E-04	1.89E-02	2.27E-02	6.14E-04	3.74E-03	9.96E-04	4.75E-02
	KL	3.03E-04	3.39E-05	3.17E-08	5.51E-07	1.17E-04	1.89E-02	2.27E-02	6.14E-04	3.72E-03	9.96E-04	4.75E-02
	LEC	3.03E-04	3.39E-05	3.17E-08	1.21E-06	1.17E-04	1.89E-02	2.27E-02	6.14E-04	3.73E-03	9.96E-04	4.75E-02
	LWC	3.03E-04	3.39E-05	3.17E-08	5.94E-07	1.17E-04	1.89E-02	2.27E-02	6.14E-04	3.72E-03	9.96E-04	4.75E-02
	MC	3.03E-04	3.39E-05	3.17E-08	3.34E-07	1.17E-04	1.89E-02	2.27E-02	6.14E-04	3.72E-03	9.96E-04	4.74E-02
	TC	3.03E-04	3.39E-05	3.17E-08	5.50E-07	1.17E-04	1.89E-02	2.27E-02	6.14E-04	3.72E-03	9.96E-04	4.75E-02
	WC	3.03E-04	3.39E-05	3.17E-08	4.39E-07	1.17E-04	1.89E-02	2.27E-02	6.14E-04	3.72E-03	9.96E-04	4.75E-02
PDC	MPOI	3.04E-04	3.39E-05	3.17E-08	6.35E-05	2.54E-04	1.89E-02	2.27E-02	1.23E-03	8.08E-03	1.00E-03	5.26E-02
	AC	3.03E-04	3.39E-05	3.17E-08	3.11E-07	2.34E-04	1.89E-02	2.27E-02	1.23E-03	7.44E-03	9.98E-04	5.19E-02
	AR	3.03E-04	3.39E-05	3.17E-08	6.73E-07	2.34E-04	1.89E-02	2.27E-02	1.23E-03	7.44E-03	9.98E-04	5.19E-02
	BC	3.03E-04	3.39E-05	3.17E-08	7.19E-07	2.34E-04	1.89E-02	2.27E-02	1.23E-03	7.44E-03	9.98E-04	5.19E-02
	BL	3.03E-04	3.39E-05	3.17E-08	6.72E-07	2.34E-04	1.89E-02	2.27E-02	1.23E-03	7.44E-03	9.98E-04	5.19E-02
	DC	3.03E-04	3.39E-05	3.17E-08	7.99E-07	2.34E-04	1.89E-02	2.27E-02	1.23E-03	7.44E-03	9.98E-04	5.19E-02
	DSC	3.03E-04	3.39E-05	3.17E-08	9.99E-07	2.34E-04	1.89E-02	2.27E-02	1.23E-03	7.44E-03	9.98E-04	5.19E-02
	FC	3.03E-04	3.39E-05	3.17E-08	8.76E-07	2.34E-04	1.89E-02	2.27E-02	1.23E-03	7.44E-03	9.98E-04	5.19E-02
	FMK	3.03E-04	3.39E-05	3.17E-08	7.67E-07	2.34E-04	1.89E-02	2.27E-02	1.23E-03	7.44E-03	9.98E-04	5.19E-02
	FMM	3.03E-04	3.39E-05	3.17E-08	3.20E-06	2.35E-04	1.89E-02	2.27E-02	1.23E-03	7.46E-03	9.98E-04	5.19E-02
	FMT	3.03E-04	3.39E-05	3.17E-08	7.96E-07	2.34E-04	1.89E-02	2.27E-02	1.23E-03	7.44E-03	9.98E-04	5.19E-02
	FMT1	3.03E-04	3.39E-05	3.17E-08	1.43E-07	2.34E-04	1.89E-02	2.27E-02	1.23E-03	7.43E-03	9.98E-04	5.19E-02
	FMT2	3.03E-04	3.39E-05	3.17E-08	7.32E-07	2.34E-04	1.89E-02	2.27E-02	1.23E-03	7.44E-03	9.98E-04	5.19E-02
	GEC	3.03E-04	3.39E-05	3.17E-08	2.86E-06	2.34E-04	1.89E-02	2.27E-02	1.23E-03	7.46E-03	9.98E-04	5.19E-02
	GWC	3.03E-04	3.39E-05	3.17E-08	3.55E-06	2.35E-04	1.89E-02	2.27E-02	1.23E-03	7.47E-03	9.98E-04	5.19E-02
	KL	3.03E-04	3.39E-05	3.17E-08	7.51E-07	2.34E-04	1.89E-02	2.27E-02	1.23E-03	7.44E-03	9.98E-04	5.19E-02
	LEC	3.03E-04	3.39E-05	3.17E-08	1.34E-06	2.34E-04	1.89E-02	2.27E-02	1.23E-03	7.45E-03	9.98E-04	5.19E-02
	LWC	3.03E-04	3.39E-05	3.17E-08	7.71E-07	2.34E-04	1.89E-02	2.27E-02	1.23E-03	7.44E-03	9.98E-04	5.19E-02
	MC	3.03E-04	3.39E-05	3.17E-08	7.60E-07	2.34E-04	1.89E-02	2.27E-02	1.23E-03	7.44E-03	9.98E-04	5.19E-02
	TC	3.03E-04	3.39E-05	3.17E-08	7.53E-07	2.34E-04	1.89E-02	2.27E-02	1.23E-03	7.44E-03	9.98E-04	5.19E-02
	WC	3.03E-04	3.39E-05	3.17E-08	6.94E-07	2.34E-04	1.89E-02	2.27E-02	1.23E-03	7.44E-03	9.98E-04	5.19E-02

Table SIR3 22-3: Noncarcinogenic Risk Estimates for Chronic Acenaphthene Exposures

HQ	Receptor Location	Hazard Quotient (EDI/TDI)										Total HQ
		Soil Ingestion	Soil Dermal	Soil Inhalation	Air Inhalation	Surface Water Ingestion	Lab Tea Ingestion	Cattail Ingestion	Berries Ingestion	Fish Ingestion	Wild Game Ingestion	
BASELINE	MPOI	1.01E-05	1.74E-06	8.92E-10	8.72E-05	3.03E-06	6.31E-04	6.31E-04	1.83E-04	9.6E-05	3.11E-03	4.76E-03
	AC	1.01E-05	1.74E-06	8.92E-10	9.87E-08	3.03E-06	6.31E-04	6.31E-04	1.83E-04	9.6E-05	3.11E-03	4.67E-03
	AR	1.01E-05	1.74E-06	8.92E-10	6.57E-07	3.03E-06	6.31E-04	6.31E-04	1.83E-04	9.6E-05	3.11E-03	4.67E-03
	BC	1.01E-05	1.74E-06	8.92E-10	1.10E-06	3.03E-06	6.31E-04	6.31E-04	1.83E-04	9.6E-05	3.11E-03	4.67E-03
	BL	1.01E-05	1.74E-06	8.92E-10	7.84E-07	3.03E-06	6.31E-04	6.31E-04	1.83E-04	9.6E-05	3.11E-03	4.67E-03
	DC	1.01E-05	1.74E-06	8.92E-10	5.65E-07	3.03E-06	6.31E-04	6.31E-04	1.83E-04	9.6E-05	3.11E-03	4.67E-03
	DSC	1.01E-05	1.74E-06	8.92E-10	8.45E-07	3.03E-06	6.31E-04	6.31E-04	1.83E-04	9.6E-05	3.11E-03	4.67E-03
	FC	1.01E-05	1.74E-06	8.92E-10	6.51E-07	3.03E-06	6.31E-04	6.31E-04	1.83E-04	9.6E-05	3.11E-03	4.67E-03
	FMK	1.01E-05	1.74E-06	8.92E-10	7.76E-07	3.03E-06	6.31E-04	6.31E-04	1.83E-04	9.6E-05	3.11E-03	4.67E-03
	FMM	1.01E-05	1.74E-06	8.92E-10	3.92E-06	3.03E-06	6.31E-04	6.31E-04	1.83E-04	9.6E-05	3.11E-03	4.67E-03
	FMT	1.01E-05	1.74E-06	8.92E-10	4.87E-07	3.03E-06	6.31E-04	6.31E-04	1.83E-04	9.6E-05	3.11E-03	4.67E-03
	FMT1	1.01E-05	1.74E-06	8.92E-10	3.70E-08	3.03E-06	6.31E-04	6.31E-04	1.83E-04	9.6E-05	3.11E-03	4.67E-03
	FMT2	1.01E-05	1.74E-06	8.92E-10	7.73E-07	3.03E-06	6.31E-04	6.31E-04	1.83E-04	9.6E-05	3.11E-03	4.67E-03
	GEC	1.01E-05	1.74E-06	8.92E-10	3.13E-06	3.03E-06	6.31E-04	6.31E-04	1.83E-04	9.6E-05	3.11E-03	4.67E-03
	GWC	1.01E-05	1.74E-06	8.92E-10	4.21E-06	3.03E-06	6.31E-04	6.31E-04	1.83E-04	9.6E-05	3.11E-03	4.67E-03
	KL	1.01E-05	1.74E-06	8.92E-10	9.53E-07	3.03E-06	6.31E-04	6.31E-04	1.83E-04	9.6E-05	3.11E-03	4.67E-03
	LEC	1.01E-05	1.74E-06	8.92E-10	3.87E-07	3.03E-06	6.31E-04	6.31E-04	1.83E-04	9.6E-05	3.11E-03	4.67E-03
	LWC	1.01E-05	1.74E-06	8.92E-10	7.61E-07	3.03E-06	6.31E-04	6.31E-04	1.83E-04	9.6E-05	3.11E-03	4.67E-03
	MC	1.01E-05	1.74E-06	8.92E-10	3.51E-07	3.03E-06	6.31E-04	6.31E-04	1.83E-04	9.6E-05	3.11E-03	4.67E-03
	TC	1.01E-05	1.74E-06	8.92E-10	1.12E-06	3.03E-06	6.31E-04	6.31E-04	1.83E-04	9.6E-05	3.11E-03	4.67E-03
	WC	1.01E-05	1.74E-06	8.92E-10	6.02E-07	3.03E-06	6.31E-04	6.31E-04	1.83E-04	9.6E-05	3.11E-03	4.67E-03
PROJECT ALONE	MPOI	4.37E-12	7.52E-13	3.86E-16	2.25E-10	1.69E-10	1.77E-12	1.74E-12	9.69E-11	5.37E-09	1.65E-09	7.52E-09
	AC	6.18E-13	1.06E-13	5.46E-17	3.18E-11	2.39E-11	2.50E-13	2.46E-13	1.37E-11	7.59E-10	2.33E-10	1.06E-09
	AR	2.61E-12	4.48E-13	2.30E-16	1.34E-10	1.01E-10	1.06E-12	1.04E-12	5.77E-11	3.20E-09	9.82E-10	4.48E-09
	BC	2.00E-12	3.45E-13	1.77E-16	1.03E-10	7.74E-11	8.12E-13	8.00E-13	4.44E-11	2.46E-09	7.55E-10	3.45E-09
	BL	3.11E-12	5.34E-13	2.74E-16	1.60E-10	1.20E-10	1.26E-12	1.24E-12	6.88E-11	3.82E-09	1.17E-09	5.34E-09
	DC	2.20E-12	3.79E-13	1.94E-16	1.13E-10	8.50E-11	8.92E-13	8.78E-13	4.88E-11	2.71E-09	8.29E-10	3.79E-09
	DSC	2.82E-12	4.86E-13	2.49E-16	1.46E-10	1.09E-10	1.14E-12	1.13E-12	6.25E-11	3.47E-09	1.06E-09	4.85E-09
	FC	4.25E-12	7.31E-13	3.75E-16	2.19E-10	1.64E-10	1.72E-12	1.70E-12	9.42E-11	5.22E-09	1.60E-09	7.31E-09
	FMK	2.07E-12	3.56E-13	1.83E-16	1.07E-10	7.99E-11	8.38E-13	8.26E-13	4.59E-11	2.54E-09	7.80E-10	3.56E-09
	FMM	2.46E-12	4.23E-13	2.17E-16	1.27E-10	9.50E-11	9.96E-13	9.81E-13	5.45E-11	3.02E-09	9.27E-10	4.23E-09
	FMT	2.77E-12	4.76E-13	2.45E-16	1.43E-10	1.07E-10	1.12E-12	1.10E-12	6.14E-11	3.40E-09	1.04E-09	4.76E-09
	FMT1	3.86E-13	6.64E-14	3.41E-17	1.99E-11	1.49E-11	1.56E-13	1.54E-13	8.56E-12	4.75E-10	1.45E-10	6.64E-10
	FMT2	2.19E-12	3.77E-13	1.94E-16	1.13E-10	8.47E-11	8.89E-13	8.75E-13	4.86E-11	2.70E-09	8.26E-10	3.77E-09
	GEC	1.21E-11	2.08E-12	1.07E-15	6.24E-10	4.67E-10	4.90E-12	4.83E-12	2.68E-10	1.49E-08	4.56E-09	2.08E-08
	GWC	7.64E-12	1.31E-12	6.75E-16	3.94E-10	2.95E-10	3.09E-12	3.05E-12	1.69E-10	9.38E-09	2.88E-09	1.31E-08
	KL	1.38E-12	2.38E-13	1.22E-16	7.14E-11	5.35E-11	5.61E-13	5.52E-13	3.07E-11	1.70E-09	5.22E-10	2.38E-09
	LEC	1.34E-12	2.31E-13	1.19E-16	6.93E-11	5.19E-11	5.45E-13	5.36E-13	2.98E-11	1.65E-09	5.07E-10	2.31E-09
	LWC	1.01E-12	1.74E-13	8.95E-17	5.22E-11	3.91E-11	4.10E-13	4.04E-13	2.24E-11	1.25E-09	3.82E-10	1.74E-09
	MC	2.00E-12	3.44E-13	1.77E-16	1.03E-10	7.73E-11	8.10E-13	7.98E-13	4.43E-11	2.46E-09	7.54E-10	3.44E-09
	TC	1.40E-12	2.41E-13	1.24E-16	7.23E-11	5.42E-11	5.68E-13	5.60E-13	3.11E-11	1.72E-09	5.29E-10	2.41E-09
	WC	2.79E-12	4.80E-13	2.47E-16	1.44E-10	1.08E-10	1.13E-12	1.11E-12	6.19E-11	3.43E-09	1.05E-09	4.80E-09

HQ	Receptor Location	Hazard Quotient (EDI/TDI)										Total HQ
		Soil Ingestion	Soil Dermal	Soil Inhalation	Air Inhalation	Surface Water Ingestion	Lab Tea Ingestion	Cattail Ingestion	Berries Ingestion	Fish Ingestion	Wild Game Ingestion	
APPLICATION	MPOI	1.01E-05	1.74E-06	8.92E-10	8.72E-05	3.03E-06	6.31E-04	6.31E-04	1.83E-04	9.64E-05	3.11E-03	4.76E-03
	AC	1.01E-05	1.74E-06	8.92E-10	9.88E-08	3.03E-06	6.31E-04	6.31E-04	1.83E-04	9.64E-05	3.11E-03	4.67E-03
	AR	1.01E-05	1.74E-06	8.92E-10	6.57E-07	3.03E-06	6.31E-04	6.31E-04	1.83E-04	9.64E-05	3.11E-03	4.67E-03
	BC	1.01E-05	1.74E-06	8.92E-10	1.10E-06	3.03E-06	6.31E-04	6.31E-04	1.83E-04	9.64E-05	3.11E-03	4.67E-03
	BL	1.01E-05	1.74E-06	8.92E-10	7.84E-07	3.03E-06	6.31E-04	6.31E-04	1.83E-04	9.64E-05	3.11E-03	4.67E-03
	DC	1.01E-05	1.74E-06	8.92E-10	5.66E-07	3.03E-06	6.31E-04	6.31E-04	1.83E-04	9.64E-05	3.11E-03	4.67E-03
	DSC	1.01E-05	1.74E-06	8.92E-10	8.45E-07	3.03E-06	6.31E-04	6.31E-04	1.83E-04	9.64E-05	3.11E-03	4.67E-03
	FC	1.01E-05	1.74E-06	8.92E-10	6.51E-07	3.03E-06	6.31E-04	6.31E-04	1.83E-04	9.64E-05	3.11E-03	4.67E-03
	FMK	1.01E-05	1.74E-06	8.92E-10	7.76E-07	3.03E-06	6.31E-04	6.31E-04	1.83E-04	9.64E-05	3.11E-03	4.67E-03
	FMM	1.01E-05	1.74E-06	8.92E-10	3.92E-06	3.03E-06	6.31E-04	6.31E-04	1.83E-04	9.64E-05	3.11E-03	4.67E-03
	FMT	1.01E-05	1.74E-06	8.92E-10	4.87E-07	3.03E-06	6.31E-04	6.31E-04	1.83E-04	9.64E-05	3.11E-03	4.67E-03
	FMT1	1.01E-05	1.74E-06	8.92E-10	3.70E-08	3.03E-06	6.31E-04	6.31E-04	1.83E-04	9.64E-05	3.11E-03	4.67E-03
	FMT2	1.01E-05	1.74E-06	8.92E-10	7.73E-07	3.03E-06	6.31E-04	6.31E-04	1.83E-04	9.64E-05	3.11E-03	4.67E-03
	GEC	1.01E-05	1.74E-06	8.92E-10	3.13E-06	3.03E-06	6.31E-04	6.31E-04	1.83E-04	9.65E-05	3.11E-03	4.67E-03
	GWC	1.01E-05	1.74E-06	8.92E-10	4.21E-06	3.03E-06	6.31E-04	6.31E-04	1.83E-04	9.64E-05	3.11E-03	4.67E-03
	KL	1.01E-05	1.74E-06	8.92E-10	9.53E-07	3.03E-06	6.31E-04	6.31E-04	1.83E-04	9.64E-05	3.11E-03	4.67E-03
	LEC	1.01E-05	1.74E-06	8.92E-10	3.87E-07	3.03E-06	6.31E-04	6.31E-04	1.83E-04	9.64E-05	3.11E-03	4.67E-03
	LWC	1.01E-05	1.74E-06	8.92E-10	7.61E-07	3.03E-06	6.31E-04	6.31E-04	1.83E-04	9.64E-05	3.11E-03	4.67E-03
	MC	1.01E-05	1.74E-06	8.92E-10	3.51E-07	3.03E-06	6.31E-04	6.31E-04	1.83E-04	9.64E-05	3.11E-03	4.67E-03
	TC	1.01E-05	1.74E-06	8.92E-10	1.12E-06	3.03E-06	6.31E-04	6.31E-04	1.83E-04	9.64E-05	3.11E-03	4.67E-03
	WC	1.01E-05	1.74E-06	8.92E-10	6.03E-07	3.03E-06	6.31E-04	6.31E-04	1.83E-04	9.64E-05	3.11E-03	4.67E-03
PDC	MPOI	1.17E-05	2.01E-06	1.03E-09	1.69E-04	7.25E-05	6.32E-04	6.32E-04	2.19E-04	2.31E-03	3.73E-03	7.77E-03
	AC	1.01E-05	1.74E-06	8.92E-10	1.39E-07	1.01E-05	6.31E-04	6.31E-04	1.84E-04	3.23E-04	3.12E-03	4.92E-03
	AR	1.01E-05	1.74E-06	8.93E-10	8.83E-07	1.03E-05	6.31E-04	6.31E-04	1.84E-04	3.27E-04	3.13E-03	4.92E-03
	BC	1.01E-05	1.74E-06	8.93E-10	1.38E-06	1.03E-05	6.31E-04	6.31E-04	1.84E-04	3.29E-04	3.13E-03	4.92E-03
	BL	1.01E-05	1.74E-06	8.93E-10	1.06E-06	1.03E-05	6.31E-04	6.31E-04	1.84E-04	3.29E-04	3.13E-03	4.92E-03
	DC	1.01E-05	1.74E-06	8.93E-10	1.02E-06	1.05E-05	6.31E-04	6.31E-04	1.84E-04	3.33E-04	3.13E-03	4.93E-03
	DSC	1.01E-05	1.74E-06	8.94E-10	1.56E-06	1.07E-05	6.31E-04	6.31E-04	1.84E-04	3.39E-04	3.13E-03	4.94E-03
	FC	1.01E-05	1.74E-06	8.93E-10	1.15E-06	1.05E-05	6.31E-04	6.31E-04	1.84E-04	3.34E-04	3.13E-03	4.93E-03
	FMK	1.01E-05	1.74E-06	8.93E-10	1.15E-06	1.04E-05	6.31E-04	6.31E-04	1.84E-04	3.31E-04	3.13E-03	4.93E-03
	FMM	1.02E-05	1.75E-06	8.99E-10	7.55E-06	1.29E-05	6.31E-04	6.31E-04	1.85E-04	4.09E-04	3.15E-03	5.04E-03
	FMT	1.01E-05	1.74E-06	8.93E-10	9.27E-07	1.04E-05	6.31E-04	6.31E-04	1.84E-04	3.33E-04	3.13E-03	4.93E-03
	FMT1	1.01E-05	1.74E-06	8.92E-10	6.32E-08	1.01E-05	6.31E-04	6.31E-04	1.84E-04	3.23E-04	3.12E-03	4.92E-03
	FMT2	1.01E-05	1.74E-06	8.93E-10	1.09E-06	1.04E-05	6.31E-04	6.31E-04	1.84E-04	3.30E-04	3.13E-03	4.93E-03
	GEC	1.02E-05	1.75E-06	8.97E-10	6.03E-06	1.23E-05	6.31E-04	6.31E-04	1.85E-04	3.92E-04	3.15E-03	5.02E-03
	GWC	1.02E-05	1.75E-06	8.99E-10	8.12E-06	1.31E-05	6.31E-04	6.31E-04	1.85E-04	4.16E-04	3.15E-03	5.05E-03
	KL	1.01E-05	1.74E-06	8.93E-10	1.08E-06	1.02E-05	6.31E-04	6.31E-04	1.84E-04	3.25E-04	3.12E-03	4.92E-03
	LEC	1.01E-05	1.74E-06	8.93E-10	4.73E-07	1.02E-05	6.31E-04	6.31E-04	1.84E-04	3.24E-04	3.12E-03	4.92E-03
	LWC	1.01E-05	1.74E-06	8.93E-10	8.55E-07	1.02E-05	6.31E-04	6.31E-04	1.84E-04	3.24E-04	3.12E-03	4.92E-03
	MC	1.01E-05	1.74E-06	8.93E-10	5.51E-07	1.03E-05	6.31E-04	6.31E-04	1.84E-04	3.27E-04	3.13E-03	4.92E-03
	TC	1.01E-05	1.74E-06	8.93E-10	1.25E-06	1.02E-05	6.31E-04	6.31E-04	1.84E-04	3.25E-04	3.12E-03	4.92E-03
	WC	1.01E-05	1.74E-06	8.93E-10	8.49E-07	1.03E-05	6.31E-04	6.31E-04	1.84E-04	3.28E-04	3.13E-03	4.92E-03

Table SIR3 22-4: Noncarcinogenic Risk Estimates for Chronic Acenaphthylene Exposures

HQ	Receptor Location	Hazard Quotient (EDI/TDI)										Total HQ
		Soil Ingestion	Soil Dermal	Soil Inhalation	Air Inhalation	Surface Water Ingestion	Lab Tea Ingestion	Cattail Ingestion	Berries Ingestion	Fish Ingestion	Wild Game Ingestion	
BASELINE	MPOI	8.54E-05	9.54E-06	2.71E-09	5.96E-04	2.56E-05	5.34E-03	5.34E-03	3.00E-04	1.1E-03	1.29E-03	1.41E-02
	AC	8.54E-05	9.54E-06	2.71E-09	6.75E-07	2.56E-05	5.34E-03	5.34E-03	2.99E-04	1.1E-03	1.29E-03	1.35E-02
	AR	8.54E-05	9.54E-06	2.71E-09	4.50E-06	2.56E-05	5.34E-03	5.34E-03	2.99E-04	1.1E-03	1.29E-03	1.35E-02
	BC	8.54E-05	9.54E-06	2.71E-09	7.53E-06	2.56E-05	5.34E-03	5.34E-03	2.99E-04	1.1E-03	1.29E-03	1.35E-02
	BL	8.54E-05	9.54E-06	2.71E-09	5.36E-06	2.56E-05	5.34E-03	5.34E-03	2.99E-04	1.1E-03	1.29E-03	1.35E-02
	DC	8.54E-05	9.54E-06	2.71E-09	3.86E-06	2.56E-05	5.34E-03	5.34E-03	2.99E-04	1.1E-03	1.29E-03	1.35E-02
	DSC	8.54E-05	9.54E-06	2.71E-09	5.78E-06	2.56E-05	5.34E-03	5.34E-03	2.99E-04	1.1E-03	1.29E-03	1.35E-02
	FC	8.54E-05	9.54E-06	2.71E-09	4.45E-06	2.56E-05	5.34E-03	5.34E-03	2.99E-04	1.1E-03	1.29E-03	1.35E-02
	FMK	8.54E-05	9.54E-06	2.71E-09	5.33E-06	2.56E-05	5.34E-03	5.34E-03	2.99E-04	1.1E-03	1.29E-03	1.35E-02
	FMM	8.54E-05	9.54E-06	2.71E-09	2.68E-05	2.56E-05	5.34E-03	5.34E-03	2.99E-04	1.1E-03	1.29E-03	1.35E-02
	FMT	8.54E-05	9.54E-06	2.71E-09	3.32E-06	2.56E-05	5.34E-03	5.34E-03	2.99E-04	1.1E-03	1.29E-03	1.35E-02
	FMT1	8.54E-05	9.54E-06	2.71E-09	2.52E-07	2.56E-05	5.34E-03	5.34E-03	2.99E-04	1.1E-03	1.29E-03	1.35E-02
	FMT2	8.54E-05	9.54E-06	2.71E-09	5.30E-06	2.56E-05	5.34E-03	5.34E-03	2.99E-04	1.1E-03	1.29E-03	1.35E-02
	GEC	8.54E-05	9.54E-06	2.71E-09	2.14E-05	2.56E-05	5.34E-03	5.34E-03	2.99E-04	1.1E-03	1.29E-03	1.35E-02
	GWC	8.54E-05	9.54E-06	2.71E-09	2.88E-05	2.56E-05	5.34E-03	5.34E-03	2.99E-04	1.1E-03	1.29E-03	1.35E-02
	KL	8.54E-05	9.54E-06	2.71E-09	6.53E-06	2.56E-05	5.34E-03	5.34E-03	2.99E-04	1.1E-03	1.29E-03	1.35E-02
	LEC	8.54E-05	9.54E-06	2.71E-09	2.64E-06	2.56E-05	5.34E-03	5.34E-03	2.99E-04	1.1E-03	1.29E-03	1.35E-02
	LWC	8.54E-05	9.54E-06	2.71E-09	5.21E-06	2.56E-05	5.34E-03	5.34E-03	2.99E-04	1.1E-03	1.29E-03	1.35E-02
	MC	8.54E-05	9.54E-06	2.71E-09	2.40E-06	2.56E-05	5.34E-03	5.34E-03	2.99E-04	1.1E-03	1.29E-03	1.35E-02
	TC	8.54E-05	9.54E-06	2.71E-09	7.68E-06	2.56E-05	5.34E-03	5.34E-03	2.99E-04	1.1E-03	1.29E-03	1.35E-02
	WC	8.54E-05	9.54E-06	2.71E-09	4.13E-06	2.56E-05	5.34E-03	5.34E-03	2.99E-04	1.1E-03	1.29E-03	1.35E-02
PROJECT ALONE	MPOI	7.42E-12	8.29E-13	2.36E-16	5.71E-10	1.45E-09	3.26E-05	4.31E-13	1.63E-04	6.35E-08	1.13E-03	1.33E-03
	AC	1.26E-12	1.41E-13	4.00E-17	9.69E-11	2.46E-10	3.26E-05	7.31E-14	1.63E-04	1.08E-08	1.13E-03	1.33E-03
	AR	5.04E-12	5.64E-13	1.60E-16	3.89E-10	9.86E-10	3.26E-05	2.93E-13	1.63E-04	4.32E-08	1.13E-03	1.33E-03
	BC	4.04E-12	4.52E-13	1.29E-16	3.11E-10	7.91E-10	3.26E-05	2.35E-13	1.63E-04	3.46E-08	1.13E-03	1.33E-03
	BL	6.30E-12	7.05E-13	2.00E-16	4.86E-10	1.23E-09	3.26E-05	3.67E-13	1.63E-04	5.40E-08	1.13E-03	1.33E-03
	DC	4.49E-12	5.02E-13	1.43E-16	3.46E-10	8.78E-10	3.26E-05	2.61E-13	1.63E-04	3.84E-08	1.13E-03	1.33E-03
	DSC	5.75E-12	6.43E-13	1.83E-16	4.43E-10	1.12E-09	3.26E-05	3.34E-13	1.63E-04	4.92E-08	1.13E-03	1.33E-03
	FC	8.64E-12	9.66E-13	2.75E-16	6.66E-10	1.69E-09	3.26E-05	5.03E-13	1.63E-04	7.40E-08	1.13E-03	1.33E-03
	FMK	4.19E-12	4.69E-13	1.33E-16	3.23E-10	8.20E-10	3.26E-05	2.44E-13	1.63E-04	3.59E-08	1.13E-03	1.33E-03
	FMM	5.04E-12	5.64E-13	1.60E-16	3.89E-10	9.86E-10	3.26E-05	2.93E-13	1.63E-04	4.32E-08	1.13E-03	1.33E-03
	FMT	5.67E-12	6.34E-13	1.80E-16	4.37E-10	1.11E-09	3.26E-05	3.30E-13	1.63E-04	4.86E-08	1.13E-03	1.33E-03
	FMT1	7.85E-13	8.78E-14	2.50E-17	6.05E-11	1.54E-10	3.26E-05	4.57E-14	1.63E-04	6.72E-09	1.13E-03	1.33E-03
	FMT2	4.45E-12	4.98E-13	1.42E-16	3.43E-10	8.70E-10	3.26E-05	2.59E-13	1.63E-04	3.81E-08	1.13E-03	1.33E-03
	GEC	2.46E-11	2.75E-12	7.82E-16	1.89E-09	4.81E-09	3.26E-05	1.43E-12	1.63E-04	2.10E-07	1.13E-03	1.33E-03
	GWC	1.52E-11	1.70E-12	4.83E-16	1.17E-09	2.97E-09	3.26E-05	8.84E-13	1.63E-04	1.30E-07	1.13E-03	1.33E-03
	KL	2.82E-12	3.15E-13	8.96E-17	2.17E-10	5.51E-10	3.26E-05	1.64E-13	1.63E-04	2.41E-08	1.13E-03	1.33E-03
	LEC	2.73E-12	3.06E-13	8.69E-17	2.11E-10	5.35E-10	3.26E-05	1.59E-13	1.63E-04	2.34E-08	1.13E-03	1.33E-03
	LWC	2.08E-12	2.32E-13	6.60E-17	1.60E-10	4.06E-10	3.26E-05	1.21E-13	1.63E-04	1.78E-08	1.13E-03	1.33E-03
	MC	4.07E-12	4.55E-13	1.29E-16	3.14E-10	7.96E-10	3.26E-05	2.37E-13	1.63E-04	3.49E-08	1.13E-03	1.33E-03
	TC	2.86E-12	3.19E-13	9.08E-17	2.20E-10	5.58E-10	3.26E-05	1.66E-13	1.63E-04	2.44E-08	1.13E-03	1.33E-03
	WC	5.71E-12	6.39E-13	1.82E-16	4.40E-10	1.12E-09	3.26E-05	3.32E-13	1.63E-04	4.89E-08	1.13E-03	1.33E-03

HQ	Receptor Location	Hazard Quotient (EDI/TDI)										Total HQ
		Soil Ingestion	Soil Dermal	Soil Inhalation	Air Inhalation	Surface Water Ingestion	Lab Tea Ingestion	Cattail Ingestion	Berries Ingestion	Fish Ingestion	Wild Game Ingestion	
APPLICATION	MPOI	8.54E-05	9.54E-06	2.71E-09	5.96E-04	2.56E-05	5.37E-03	5.34E-03	4.63E-04	1.12E-03	2.42E-03	1.54E-02
	AC	8.54E-05	9.54E-06	2.71E-09	6.75E-07	2.56E-05	5.37E-03	5.34E-03	4.62E-04	1.12E-03	2.42E-03	1.48E-02
	AR	8.54E-05	9.54E-06	2.71E-09	4.50E-06	2.56E-05	5.37E-03	5.34E-03	4.62E-04	1.12E-03	2.42E-03	1.48E-02
	BC	8.54E-05	9.54E-06	2.71E-09	7.53E-06	2.56E-05	5.37E-03	5.34E-03	4.62E-04	1.12E-03	2.42E-03	1.48E-02
	BL	8.54E-05	9.54E-06	2.71E-09	5.36E-06	2.56E-05	5.37E-03	5.34E-03	4.62E-04	1.12E-03	2.42E-03	1.48E-02
	DC	8.54E-05	9.54E-06	2.71E-09	3.86E-06	2.56E-05	5.37E-03	5.34E-03	4.62E-04	1.12E-03	2.42E-03	1.48E-02
	DSC	8.54E-05	9.54E-06	2.71E-09	5.78E-06	2.56E-05	5.37E-03	5.34E-03	4.62E-04	1.12E-03	2.42E-03	1.48E-02
	FC	8.54E-05	9.54E-06	2.71E-09	4.45E-06	2.56E-05	5.37E-03	5.34E-03	4.62E-04	1.12E-03	2.42E-03	1.48E-02
	FMK	8.54E-05	9.54E-06	2.71E-09	5.33E-06	2.56E-05	5.37E-03	5.34E-03	4.62E-04	1.12E-03	2.42E-03	1.48E-02
	FMM	8.54E-05	9.54E-06	2.71E-09	2.68E-05	2.56E-05	5.37E-03	5.34E-03	4.62E-04	1.12E-03	2.42E-03	1.49E-02
	FMT	8.54E-05	9.54E-06	2.71E-09	3.32E-06	2.56E-05	5.37E-03	5.34E-03	4.62E-04	1.12E-03	2.42E-03	1.48E-02
	FMT1	8.54E-05	9.54E-06	2.71E-09	2.52E-07	2.56E-05	5.37E-03	5.34E-03	4.62E-04	1.12E-03	2.42E-03	1.48E-02
	FMT2	8.54E-05	9.54E-06	2.71E-09	5.30E-06	2.56E-05	5.37E-03	5.34E-03	4.62E-04	1.12E-03	2.42E-03	1.48E-02
	GEC	8.54E-05	9.54E-06	2.71E-09	2.14E-05	2.56E-05	5.37E-03	5.34E-03	4.62E-04	1.12E-03	2.42E-03	1.48E-02
	GWC	8.54E-05	9.54E-06	2.71E-09	2.88E-05	2.56E-05	5.37E-03	5.34E-03	4.62E-04	1.12E-03	2.42E-03	1.49E-02
	KL	8.54E-05	9.54E-06	2.71E-09	6.53E-06	2.56E-05	5.37E-03	5.34E-03	4.62E-04	1.12E-03	2.42E-03	1.48E-02
	LEC	8.54E-05	9.54E-06	2.71E-09	2.64E-06	2.56E-05	5.37E-03	5.34E-03	4.62E-04	1.12E-03	2.42E-03	1.48E-02
	LWC	8.54E-05	9.54E-06	2.71E-09	5.21E-06	2.56E-05	5.37E-03	5.34E-03	4.62E-04	1.12E-03	2.42E-03	1.48E-02
	MC	8.54E-05	9.54E-06	2.71E-09	2.40E-06	2.56E-05	5.37E-03	5.34E-03	4.62E-04	1.12E-03	2.42E-03	1.48E-02
	TC	8.54E-05	9.54E-06	2.71E-09	7.68E-06	2.56E-05	5.37E-03	5.34E-03	4.62E-04	1.12E-03	2.42E-03	1.48E-02
	WC	8.54E-05	9.54E-06	2.71E-09	4.13E-06	2.56E-05	5.37E-03	5.34E-03	4.62E-04	1.12E-03	2.42E-03	1.48E-02
PDC	MPOI	1.00E-04	1.12E-05	3.19E-09	1.16E-03	3.63E-03	5.37E-03	5.34E-03	6.24E-04	1.59E-01	2.52E-03	1.78E-01
	AC	8.54E-05	9.54E-06	2.71E-09	9.47E-07	6.89E-04	5.37E-03	5.34E-03	5.98E-04	3.02E-02	2.44E-03	4.47E-02
	AR	8.54E-05	9.55E-06	2.72E-09	6.04E-06	7.02E-04	5.37E-03	5.34E-03	5.98E-04	3.07E-02	2.44E-03	4.53E-02
	BC	8.55E-05	9.56E-06	2.72E-09	9.48E-06	7.11E-04	5.37E-03	5.34E-03	5.98E-04	3.11E-02	2.44E-03	4.57E-02
	BL	8.55E-05	9.55E-06	2.72E-09	7.25E-06	7.05E-04	5.37E-03	5.34E-03	5.98E-04	3.09E-02	2.44E-03	4.54E-02
	DC	8.55E-05	9.55E-06	2.72E-09	7.00E-06	7.05E-04	5.37E-03	5.34E-03	5.98E-04	3.08E-02	2.44E-03	4.54E-02
	DSC	8.55E-05	9.56E-06	2.72E-09	1.07E-05	7.14E-04	5.37E-03	5.34E-03	5.98E-04	3.13E-02	2.44E-03	4.58E-02
	FC	8.55E-05	9.55E-06	2.72E-09	7.88E-06	7.07E-04	5.37E-03	5.34E-03	5.98E-04	3.09E-02	2.44E-03	4.55E-02
	FMK	8.55E-05	9.55E-06	2.72E-09	7.91E-06	7.07E-04	5.37E-03	5.34E-03	5.98E-04	3.10E-02	2.44E-03	4.55E-02
	FMM	8.60E-05	9.62E-06	2.74E-09	5.16E-05	8.18E-04	5.37E-03	5.34E-03	5.99E-04	3.58E-02	2.44E-03	5.05E-02
	FMT	8.54E-05	9.55E-06	2.72E-09	6.33E-06	7.03E-04	5.37E-03	5.34E-03	5.98E-04	3.08E-02	2.44E-03	4.53E-02
	FMT1	8.54E-05	9.54E-06	2.71E-09	4.30E-07	6.88E-04	5.37E-03	5.34E-03	5.98E-04	3.01E-02	2.44E-03	4.46E-02
	FMT2	8.55E-05	9.55E-06	2.72E-09	7.49E-06	7.06E-04	5.37E-03	5.34E-03	5.98E-04	3.09E-02	2.44E-03	4.54E-02
	GEC	8.59E-05	9.60E-06	2.73E-09	4.12E-05	7.92E-04	5.37E-03	5.34E-03	5.99E-04	3.46E-02	2.44E-03	4.93E-02
	GWC	8.61E-05	9.62E-06	2.74E-09	5.55E-05	8.28E-04	5.37E-03	5.34E-03	5.99E-04	3.62E-02	2.44E-03	5.10E-02
	KL	8.55E-05	9.55E-06	2.72E-09	7.43E-06	7.06E-04	5.37E-03	5.34E-03	5.98E-04	3.09E-02	2.44E-03	4.54E-02
	LEC	8.54E-05	9.55E-06	2.72E-09	3.22E-06	6.95E-04	5.37E-03	5.34E-03	5.98E-04	3.04E-02	2.44E-03	4.50E-02
	LWC	8.54E-05	9.55E-06	2.72E-09	5.86E-06	7.02E-04	5.37E-03	5.34E-03	5.98E-04	3.07E-02	2.44E-03	4.53E-02
	MC	8.54E-05	9.55E-06	2.72E-09	3.77E-06	6.97E-04	5.37E-03	5.34E-03	5.98E-04	3.05E-02	2.44E-03	4.50E-02
	TC	8.55E-05	9.56E-06	2.72E-09	8.58E-06	7.09E-04	5.37E-03	5.34E-03	5.98E-04	3.10E-02	2.44E-03	4.56E-02
	WC	8.54E-05	9.55E-06	2.72E-09	5.81E-06	7.02E-04	5.37E-03	5.34E-03	5.98E-04	3.07E-02	2.44E-03	4.53E-02

Table SIR3 22-5: Noncarcinogenic Risk Estimates for Chronic Aliphatics C_{17}-C_{34} Exposures

HQ	Receptor Location	Hazard Quotient (EDI/TDI)										Total HQ
		Soil Ingestion	Soil Dermal	Soil Inhalation	Air Inhalation	Surface Water Ingestion	Lab Tea Ingestion	Cattail Ingestion	Berries Ingestion	Fish Ingestion	Wild Game Ingestion	
BASELINE	MPOI	1.85E-07	3.19E-08	1.64E-11	3.02E-04	2.92E-06	4.49E-03	2.52E-08	2.25E-02	2.2E-06	1.91E-05	2.73E-02
	AC	5.88E-10	1.01E-10	5.19E-14	9.57E-07	9.27E-09	1.42E-05	7.99E-11	7.12E-05	6.9E-09	6.05E-08	8.64E-05
	AR	1.18E-08	2.03E-09	1.04E-12	1.92E-05	1.86E-07	2.86E-04	1.60E-09	1.43E-03	1.4E-07	1.21E-06	1.73E-03
	BC	6.65E-09	1.14E-09	5.88E-13	1.08E-05	1.05E-07	1.61E-04	9.04E-10	8.05E-04	7.8E-08	6.84E-07	9.78E-04
	BL	8.97E-09	1.54E-09	7.93E-13	1.46E-05	1.41E-07	2.17E-04	1.22E-09	1.09E-03	1.1E-07	9.23E-07	1.32E-03
	DC	2.94E-09	5.05E-10	2.60E-13	4.78E-06	4.63E-08	7.11E-05	3.99E-10	3.56E-04	3.5E-08	3.02E-07	4.32E-04
	DSC	1.90E-09	3.26E-10	1.67E-13	3.08E-06	2.99E-08	4.59E-05	2.58E-10	2.29E-04	2.2E-08	1.95E-07	2.79E-04
	FC	2.45E-09	4.22E-10	2.17E-13	3.99E-06	3.87E-08	5.94E-05	3.33E-10	2.97E-04	2.9E-08	2.52E-07	3.61E-04
	FMK	5.06E-09	8.71E-10	4.47E-13	8.24E-06	7.98E-08	1.23E-04	6.88E-10	6.13E-04	6.0E-08	5.21E-07	7.44E-04
	FMM	1.19E-09	2.04E-10	1.05E-13	1.93E-06	1.87E-08	2.88E-05	1.61E-10	1.44E-04	1.4E-08	1.22E-07	1.75E-04
	FMT	4.00E-10	6.88E-11	3.53E-14	6.51E-07	6.31E-09	9.69E-06	5.44E-11	4.84E-05	4.7E-09	4.12E-08	5.88E-05
	FMT1	1.93E-10	3.32E-11	1.70E-14	3.14E-07	3.04E-09	4.67E-06	2.62E-11	2.34E-05	2.3E-09	1.98E-08	2.84E-05
	FMT2	6.45E-09	1.11E-09	5.70E-13	1.05E-05	1.02E-07	1.56E-04	8.77E-10	7.81E-04	7.6E-08	6.64E-07	9.48E-04
	GEC	1.07E-09	1.85E-10	9.49E-14	1.75E-06	1.69E-08	2.60E-05	1.46E-10	1.30E-04	1.3E-08	1.10E-07	1.58E-04
	GWC	1.11E-09	1.91E-10	9.79E-14	1.80E-06	1.75E-08	2.68E-05	1.51E-10	1.34E-04	1.3E-08	1.14E-07	1.63E-04
	KL	6.49E-09	1.12E-09	5.73E-13	1.06E-05	1.02E-07	1.57E-04	8.82E-10	7.85E-04	7.6E-08	6.67E-07	9.54E-04
	LEC	2.19E-09	3.77E-10	1.94E-13	3.57E-06	3.45E-08	5.30E-05	2.98E-10	2.65E-04	2.6E-08	2.25E-07	3.22E-04
	LWC	3.71E-09	6.38E-10	3.28E-13	6.04E-06	5.85E-08	8.99E-05	5.05E-10	4.49E-04	4.4E-08	3.82E-07	5.46E-04
	MC	2.45E-09	4.21E-10	2.16E-13	3.99E-06	3.86E-08	5.93E-05	3.33E-10	2.97E-04	2.9E-08	2.52E-07	3.60E-04
	TC	7.82E-09	1.34E-09	6.91E-13	1.27E-05	1.23E-07	1.89E-04	1.06E-09	9.46E-04	9.2E-08	8.04E-07	1.15E-03
	WC	8.27E-09	1.42E-09	7.31E-13	1.35E-05	1.30E-07	2.00E-04	1.12E-09	1.00E-03	9.8E-08	8.51E-07	1.22E-03
PROJECT ALONE	MPOI	4.50E-12	7.74E-13	3.98E-16	7.33E-09	7.10E-11	1.09E-10	6.12E-13	5.45E-10	5.31E-11	4.70E-13	8.11E-09
	AC	1.31E-12	2.26E-13	1.16E-16	2.13E-09	2.07E-11	3.18E-11	1.78E-13	1.59E-10	1.55E-11	1.37E-13	2.36E-09
	AR	3.91E-12	6.72E-13	3.45E-16	6.36E-09	6.17E-11	9.47E-11	5.32E-13	4.73E-10	4.61E-11	4.08E-13	7.04E-09
	BC	3.21E-12	5.52E-13	2.84E-16	5.23E-09	5.07E-11	7.78E-11	4.37E-13	3.89E-10	3.79E-11	3.35E-13	5.79E-09
	BL	4.41E-12	7.58E-13	3.89E-16	7.17E-09	6.95E-11	1.07E-10	5.99E-13	5.34E-10	5.20E-11	4.60E-13	7.94E-09
	DC	4.86E-12	8.35E-13	4.29E-16	7.90E-09	7.66E-11	1.18E-10	6.60E-13	5.88E-10	5.72E-11	5.07E-13	8.75E-09
	DSC	3.11E-12	5.35E-13	2.75E-16	5.07E-09	4.91E-11	7.54E-11	4.23E-13	3.77E-10	3.67E-11	3.25E-13	5.61E-09
	FC	4.72E-12	8.12E-13	4.17E-16	7.68E-09	7.44E-11	1.14E-10	6.42E-13	5.71E-10	5.56E-11	4.92E-13	8.50E-09
	FMK	3.27E-12	5.63E-13	2.89E-16	5.33E-09	5.16E-11	7.92E-11	4.45E-13	3.96E-10	3.86E-11	3.42E-13	5.90E-09
	FMM	3.50E-12	6.01E-13	3.09E-16	5.69E-09	5.51E-11	8.47E-11	4.75E-13	4.23E-10	4.12E-11	3.65E-13	6.30E-09
	FMT	4.66E-12	8.01E-13	4.12E-16	7.58E-09	7.35E-11	1.13E-10	6.34E-13	5.64E-10	5.49E-11	4.86E-13	8.40E-09
	FMT1	9.86E-13	1.70E-13	8.72E-17	1.61E-09	1.56E-11	2.39E-11	1.34E-13	1.19E-10	1.16E-11	1.03E-13	1.78E-09
	FMT2	3.47E-12	5.96E-13	3.06E-16	5.64E-09	5.47E-11	8.39E-11	4.71E-13	4.20E-10	4.09E-11	3.62E-13	6.25E-09
	GEC	1.79E-11	3.07E-12	1.58E-15	2.91E-08	2.82E-10	4.32E-10	2.43E-12	2.16E-09	2.10E-10	1.86E-12	3.22E-08
	GWC	1.08E-11	1.87E-12	9.58E-16	1.77E-08	1.71E-10	2.63E-10	1.47E-12	1.31E-09	1.28E-10	1.13E-12	1.95E-08
	KL	2.41E-12	4.14E-13	2.12E-16	3.91E-09	3.79E-11	5.82E-11	3.27E-13	2.91E-10	2.84E-11	2.51E-13	4.33E-09
	LEC	2.36E-12	4.06E-13	2.09E-16	3.84E-09	3.72E-11	5.71E-11	3.21E-13	2.86E-10	2.78E-11	2.46E-13	4.25E-09
	LWC	1.84E-12	3.16E-13	1.62E-16	2.99E-09	2.90E-11	4.45E-11	2.50E-13	2.22E-10	2.17E-11	1.92E-13	3.31E-09
	MC	3.41E-12	5.86E-13	3.01E-16	5.55E-09	5.37E-11	8.25E-11	4.63E-13	4.13E-10	4.02E-11	3.56E-13	6.14E-09
	TC	2.44E-12	4.20E-13	2.16E-16	3.97E-09	3.85E-11	5.91E-11	3.32E-13	2.96E-10	2.88E-11	2.55E-13	4.40E-09
	WC	4.33E-12	7.45E-13	3.83E-16	7.05E-09	6.83E-11	1.05E-10	5.89E-13	5.24E-10	5.11E-11	4.52E-13	7.80E-09

HQ	Receptor Location	Hazard Quotient (EDI/TDI)										Total HQ
		Soil Ingestion	Soil Dermal	Soil Inhalation	Air Inhalation	Surface Water Ingestion	Lab Tea Ingestion	Cattail Ingestion	Berries Ingestion	Fish Ingestion	Wild Game Ingestion	
APPLICATION	MPOI	1.85E-07	3.19E-08	1.64E-11	3.02E-04	2.92E-06	4.49E-03	2.52E-08	2.25E-02	2.19E-06	1.91E-05	2.73E-02
	AC	5.89E-10	1.01E-10	5.20E-14	9.59E-07	9.29E-09	1.42E-05	8.01E-11	7.12E-05	6.94E-09	6.05E-08	8.64E-05
	AR	1.18E-08	2.03E-09	1.04E-12	1.92E-05	1.86E-07	2.86E-04	1.60E-09	1.43E-03	1.39E-07	1.21E-06	1.73E-03
	BC	6.66E-09	1.14E-09	5.88E-13	1.08E-05	1.05E-07	1.61E-04	9.05E-10	8.05E-04	7.85E-08	6.84E-07	9.78E-04
	BL	8.98E-09	1.54E-09	7.93E-13	1.46E-05	1.42E-07	2.17E-04	1.22E-09	1.09E-03	1.06E-07	9.23E-07	1.32E-03
	DC	2.94E-09	5.06E-10	2.60E-13	4.79E-06	4.64E-08	7.11E-05	4.00E-10	3.56E-04	3.47E-08	3.02E-07	4.32E-04
	DSC	1.90E-09	3.27E-10	1.68E-13	3.09E-06	2.99E-08	4.59E-05	2.58E-10	2.29E-04	2.24E-08	1.95E-07	2.79E-04
	FC	2.46E-09	4.23E-10	2.17E-13	4.00E-06	3.87E-08	5.94E-05	3.34E-10	2.97E-04	2.90E-08	2.52E-07	3.61E-04
	FMK	5.06E-09	8.71E-10	4.47E-13	8.24E-06	7.99E-08	1.23E-04	6.89E-10	6.13E-04	5.97E-08	5.21E-07	7.44E-04
	FMM	1.19E-09	2.05E-10	1.05E-13	1.94E-06	1.88E-08	2.88E-05	1.62E-10	1.44E-04	1.40E-08	1.22E-07	1.75E-04
	FMT	4.05E-10	6.96E-11	3.57E-14	6.59E-07	6.38E-09	9.69E-06	5.50E-11	4.84E-05	4.77E-09	4.12E-08	5.88E-05
	FMT1	1.94E-10	3.34E-11	1.71E-14	3.16E-07	3.06E-09	4.67E-06	2.64E-11	2.34E-05	2.29E-09	1.98E-08	2.84E-05
	FMT2	6.45E-09	1.11E-09	5.70E-13	1.05E-05	1.02E-07	1.56E-04	8.77E-10	7.81E-04	7.61E-08	6.64E-07	9.48E-04
	GEC	1.09E-09	1.88E-10	9.65E-14	1.78E-06	1.72E-08	2.60E-05	1.48E-10	1.30E-04	1.29E-08	1.10E-07	1.58E-04
	GWC	1.12E-09	1.92E-10	9.88E-14	1.82E-06	1.76E-08	2.68E-05	1.52E-10	1.34E-04	1.32E-08	1.14E-07	1.63E-04
	KL	6.49E-09	1.12E-09	5.73E-13	1.06E-05	1.02E-07	1.57E-04	8.82E-10	7.85E-04	7.65E-08	6.67E-07	9.54E-04
	LEC	2.19E-09	3.77E-10	1.94E-13	3.57E-06	3.46E-08	5.30E-05	2.98E-10	2.65E-04	2.59E-08	2.25E-07	3.22E-04
	LWC	3.71E-09	6.39E-10	3.28E-13	6.04E-06	5.86E-08	8.99E-05	5.05E-10	4.49E-04	4.38E-08	3.82E-07	5.46E-04
	MC	2.45E-09	4.22E-10	2.17E-13	3.99E-06	3.87E-08	5.93E-05	3.34E-10	2.97E-04	2.89E-08	2.52E-07	3.60E-04
	TC	7.82E-09	1.35E-09	6.91E-13	1.27E-05	1.23E-07	1.89E-04	1.06E-09	9.46E-04	9.22E-08	8.04E-07	1.15E-03
	WC	8.28E-09	1.42E-09	7.31E-13	1.35E-05	1.31E-07	2.00E-04	1.13E-09	1.00E-03	9.76E-08	8.51E-07	1.22E-03
PDC	MPOI	1.86E-07	3.20E-08	1.64E-11	3.03E-04	2.93E-06	4.50E-03	2.53E-08	2.25E-02	2.19E-06	1.91E-05	2.73E-02
	AC	8.20E-10	1.41E-10	7.25E-14	1.34E-06	1.29E-08	1.99E-05	1.12E-10	9.93E-05	9.67E-09	8.44E-08	1.21E-04
	AR	1.22E-08	2.10E-09	1.08E-12	1.99E-05	1.92E-07	2.95E-04	1.66E-09	1.48E-03	1.44E-07	1.25E-06	1.79E-03
	BC	7.27E-09	1.25E-09	6.42E-13	1.18E-05	1.15E-07	1.76E-04	9.88E-10	8.80E-04	8.57E-08	7.48E-07	1.07E-03
	BL	9.32E-09	1.60E-09	8.23E-13	1.52E-05	1.47E-07	2.26E-04	1.27E-09	1.13E-03	1.10E-07	9.58E-07	1.37E-03
	DC	3.25E-09	5.59E-10	2.87E-13	5.29E-06	5.13E-08	7.87E-05	4.42E-10	3.94E-04	3.83E-08	3.35E-07	4.78E-04
	DSC	2.25E-09	3.87E-10	1.99E-13	3.66E-06	3.54E-08	5.44E-05	3.06E-10	2.72E-04	2.65E-08	2.31E-07	3.30E-04
	FC	2.86E-09	4.92E-10	2.53E-13	4.65E-06	4.51E-08	6.92E-05	3.89E-10	3.46E-04	3.37E-08	2.94E-07	4.20E-04
	FMK	5.75E-09	9.89E-10	5.08E-13	9.36E-06	9.07E-08	1.39E-04	7.82E-10	6.96E-04	6.78E-08	5.92E-07	8.46E-04
	FMM	1.40E-09	2.41E-10	1.24E-13	2.28E-06	2.21E-08	3.40E-05	1.91E-10	1.70E-04	1.65E-08	1.44E-07	2.06E-04
	FMT	5.34E-10	9.19E-11	4.72E-14	8.69E-07	8.43E-09	1.29E-05	7.26E-11	6.47E-05	6.30E-09	5.50E-08	7.85E-05
	FMT1	2.74E-10	4.71E-11	2.42E-14	4.45E-07	4.32E-09	6.63E-06	3.72E-11	3.31E-05	3.23E-09	2.82E-08	4.02E-05
	FMT2	6.99E-09	1.20E-09	6.18E-13	1.14E-05	1.10E-07	1.69E-04	9.51E-10	8.47E-04	8.25E-08	7.20E-07	1.03E-03
	GEC	1.30E-09	2.24E-10	1.15E-13	2.12E-06	2.06E-08	3.16E-05	1.77E-10	1.58E-04	1.54E-08	1.34E-07	1.92E-04
	GWC	1.33E-09	2.28E-10	1.17E-13	2.16E-06	2.09E-08	3.21E-05	1.80E-10	1.60E-04	1.56E-08	1.36E-07	1.95E-04
	KL	6.88E-09	1.18E-09	6.08E-13	1.12E-05	1.08E-07	1.67E-04	9.35E-10	8.33E-04	8.11E-08	7.08E-07	1.01E-03
	LEC	2.46E-09	4.24E-10	2.18E-13	4.01E-06	3.88E-08	5.96E-05	3.35E-10	2.98E-04	2.90E-08	2.53E-07	3.62E-04
	LWC	4.10E-09	7.05E-10	3.62E-13	6.67E-06	6.46E-08	9.92E-05	5.57E-10	4.96E-04	4.83E-08	4.22E-07	6.03E-04
	MC	3.83E-09	6.60E-10	3.39E-13	6.24E-06	6.05E-08	9.29E-05	5.21E-10	4.64E-04	4.52E-08	3.95E-07	5.64E-04
	TC	8.21E-09	1.41E-09	7.25E-13	1.34E-05	1.29E-07	1.99E-04	1.12E-09	9.94E-04	9.68E-08	8.44E-07	1.21E-03
	WC	8.65E-09	1.49E-09	7.65E-13	1.41E-05	1.37E-07	2.10E-04	1.18E-09	1.05E-03	1.02E-07	8.90E-07	1.27E-03

The chronic multi-media health risks for anthracene are presented as hazard quotients in Table SIR3 22-6. None of the hazard quotients exceed 1.0 at any of the receptor locations for the four assessment cases. As such, it is unlikely that chronic multi-media exposure to anthracene will result in adverse health effects.

The chronic multi-media health risks for fluoranthene are presented as hazard quotients in Table SIR3 22-7. With the exception of the MPOI in the Planned Development Case (PDC) (HQ=3.18), none of the hazard quotients exceed 1.0 at the receptor locations for the four assessment cases. Most of the exceedance at the MPOI results from the ingestion of fish (3.15 out of 3.18). However, PAHs are not accumulated by fish through dietary exposure because of the combined effects of poor absorption efficiencies and rapid elimination times. Uptake of PAHs from water by living organisms is considered to be regulated primarily by equilibrium exchange processes between water and lipids, and to take place across permeable or vascular surfaces, such as gills or egg membranes (Environment Canada and Health Canada 2011). Once inside the organism, hydrocarbons become part of the generalized lipid pool, and may or may not be metabolized. Vertebrate species are capable of metabolizing and excreting most hydrocarbon compounds including PAHs, and bioaccumulation is less pronounced. There are no empirically observed bioconcentration or bioaccumulation factor values recorded for any species of invertebrates or vertebrates, likely as a result of very low bioavailability and thus poor dietary assimilation efficiency. There is no evidence that petroleum hydrocarbons biomagnify up food chains (Environment Canada and Health Canada 2011). Since modelling of PAH uptake in fish do not account for metabolism, it can then be assumed that human exposure through fish ingestion would be less than what is expected through modelling. For the reasons stated and given that the exceedance is predicted at only one receptor location (MPOI), it is unlikely that chronic multi-media exposure to fluoranthene will result in adverse health effects.

The chronic multi-media health risks for fluorene are presented as hazard quotients in Table SIR3 22-8. With the exception of the MPOI in the PDC case, none of the hazard quotients exceed 1.0 at the receptor locations for the four assessment cases. There are essentially no differences between the Baseline Case and Application Case risks for phenanthrene, indicating that the Project is expected to have a negligible impact on the phenanthrene-related health risks in the region. Most of the exceedance at the MPOI results from the ingestion of fish (1.58 out of 1.62). For the reasons stated in the discussion of the fluoranthene exceedance, it is unlikely that chronic multi-media exposure to fluorene will result in adverse health effects.

The chronic multi-media health risks for phenanthrene are presented as hazard quotients in Table SIR3 22-9. With the exception of the MPOI in the CEA case, none of the hazard quotients exceed 1.0 at the receptor locations for the four assessment cases. However, most of the exceedance at the MPOI is due to the ingestion of fish (1.13 out of 3.00) and air inhalation (1.85 out of 3.00). For the reasons stated in the fluoranthene discussion, the ingestion of fish is not expected to result in phenanthrene-related health effects.

As for the air inhalation pathway, it is not anticipated that anyone would live permanently at the MPOI and, therefore, the likelihood of a person being continuously exposed at the MPOI is considered remote.

Table SIR3 22-6: Noncarcinogenic Risk Estimates for Chronic Anthracene Exposures

HQ	Receptor Location	Hazard Quotient (EDI/TDI)										Total HQ
		Soil Ingestion	Soil Dermal	Soil Inhalation	Air Inhalation	Surface Water Ingestion	Lab Tea Ingestion	Cattail Ingestion	Berries Ingestion	Fish Ingestion	Wild Game Ingestion	
BASELINE	MPOI	2.02E-07	2.26E-08	1.78E-11	7.48E-06	4.24E-07	1.26E-04	1.26E-04	1.86E-07	6.9E-05	3.12E-05	3.61E-04
	AC	2.02E-07	2.26E-08	1.78E-11	8.59E-09	4.24E-07	1.26E-04	1.26E-04	1.85E-07	6.9E-05	3.12E-05	3.54E-04
	AR	2.02E-07	2.26E-08	1.78E-11	5.66E-08	4.24E-07	1.26E-04	1.26E-04	1.85E-07	6.9E-05	3.12E-05	3.54E-04
	BC	2.02E-07	2.26E-08	1.78E-11	9.42E-08	4.24E-07	1.26E-04	1.26E-04	1.85E-07	6.9E-05	3.12E-05	3.54E-04
	BL	2.02E-07	2.26E-08	1.78E-11	6.73E-08	4.24E-07	1.26E-04	1.26E-04	1.85E-07	6.9E-05	3.12E-05	3.54E-04
	DC	2.02E-07	2.26E-08	1.78E-11	4.87E-08	4.24E-07	1.26E-04	1.26E-04	1.85E-07	6.9E-05	3.12E-05	3.54E-04
	DSC	2.02E-07	2.26E-08	1.78E-11	7.27E-08	4.24E-07	1.26E-04	1.26E-04	1.85E-07	6.9E-05	3.12E-05	3.54E-04
	FC	2.02E-07	2.26E-08	1.78E-11	5.60E-08	4.24E-07	1.26E-04	1.26E-04	1.85E-07	6.9E-05	3.12E-05	3.54E-04
	FMK	2.02E-07	2.26E-08	1.78E-11	6.67E-08	4.24E-07	1.26E-04	1.26E-04	1.85E-07	6.9E-05	3.12E-05	3.54E-04
	FMM	2.02E-07	2.26E-08	1.78E-11	3.37E-07	4.24E-07	1.26E-04	1.26E-04	1.85E-07	6.9E-05	3.12E-05	3.54E-04
	FMT	2.02E-07	2.26E-08	1.78E-11	4.19E-08	4.24E-07	1.26E-04	1.26E-04	1.85E-07	6.9E-05	3.12E-05	3.54E-04
	FMT1	2.02E-07	2.26E-08	1.78E-11	3.22E-09	4.24E-07	1.26E-04	1.26E-04	1.85E-07	6.9E-05	3.12E-05	3.54E-04
	FMT2	2.02E-07	2.26E-08	1.78E-11	6.64E-08	4.24E-07	1.26E-04	1.26E-04	1.85E-07	6.9E-05	3.12E-05	3.54E-04
	GEC	2.02E-07	2.26E-08	1.78E-11	2.68E-07	4.24E-07	1.26E-04	1.26E-04	1.85E-07	6.9E-05	3.12E-05	3.54E-04
	GWC	2.02E-07	2.26E-08	1.78E-11	3.62E-07	4.24E-07	1.26E-04	1.26E-04	1.85E-07	6.9E-05	3.12E-05	3.54E-04
	KL	2.02E-07	2.26E-08	1.78E-11	8.21E-08	4.24E-07	1.26E-04	1.26E-04	1.85E-07	6.9E-05	3.12E-05	3.54E-04
	LEC	2.02E-07	2.26E-08	1.78E-11	3.39E-08	4.24E-07	1.26E-04	1.26E-04	1.85E-07	6.9E-05	3.12E-05	3.54E-04
	LWC	2.02E-07	2.26E-08	1.78E-11	6.55E-08	4.24E-07	1.26E-04	1.26E-04	1.85E-07	6.9E-05	3.12E-05	3.54E-04
	MC	2.02E-07	2.26E-08	1.78E-11	3.02E-08	4.24E-07	1.26E-04	1.26E-04	1.85E-07	6.9E-05	3.12E-05	3.54E-04
	TC	2.02E-07	2.26E-08	1.78E-11	9.65E-08	4.24E-07	1.26E-04	1.26E-04	1.85E-07	6.9E-05	3.12E-05	3.54E-04
	WC	2.02E-07	2.26E-08	1.78E-11	5.19E-08	4.24E-07	1.26E-04	1.26E-04	1.85E-07	6.9E-05	3.12E-05	3.54E-04
PROJECT ALONE	MPOI	5.11E-12	5.71E-13	4.51E-16	5.82E-11	6.62E-11	3.02E-10	1.44E-14	1.51E-09	1.08E-08	1.29E-06	1.31E-06
	AC	7.46E-13	8.34E-14	6.59E-17	8.50E-12	9.66E-12	3.01E-10	2.11E-15	1.51E-09	1.58E-09	1.29E-06	1.30E-06
	AR	3.00E-12	3.35E-13	2.65E-16	3.42E-11	3.88E-11	3.02E-10	8.47E-15	1.51E-09	6.33E-09	1.29E-06	1.30E-06
	BC	2.40E-12	2.69E-13	2.12E-16	2.74E-11	3.11E-11	3.01E-10	6.79E-15	1.51E-09	5.07E-09	1.29E-06	1.30E-06
	BL	3.74E-12	4.18E-13	3.30E-16	4.26E-11	4.84E-11	3.02E-10	1.06E-14	1.51E-09	7.90E-09	1.29E-06	1.30E-06
	DC	2.66E-12	2.97E-13	2.35E-16	3.03E-11	3.44E-11	3.01E-10	7.51E-15	1.51E-09	5.61E-09	1.29E-06	1.30E-06
	DSC	3.41E-12	3.81E-13	3.01E-16	3.89E-11	4.41E-11	3.02E-10	9.62E-15	1.51E-09	7.20E-09	1.29E-06	1.30E-06
	FC	5.12E-12	5.73E-13	4.53E-16	5.84E-11	6.63E-11	3.02E-10	1.45E-14	1.51E-09	1.08E-08	1.29E-06	1.31E-06
	FMK	2.49E-12	2.78E-13	2.20E-16	2.84E-11	3.23E-11	3.01E-10	7.04E-15	1.51E-09	5.26E-09	1.29E-06	1.30E-06
	FMM	2.95E-12	3.30E-13	2.61E-16	3.36E-11	3.82E-11	3.01E-10	8.33E-15	1.51E-09	6.23E-09	1.29E-06	1.30E-06
	FMT	3.34E-12	3.74E-13	2.95E-16	3.81E-11	4.33E-11	3.02E-10	9.44E-15	1.51E-09	7.06E-09	1.29E-06	1.30E-06
	FMT1	4.66E-13	5.21E-14	4.11E-17	5.31E-12	6.03E-12	3.01E-10	1.32E-15	1.51E-09	9.84E-10	1.29E-06	1.29E-06
	FMT2	2.64E-12	2.96E-13	2.34E-16	3.02E-11	3.43E-11	3.01E-10	7.47E-15	1.51E-09	5.59E-09	1.29E-06	1.30E-06
	GEC	1.46E-11	1.63E-12	1.29E-15	1.66E-10	1.89E-10	3.04E-10	4.12E-14	1.52E-09	3.08E-08	1.29E-06	1.33E-06
	GWC	9.19E-12	1.03E-12	8.12E-16	1.05E-10	1.19E-10	3.03E-10	2.60E-14	1.51E-09	1.94E-08	1.29E-06	1.31E-06
	KL	1.68E-12	1.88E-13	1.49E-16	1.92E-11	2.18E-11	3.01E-10	4.76E-15	1.51E-09	3.56E-09	1.29E-06	1.30E-06
	LEC	1.62E-12	1.81E-13	1.43E-16	1.85E-11	2.10E-11	3.01E-10	4.58E-15	1.51E-09	3.42E-09	1.29E-06	1.30E-06
	LWC	1.22E-12	1.37E-13	1.08E-16	1.39E-11	1.58E-11	3.01E-10	3.45E-15	1.51E-09	2.58E-09	1.29E-06	1.30E-06
	MC	2.41E-12	2.70E-13	2.13E-16	2.75E-11	3.12E-11	3.01E-10	6.81E-15	1.51E-09	5.10E-09	1.29E-06	1.30E-06
	TC	1.70E-12	1.90E-13	1.50E-16	1.94E-11	2.20E-11	3.01E-10	4.80E-15	1.51E-09	3.59E-09	1.29E-06	1.30E-06
	WC	3.37E-12	3.76E-13	2.97E-16	3.84E-11	4.36E-11	3.02E-10	9.51E-15	1.51E-09	7.11E-09	1.29E-06	1.30E-06

HQ	Receptor Location	Hazard Quotient (EDI/TDI)										Total HQ
		Soil Ingestion	Soil Dermal	Soil Inhalation	Air Inhalation	Surface Water Ingestion	Lab Tea Ingestion	Cattail Ingestion	Berries Ingestion	Fish Ingestion	Wild Game Ingestion	
APPLICATION	MPOI	2.02E-07	2.26E-08	1.78E-11	7.48E-06	4.24E-07	1.26E-04	1.26E-04	1.87E-07	6.92E-05	3.25E-05	3.63E-04
	AC	2.02E-07	2.26E-08	1.78E-11	8.60E-09	4.24E-07	1.26E-04	1.26E-04	1.87E-07	6.92E-05	3.25E-05	3.55E-04
	AR	2.02E-07	2.26E-08	1.78E-11	5.66E-08	4.24E-07	1.26E-04	1.26E-04	1.87E-07	6.92E-05	3.25E-05	3.55E-04
	BC	2.02E-07	2.26E-08	1.78E-11	9.43E-08	4.24E-07	1.26E-04	1.26E-04	1.87E-07	6.92E-05	3.25E-05	3.55E-04
	BL	2.02E-07	2.26E-08	1.78E-11	6.74E-08	4.24E-07	1.26E-04	1.26E-04	1.87E-07	6.92E-05	3.25E-05	3.55E-04
	DC	2.02E-07	2.26E-08	1.78E-11	4.87E-08	4.24E-07	1.26E-04	1.26E-04	1.87E-07	6.92E-05	3.25E-05	3.55E-04
	DSC	2.02E-07	2.26E-08	1.78E-11	7.27E-08	4.24E-07	1.26E-04	1.26E-04	1.87E-07	6.92E-05	3.25E-05	3.55E-04
	FC	2.02E-07	2.26E-08	1.78E-11	5.61E-08	4.24E-07	1.26E-04	1.26E-04	1.87E-07	6.92E-05	3.25E-05	3.55E-04
	FMK	2.02E-07	2.26E-08	1.78E-11	6.67E-08	4.24E-07	1.26E-04	1.26E-04	1.87E-07	6.92E-05	3.25E-05	3.55E-04
	FMM	2.02E-07	2.26E-08	1.78E-11	3.37E-07	4.24E-07	1.26E-04	1.26E-04	1.87E-07	6.92E-05	3.25E-05	3.55E-04
	FMT	2.02E-07	2.26E-08	1.78E-11	4.20E-08	4.24E-07	1.26E-04	1.26E-04	1.87E-07	6.92E-05	3.25E-05	3.55E-04
	FMT1	2.02E-07	2.26E-08	1.78E-11	3.23E-09	4.24E-07	1.26E-04	1.26E-04	1.87E-07	6.92E-05	3.25E-05	3.55E-04
	FMT2	2.02E-07	2.26E-08	1.78E-11	6.65E-08	4.24E-07	1.26E-04	1.26E-04	1.87E-07	6.92E-05	3.25E-05	3.55E-04
	GEC	2.02E-07	2.26E-08	1.78E-11	2.68E-07	4.24E-07	1.26E-04	1.26E-04	1.87E-07	6.92E-05	3.25E-05	3.55E-04
	GWC	2.02E-07	2.26E-08	1.78E-11	3.62E-07	4.24E-07	1.26E-04	1.26E-04	1.87E-07	6.92E-05	3.25E-05	3.55E-04
	KL	2.02E-07	2.26E-08	1.78E-11	8.21E-08	4.24E-07	1.26E-04	1.26E-04	1.87E-07	6.92E-05	3.25E-05	3.55E-04
	LEC	2.02E-07	2.26E-08	1.78E-11	3.39E-08	4.24E-07	1.26E-04	1.26E-04	1.87E-07	6.92E-05	3.25E-05	3.55E-04
	LWC	2.02E-07	2.26E-08	1.78E-11	6.55E-08	4.24E-07	1.26E-04	1.26E-04	1.87E-07	6.92E-05	3.25E-05	3.55E-04
	MC	2.02E-07	2.26E-08	1.78E-11	3.03E-08	4.24E-07	1.26E-04	1.26E-04	1.87E-07	6.92E-05	3.25E-05	3.55E-04
	TC	2.02E-07	2.26E-08	1.78E-11	9.65E-08	4.24E-07	1.26E-04	1.26E-04	1.87E-07	6.92E-05	3.25E-05	3.55E-04
	WC	2.02E-07	2.26E-08	1.78E-11	5.19E-08	4.24E-07	1.26E-04	1.26E-04	1.87E-07	6.92E-05	3.25E-05	3.55E-04
PDC	MPOI	8.21E-07	9.18E-08	7.25E-11	1.45E-05	8.67E-06	1.26E-04	1.26E-04	9.35E-07	1.41E-03	1.41E-04	1.83E-03
	AC	2.02E-07	2.26E-08	1.79E-11	1.21E-08	5.51E-07	1.26E-04	1.26E-04	3.71E-07	8.99E-05	3.29E-05	3.76E-04
	AR	2.04E-07	2.28E-08	1.80E-11	7.61E-08	5.70E-07	1.26E-04	1.26E-04	3.72E-07	9.29E-05	3.31E-05	3.80E-04
	BC	2.04E-07	2.28E-08	1.80E-11	1.19E-07	5.76E-07	1.26E-04	1.26E-04	3.73E-07	9.39E-05	3.32E-05	3.81E-04
	BL	2.04E-07	2.28E-08	1.80E-11	9.12E-08	5.75E-07	1.26E-04	1.26E-04	3.73E-07	9.38E-05	3.32E-05	3.81E-04
	DC	2.05E-07	2.30E-08	1.82E-11	8.83E-08	5.93E-07	1.26E-04	1.26E-04	3.74E-07	9.67E-05	3.34E-05	3.84E-04
	DSC	2.07E-07	2.32E-08	1.83E-11	1.34E-07	6.18E-07	1.26E-04	1.26E-04	3.76E-07	1.01E-04	3.38E-05	3.88E-04
	FC	2.06E-07	2.30E-08	1.82E-11	9.93E-08	5.97E-07	1.26E-04	1.26E-04	3.74E-07	9.74E-05	3.35E-05	3.85E-04
	FMK	2.05E-07	2.29E-08	1.81E-11	9.93E-08	5.85E-07	1.26E-04	1.26E-04	3.73E-07	9.54E-05	3.33E-05	3.83E-04
	FMM	2.29E-07	2.56E-08	2.03E-11	6.48E-07	9.06E-07	1.26E-04	1.26E-04	3.96E-07	1.48E-04	3.76E-05	4.40E-04
	FMT	2.05E-07	2.30E-08	1.81E-11	7.98E-08	5.91E-07	1.26E-04	1.26E-04	3.74E-07	9.64E-05	3.34E-05	3.84E-04
	FMT1	2.02E-07	2.26E-08	1.79E-11	5.51E-09	5.50E-07	1.26E-04	1.26E-04	3.71E-07	8.97E-05	3.28E-05	3.76E-04
	FMT2	2.04E-07	2.29E-08	1.81E-11	9.40E-08	5.79E-07	1.26E-04	1.26E-04	3.73E-07	9.44E-05	3.32E-05	3.81E-04
	GEC	2.24E-07	2.50E-08	1.98E-11	5.18E-07	8.34E-07	1.26E-04	1.26E-04	3.91E-07	1.36E-04	3.66E-05	4.27E-04
	GWC	2.31E-07	2.59E-08	2.04E-11	6.97E-07	9.34E-07	1.26E-04	1.26E-04	3.98E-07	1.52E-04	3.80E-05	4.45E-04
	KL	2.03E-07	2.27E-08	1.79E-11	9.35E-08	5.61E-07	1.26E-04	1.26E-04	3.72E-07	9.14E-05	3.30E-05	3.78E-04
	LEC	2.03E-07	2.27E-08	1.79E-11	4.14E-08	5.56E-07	1.26E-04	1.26E-04	3.71E-07	9.07E-05	3.29E-05	3.77E-04
	LWC	2.03E-07	2.27E-08	1.79E-11	7.37E-08	5.57E-07	1.26E-04	1.26E-04	3.71E-07	9.08E-05	3.29E-05	3.77E-04
	MC	2.04E-07	2.28E-08	1.80E-11	4.77E-08	5.68E-07	1.26E-04	1.26E-04	3.72E-07	9.26E-05	3.31E-05	3.79E-04
	TC	2.03E-07	2.27E-08	1.79E-11	1.08E-07	5.61E-07	1.26E-04	1.26E-04	3.72E-07	9.14E-05	3.30E-05	3.78E-04
	WC	2.04E-07	2.28E-08	1.80E-11	7.32E-08	5.72E-07	1.26E-04	1.26E-04	3.73E-07	9.33E-05	3.31E-05	3.80E-04

Table SIR3 22-7: Noncarcinogenic Risk Estimates for Chronic Fluoranthene Exposures

HQ	Receptor Location	Hazard Quotient (EDI/TDI)										Total HQ
		Soil Ingestion	Soil Dermal	Soil Inhalation	Air Inhalation	Surface Water Ingestion	Lab Tea Ingestion	Cattail Ingestion	Berries Ingestion	Fish Ingestion	Wild Game Ingestion	
BASELINE	MPOI	1.21E-05	1.36E-06	1.07E-09	1.85E-04	1.82E-05	9.47E-04	9.47E-04	5.91E-06	4.1E-03	1.65E-05	6.19E-03
	AC	1.21E-05	1.36E-06	1.07E-09	2.10E-07	1.82E-05	9.47E-04	9.47E-04	5.82E-06	4.1E-03	1.64E-05	6.01E-03
	AR	1.21E-05	1.36E-06	1.07E-09	1.40E-06	1.82E-05	9.47E-04	9.47E-04	5.82E-06	4.1E-03	1.64E-05	6.01E-03
	BC	1.21E-05	1.36E-06	1.07E-09	2.34E-06	1.82E-05	9.47E-04	9.47E-04	5.82E-06	4.1E-03	1.64E-05	6.01E-03
	BL	1.21E-05	1.36E-06	1.07E-09	1.67E-06	1.82E-05	9.47E-04	9.47E-04	5.82E-06	4.1E-03	1.64E-05	6.01E-03
	DC	1.21E-05	1.36E-06	1.07E-09	1.20E-06	1.82E-05	9.47E-04	9.47E-04	5.82E-06	4.1E-03	1.64E-05	6.01E-03
	DSC	1.21E-05	1.36E-06	1.07E-09	1.80E-06	1.82E-05	9.47E-04	9.47E-04	5.82E-06	4.1E-03	1.64E-05	6.01E-03
	FC	1.21E-05	1.36E-06	1.07E-09	1.38E-06	1.82E-05	9.47E-04	9.47E-04	5.82E-06	4.1E-03	1.64E-05	6.01E-03
	FMK	1.21E-05	1.36E-06	1.07E-09	1.65E-06	1.82E-05	9.47E-04	9.47E-04	5.82E-06	4.1E-03	1.64E-05	6.01E-03
	FMM	1.21E-05	1.36E-06	1.07E-09	8.33E-06	1.82E-05	9.47E-04	9.47E-04	5.82E-06	4.1E-03	1.64E-05	6.02E-03
	FMT	1.21E-05	1.36E-06	1.07E-09	1.03E-06	1.82E-05	9.47E-04	9.47E-04	5.82E-06	4.1E-03	1.64E-05	6.01E-03
	FMT1	1.21E-05	1.36E-06	1.07E-09	7.87E-08	1.82E-05	9.47E-04	9.47E-04	5.82E-06	4.1E-03	1.64E-05	6.01E-03
	FMT2	1.21E-05	1.36E-06	1.07E-09	1.65E-06	1.82E-05	9.47E-04	9.47E-04	5.82E-06	4.1E-03	1.64E-05	6.01E-03
	GEC	1.21E-05	1.36E-06	1.07E-09	6.64E-06	1.82E-05	9.47E-04	9.47E-04	5.82E-06	4.1E-03	1.64E-05	6.01E-03
	GWC	1.21E-05	1.36E-06	1.07E-09	8.95E-06	1.82E-05	9.47E-04	9.47E-04	5.82E-06	4.1E-03	1.64E-05	6.02E-03
	KL	1.21E-05	1.36E-06	1.07E-09	2.03E-06	1.82E-05	9.47E-04	9.47E-04	5.82E-06	4.1E-03	1.64E-05	6.01E-03
	LEC	1.21E-05	1.36E-06	1.07E-09	8.25E-07	1.82E-05	9.47E-04	9.47E-04	5.82E-06	4.1E-03	1.64E-05	6.01E-03
	LWC	1.21E-05	1.36E-06	1.07E-09	1.62E-06	1.82E-05	9.47E-04	9.47E-04	5.82E-06	4.1E-03	1.64E-05	6.01E-03
	MC	1.21E-05	1.36E-06	1.07E-09	7.47E-07	1.82E-05	9.47E-04	9.47E-04	5.82E-06	4.1E-03	1.64E-05	6.01E-03
	TC	1.21E-05	1.36E-06	1.07E-09	2.38E-06	1.82E-05	9.47E-04	9.47E-04	5.82E-06	4.1E-03	1.64E-05	6.01E-03
	WC	1.21E-05	1.36E-06	1.07E-09	1.28E-06	1.82E-05	9.47E-04	9.47E-04	5.82E-06	4.1E-03	1.64E-05	6.01E-03
PROJECT ALONE	MPOI	4.78E-11	5.35E-12	4.23E-15	5.64E-10	7.28E-10	2.98E-08	1.35E-13	1.49E-07	1.63E-07	1.48E-06	1.83E-06
	AC	6.76E-12	7.56E-13	5.97E-16	7.96E-11	1.03E-10	2.98E-08	1.90E-14	1.49E-07	2.30E-08	1.48E-06	1.69E-06
	AR	2.72E-11	3.04E-12	2.40E-15	3.20E-10	4.14E-10	2.98E-08	7.65E-14	1.49E-07	9.24E-08	1.48E-06	1.76E-06
	BC	2.18E-11	2.43E-12	1.92E-15	2.56E-10	3.31E-10	2.98E-08	6.12E-14	1.49E-07	7.40E-08	1.48E-06	1.74E-06
	BL	3.40E-11	3.80E-12	3.00E-15	4.00E-10	5.17E-10	2.98E-08	9.55E-14	1.49E-07	1.15E-07	1.48E-06	1.78E-06
	DC	2.41E-11	2.70E-12	2.13E-15	2.84E-10	3.67E-10	2.98E-08	6.78E-14	1.49E-07	8.20E-08	1.48E-06	1.75E-06
	DSC	3.10E-11	3.46E-12	2.74E-15	3.65E-10	4.72E-10	2.98E-08	8.71E-14	1.49E-07	1.05E-07	1.48E-06	1.77E-06
	FC	4.65E-11	5.19E-12	4.10E-15	5.47E-10	7.07E-10	2.98E-08	1.31E-13	1.49E-07	1.58E-07	1.48E-06	1.82E-06
	FMK	2.27E-11	2.54E-12	2.01E-15	2.68E-10	3.46E-10	2.98E-08	6.39E-14	1.49E-07	7.72E-08	1.48E-06	1.74E-06
	FMM	2.67E-11	2.98E-12	2.36E-15	3.14E-10	4.06E-10	2.98E-08	7.50E-14	1.49E-07	9.07E-08	1.48E-06	1.75E-06
	FMT	3.03E-11	3.39E-12	2.68E-15	3.57E-10	4.62E-10	2.98E-08	8.54E-14	1.49E-07	1.03E-07	1.48E-06	1.77E-06
	FMT1	4.23E-12	4.72E-13	3.73E-16	4.98E-11	6.43E-11	2.98E-08	1.19E-14	1.49E-07	1.44E-08	1.48E-06	1.68E-06
	FMT2	2.40E-11	2.69E-12	2.12E-15	2.83E-10	3.66E-10	2.98E-08	6.76E-14	1.49E-07	8.17E-08	1.48E-06	1.75E-06
	GEC	1.32E-10	1.48E-11	1.17E-14	1.56E-09	2.02E-09	2.98E-08	3.72E-13	1.49E-07	4.50E-07	1.48E-06	2.12E-06
	GWC	8.35E-11	9.33E-12	7.38E-15	9.84E-10	1.27E-09	2.98E-08	2.35E-13	1.49E-07	2.84E-07	1.48E-06	1.95E-06
	KL	1.53E-11	1.71E-12	1.35E-15	1.80E-10	2.33E-10	2.98E-08	4.31E-14	1.49E-07	5.20E-08	1.48E-06	1.72E-06
	LEC	1.47E-11	1.64E-12	1.30E-15	1.73E-10	2.24E-10	2.98E-08	4.13E-14	1.49E-07	4.99E-08	1.48E-06	1.71E-06
	LWC	1.11E-11	1.24E-12	9.83E-16	1.31E-10	1.69E-10	2.98E-08	3.13E-14	1.49E-07	3.78E-08	1.48E-06	1.70E-06
	MC	2.19E-11	2.45E-12	1.94E-15	2.58E-10	3.34E-10	2.98E-08	6.16E-14	1.49E-07	7.45E-08	1.48E-06	1.74E-06
	TC	1.56E-11	1.74E-12	1.37E-15	1.83E-10	2.37E-10	2.98E-08	4.37E-14	1.49E-07	5.29E-08	1.48E-06	1.72E-06
	WC	3.05E-11	3.41E-12	2.70E-15	3.60E-10	4.65E-10	2.98E-08	8.59E-14	1.49E-07	1.04E-07	1.48E-06	1.77E-06

HQ	Receptor Location	Hazard Quotient (EDI/TDI)										Total HQ
		Soil Ingestion	Soil Dermal	Soil Inhalation	Air Inhalation	Surface Water Ingestion	Lab Tea Ingestion	Cattail Ingestion	Berries Ingestion	Fish Ingestion	Wild Game Ingestion	
APPLICATION	MPOI	1.21E-05	1.36E-06	1.07E-09	1.85E-04	1.82E-05	9.47E-04	9.47E-04	6.06E-06	4.06E-03	1.80E-05	6.19E-03
	AC	1.21E-05	1.36E-06	1.07E-09	2.10E-07	1.82E-05	9.47E-04	9.47E-04	5.97E-06	4.06E-03	1.79E-05	6.01E-03
	AR	1.21E-05	1.36E-06	1.07E-09	1.40E-06	1.82E-05	9.47E-04	9.47E-04	5.97E-06	4.06E-03	1.79E-05	6.01E-03
	BC	1.21E-05	1.36E-06	1.07E-09	2.34E-06	1.82E-05	9.47E-04	9.47E-04	5.97E-06	4.06E-03	1.79E-05	6.01E-03
	BL	1.21E-05	1.36E-06	1.07E-09	1.67E-06	1.82E-05	9.47E-04	9.47E-04	5.97E-06	4.06E-03	1.79E-05	6.01E-03
	DC	1.21E-05	1.36E-06	1.07E-09	1.20E-06	1.82E-05	9.47E-04	9.47E-04	5.97E-06	4.06E-03	1.79E-05	6.01E-03
	DSC	1.21E-05	1.36E-06	1.07E-09	1.80E-06	1.82E-05	9.47E-04	9.47E-04	5.97E-06	4.06E-03	1.79E-05	6.01E-03
	FC	1.21E-05	1.36E-06	1.07E-09	1.38E-06	1.82E-05	9.47E-04	9.47E-04	5.97E-06	4.06E-03	1.79E-05	6.01E-03
	FMK	1.21E-05	1.36E-06	1.07E-09	1.65E-06	1.82E-05	9.47E-04	9.47E-04	5.97E-06	4.06E-03	1.79E-05	6.01E-03
	FMM	1.21E-05	1.36E-06	1.07E-09	8.33E-06	1.82E-05	9.47E-04	9.47E-04	5.97E-06	4.06E-03	1.79E-05	6.02E-03
	FMT	1.21E-05	1.36E-06	1.07E-09	1.03E-06	1.82E-05	9.47E-04	9.47E-04	5.97E-06	4.06E-03	1.79E-05	6.01E-03
	FMT1	1.21E-05	1.36E-06	1.07E-09	7.88E-08	1.82E-05	9.47E-04	9.47E-04	5.97E-06	4.06E-03	1.79E-05	6.01E-03
	FMT2	1.21E-05	1.36E-06	1.07E-09	1.65E-06	1.82E-05	9.47E-04	9.47E-04	5.97E-06	4.06E-03	1.79E-05	6.01E-03
	GEC	1.21E-05	1.36E-06	1.07E-09	6.64E-06	1.82E-05	9.47E-04	9.47E-04	5.97E-06	4.06E-03	1.79E-05	6.02E-03
	GWC	1.21E-05	1.36E-06	1.07E-09	8.95E-06	1.82E-05	9.47E-04	9.47E-04	5.97E-06	4.06E-03	1.79E-05	6.02E-03
	KL	1.21E-05	1.36E-06	1.07E-09	2.03E-06	1.82E-05	9.47E-04	9.47E-04	5.97E-06	4.06E-03	1.79E-05	6.01E-03
	LEC	1.21E-05	1.36E-06	1.07E-09	8.26E-07	1.82E-05	9.47E-04	9.47E-04	5.97E-06	4.06E-03	1.79E-05	6.01E-03
	LWC	1.21E-05	1.36E-06	1.07E-09	1.62E-06	1.82E-05	9.47E-04	9.47E-04	5.97E-06	4.06E-03	1.79E-05	6.01E-03
	MC	1.21E-05	1.36E-06	1.07E-09	7.47E-07	1.82E-05	9.47E-04	9.47E-04	5.97E-06	4.06E-03	1.79E-05	6.01E-03
	TC	1.21E-05	1.36E-06	1.07E-09	2.38E-06	1.82E-05	9.47E-04	9.47E-04	5.97E-06	4.06E-03	1.79E-05	6.01E-03
	WC	1.21E-05	1.36E-06	1.07E-09	1.28E-06	1.82E-05	9.47E-04	9.47E-04	5.97E-06	4.06E-03	1.79E-05	6.01E-03
PDC	MPOI	9.24E-04	1.03E-04	8.16E-08	1.09E-02	1.41E-02	1.03E-03	9.50E-04	4.43E-04	3.15E+00	1.51E-03	3.18E+00
	AC	1.64E-05	1.84E-06	1.45E-09	5.11E-05	9.22E-05	9.47E-04	9.47E-04	1.37E-05	2.06E-02	2.52E-05	2.27E-02
	AR	2.13E-05	2.38E-06	1.88E-09	1.09E-04	1.67E-04	9.48E-04	9.47E-04	1.60E-05	3.72E-02	3.31E-05	3.95E-02
	BC	2.04E-05	2.28E-06	1.80E-09	1.00E-04	1.54E-04	9.48E-04	9.47E-04	1.56E-05	3.43E-02	3.17E-05	3.65E-02
	BL	2.20E-05	2.46E-06	1.94E-09	1.18E-04	1.78E-04	9.48E-04	9.47E-04	1.63E-05	3.98E-02	3.43E-05	4.21E-02
	DC	2.23E-05	2.49E-06	1.97E-09	1.21E-04	1.82E-04	9.48E-04	9.47E-04	1.64E-05	4.07E-02	3.47E-05	4.30E-02
	DSC	2.35E-05	2.63E-06	2.08E-09	1.36E-04	2.02E-04	9.48E-04	9.47E-04	1.70E-05	4.50E-02	3.68E-05	4.73E-02
	FC	2.31E-05	2.58E-06	2.04E-09	1.30E-04	1.95E-04	9.48E-04	9.47E-04	1.68E-05	4.35E-02	3.60E-05	4.58E-02
	FMK	2.04E-05	2.29E-06	1.81E-09	9.96E-05	1.54E-04	9.48E-04	9.47E-04	1.56E-05	3.44E-02	3.17E-05	3.66E-02
	FMM	2.54E-05	2.84E-06	2.24E-09	1.64E-04	2.30E-04	9.48E-04	9.47E-04	1.79E-05	5.14E-02	3.98E-05	5.37E-02
	FMT	2.81E-05	3.14E-06	2.48E-09	1.89E-04	2.72E-04	9.49E-04	9.47E-04	1.92E-05	6.08E-02	4.43E-05	6.33E-02
	FMT1	1.56E-05	1.74E-06	1.38E-09	4.08E-05	7.89E-05	9.47E-04	9.47E-04	1.33E-05	1.76E-02	2.37E-05	1.97E-02
	FMT2	2.07E-05	2.32E-06	1.83E-09	1.03E-04	1.58E-04	9.48E-04	9.47E-04	1.57E-05	3.54E-02	3.22E-05	3.76E-02
	GEC	2.59E-05	2.90E-06	2.29E-09	1.69E-04	2.39E-04	9.48E-04	9.47E-04	1.82E-05	5.33E-02	4.07E-05	5.57E-02
	GWC	2.58E-05	2.89E-06	2.28E-09	1.71E-04	2.37E-04	9.48E-04	9.47E-04	1.81E-05	5.30E-02	4.05E-05	5.54E-02
	KL	1.94E-05	2.17E-06	1.72E-09	8.82E-05	1.39E-04	9.48E-04	9.47E-04	1.51E-05	3.09E-02	3.01E-05	3.31E-02
	LEC	1.85E-05	2.07E-06	1.64E-09	7.61E-05	1.24E-04	9.48E-04	9.47E-04	1.47E-05	2.77E-02	2.85E-05	2.99E-02
	LWC	1.88E-05	2.10E-06	1.66E-09	8.05E-05	1.29E-04	9.48E-04	9.47E-04	1.48E-05	2.88E-02	2.91E-05	3.10E-02
	MC	1.99E-05	2.22E-06	1.76E-09	9.21E-05	1.45E-04	9.48E-04	9.47E-04	1.53E-05	3.24E-02	3.08E-05	3.46E-02
	TC	1.95E-05	2.18E-06	1.72E-09	8.96E-05	1.40E-04	9.48E-04	9.47E-04	1.51E-05	3.12E-02	3.02E-05	3.34E-02
	WC	2.15E-05	2.41E-06	1.90E-09	1.12E-04	1.71E-04	9.48E-04	9.47E-04	1.61E-05	3.82E-02	3.35E-05	4.04E-02

Table SIR3 22-8: Noncarcinogenic Risk Estimates for Chronic Fluorene Exposures

HQ	Receptor Location	Hazard Quotient (EDI/TDI)										Total HQ
		Soil Ingestion	Soil Dermal	Soil Inhalation	Air Inhalation	Surface Water Ingestion	Lab Tea Ingestion	Cattail Ingestion	Berries Ingestion	Fish Ingestion	Wild Game Ingestion	
BASELINE	MPOI	1.52E-05	1.69E-06	1.34E-09	6.79E-04	9.09E-06	9.47E-04	9.47E-04	2.06E-05	6.8E-04	2.44E-05	3.32E-03
	AC	1.52E-05	1.69E-06	1.34E-09	7.67E-07	9.09E-06	9.47E-04	9.47E-04	2.06E-05	6.8E-04	2.44E-05	2.64E-03
	AR	1.52E-05	1.69E-06	1.34E-09	5.12E-06	9.09E-06	9.47E-04	9.47E-04	2.06E-05	6.8E-04	2.44E-05	2.65E-03
	BC	1.52E-05	1.69E-06	1.34E-09	8.56E-06	9.09E-06	9.47E-04	9.47E-04	2.06E-05	6.8E-04	2.44E-05	2.65E-03
	BL	1.52E-05	1.69E-06	1.34E-09	6.11E-06	9.09E-06	9.47E-04	9.47E-04	2.06E-05	6.8E-04	2.44E-05	2.65E-03
	DC	1.52E-05	1.69E-06	1.34E-09	4.40E-06	9.09E-06	9.47E-04	9.47E-04	2.06E-05	6.8E-04	2.44E-05	2.65E-03
	DSC	1.52E-05	1.69E-06	1.34E-09	6.58E-06	9.09E-06	9.47E-04	9.47E-04	2.06E-05	6.8E-04	2.44E-05	2.65E-03
	FC	1.52E-05	1.69E-06	1.34E-09	5.07E-06	9.09E-06	9.47E-04	9.47E-04	2.06E-05	6.8E-04	2.44E-05	2.65E-03
	FMK	1.52E-05	1.69E-06	1.34E-09	6.06E-06	9.09E-06	9.47E-04	9.47E-04	2.06E-05	6.8E-04	2.44E-05	2.65E-03
	FMM	1.52E-05	1.69E-06	1.34E-09	3.06E-05	9.09E-06	9.47E-04	9.47E-04	2.06E-05	6.8E-04	2.44E-05	2.67E-03
	FMT	1.52E-05	1.69E-06	1.34E-09	3.79E-06	9.09E-06	9.47E-04	9.47E-04	2.06E-05	6.8E-04	2.44E-05	2.65E-03
	FMT1	1.52E-05	1.69E-06	1.34E-09	2.87E-07	9.09E-06	9.47E-04	9.47E-04	2.06E-05	6.8E-04	2.44E-05	2.64E-03
	FMT2	1.52E-05	1.69E-06	1.34E-09	6.03E-06	9.09E-06	9.47E-04	9.47E-04	2.06E-05	6.8E-04	2.44E-05	2.65E-03
	GEC	1.52E-05	1.69E-06	1.34E-09	2.43E-05	9.09E-06	9.47E-04	9.47E-04	2.06E-05	6.8E-04	2.44E-05	2.67E-03
	GWC	1.52E-05	1.69E-06	1.34E-09	3.28E-05	9.09E-06	9.47E-04	9.47E-04	2.06E-05	6.8E-04	2.44E-05	2.68E-03
	KL	1.52E-05	1.69E-06	1.34E-09	7.43E-06	9.09E-06	9.47E-04	9.47E-04	2.06E-05	6.8E-04	2.44E-05	2.65E-03
	LEC	1.52E-05	1.69E-06	1.34E-09	3.00E-06	9.09E-06	9.47E-04	9.47E-04	2.06E-05	6.8E-04	2.44E-05	2.65E-03
	LWC	1.52E-05	1.69E-06	1.34E-09	5.92E-06	9.09E-06	9.47E-04	9.47E-04	2.06E-05	6.8E-04	2.44E-05	2.65E-03
	MC	1.52E-05	1.69E-06	1.34E-09	2.73E-06	9.09E-06	9.47E-04	9.47E-04	2.06E-05	6.8E-04	2.44E-05	2.65E-03
	TC	1.52E-05	1.69E-06	1.34E-09	8.74E-06	9.09E-06	9.47E-04	9.47E-04	2.06E-05	6.8E-04	2.44E-05	2.65E-03
	WC	1.52E-05	1.69E-06	1.34E-09	4.69E-06	9.09E-06	9.47E-04	9.47E-04	2.06E-05	6.8E-04	2.44E-05	2.65E-03
PROJECT ALONE	MPOI	6.46E-12	7.22E-13	5.71E-16	5.64E-10	7.76E-10	1.76E-12	2.30E-14	8.78E-12	5.80E-08	2.71E-11	5.94E-08
	AC	8.53E-13	9.54E-14	7.54E-17	7.44E-11	1.02E-10	2.32E-13	3.03E-15	1.16E-12	7.66E-09	3.57E-12	7.84E-09
	AR	3.42E-12	3.83E-13	3.03E-16	2.99E-10	4.11E-10	9.31E-13	1.22E-14	4.66E-12	3.07E-08	1.43E-11	3.15E-08
	BC	2.75E-12	3.07E-13	2.43E-16	2.40E-10	3.30E-10	7.47E-13	9.76E-15	3.73E-12	2.47E-08	1.15E-11	2.52E-08
	BL	4.28E-12	4.79E-13	3.78E-16	3.73E-10	5.14E-10	1.16E-12	1.52E-14	5.82E-12	3.84E-08	1.79E-11	3.93E-08
	DC	3.02E-12	3.38E-13	2.67E-16	2.63E-10	3.63E-10	8.21E-13	1.07E-14	4.11E-12	2.71E-08	1.26E-11	2.78E-08
	DSC	3.91E-12	4.37E-13	3.45E-16	3.41E-10	4.70E-10	1.06E-12	1.39E-14	5.31E-12	3.51E-08	1.64E-11	3.59E-08
	FC	5.86E-12	6.56E-13	5.18E-16	5.12E-10	7.04E-10	1.59E-12	2.08E-14	7.97E-12	5.26E-08	2.46E-11	5.39E-08
	FMK	2.86E-12	3.20E-13	2.53E-16	2.49E-10	3.43E-10	7.77E-13	1.02E-14	3.89E-12	2.57E-08	1.20E-11	2.63E-08
	FMM	3.39E-12	3.79E-13	3.00E-16	2.96E-10	4.08E-10	9.22E-13	1.21E-14	4.61E-12	3.05E-08	1.42E-11	3.12E-08
	FMT	3.83E-12	4.28E-13	3.38E-16	3.34E-10	4.60E-10	1.04E-12	1.36E-14	5.20E-12	3.44E-08	1.60E-11	3.52E-08
	FMT1	5.32E-13	5.94E-14	4.70E-17	4.64E-11	6.38E-11	1.45E-13	1.89E-15	7.23E-13	4.77E-09	2.23E-12	4.88E-09
	FMT2	3.04E-12	3.40E-13	2.68E-16	2.65E-10	3.65E-10	8.26E-13	1.08E-14	4.13E-12	2.73E-08	1.27E-11	2.79E-08
	GEC	1.68E-11	1.88E-12	1.48E-15	1.47E-09	2.02E-09	4.57E-12	5.97E-14	2.28E-11	1.51E-07	7.03E-11	1.54E-07
	GWC	1.05E-11	1.17E-12	9.28E-16	9.16E-10	1.26E-09	2.85E-12	3.73E-14	1.43E-11	9.43E-08	4.40E-11	9.65E-08
	KL	1.94E-12	2.17E-13	1.71E-16	1.69E-10	2.33E-10	5.27E-13	6.89E-15	2.64E-12	1.74E-08	8.12E-12	1.78E-08
	LEC	1.86E-12	2.08E-13	1.64E-16	1.62E-10	2.23E-10	5.05E-13	6.60E-15	2.53E-12	1.67E-08	7.78E-12	1.71E-08
	LWC	1.39E-12	1.55E-13	1.23E-16	1.21E-10	1.67E-10	3.78E-13	4.94E-15	1.89E-12	1.25E-08	5.82E-12	1.28E-08
	MC	2.75E-12	3.07E-13	2.43E-16	2.40E-10	3.30E-10	7.47E-13	9.76E-15	3.73E-12	2.47E-08	1.15E-11	2.52E-08
	TC	1.97E-12	2.20E-13	1.74E-16	1.72E-10	2.37E-10	5.36E-13	7.00E-15	2.68E-12	1.77E-08	8.25E-12	1.81E-08
	WC	3.83E-12	4.28E-13	3.38E-16	3.34E-10	4.60E-10	1.04E-12	1.36E-14	5.20E-12	3.44E-08	1.60E-11	3.52E-08

HQ	Receptor Location	Hazard Quotient (EDI/TDI)										Total HQ
		Soil Ingestion	Soil Dermal	Soil Inhalation	Air Inhalation	Surface Water Ingestion	Lab Tea Ingestion	Cattail Ingestion	Berries Ingestion	Fish Ingestion	Wild Game Ingestion	
APPLICATION	MPOI	1.52E-05	1.69E-06	1.34E-09	6.79E-04	9.09E-06	9.47E-04	9.47E-04	2.06E-05	6.79E-04	2.44E-05	3.32E-03
	AC	1.52E-05	1.69E-06	1.34E-09	7.67E-07	9.09E-06	9.47E-04	9.47E-04	2.06E-05	6.79E-04	2.44E-05	2.64E-03
	AR	1.52E-05	1.69E-06	1.34E-09	5.12E-06	9.09E-06	9.47E-04	9.47E-04	2.06E-05	6.79E-04	2.44E-05	2.65E-03
	BC	1.52E-05	1.69E-06	1.34E-09	8.56E-06	9.09E-06	9.47E-04	9.47E-04	2.06E-05	6.79E-04	2.44E-05	2.65E-03
	BL	1.52E-05	1.69E-06	1.34E-09	6.11E-06	9.09E-06	9.47E-04	9.47E-04	2.06E-05	6.79E-04	2.44E-05	2.65E-03
	DC	1.52E-05	1.69E-06	1.34E-09	4.40E-06	9.09E-06	9.47E-04	9.47E-04	2.06E-05	6.79E-04	2.44E-05	2.65E-03
	DSC	1.52E-05	1.69E-06	1.34E-09	6.58E-06	9.09E-06	9.47E-04	9.47E-04	2.06E-05	6.79E-04	2.44E-05	2.65E-03
	FC	1.52E-05	1.69E-06	1.34E-09	5.07E-06	9.09E-06	9.47E-04	9.47E-04	2.06E-05	6.79E-04	2.44E-05	2.65E-03
	FMK	1.52E-05	1.69E-06	1.34E-09	6.06E-06	9.09E-06	9.47E-04	9.47E-04	2.06E-05	6.79E-04	2.44E-05	2.65E-03
	FMM	1.52E-05	1.69E-06	1.34E-09	3.06E-05	9.09E-06	9.47E-04	9.47E-04	2.06E-05	6.79E-04	2.44E-05	2.67E-03
	FMT	1.52E-05	1.69E-06	1.34E-09	3.79E-06	9.09E-06	9.47E-04	9.47E-04	2.06E-05	6.79E-04	2.44E-05	2.65E-03
	FMT1	1.52E-05	1.69E-06	1.34E-09	2.87E-07	9.09E-06	9.47E-04	9.47E-04	2.06E-05	6.79E-04	2.44E-05	2.64E-03
	FMT2	1.52E-05	1.69E-06	1.34E-09	6.03E-06	9.09E-06	9.47E-04	9.47E-04	2.06E-05	6.79E-04	2.44E-05	2.65E-03
	GEC	1.52E-05	1.69E-06	1.34E-09	2.43E-05	9.09E-06	9.47E-04	9.47E-04	2.06E-05	6.79E-04	2.44E-05	2.67E-03
	GWC	1.52E-05	1.69E-06	1.34E-09	3.28E-05	9.09E-06	9.47E-04	9.47E-04	2.06E-05	6.79E-04	2.44E-05	2.68E-03
	KL	1.52E-05	1.69E-06	1.34E-09	7.43E-06	9.09E-06	9.47E-04	9.47E-04	2.06E-05	6.79E-04	2.44E-05	2.65E-03
	LEC	1.52E-05	1.69E-06	1.34E-09	3.00E-06	9.09E-06	9.47E-04	9.47E-04	2.06E-05	6.79E-04	2.44E-05	2.65E-03
	LWC	1.52E-05	1.69E-06	1.34E-09	5.92E-06	9.09E-06	9.47E-04	9.47E-04	2.06E-05	6.79E-04	2.44E-05	2.65E-03
	MC	1.52E-05	1.69E-06	1.34E-09	2.73E-06	9.09E-06	9.47E-04	9.47E-04	2.06E-05	6.79E-04	2.44E-05	2.65E-03
	TC	1.52E-05	1.69E-06	1.34E-09	8.74E-06	9.09E-06	9.47E-04	9.47E-04	2.06E-05	6.79E-04	2.44E-05	2.65E-03
	WC	1.52E-05	1.69E-06	1.34E-09	4.69E-06	9.09E-06	9.47E-04	9.47E-04	2.06E-05	6.79E-04	2.44E-05	2.65E-03
PDC	MPOI	1.88E-04	2.10E-05	1.66E-08	1.58E-02	2.11E-02	9.94E-04	9.48E-04	2.77E-04	1.58E+00	7.56E-04	1.62E+00
	AC	1.60E-05	1.79E-06	1.41E-09	7.44E-05	1.27E-04	9.47E-04	9.47E-04	4.23E-05	9.46E-03	2.83E-05	1.16E-02
	AR	1.69E-05	1.89E-06	1.50E-09	1.61E-04	2.42E-04	9.47E-04	9.47E-04	4.36E-05	1.81E-02	3.23E-05	2.05E-02
	BC	1.68E-05	1.88E-06	1.48E-09	1.51E-04	2.22E-04	9.47E-04	9.47E-04	4.34E-05	1.66E-02	3.16E-05	1.89E-02
	BL	1.71E-05	1.91E-06	1.51E-09	1.75E-04	2.60E-04	9.47E-04	9.47E-04	4.38E-05	1.94E-02	3.29E-05	2.19E-02
	DC	1.72E-05	1.92E-06	1.52E-09	1.79E-04	2.68E-04	9.48E-04	9.47E-04	4.39E-05	2.00E-02	3.32E-05	2.25E-02
	DSC	1.74E-05	1.95E-06	1.54E-09	2.04E-04	2.99E-04	9.48E-04	9.47E-04	4.43E-05	2.23E-02	3.43E-05	2.48E-02
	FC	1.73E-05	1.94E-06	1.53E-09	1.93E-04	2.87E-04	9.48E-04	9.47E-04	4.41E-05	2.14E-02	3.38E-05	2.39E-02
	FMK	1.68E-05	1.88E-06	1.48E-09	1.49E-04	2.24E-04	9.47E-04	9.47E-04	4.34E-05	1.67E-02	3.16E-05	1.91E-02
	FMM	1.79E-05	2.00E-06	1.58E-09	2.71E-04	3.60E-04	9.48E-04	9.47E-04	4.50E-05	2.69E-02	3.64E-05	2.95E-02
	FMT	1.83E-05	2.04E-06	1.61E-09	2.77E-04	4.05E-04	9.48E-04	9.47E-04	4.54E-05	3.02E-02	3.79E-05	3.29E-02
	FMT1	1.58E-05	1.77E-06	1.40E-09	5.92E-05	1.06E-04	9.47E-04	9.47E-04	4.21E-05	7.92E-03	2.76E-05	1.01E-02
	FMT2	1.68E-05	1.88E-06	1.49E-09	1.54E-04	2.30E-04	9.47E-04	9.47E-04	4.35E-05	1.72E-02	3.19E-05	1.95E-02
	GEC	1.79E-05	2.01E-06	1.59E-09	2.68E-04	3.64E-04	9.48E-04	9.47E-04	4.50E-05	2.72E-02	3.65E-05	2.98E-02
	GWC	1.80E-05	2.01E-06	1.59E-09	2.77E-04	3.65E-04	9.48E-04	9.47E-04	4.50E-05	2.73E-02	3.66E-05	2.99E-02
	KL	1.66E-05	1.85E-06	1.46E-09	1.32E-04	1.98E-04	9.47E-04	9.47E-04	4.31E-05	1.48E-02	3.07E-05	1.71E-02
	LEC	1.64E-05	1.83E-06	1.45E-09	1.12E-04	1.76E-04	9.47E-04	9.47E-04	4.29E-05	1.31E-02	3.00E-05	1.54E-02
	LWC	1.65E-05	1.84E-06	1.45E-09	1.20E-04	1.83E-04	9.47E-04	9.47E-04	4.30E-05	1.37E-02	3.02E-05	1.59E-02
	MC	1.67E-05	1.86E-06	1.47E-09	1.36E-04	2.09E-04	9.47E-04	9.47E-04	4.33E-05	1.56E-02	3.11E-05	1.80E-02
	TC	1.66E-05	1.86E-06	1.47E-09	1.35E-04	2.00E-04	9.47E-04	9.47E-04	4.32E-05	1.49E-02	3.08E-05	1.73E-02
	WC	1.70E-05	1.90E-06	1.50E-09	1.66E-04	2.49E-04	9.47E-04	9.47E-04	4.37E-05	1.86E-02	3.25E-05	2.10E-02

Table SIR3 22-9: Noncarcinogenic Risk Estimates for Chronic Phenanthrene Exposures

HQ	Receptor Location	Hazard Quotient (EDI/TDI)										Total HQ
		Soil Ingestion	Soil Dermal	Soil Inhalation	Air Inhalation	Surface Water Ingestion	Lab Tea Ingestion	Cattail Ingestion	Berries Ingestion	Fish Ingestion	Wild Game Ingestion	
BASELINE	MPOI	8.54E-05	1.32E-05	9.50E-07	9.50E-01	2.56E-05	5.34E-03	5.34E-03	7.91E-05	2.4E-03	1.30E-04	9.64E-01
	AC	8.54E-05	1.32E-05	9.50E-07	1.08E-03	2.56E-05	5.34E-03	5.34E-03	7.84E-05	2.4E-03	1.29E-04	1.44E-02
	AR	8.54E-05	1.32E-05	9.50E-07	7.20E-03	2.56E-05	5.34E-03	5.34E-03	7.84E-05	2.4E-03	1.29E-04	2.06E-02
	BC	8.54E-05	1.32E-05	9.50E-07	1.20E-02	2.56E-05	5.34E-03	5.34E-03	7.84E-05	2.4E-03	1.29E-04	2.54E-02
	BL	8.54E-05	1.32E-05	9.50E-07	8.57E-03	2.56E-05	5.34E-03	5.34E-03	7.84E-05	2.4E-03	1.29E-04	2.19E-02
	DC	8.54E-05	1.32E-05	9.50E-07	6.17E-03	2.56E-05	5.34E-03	5.34E-03	7.84E-05	2.4E-03	1.29E-04	1.95E-02
	DSC	8.54E-05	1.32E-05	9.50E-07	9.22E-03	2.56E-05	5.34E-03	5.34E-03	7.84E-05	2.4E-03	1.29E-04	2.26E-02
	FC	8.54E-05	1.32E-05	9.50E-07	7.10E-03	2.56E-05	5.34E-03	5.34E-03	7.84E-05	2.4E-03	1.29E-04	2.05E-02
	FMK	8.54E-05	1.32E-05	9.50E-07	8.51E-03	2.56E-05	5.34E-03	5.34E-03	7.84E-05	2.4E-03	1.29E-04	2.19E-02
	FMM	8.54E-05	1.32E-05	9.50E-07	4.28E-02	2.56E-05	5.34E-03	5.34E-03	7.84E-05	2.4E-03	1.29E-04	5.61E-02
	FMT	8.54E-05	1.32E-05	9.50E-07	5.31E-03	2.56E-05	5.34E-03	5.34E-03	7.84E-05	2.4E-03	1.29E-04	1.87E-02
	FMT1	8.54E-05	1.32E-05	9.50E-07	4.04E-04	2.56E-05	5.34E-03	5.34E-03	7.84E-05	2.4E-03	1.29E-04	1.38E-02
	FMT2	8.54E-05	1.32E-05	9.50E-07	8.47E-03	2.56E-05	5.34E-03	5.34E-03	7.84E-05	2.4E-03	1.29E-04	2.18E-02
	GEC	8.54E-05	1.32E-05	9.50E-07	3.41E-02	2.56E-05	5.34E-03	5.34E-03	7.84E-05	2.4E-03	1.29E-04	4.74E-02
	GWC	8.54E-05	1.32E-05	9.50E-07	4.59E-02	2.56E-05	5.34E-03	5.34E-03	7.84E-05	2.4E-03	1.29E-04	5.93E-02
	KL	8.54E-05	1.32E-05	9.50E-07	1.04E-02	2.56E-05	5.34E-03	5.34E-03	7.84E-05	2.4E-03	1.29E-04	2.38E-02
	LEC	8.54E-05	1.32E-05	9.50E-07	4.24E-03	2.56E-05	5.34E-03	5.34E-03	7.84E-05	2.4E-03	1.29E-04	1.76E-02
	LWC	8.54E-05	1.32E-05	9.50E-07	8.34E-03	2.56E-05	5.34E-03	5.34E-03	7.84E-05	2.4E-03	1.29E-04	2.17E-02
	MC	8.54E-05	1.32E-05	9.50E-07	3.84E-03	2.56E-05	5.34E-03	5.34E-03	7.84E-05	2.4E-03	1.29E-04	1.72E-02
	TC	8.54E-05	1.32E-05	9.50E-07	1.23E-02	2.56E-05	5.34E-03	5.34E-03	7.84E-05	2.4E-03	1.29E-04	2.56E-02
	WC	8.54E-05	1.32E-05	9.50E-07	6.59E-03	2.56E-05	5.34E-03	5.34E-03	7.84E-05	2.4E-03	1.29E-04	2.00E-02
PROJECT ALONE	MPOI	6.40E-10	9.91E-11	7.12E-12	2.10E-06	2.81E-08	1.52E-07	2.20E-12	7.60E-07	2.59E-06	6.52E-06	1.21E-05
	AC	9.78E-11	1.51E-11	1.09E-12	3.21E-07	4.29E-09	1.52E-07	3.36E-13	7.59E-07	3.95E-07	6.51E-06	8.15E-06
	AR	3.92E-10	6.08E-11	4.37E-12	1.29E-06	1.72E-08	1.52E-07	1.35E-12	7.59E-07	1.59E-06	6.52E-06	1.03E-05
	BC	3.14E-10	4.86E-11	3.49E-12	1.03E-06	1.38E-08	1.52E-07	1.08E-12	7.59E-07	1.27E-06	6.52E-06	9.74E-06
	BL	4.90E-10	7.59E-11	5.45E-12	1.61E-06	2.15E-08	1.52E-07	1.68E-12	7.59E-07	1.98E-06	6.52E-06	1.10E-05
	DC	3.48E-10	5.39E-11	3.87E-12	1.14E-06	1.53E-08	1.52E-07	1.19E-12	7.59E-07	1.41E-06	6.52E-06	9.99E-06
	DSC	4.46E-10	6.91E-11	4.97E-12	1.47E-06	1.96E-08	1.52E-07	1.53E-12	7.59E-07	1.80E-06	6.52E-06	1.07E-05
	FC	6.71E-10	1.04E-10	7.47E-12	2.20E-06	2.95E-08	1.52E-07	2.30E-12	7.60E-07	2.71E-06	6.52E-06	1.24E-05
	FMK	3.27E-10	5.06E-11	3.64E-12	1.07E-06	1.43E-08	1.52E-07	1.12E-12	7.59E-07	1.32E-06	6.52E-06	9.83E-06
	FMM	3.87E-10	5.99E-11	4.31E-12	1.27E-06	1.70E-08	1.52E-07	1.33E-12	7.59E-07	1.56E-06	6.52E-06	1.03E-05
	FMT	4.38E-10	6.78E-11	4.87E-12	1.44E-06	1.92E-08	1.52E-07	1.50E-12	7.59E-07	1.77E-06	6.52E-06	1.07E-05
	FMT1	6.10E-11	9.44E-12	6.79E-13	2.00E-07	2.68E-09	1.52E-07	2.09E-13	7.59E-07	2.47E-07	6.51E-06	7.87E-06
	FMT2	3.46E-10	5.36E-11	3.85E-12	1.14E-06	1.52E-08	1.52E-07	1.19E-12	7.59E-07	1.40E-06	6.52E-06	9.98E-06
	GEC	1.91E-09	2.96E-10	2.13E-11	6.27E-06	8.38E-08	1.52E-07	6.56E-12	7.61E-07	7.72E-06	6.52E-06	2.15E-05
	GWC	1.20E-09	1.86E-10	1.34E-11	3.95E-06	5.28E-08	1.52E-07	4.13E-12	7.60E-07	4.87E-06	6.52E-06	1.63E-05
	KL	2.19E-10	3.40E-11	2.44E-12	7.20E-07	9.63E-09	1.52E-07	7.53E-13	7.59E-07	8.87E-07	6.52E-06	9.04E-06
	LEC	2.12E-10	3.29E-11	2.36E-12	6.97E-07	9.32E-09	1.52E-07	7.29E-13	7.59E-07	8.59E-07	6.52E-06	8.99E-06
	LWC	1.60E-10	2.48E-11	1.78E-12	5.25E-07	7.02E-09	1.52E-07	5.49E-13	7.59E-07	6.47E-07	6.51E-06	8.60E-06
	MC	3.16E-10	4.89E-11	3.52E-12	1.04E-06	1.39E-08	1.52E-07	1.08E-12	7.59E-07	1.28E-06	6.52E-06	9.76E-06
	TC	2.22E-10	3.44E-11	2.48E-12	7.30E-07	9.76E-09	1.52E-07	7.63E-13	7.59E-07	8.99E-07	6.52E-06	9.07E-06
	WC	4.41E-10	6.83E-11	4.91E-12	1.45E-06	1.94E-08	1.52E-07	1.51E-12	7.59E-07	1.78E-06	6.52E-06	1.07E-05

HQ	Receptor Location	Hazard Quotient (EDI/TDI)										Total HQ
		Soil Ingestion	Soil Dermal	Soil Inhalation	Air Inhalation	Surface Water Ingestion	Lab Tea Ingestion	Cattail Ingestion	Berries Ingestion	Fish Ingestion	Wild Game Ingestion	
APPLICATION	MPOI	8.54E-05	1.32E-05	9.50E-07	9.50E-01	2.56E-05	5.34E-03	5.34E-03	7.99E-05	2.36E-03	1.36E-04	9.64E-01
	AC	8.54E-05	1.32E-05	9.50E-07	1.08E-03	2.56E-05	5.34E-03	5.34E-03	7.91E-05	2.36E-03	1.36E-04	1.45E-02
	AR	8.54E-05	1.32E-05	9.50E-07	7.20E-03	2.56E-05	5.34E-03	5.34E-03	7.91E-05	2.36E-03	1.36E-04	2.06E-02
	BC	8.54E-05	1.32E-05	9.50E-07	1.20E-02	2.56E-05	5.34E-03	5.34E-03	7.92E-05	2.36E-03	1.36E-04	2.54E-02
	BL	8.54E-05	1.32E-05	9.50E-07	8.57E-03	2.56E-05	5.34E-03	5.34E-03	7.92E-05	2.36E-03	1.36E-04	2.19E-02
	DC	8.54E-05	1.32E-05	9.50E-07	6.17E-03	2.56E-05	5.34E-03	5.34E-03	7.91E-05	2.36E-03	1.36E-04	1.95E-02
	DSC	8.54E-05	1.32E-05	9.50E-07	9.22E-03	2.56E-05	5.34E-03	5.34E-03	7.92E-05	2.36E-03	1.36E-04	2.26E-02
	FC	8.54E-05	1.32E-05	9.50E-07	7.11E-03	2.56E-05	5.34E-03	5.34E-03	7.91E-05	2.36E-03	1.36E-04	2.05E-02
	FMK	8.54E-05	1.32E-05	9.50E-07	8.51E-03	2.56E-05	5.34E-03	5.34E-03	7.92E-05	2.36E-03	1.36E-04	2.19E-02
	FMM	8.54E-05	1.32E-05	9.50E-07	4.28E-02	2.56E-05	5.34E-03	5.34E-03	7.92E-05	2.36E-03	1.36E-04	5.61E-02
	FMT	8.54E-05	1.32E-05	9.50E-07	5.31E-03	2.56E-05	5.34E-03	5.34E-03	7.91E-05	2.36E-03	1.36E-04	1.87E-02
	FMT1	8.54E-05	1.32E-05	9.50E-07	4.04E-04	2.56E-05	5.34E-03	5.34E-03	7.91E-05	2.36E-03	1.36E-04	1.38E-02
	FMT2	8.54E-05	1.32E-05	9.50E-07	8.47E-03	2.56E-05	5.34E-03	5.34E-03	7.92E-05	2.36E-03	1.36E-04	2.18E-02
	GEC	8.54E-05	1.32E-05	9.50E-07	3.41E-02	2.57E-05	5.34E-03	5.34E-03	7.92E-05	2.37E-03	1.36E-04	4.75E-02
	GWC	8.54E-05	1.32E-05	9.50E-07	4.59E-02	2.57E-05	5.34E-03	5.34E-03	7.92E-05	2.36E-03	1.36E-04	5.93E-02
	KL	8.54E-05	1.32E-05	9.50E-07	1.04E-02	2.56E-05	5.34E-03	5.34E-03	7.92E-05	2.36E-03	1.36E-04	2.38E-02
	LEC	8.54E-05	1.32E-05	9.50E-07	4.24E-03	2.56E-05	5.34E-03	5.34E-03	7.91E-05	2.36E-03	1.36E-04	1.76E-02
	LWC	8.54E-05	1.32E-05	9.50E-07	8.34E-03	2.56E-05	5.34E-03	5.34E-03	7.91E-05	2.36E-03	1.36E-04	2.17E-02
	MC	8.54E-05	1.32E-05	9.50E-07	3.84E-03	2.56E-05	5.34E-03	5.34E-03	7.91E-05	2.36E-03	1.36E-04	1.72E-02
	TC	8.54E-05	1.32E-05	9.50E-07	1.23E-02	2.56E-05	5.34E-03	5.34E-03	7.92E-05	2.36E-03	1.36E-04	2.56E-02
	WC	8.54E-05	1.32E-05	9.50E-07	6.59E-03	2.56E-05	5.34E-03	5.34E-03	7.91E-05	2.36E-03	1.36E-04	2.00E-02
PDC	MPOI	3.59E-04	5.55E-05	3.99E-06	1.85E+00	1.23E-02	5.39E-03	5.34E-03	4.07E-04	1.13E+00	8.33E-04	3.00E+00
	AC	8.55E-05	1.32E-05	9.51E-07	1.52E-03	1.15E-04	5.34E-03	5.34E-03	1.57E-04	1.06E-02	1.38E-04	2.33E-02
	AR	8.61E-05	1.33E-05	9.58E-07	9.66E-03	1.42E-04	5.34E-03	5.34E-03	1.57E-04	1.31E-02	1.40E-04	3.40E-02
	BC	8.63E-05	1.34E-05	9.61E-07	1.52E-02	1.51E-04	5.34E-03	5.34E-03	1.58E-04	1.39E-02	1.40E-04	4.03E-02
	BL	8.63E-05	1.34E-05	9.60E-07	1.16E-02	1.50E-04	5.34E-03	5.34E-03	1.58E-04	1.38E-02	1.40E-04	3.66E-02
	DC	8.69E-05	1.35E-05	9.67E-07	1.12E-02	1.77E-04	5.34E-03	5.34E-03	1.58E-04	1.63E-02	1.42E-04	3.87E-02
	DSC	8.77E-05	1.36E-05	9.76E-07	1.70E-02	2.14E-04	5.34E-03	5.34E-03	1.59E-04	1.98E-02	1.44E-04	4.81E-02
	FC	8.70E-05	1.35E-05	9.69E-07	1.26E-02	1.83E-04	5.34E-03	5.34E-03	1.58E-04	1.69E-02	1.42E-04	4.07E-02
	FMK	8.66E-05	1.34E-05	9.64E-07	1.26E-02	1.65E-04	5.34E-03	5.34E-03	1.58E-04	1.52E-02	1.41E-04	3.91E-02
	FMM	9.74E-05	1.51E-05	1.08E-06	8.24E-02	6.46E-04	5.34E-03	5.34E-03	1.68E-04	5.95E-02	1.69E-04	1.54E-01
	FMT	8.68E-05	1.34E-05	9.66E-07	1.01E-02	1.74E-04	5.34E-03	5.34E-03	1.58E-04	1.60E-02	1.42E-04	3.74E-02
	FMT1	8.54E-05	1.32E-05	9.51E-07	6.89E-04	1.13E-04	5.34E-03	5.34E-03	1.57E-04	1.04E-02	1.38E-04	2.22E-02
	FMT2	8.64E-05	1.34E-05	9.62E-07	1.20E-02	1.56E-04	5.34E-03	5.34E-03	1.58E-04	1.44E-02	1.41E-04	3.76E-02
	GEC	9.50E-05	1.47E-05	1.06E-06	6.57E-02	5.38E-04	5.34E-03	5.34E-03	1.66E-04	4.96E-02	1.62E-04	1.27E-01
	GWC	9.83E-05	1.52E-05	1.09E-06	8.86E-02	6.87E-04	5.34E-03	5.34E-03	1.69E-04	6.33E-02	1.71E-04	1.64E-01
	KL	8.58E-05	1.33E-05	9.55E-07	1.19E-02	1.28E-04	5.34E-03	5.34E-03	1.57E-04	1.18E-02	1.39E-04	3.49E-02
	LEC	8.56E-05	1.33E-05	9.53E-07	5.17E-03	1.21E-04	5.34E-03	5.34E-03	1.57E-04	1.12E-02	1.39E-04	2.75E-02
	LWC	8.57E-05	1.33E-05	9.53E-07	9.37E-03	1.23E-04	5.34E-03	5.34E-03	1.57E-04	1.13E-02	1.39E-04	3.19E-02
	MC	8.60E-05	1.33E-05	9.57E-07	6.03E-03	1.38E-04	5.34E-03	5.34E-03	1.57E-04	1.27E-02	1.40E-04	3.00E-02
	TC	8.58E-05	1.33E-05	9.55E-07	1.37E-02	1.28E-04	5.34E-03	5.34E-03	1.57E-04	1.18E-02	1.39E-04	3.67E-02
	WC	8.62E-05	1.33E-05	9.59E-07	9.28E-03	1.45E-04	5.34E-03	5.34E-03	1.58E-04	1.34E-02	1.40E-04	3.39E-02

The predicted annual average air concentration of phenanthrene at the MPOI is 0.18 µg/m^3. The inhalation hazard quotient for phenanthrene is based on an Initial Threshold Screening Level from the Michigan Department of Environmental Quality of 0.1 µg/m^3, for which limited supporting documentation is available. Health Canada characterizes the toxicity of phenanthrene by comparing it to the carcinogenic potential of benzo(a)pyrene. It does so by assigning a toxic equivalency factor of 0.001 to phenanthrene when compared to benzo(a)pyrene's risk-specific concentration of 0.32 µg/m^3 (based on a 1 in 100,000 risk level) (Health Canada 2009). As such, Health Canada's inhalation exposure limit for phenanthrene is 320 µg/m^3 (i.e., 0.32 divided by 0.001), which is more than 1,700-fold greater than the predicted air concentration at the MPOI for the PDC (i.e., 320 µg/m^3 vs. 0.18 µg/m^3). This suggests that the inhalation risks to phenanthrene are most likely considerably less than those presented in Table SIR3 22-9.

For the reasons stated, health effects related to the inhalation of phenanthrene or other routes of exposure of phenanthrene are not expected.

The chronic multi-media health risks for aluminum are presented as hazard quotients in Table SIR3 21-3. For the Baseline Case, Project Alone and Application Case, the total HQ values are all below 1.0. The total HQ values for the PDC are 2.9 for all receptor locations. The ingestion of fish is the only exposure pathway that resulted in an HQ greater than 1.0 and therefore, contributed the most to the overall risk (HQ=2.7 for fish ingestion out of total HQ=2.9). The reason for the higher HQ value in PDC compared to the Baseline Case is mainly due to the multimedia modelling which overestimates the amount of metals being bioavailable in soil and surface water. Aluminum bioavailability is strongly related to pH in both soil and water. In the case of the Project, average surface water pH was observed to be 8.0. The US EPA OSW considers aluminum to be essentially insoluble at pH above 5.5 and, therefore, not bioavailable (US EPA 2003b). Also, studies have shown that fish exposed to inorganic aluminum accumulate most of the metal on the epithelial cells of the gill; however, there is little accumulation of aluminum in the blood, muscle tissue or internal organs (Spry & Wiener 1991). However, the modelling of metal uptake in fish did not account for this kind of organ specific accumulation. It can then be assumed that human exposure through fish ingestion would be less than what is expected through modelling. In addition, a report from NEHF (1998) states that "Aluminum is among the least mobile of the major elements in the geological sedimentary cycle. Environmental exposure is not simply a question of release and toxic concentrations, but also of bioavailability".

Since the HQs for the Baseline and Application Case are less than 1.0 for all of the receptor locations and because modelling resulted in an overestimation of the exposure of aluminum through fish ingestion, it is unlikely that adverse health effects would occur for people exposed to the emissions of aluminum from the Project.

The chronic multi-media health risks for lead are presented as hazard quotients in Table SIR3 21-4. None of the hazard quotients exceed 1.0 at any of the receptor locations for the four assessment cases. As such, it is unlikely that chronic multi-media exposure to lead will result in adverse health effects.

The chronic multi-media health risks for manganese are presented as hazard quotients in Table SIR3 21-5. For the Baseline Case, all receptor locations have total HQ values above the criterion of 1. The total HQ value is 2.95 at all receptor locations except the MPOI with an HQ of 2.96. Labrador tea (HQ of 1.1) and fish ingestion (marginally with an HQ of 1.02) are the two pathways where the risks are exceeding the criterion of 1.

For the Project Alone case, all the receptor locations have a total HQ lower than 1.0. The total HQ values range from 5.52×10^{-7} at FMT1 to 5.00×10^{-5} at the MPOI.

The total HQ values for the PDC are 2.98 for all receptor locations except the MPOI at 3.00. Again, the ingestion of Labrador tea and fish are the only exposure pathways that exceed 1.0 and, therefore, contribute the most to the overall risk (1.02 for Labrador tea and 1.11 for fish out of 2.96.

When assessing the bio-transfer of metals to aquatic organisms, the multi-media model assumes that 100% of the COC is bio-available. However, for manganese there is evidence to the contrary. First, in freshwater, the forms in which manganese occur are mainly particulate or complexed forms decreasing the bioavailability of the metal to the fish (Seymoret 1994). Secondly, like aluminum, manganese accumulates mainly in fish gills with little accumulation of manganese in the rest of the body (Nussey *et al.* 2000). But again, modelling of metal uptake in fish does not account for this kind of organ specific accumulation. It can then be assumed that human exposure through fish ingestion would be less than what is expected through modelling.

It should be noted that the hazard quotients associated with the ingestion of Labrador tea only marginally exceeded 1.0 (i.e., 1.02). As such, no adverse manganese-related health effects are anticipated. Since the HQs for the Project alone are less than 1.0 for all of the receptor locations and because modelling resulted in an overestimation of the toxicity of manganese through fish ingestion, it is unlikely that adverse health effects would occur for people exposed to the emissions of manganese from the Project.

c. Explain how the heavier polycyclic aromatic hydrocarbons (PAHs) many with log K_{ow} greater than 3.5 and 5 and half lives from hours to days were not included as COPC in the multi-media assessment.

In the previous screening methodology used, the screening criteria were not based on Log K_{ow} values and half-lives alone, but also considered their respective emission rates. Consequently, some of the COPCs with Log K_{ow} values greater than 3.5 but with low emission rates were excluded.

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23. Volume 5, Supplemental Information Request #2, Response SIR 102a, Page AENV-138
Ivanhoe states *See response to SIR2 98a. When using the unit risk in the screening process, naphthalene is screened out of the COPC list*. Naphthalene was screened off using the methods described in SIR response 98; however, as arsenic contributed over 70% of the total toxicity potency, it is required that arsenic be added directly as a COPC and the carcinogens be re-screened.

a. Ensure naphthalene is included as a carcinogen in the chronic inhalation screening of the carcinogenic chemicals.

Please refer to SIR3 21b where a revised chronic inhalation screening table for carcinogens is presented and includes naphthalene as one the COPCs. The chronic multi-media health risks for naphthalene are presented as hazard quotients in Table SIR3 23-1 and incremental lifetime cancer risk (ILCR) in Table SIR3 23-2. None of the hazard quotients exceed 1.0 at any of the receptor locations for the four assessment cases. None of the ILCR exceeds 1.0×10^{-5} at any receptor location. As such, it is unlikely that chronic multi-media exposure to naphthalene will result in adverse health effects.

Table SIR3 23-1: Noncarcinogenic Risk Estimates for Chronic Naphthalene Exposures

HQ	Receptor Location	Hazard Quotient (EDI/TDI)										Total HQ
		Soil Ingestion	Soil Dermal	Soil Inhalation	Air Inhalation	Surface Water Ingestion	Lab Tea Ingestion	Cattail Ingestion	Berries Ingestion	Fish Ingestion	Wild Game Ingestion	
BASELINE	MPOI	9.09E-06	1.02E-06	9.50E-09	1.04E-01	6.36E-05	1.89E-03	1.89E-03	4.10E-05	7.0E-04	2.88E-05	1.08E-01
	AC	9.09E-06	1.02E-06	9.50E-09	1.86E-04	6.36E-05	1.89E-03	1.89E-03	4.08E-05	7.0E-04	2.87E-05	4.82E-03
	AR	9.09E-06	1.02E-06	9.50E-09	6.18E-03	6.36E-05	1.89E-03	1.89E-03	4.08E-05	7.0E-04	2.88E-05	1.08E-02
	BC	9.09E-06	1.02E-06	9.50E-09	2.42E-03	6.36E-05	1.89E-03	1.89E-03	4.08E-05	7.0E-04	2.88E-05	7.05E-03
	BL	9.09E-06	1.02E-06	9.50E-09	2.09E-02	6.36E-05	1.89E-03	1.89E-03	4.09E-05	7.0E-04	2.88E-05	2.55E-02
	DC	9.09E-06	1.02E-06	9.50E-09	1.46E-03	6.36E-05	1.89E-03	1.89E-03	4.08E-05	7.0E-04	2.88E-05	6.09E-03
	DSC	9.09E-06	1.02E-06	9.50E-09	1.63E-03	6.36E-05	1.89E-03	1.89E-03	4.08E-05	7.0E-04	2.88E-05	6.26E-03
	FC	9.09E-06	1.02E-06	9.50E-09	1.83E-03	6.36E-05	1.89E-03	1.89E-03	4.08E-05	7.0E-04	2.88E-05	6.46E-03
	FMK	9.09E-06	1.02E-06	9.50E-09	2.26E-03	6.36E-05	1.89E-03	1.89E-03	4.08E-05	7.0E-04	2.88E-05	6.88E-03
	FMM	9.09E-06	1.02E-06	9.50E-09	5.02E-03	6.36E-05	1.89E-03	1.89E-03	4.08E-05	7.0E-04	2.88E-05	9.65E-03
	FMT	9.09E-06	1.02E-06	9.50E-09	6.45E-04	6.36E-05	1.89E-03	1.89E-03	4.08E-05	7.0E-04	2.88E-05	5.27E-03
	FMT1	9.09E-06	1.02E-06	9.50E-09	7.68E-05	6.36E-05	1.89E-03	1.89E-03	4.08E-05	7.0E-04	2.87E-05	4.71E-03
	FMT2	9.09E-06	1.02E-06	9.50E-09	3.06E-03	6.36E-05	1.89E-03	1.89E-03	4.08E-05	7.0E-04	2.88E-05	7.69E-03
	GEC	9.09E-06	1.02E-06	9.50E-09	3.93E-03	6.36E-05	1.89E-03	1.89E-03	4.08E-05	7.0E-04	2.88E-05	8.56E-03
	GWC	9.09E-06	1.02E-06	9.50E-09	5.27E-03	6.36E-05	1.89E-03	1.89E-03	4.08E-05	7.0E-04	2.88E-05	9.90E-03
	KL	9.09E-06	1.02E-06	9.50E-09	1.60E-03	6.36E-05	1.89E-03	1.89E-03	4.08E-05	7.0E-04	2.88E-05	6.23E-03
	LEC	9.09E-06	1.02E-06	9.50E-09	7.02E-04	6.36E-05	1.89E-03	1.89E-03	4.08E-05	7.0E-04	2.88E-05	5.33E-03
	LWC	9.09E-06	1.02E-06	9.50E-09	1.17E-03	6.36E-05	1.89E-03	1.89E-03	4.08E-05	7.0E-04	2.88E-05	5.80E-03
	MC	9.09E-06	1.02E-06	9.50E-09	1.01E-03	6.36E-05	1.89E-03	1.89E-03	4.08E-05	7.0E-04	2.88E-05	5.64E-03
	TC	9.09E-06	1.02E-06	9.50E-09	1.84E-03	6.36E-05	1.89E-03	1.89E-03	4.08E-05	7.0E-04	2.88E-05	6.47E-03
	WC	9.09E-06	1.02E-06	9.50E-09	4.68E-03	6.36E-05	1.89E-03	1.89E-03	4.08E-05	7.0E-04	2.88E-05	9.31E-03
PROJECT ALONE	MPOI	7.79E-10	8.71E-11	8.14E-13	2.50E-06	8.52E-08	6.99E-10	3.93E-10	3.50E-09	9.35E-07	3.34E-09	3.53E-06
	AC	1.21E-10	1.36E-11	1.27E-13	3.89E-07	1.33E-08	1.09E-10	6.12E-11	5.45E-10	1.46E-07	5.20E-10	5.50E-07
	AR	4.85E-10	5.42E-11	5.07E-13	1.56E-06	5.31E-08	4.36E-10	2.45E-10	2.18E-09	5.82E-07	2.08E-09	2.20E-06
	BC	4.01E-10	4.49E-11	4.19E-13	1.29E-06	4.39E-08	3.60E-10	2.02E-10	1.80E-09	4.82E-07	1.72E-09	1.82E-06
	BL	6.38E-10	7.13E-11	6.66E-13	2.05E-06	6.98E-08	5.73E-10	3.22E-10	2.86E-09	7.66E-07	2.73E-09	2.89E-06
	DC	6.51E-10	7.28E-11	6.80E-13	2.09E-06	7.12E-08	5.85E-10	3.28E-10	2.92E-09	7.82E-07	2.79E-09	2.95E-06
	DSC	5.46E-10	6.10E-11	5.70E-13	1.75E-06	5.97E-08	4.90E-10	2.75E-10	2.45E-09	6.55E-07	2.34E-09	2.47E-06
	FC	7.01E-10	7.83E-11	7.32E-13	2.25E-06	7.67E-08	6.29E-10	3.53E-10	3.15E-09	8.41E-07	3.00E-09	3.18E-06
	FMK	4.12E-10	4.61E-11	4.30E-13	1.32E-06	4.51E-08	3.70E-10	2.08E-10	1.85E-09	4.95E-07	1.76E-09	1.87E-06
	FMM	4.72E-10	5.28E-11	4.94E-13	1.52E-06	5.17E-08	4.24E-10	2.38E-10	2.12E-09	5.67E-07	2.02E-09	2.14E-06
	FMT	5.35E-10	5.99E-11	5.59E-13	1.72E-06	5.86E-08	4.81E-10	2.70E-10	2.40E-09	6.43E-07	2.29E-09	2.43E-06
	FMT1	7.46E-11	8.34E-12	7.79E-14	2.39E-07	8.16E-09	6.70E-11	3.76E-11	3.35E-10	8.96E-08	3.19E-10	3.38E-07
	FMT2	4.34E-10	4.85E-11	4.53E-13	1.39E-06	4.75E-08	3.90E-10	2.19E-10	1.95E-09	5.21E-07	1.86E-09	1.97E-06
	GEC	2.76E-09	3.08E-10	2.88E-12	8.85E-06	3.02E-07	2.48E-09	1.39E-09	1.24E-08	3.31E-06	1.18E-08	1.25E-05
	GWC	1.47E-09	1.65E-10	1.54E-12	4.73E-06	1.61E-07	1.32E-09	7.43E-10	6.61E-09	1.77E-06	6.31E-09	6.67E-06
	KL	2.66E-10	2.98E-11	2.78E-13	8.54E-07	2.91E-08	2.39E-10	1.34E-10	1.20E-09	3.20E-07	1.14E-09	1.21E-06
	LEC	2.51E-10	2.81E-11	2.63E-13	8.07E-07	2.75E-08	2.26E-10	1.27E-10	1.13E-09	3.02E-07	1.08E-09	1.14E-06
	LWC	2.07E-10	2.32E-11	2.16E-13	6.65E-07	2.27E-08	1.86E-10	1.04E-10	9.30E-10	2.49E-07	8.87E-10	9.39E-07
	MC	3.95E-10	4.42E-11	4.13E-13	1.27E-06	4.33E-08	3.55E-10	1.99E-10	1.78E-09	4.75E-07	1.69E-09	1.79E-06
	TC	2.69E-10	3.01E-11	2.82E-13	8.65E-07	2.95E-08	2.42E-10	1.36E-10	1.21E-09	3.24E-07	1.15E-09	1.22E-06
	WC	5.39E-10	6.02E-11	5.63E-13	1.73E-06	5.90E-08	4.84E-10	2.72E-10	2.42E-09	6.47E-07	2.31E-09	2.44E-06

HQ	Receptor Location	Hazard Quotient (EDI/TDI)										Total HQ
		Soil Ingestion	Soil Dermal	Soil Inhalation	Air Inhalation	Surface Water Ingestion	Lab Tea Ingestion	Cattail Ingestion	Berries Ingestion	Fish Ingestion	Wild Game Ingestion	
APPLICATION	MPOI	9.09E-06	1.02E-06	9.50E-09	1.04E-01	6.37E-05	1.89E-03	1.89E-03	4.11E-05	6.99E-04	2.88E-05	1.08E-01
	AC	9.09E-06	1.02E-06	9.50E-09	1.87E-04	6.36E-05	1.89E-03	1.89E-03	4.08E-05	6.98E-04	2.88E-05	4.82E-03
	AR	9.09E-06	1.02E-06	9.50E-09	6.18E-03	6.37E-05	1.89E-03	1.89E-03	4.08E-05	6.99E-04	2.88E-05	1.08E-02
	BC	9.09E-06	1.02E-06	9.50E-09	2.42E-03	6.37E-05	1.89E-03	1.89E-03	4.08E-05	6.99E-04	2.88E-05	7.05E-03
	BL	9.09E-06	1.02E-06	9.50E-09	2.09E-02	6.37E-05	1.89E-03	1.89E-03	4.09E-05	6.99E-04	2.88E-05	2.55E-02
	DC	9.09E-06	1.02E-06	9.50E-09	1.46E-03	6.37E-05	1.89E-03	1.89E-03	4.08E-05	6.99E-04	2.88E-05	6.09E-03
	DSC	9.09E-06	1.02E-06	9.50E-09	1.64E-03	6.37E-05	1.89E-03	1.89E-03	4.08E-05	6.99E-04	2.88E-05	6.27E-03
	FC	9.09E-06	1.02E-06	9.50E-09	1.83E-03	6.37E-05	1.89E-03	1.89E-03	4.08E-05	6.99E-04	2.88E-05	6.46E-03
	FMK	9.09E-06	1.02E-06	9.50E-09	2.26E-03	6.37E-05	1.89E-03	1.89E-03	4.08E-05	6.99E-04	2.88E-05	6.89E-03
	FMM	9.09E-06	1.02E-06	9.50E-09	5.02E-03	6.37E-05	1.89E-03	1.89E-03	4.08E-05	6.99E-04	2.88E-05	9.65E-03
	FMT	9.09E-06	1.02E-06	9.50E-09	6.47E-04	6.37E-05	1.89E-03	1.89E-03	4.08E-05	6.99E-04	2.88E-05	5.28E-03
	FMT1	9.09E-06	1.02E-06	9.50E-09	7.71E-05	6.36E-05	1.89E-03	1.89E-03	4.08E-05	6.98E-04	2.87E-05	4.71E-03
	FMT2	9.09E-06	1.02E-06	9.50E-09	3.06E-03	6.37E-05	1.89E-03	1.89E-03	4.08E-05	6.99E-04	2.88E-05	7.69E-03
	GEC	9.09E-06	1.02E-06	9.50E-09	3.93E-03	6.39E-05	1.89E-03	1.89E-03	4.08E-05	7.02E-04	2.88E-05	8.57E-03
	GWC	9.09E-06	1.02E-06	9.50E-09	5.27E-03	6.38E-05	1.89E-03	1.89E-03	4.08E-05	7.00E-04	2.88E-05	9.91E-03
	KL	9.09E-06	1.02E-06	9.50E-09	1.60E-03	6.37E-05	1.89E-03	1.89E-03	4.08E-05	6.99E-04	2.88E-05	6.23E-03
	LEC	9.09E-06	1.02E-06	9.50E-09	7.03E-04	6.37E-05	1.89E-03	1.89E-03	4.08E-05	6.99E-04	2.88E-05	5.33E-03
	LWC	9.09E-06	1.02E-06	9.50E-09	1.17E-03	6.37E-05	1.89E-03	1.89E-03	4.08E-05	6.98E-04	2.88E-05	5.80E-03
	MC	9.09E-06	1.02E-06	9.50E-09	1.01E-03	6.37E-05	1.89E-03	1.89E-03	4.08E-05	6.99E-04	2.88E-05	5.64E-03
	TC	9.09E-06	1.02E-06	9.50E-09	1.84E-03	6.37E-05	1.89E-03	1.89E-03	4.08E-05	6.99E-04	2.88E-05	6.47E-03
	WC	9.09E-06	1.02E-06	9.50E-09	4.68E-03	6.37E-05	1.89E-03	1.89E-03	4.08E-05	6.99E-04	2.88E-05	9.31E-03
PDC	MPOI	3.95E-05	4.42E-06	4.13E-08	2.01E-01	3.43E-03	1.92E-03	1.91E-03	2.19E-04	3.76E-02	1.60E-04	2.46E-01
	AC	9.11E-06	1.02E-06	9.52E-09	2.37E-04	7.39E-05	1.89E-03	1.89E-03	8.17E-05	8.10E-04	2.89E-05	5.03E-03
	AR	9.18E-06	1.03E-06	9.59E-09	6.45E-03	8.15E-05	1.89E-03	1.89E-03	8.20E-05	8.94E-04	2.92E-05	1.13E-02
	BC	9.20E-06	1.03E-06	9.62E-09	2.77E-03	8.43E-05	1.89E-03	1.89E-03	8.22E-05	9.25E-04	2.93E-05	7.69E-03
	BL	9.17E-06	1.02E-06	9.58E-09	2.11E-02	8.03E-05	1.89E-03	1.89E-03	8.20E-05	8.82E-04	2.92E-05	2.60E-02
	DC	9.23E-06	1.03E-06	9.64E-09	1.90E-03	8.72E-05	1.89E-03	1.89E-03	8.23E-05	9.57E-04	2.94E-05	6.85E-03
	DSC	9.36E-06	1.05E-06	9.78E-09	2.49E-03	1.02E-04	1.89E-03	1.89E-03	8.29E-05	1.11E-03	3.00E-05	7.62E-03
	FC	9.26E-06	1.04E-06	9.68E-09	2.39E-03	9.12E-05	1.89E-03	1.89E-03	8.24E-05	1.00E-03	2.96E-05	7.39E-03
	FMK	9.24E-06	1.03E-06	9.65E-09	2.72E-03	8.81E-05	1.89E-03	1.89E-03	8.23E-05	9.66E-04	2.95E-05	7.68E-03
	FMM	1.04E-05	1.17E-06	1.09E-08	9.33E-03	2.20E-04	1.90E-03	1.89E-03	8.77E-05	2.42E-03	3.46E-05	1.59E-02
	FMT	9.26E-06	1.03E-06	9.67E-09	1.18E-03	9.04E-05	1.89E-03	1.89E-03	8.24E-05	9.92E-04	2.96E-05	6.17E-03
	FMT1	9.10E-06	1.02E-06	9.51E-09	1.10E-04	7.33E-05	1.89E-03	1.89E-03	8.17E-05	8.04E-04	2.89E-05	4.90E-03
	FMT2	9.21E-06	1.03E-06	9.63E-09	3.46E-03	8.57E-05	1.89E-03	1.89E-03	8.22E-05	9.40E-04	2.94E-05	8.39E-03
	GEC	1.02E-05	1.14E-06	1.06E-08	7.35E-03	1.90E-04	1.89E-03	1.89E-03	8.65E-05	2.08E-03	3.34E-05	1.35E-02
	GWC	1.05E-05	1.18E-06	1.10E-08	9.92E-03	2.32E-04	1.90E-03	1.89E-03	8.82E-05	2.54E-03	3.51E-05	1.66E-02
	KL	9.14E-06	1.02E-06	9.55E-09	1.75E-03	7.73E-05	1.89E-03	1.89E-03	8.19E-05	8.48E-04	2.90E-05	6.59E-03
	LEC	9.12E-06	1.02E-06	9.54E-09	8.10E-04	7.58E-05	1.89E-03	1.89E-03	8.18E-05	8.32E-04	2.90E-05	5.63E-03
	LWC	9.13E-06	1.02E-06	9.54E-09	1.29E-03	7.63E-05	1.89E-03	1.89E-03	8.18E-05	8.37E-04	2.90E-05	6.12E-03
	MC	9.17E-06	1.03E-06	9.58E-09	1.26E-03	8.10E-05	1.89E-03	1.89E-03	8.20E-05	8.88E-04	2.92E-05	6.14E-03
	TC	9.14E-06	1.02E-06	9.55E-09	1.99E-03	7.73E-05	1.89E-03	1.89E-03	8.19E-05	8.48E-04	2.90E-05	6.83E-03
	WC	9.19E-06	1.03E-06	9.60E-09	4.99E-03	8.25E-05	1.89E-03	1.89E-03	8.21E-05	9.05E-04	2.93E-05	9.88E-03

Table SIR3 23-2: Incremental Lifetime Cancer Risk for Exposure to Naphthalene for the Adult Receptor

ILCR	Receptor Location	Incremental Lifetime Cancer Risk (ILCR) (EDI * CSF)										Total ILCR
		Soil Ingestion	Soil Dermal	Soil Inhalation	Air Inhalation	Surface Water Ingestion	Lab Tea Ingestion	Cattail Ingestion	Berries Ingestion	Fish Ingestion	Wild Game Ingestion	
BASELINE	MPOI	3.01E-12	3.35E-12	1.62E-19	1.77E-12	2.10E-10	7.52E-09	7.52E-09	2.50E-10	2.1E-09	1.21E-10	1.78E-08
	AC	3.01E-12	3.35E-12	1.62E-19	3.19E-15	2.10E-10	7.52E-09	7.52E-09	2.48E-10	2.1E-09	1.21E-10	1.78E-08
	AR	3.01E-12	3.35E-12	1.62E-19	1.06E-13	2.10E-10	7.52E-09	7.52E-09	2.49E-10	2.1E-09	1.21E-10	1.78E-08
	BC	3.01E-12	3.35E-12	1.62E-19	4.13E-14	2.10E-10	7.52E-09	7.52E-09	2.48E-10	2.1E-09	1.21E-10	1.78E-08
	BL	3.01E-12	3.35E-12	1.62E-19	3.57E-13	2.10E-10	7.52E-09	7.52E-09	2.49E-10	2.1E-09	1.21E-10	1.78E-08
	DC	3.01E-12	3.35E-12	1.62E-19	2.50E-14	2.10E-10	7.52E-09	7.52E-09	2.48E-10	2.1E-09	1.21E-10	1.78E-08
	DSC	3.01E-12	3.35E-12	1.62E-19	2.79E-14	2.10E-10	7.52E-09	7.52E-09	2.48E-10	2.1E-09	1.21E-10	1.78E-08
	FC	3.01E-12	3.35E-12	1.62E-19	3.13E-14	2.10E-10	7.52E-09	7.52E-09	2.48E-10	2.1E-09	1.21E-10	1.78E-08
	FMK	3.01E-12	3.35E-12	1.62E-19	3.86E-14	2.10E-10	7.52E-09	7.52E-09	2.48E-10	2.1E-09	1.21E-10	1.78E-08
	FMM	3.01E-12	3.35E-12	1.62E-19	8.58E-14	2.10E-10	7.52E-09	7.52E-09	2.48E-10	2.1E-09	1.21E-10	1.78E-08
	FMT	3.01E-12	3.35E-12	1.62E-19	1.10E-14	2.10E-10	7.52E-09	7.52E-09	2.48E-10	2.1E-09	1.21E-10	1.78E-08
	FMT1	3.01E-12	3.35E-12	1.62E-19	1.31E-15	2.10E-10	7.52E-09	7.52E-09	2.48E-10	2.1E-09	1.21E-10	1.78E-08
	FMT2	3.01E-12	3.35E-12	1.62E-19	5.24E-14	2.10E-10	7.52E-09	7.52E-09	2.48E-10	2.1E-09	1.21E-10	1.78E-08
	GEC	3.01E-12	3.35E-12	1.62E-19	6.71E-14	2.10E-10	7.52E-09	7.52E-09	2.48E-10	2.1E-09	1.21E-10	1.78E-08
	GWC	3.01E-12	3.35E-12	1.62E-19	9.01E-14	2.10E-10	7.52E-09	7.52E-09	2.48E-10	2.1E-09	1.21E-10	1.78E-08
	KL	3.01E-12	3.35E-12	1.62E-19	2.74E-14	2.10E-10	7.52E-09	7.52E-09	2.48E-10	2.1E-09	1.21E-10	1.78E-08
	LEC	3.01E-12	3.35E-12	1.62E-19	1.20E-14	2.10E-10	7.52E-09	7.52E-09	2.48E-10	2.1E-09	1.21E-10	1.78E-08
	LWC	3.01E-12	3.35E-12	1.62E-19	2.00E-14	2.10E-10	7.52E-09	7.52E-09	2.48E-10	2.1E-09	1.21E-10	1.78E-08
	MC	3.01E-12	3.35E-12	1.62E-19	1.72E-14	2.10E-10	7.52E-09	7.52E-09	2.48E-10	2.1E-09	1.21E-10	1.78E-08
	TC	3.01E-12	3.35E-12	1.62E-19	3.15E-14	2.10E-10	7.52E-09	7.52E-09	2.48E-10	2.1E-09	1.21E-10	1.78E-08
	WC	3.01E-12	3.35E-12	1.62E-19	8.01E-14	2.10E-10	7.52E-09	7.52E-09	2.48E-10	2.1E-09	1.21E-10	1.78E-08
PROJECT ALONE	MPOI	2.58E-16	2.87E-16	1.39E-23	4.27E-17	2.82E-13	2.78E-15	1.56E-15	2.13E-14	2.86E-12	1.40E-14	3.19E-12
	AC	4.01E-17	4.46E-17	2.17E-24	6.66E-18	4.39E-14	4.32E-16	2.43E-16	3.32E-15	4.46E-13	2.18E-15	4.96E-13
	AR	1.60E-16	1.78E-16	8.66E-24	2.66E-17	1.75E-13	1.73E-15	9.71E-16	1.33E-14	1.78E-12	8.73E-15	1.98E-12
	BC	1.33E-16	1.48E-16	7.17E-24	2.20E-17	1.45E-13	1.43E-15	8.03E-16	1.10E-14	1.48E-12	7.22E-15	1.64E-12
	BL	2.11E-16	2.35E-16	1.14E-23	3.50E-17	2.31E-13	2.27E-15	1.28E-15	1.74E-14	2.35E-12	1.15E-14	2.61E-12
	DC	2.15E-16	2.40E-16	1.16E-23	3.57E-17	2.36E-13	2.32E-15	1.30E-15	1.78E-14	2.39E-12	1.17E-14	2.66E-12
	DSC	1.80E-16	2.01E-16	9.75E-24	2.99E-17	1.97E-13	1.94E-15	1.09E-15	1.49E-14	2.01E-12	9.82E-15	2.23E-12
	FC	2.32E-16	2.58E-16	1.25E-23	3.85E-17	2.54E-13	2.50E-15	1.40E-15	1.91E-14	2.58E-12	1.26E-14	2.87E-12
	FMK	1.36E-16	1.52E-16	7.36E-24	2.26E-17	1.49E-13	1.47E-15	8.25E-16	1.13E-14	1.52E-12	7.41E-15	1.69E-12
	FMM	1.56E-16	1.74E-16	8.44E-24	2.59E-17	1.71E-13	1.68E-15	9.46E-16	1.29E-14	1.74E-12	8.50E-15	1.93E-12
	FMT	1.77E-16	1.97E-16	9.56E-24	2.94E-17	1.94E-13	1.91E-15	1.07E-15	1.46E-14	1.97E-12	9.63E-15	2.19E-12
	FMT1	2.47E-17	2.74E-17	1.33E-24	4.09E-18	2.70E-14	2.66E-16	1.49E-16	2.04E-15	2.74E-13	1.34E-15	3.05E-13
	FMT2	1.43E-16	1.60E-16	7.75E-24	2.38E-17	1.57E-13	1.55E-15	8.68E-16	1.19E-14	1.60E-12	7.81E-15	1.77E-12
	GEC	9.12E-16	1.01E-15	4.93E-23	1.51E-16	9.98E-13	9.83E-15	5.52E-15	7.54E-14	1.01E-11	4.96E-14	1.13E-11
	GWC	4.87E-16	5.42E-16	2.63E-23	8.08E-17	5.33E-13	5.25E-15	2.95E-15	4.02E-14	5.42E-12	2.65E-14	6.03E-12
	KL	8.80E-17	9.79E-17	4.75E-24	1.46E-17	9.63E-14	9.49E-16	5.33E-16	7.27E-15	9.79E-13	4.79E-15	1.09E-12
	LEC	8.31E-17	9.25E-17	4.49E-24	1.38E-17	9.10E-14	8.96E-16	5.03E-16	6.87E-15	9.25E-13	4.52E-15	1.03E-12
	LWC	6.85E-17	7.62E-17	3.70E-24	1.14E-17	7.50E-14	7.38E-16	4.15E-16	5.66E-15	7.62E-13	3.73E-15	8.48E-13
	MC	1.31E-16	1.45E-16	7.06E-24	2.17E-17	1.43E-13	1.41E-15	7.91E-16	1.08E-14	1.45E-12	7.11E-15	1.62E-12
	TC	8.91E-17	9.92E-17	4.81E-24	1.48E-17	9.75E-14	9.60E-16	5.39E-16	7.36E-15	9.91E-13	4.85E-15	1.10E-12
	WC	1.78E-16	1.98E-16	9.63E-24	2.96E-17	1.95E-13	1.92E-15	1.08E-15	1.47E-14	1.98E-12	9.70E-15	2.21E-12

ILCR	Receptor Location	Incremental Lifetime Cancer Risk (ILCR) (EDI * CSF)										Total ILCR
		Soil Ingestion	Soil Dermal	Soil Inhalation	Air Inhalation	Surface Water Ingestion	Lab Tea Ingestion	Cattail Ingestion	Berries Ingestion	Fish Ingestion	Wild Game Ingestion	
APPLICATION	MPOI	3.01E-12	3.35E-12	1.62E-19	1.77E-12	2.11E-10	7.52E-09	7.52E-09	2.50E-10	2.14E-09	1.21E-10	1.78E-08
	AC	3.01E-12	3.35E-12	1.62E-19	3.19E-15	2.10E-10	7.52E-09	7.52E-09	2.48E-10	2.14E-09	1.21E-10	1.78E-08
	AR	3.01E-12	3.35E-12	1.62E-19	1.06E-13	2.11E-10	7.52E-09	7.52E-09	2.49E-10	2.14E-09	1.21E-10	1.78E-08
	BC	3.01E-12	3.35E-12	1.62E-19	4.13E-14	2.11E-10	7.52E-09	7.52E-09	2.48E-10	2.14E-09	1.21E-10	1.78E-08
	BL	3.01E-12	3.35E-12	1.62E-19	3.57E-13	2.11E-10	7.52E-09	7.52E-09	2.49E-10	2.14E-09	1.21E-10	1.78E-08
	DC	3.01E-12	3.35E-12	1.62E-19	2.50E-14	2.11E-10	7.52E-09	7.52E-09	2.48E-10	2.14E-09	1.21E-10	1.78E-08
	DSC	3.01E-12	3.35E-12	1.62E-19	2.80E-14	2.11E-10	7.52E-09	7.52E-09	2.48E-10	2.14E-09	1.21E-10	1.78E-08
	FC	3.01E-12	3.35E-12	1.62E-19	3.13E-14	2.11E-10	7.52E-09	7.52E-09	2.48E-10	2.14E-09	1.21E-10	1.78E-08
	FMK	3.01E-12	3.35E-12	1.62E-19	3.86E-14	2.11E-10	7.52E-09	7.52E-09	2.48E-10	2.14E-09	1.21E-10	1.78E-08
	FMM	3.01E-12	3.35E-12	1.62E-19	8.59E-14	2.11E-10	7.52E-09	7.52E-09	2.48E-10	2.14E-09	1.21E-10	1.78E-08
	FMT	3.01E-12	3.35E-12	1.62E-19	1.11E-14	2.11E-10	7.52E-09	7.52E-09	2.48E-10	2.14E-09	1.21E-10	1.78E-08
	FMT1	3.01E-12	3.35E-12	1.62E-19	1.32E-15	2.10E-10	7.52E-09	7.52E-09	2.48E-10	2.14E-09	1.21E-10	1.78E-08
	FMT2	3.01E-12	3.35E-12	1.62E-19	5.24E-14	2.11E-10	7.52E-09	7.52E-09	2.48E-10	2.14E-09	1.21E-10	1.78E-08
	GEC	3.01E-12	3.35E-12	1.62E-19	6.73E-14	2.11E-10	7.52E-09	7.52E-09	2.49E-10	2.15E-09	1.21E-10	1.78E-08
	GWC	3.01E-12	3.35E-12	1.62E-19	9.02E-14	2.11E-10	7.52E-09	7.52E-09	2.49E-10	2.14E-09	1.21E-10	1.78E-08
	KL	3.01E-12	3.35E-12	1.62E-19	2.74E-14	2.11E-10	7.52E-09	7.52E-09	2.48E-10	2.14E-09	1.21E-10	1.78E-08
	LEC	3.01E-12	3.35E-12	1.62E-19	1.20E-14	2.11E-10	7.52E-09	7.52E-09	2.48E-10	2.14E-09	1.21E-10	1.78E-08
	LWC	3.01E-12	3.35E-12	1.62E-19	2.00E-14	2.11E-10	7.52E-09	7.52E-09	2.48E-10	2.14E-09	1.21E-10	1.78E-08
	MC	3.01E-12	3.35E-12	1.62E-19	1.72E-14	2.11E-10	7.52E-09	7.52E-09	2.48E-10	2.14E-09	1.21E-10	1.78E-08
	TC	3.01E-12	3.35E-12	1.62E-19	3.15E-14	2.11E-10	7.52E-09	7.52E-09	2.48E-10	2.14E-09	1.21E-10	1.78E-08
	WC	3.01E-12	3.35E-12	1.62E-19	8.01E-14	2.11E-10	7.52E-09	7.52E-09	2.48E-10	2.14E-09	1.21E-10	1.78E-08
PDC	MPOI	1.31E-11	1.45E-11	7.06E-19	3.44E-12	1.13E-08	7.62E-09	7.58E-09	1.33E-09	1.15E-07	6.70E-10	1.44E-07
	AC	3.01E-12	3.35E-12	1.63E-19	4.06E-15	2.44E-10	7.52E-09	7.52E-09	4.97E-10	2.48E-09	1.21E-10	1.84E-08
	AR	3.03E-12	3.38E-12	1.64E-19	1.10E-13	2.69E-10	7.52E-09	7.52E-09	4.99E-10	2.74E-09	1.23E-10	1.87E-08
	BC	3.04E-12	3.39E-12	1.64E-19	4.74E-14	2.79E-10	7.52E-09	7.52E-09	5.00E-10	2.83E-09	1.23E-10	1.88E-08
	BL	3.03E-12	3.37E-12	1.64E-19	3.61E-13	2.66E-10	7.52E-09	7.52E-09	4.99E-10	2.70E-09	1.23E-10	1.86E-08
	DC	3.05E-12	3.40E-12	1.65E-19	3.25E-14	2.88E-10	7.52E-09	7.52E-09	5.01E-10	2.93E-09	1.24E-10	1.89E-08
	DSC	3.09E-12	3.44E-12	1.67E-19	4.26E-14	3.36E-10	7.52E-09	7.52E-09	5.04E-10	3.42E-09	1.26E-10	1.94E-08
	FC	3.06E-12	3.41E-12	1.66E-19	4.08E-14	3.02E-10	7.52E-09	7.52E-09	5.02E-10	3.07E-09	1.24E-10	1.90E-08
	FMK	3.05E-12	3.40E-12	1.65E-19	4.65E-14	2.91E-10	7.52E-09	7.52E-09	5.01E-10	2.96E-09	1.24E-10	1.89E-08
	FMM	3.45E-12	3.84E-12	1.86E-19	1.60E-13	7.29E-10	7.52E-09	7.52E-09	5.34E-10	7.41E-09	1.45E-10	2.39E-08
	FMT	3.06E-12	3.41E-12	1.65E-19	2.01E-14	2.99E-10	7.52E-09	7.52E-09	5.01E-10	3.04E-09	1.24E-10	1.90E-08
	FMT1	3.01E-12	3.35E-12	1.63E-19	1.88E-15	2.42E-10	7.52E-09	7.52E-09	4.97E-10	2.46E-09	1.21E-10	1.84E-08
	FMT2	3.05E-12	3.39E-12	1.65E-19	5.91E-14	2.83E-10	7.52E-09	7.52E-09	5.00E-10	2.88E-09	1.23E-10	1.88E-08
	GEC	3.36E-12	3.74E-12	1.81E-19	1.26E-13	6.27E-10	7.52E-09	7.52E-09	5.26E-10	6.38E-09	1.40E-10	2.27E-08
	GWC	3.49E-12	3.88E-12	1.88E-19	1.70E-13	7.67E-10	7.52E-09	7.52E-09	5.37E-10	7.79E-09	1.47E-10	2.43E-08
	KL	3.02E-12	3.36E-12	1.63E-19	2.99E-14	2.56E-10	7.52E-09	7.52E-09	4.98E-10	2.60E-09	1.22E-10	1.85E-08
	LEC	3.02E-12	3.36E-12	1.63E-19	1.39E-14	2.51E-10	7.52E-09	7.52E-09	4.98E-10	2.55E-09	1.22E-10	1.85E-08
	LWC	3.02E-12	3.36E-12	1.63E-19	2.21E-14	2.52E-10	7.52E-09	7.52E-09	4.98E-10	2.56E-09	1.22E-10	1.85E-08
	MC	3.03E-12	3.38E-12	1.64E-19	2.16E-14	2.68E-10	7.52E-09	7.52E-09	4.99E-10	2.72E-09	1.23E-10	1.87E-08
	TC	3.02E-12	3.36E-12	1.63E-19	3.40E-14	2.56E-10	7.52E-09	7.52E-09	4.98E-10	2.60E-09	1.22E-10	1.85E-08
	WC	3.04E-12	3.38E-12	1.64E-19	8.52E-14	2.73E-10	7.52E-09	7.52E-09	4.99E-10	2.77E-09	1.23E-10	1.87E-08

24. Volume 5, Supplemental Information Request #2, Appendix SIR2 K, Tables SIR2 K-1 to K-8, Pages 1 to 19
Results were provided for three scenarios (Tables SIR2 K-1 to SIR2 K-8); however, four scenarios are discussed in the text (Baseline Case, Project Only, Application Case and Planned Development Case (PDC)). The Tables do not indicate which case belongs to which results. Results for the non-carcinogenic COPCs should include Hazard Quotient (HQ) results for the Baseline Case, Application Case and PDC. For carcinogens, Incremental Lifetime Cancer Risk (ILCR) results are required for the project emissions only.

a. Confirm that the three sets of location results provide in Tables SIR2 K-3 to K-6 are for Baseline Case (rows 1-21), Application Case (rows 22-42), and PDC (rows 43 – 63); if this is incorrect clearly indicate which results apply to which case scenario.

This is incorrect. In Volume 5, Tables SIR2 K-3 to K-6, the rows 1 to 21 represent Baseline Case, rows 22 to 42 represent Project Alone Case and rows 43 to 63 are for PDC.

b. Confirm that rows 22-42 in Tables SIR2 K-1, K-2, K-7, and K-8 are the ILCR results for Project emissions only; if this is incorrect clearly indicate which results apply to which case scenario.

This is correct. The ILCR results in rows 22 to 42 are for Project emissions only.

25. Volume 5, Supplemental Information Request #2, Appendix SIR2 K, Table SIR2 K-8, Pages 17 and 18
Ivanhoe discusses results described as ILCR-A. There are no results labeled ILCR-A in Table SIR K-8.

a. Clearly identify the ILCR results for the Project–Only emissions for this COPC.

In Volume 5, Table SIR2 K-8, the results regarding the Project-Only emission of pyrene are presented in rows 22 to 42. This table is for the composite receptor and also shows the result for Baseline Case (rows 1 to 21) as well as for PDC (rows 43 to 63). There is an error in Table SIR2 K-8 as the top-right cell should indicate “Total ILCR-A” and not “Total ILCR”.

ERRATA

26. Volume 5, SIR 111, Page AENV-148

Ivanhoe calculated pond sizing requirements. The use of the term "storage time" in the last step of the calculation suggests that there will be flow through the runoff pond during the event and that all the inflow will be stored for only 26.9 hours. In fact, the storage time could be very much longer since there should be no outlet and water would only be pumped from the pond upon its reaching a certain quality. A more appropriate description of the 26.9 hours is that the pond provides 12 percent more capacity than would be required for the adopted design standard.

Ivanhoe agrees.

27. Volume 5, Supplemental Information Request #2, Appendix SIR2 K, Page 1
Ivanhoe states *The Project alone had lower total ILCR values i.e., 3.8 x 10^{-6}, with the berries ingestion exposure pathway being the most significant source of risk.* There is no Total ILCR in Table SIR2 K-1 equal to 3.8 x 10^{-6}; however, the ILRC for Berries Ingestion for the second (Maximum Point of Impingement (MPOI) listed in Table SIR2 K-1 is 3.8 x 10^{-6}.

The sentence is unclear and should read: “The Project alone had lower total ILCR values, i.e., 4.2 x 10^{-6}, with the berries ingestion exposure pathway being the most significant source with an ILCR value of 3.8 x 10-^{6}.”

Ivanhoe Energy

Appendix SIR3 A

Record of Consultation with Aboriginal Communities

Ivanhoe Energy

Ivanhoe – Tamarack Project
Contact Summary by Aboriginal Stakeholder (June – September 2012)

NOTES:
Items in italics are/were outstanding from the previous report.
Related outstanding items have been combined into the most recent outstanding item, with references to the previous items provided.

Athabasca Chipewyan First Nation (ACFN)						
ROC#	**Event Type**	**Event Date**	**Stakeholder List**	**Team List**	**Comments**	**Follow-Up and Outstanding Actions**
3029	Letter	07/03/2012	Director (ACFN IRC)	Director, HS&E Regulatory (Ivanhoe)	1) Ivanhoe responded to ACFN's SOC from March 2011 (see ROC1345).	
3030	E-mail	07/03/2012	Director (ACFN IRC)	Consultation Coordinator (Ivanhoe)	1) Ivanhoe e-mailed a copy of its letter (see ROC3029) with responses to ACFN's SOC (see ROC 1345).	
3096	Letter	07/10/2012	Director (ACFN IRC)	Director, HS&E Regulatory (Ivanhoe)	1) Ivanhoe provided a CD copy of the SIR2 responses filed with ESRD on 12/07/06 and noted the document is also available on their website. Asked that ACFN contact them if they wish to receive additional CD copies or have any questions.	
3224	E-mail	07/31/2012	Director (ACFN IRC) Project Lead (ACFN IRC)	Consultation Coordinator (Ivanhoe)	1) In follow-up to the SOC responses provided on 12/07/03 (see ROC3029), Ivanhoe requested potential dates to meet to discuss the responses. Also requested a budget from ACFN for the review.	1) FOLLOW-UP CLOSED: Ivanhoe requested dates again on 12/08/14. See follow-up in ROC3259.
3232	E-mail	08/01/2012	Title Unknown (ACFN IRC)	Director, HS&E Regulatory (Ivanhoe)	1) ACFN provided their new address.	
3297	Phone Call	08/07/2012	Land Use Coordinator (ACFN)	Consultation Coordinator (Ivanhoe)	1) Discussed the ACFN TUS Study and Sharing Protocols. ACFN to provide a copy of the License Agreement and Protocols for Ivanhoe to review.	1) FOLLOW-UP COMPLETE: Information provided on 12/08/08 (see ROC3246).
3246	E-mail	08/08/2012	Land Use Coordinator (ACFN)	Director, HS&E Regulatory (Ivanhoe) Consultation Coordinator (Ivanhoe)	1) In follow-up to the call on 12/08/07 (see ROC3297), ACFN provided the TK protocol, request form and template for the Limited Use License. ACFN started work on the TUS in February and it is about 30% complete. Ivanhoe to review and get back to ACFN.	1) FOLLOW-UP CLOSED: Discussed further on 12/08/14. See follow-up in ROC3255.
3255	E-mail	08/14/2012	Land Use Coordinator (ACFN)	Consultation Coordinator (Ivanhoe)	1) Ivanhoe requested copies of the TK documents in Word format (see ROC3246).	1) FOLLOW-UP COMPLETE: ACFN doesn't provide Word versions of policy documents (see ROC3290, 12/08/20).

Athabasca Chipewyan First Nation (ACFN)						
ROC#	**Event Type**	**Event Date**	**Stakeholder List**	**Team List**	**Comments**	**Follow-Up and Outstanding Actions**
3259	E-mail	08/14/2012	Director (ACFN IRC) Project Lead (ACFN IRC)	Consultation Coordinator (Ivanhoe)	1) In follow-up to the 12/07/31 e-mail (see ROC3224), Ivanhoe requested potential meeting dates to discuss the SOC review, as well as a budget for the review.	1) FOLLOW-UP COMPLETE: MCFN requested to meet 12/10/11 (see ROC3315, 12/08/27).
3274	E-mail	08/16/2012	Director (ACFN IRC)	Consultation Coordinator (Ivanhoe)	1) ACFN Project Lead will work with Ivanhoe to set up a meeting with MSES to review the SOC response (see ROCs 3259, 3307).	1) FOLLOW-UP COMPLETE: Meeting requested for 12/10/11 (see ROC3315, 12/08/27).
3307	Phone Call	08/16/2012	Director (ACFN IRC)	Consultation Coordinator (Ivanhoe)	1) Discussed setting up a meeting to discuss the SOC responses. ACFN's Project Lead will contact Ivanhoe to set one up.	1) FOLLOW-UP CLOSED: Followed up by e-mail on 12/08/16. See follow-up in ROC3307.
3283	E-mail	08/17/2012	Director (ACFN IRC) Project Lead (ACFN IRC)	Consultation Coordinator (Ivanhoe)	1) Ivanhoe provided the bi-monthly consultation log for June-July. Requested that any comments be mailed to ESRD and copied to Ivanhoe; they will be included in the next bi-monthly report.	1) FOLLOW-UP CLOSED: No comments received.
3290	E-mail	08/20/2012	Land Use Coordinator (ACFN)	Consultation Coordinator (Ivanhoe)	1) ACFN does not provide Word versions of their protocol documents and asked that Ivanhoe review the version provided (see also ROCs 3246, 3255).	1) FOLLOW-UP COMPLETE: Called to discuss on 12/08/23. See follow-up in ROC3368.
3368	Phone Call	08/23/2012	Land Use Coordinator (ACFN)	Consultation Coordinator (Ivanhoe)	1) Ivanhoe left a voicemail, requesting a call back to discuss the TUS documents (see also ROCs 3246, 3255, 3290).	1) FOLLOW-UP CLOSED: Ivanhoe called again on 12/08/28. See follow-up in ROC3369.
3369	Phone Call	08/28/2012	Land Use Coordinator (ACFN)	Consultation Coordinator (Ivanhoe)	1) Ivanhoe left voicemail requesting a call back to discuss the TK documents (see also ROCs 3246, 3255, 3290, 3368).	1) FOLLOW-UP CLOSED: Ivanhoe called again on 12/08/29. See follow-up in ROC3331.
3331	E-mail	08/29/2012	Land Use Coordinator (ACFN)	Consultation Coordinator (Ivanhoe)	1) Ivanhoe left a voicemail, requesting a call back to discuss the TK documents (see ROC3369).	1) FOLLOW-UP CLOSED: ACFN returned call but Ivanhoe was unavailable (12/08/30). See follow-up in ROC3336.
3336	E-mail	08/30/2012	Land Use Coordinator (ACFN)	Consultation Coordinator (Ivanhoe)	1) ACFN returned call but Ivanhoe was not available. Will try to touch base on 12/08/31 to discuss the TK documents (see also ROCs 3246, 3255, 3290, 3368, 3369, 3331).	1) FOLLOW-UP CLOSED: ACFN left a message for Ivanhoe; will call again (12/08/31). See follow-up in ROC3340.

Athabasca Chipewyan First Nation (ACFN)						
ROC#	**Event Type**	**Event Date**	**Stakeholder List**	**Team List**	**Comments**	**Follow-Up and Outstanding Actions**
3340	E-mail	08/31/2012	Land Use Coordinator (ACFN)	Consultation Coordinator (Ivanhoe)	1) ACFN left a voicemail for Ivanhoe, requesting a call back to discuss the TK documents (see also ROCs 3246, 3255, 3290, 3368, 3369, 3331, 3336).	1) FOLLOW-UP COMPLETE: Discussed by phone on 12/09/04 (see ROC3371).
3345	E-mail	09/04/2012	Land Use Coordinator (ACFN)	Consultation Coordinator (Ivanhoe)	1) Further to their call on 12/09/04 (see ROC3371), Ivanhoe provided written comments on the TUS documents. ACFN to respond to Ivanhoe's comments.	1) FOLLOW-UP COMPLETE: Revisions provided by ACFN by e-mail on 12/09/18 (see ROC3402).
3371	Phone Call	09/04/2012	Land Use Coordinator (ACFN)	Consultation Coordinator (Ivanhoe)	1) Discussed the ACFN TUS Study and Sharing Protocols. ACFN requested that Ivanhoe send comments via e-mail so they can be forwarded to ACFN's legal counsel.	1) FOLLOW-UP COMPLETE: Comments provided by Ivanhoe on 12/09/04 (see ROC3345).
3402	E-mail	09/18/2012	Land Use Coordinator (ACFN)	Consultation Coordinator (Ivanhoe)	1) ACFN provided new wording for the TK License Agreement based on Ivanhoe's request (see ROC3345). Ivanhoe to review.	1) FOLLOW-UP COMPLETE: Ivanhoe provided a change for ACFN to review (see ROC3434, 12/09/26).
3434	E-mail	09/26/2012	Land Use Coordinator (ACFN)	Consultation Coordinator (Ivanhoe)	1) Ivanhoe requested a change to the revised wording on the Limited License Agreement. ACFN to review.	1) FOLLOW-UP COMPLETE: Review provided on 12/10/09.

Chipewyan Prairie Dene First Nation (CPDFN)						
ROC#	**Event Type**	**Event Date**	**Stakeholder List**	**Team List**	**Comments**	**Follow-Up and Outstanding Actions**
2,979	E-mail	06/19/2012	Executive Director (CPDFN IRC)	Consultation Coordinator (Ivanhoe)	1) Ivanhoe provided the consultation logs for April-May 2012. Requested that any comments be provided by e-mail to ESRD and copied to Ivanhoe, and they will be included in the next bi-monthly report.	
3,099	Letter	07/10/2012	Executive Director (CPDFN IRC)	Director, HS&E Regulatory (Ivanhoe)	1) Ivanhoe provided a CD copy of the SIR2 responses filed with ESRD on 12/07/06 and noted the document is also available on their website. Asked that CPDFN contact them if they wish to receive additional CD copies or have any questions.	

Fort McMurray #468 First Nation (FMFN #468)						
ROC#	**Event Type**	**Event Date**	**Stakeholder List**	**Team List**	**Comments**	**Follow-Up and Outstanding Actions**
3019	Workshop	06/07/2012	Chief (FMFN #468) Band Manager (FMFN #468) Interim Director (FMFN #468 IRC) Advisor (FMFN #468) Councillor 2 (FMFN #468) Councillor (FMFN #468) Consultant 1 (Dillon) Consultant 4 (Moving Forward Ltd.) Consultant 3 (Moving Forward Ltd.) Legal Representative Others from the oilsands industry	Consultation Coordinator (Ivanhoe)	1) FMFN #468 held a governance workshop, attended by FMFN #468 and oilsands industry.	
3020	Meeting	06/07/2012	Interim Director (FMFN #468 IRC)	Consultation Coordinator (Ivanhoe)	1) Short discussion during a break at the governance workshop. 2) Chief-to-Chief Meeting: Discussed final details. 3) Wildlife Report: Ivanhoe will be filing the wildlife report with the regulators. They are willing to meet with FMFN #468 to discuss.	
2953	E-mail	06/08/2012	Advisor (FMFN #468)	Director, HS&E Regulatory (Ivanhoe) Consultation Coordinator (Ivanhoe)	1) FMFN #468 Advisor provided a copy of the letter from the Chief re: the single point of contact for the First Nation (see ROC2956 for letter).	
2956	Letter	06/08/2012	Chief (FMFN #468)	Director, HS&E Regulatory (Ivanhoe) Consultation Coordinator (Ivanhoe)	1) FMFN #468 noted that the single point of contact for all resource development consultation is the new IRC Director.	
2961	Letter	06/11/2012	Chief (FMFN #468)	Director, HS&E Regulatory (Ivanhoe) Consultation Coordinator (Ivanhoe)	1) FMFN #468 has appointed a new CEO.	

Fort McMurray #468 First Nation (FMFN #468)						
ROC#	**Event Type**	**Event Date**	**Stakeholder List**	**Team List**	**Comments**	**Follow-Up and Outstanding Actions**
3021	Phone Call	06/11/2012	Interim Director (FMFN #468 IRC)	Consultation Coordinator (Ivanhoe)	1) Ivanhoe provided a list of those who will be attending the Chief-to-Chief meeting. FMFN #468 to provide a list of attendees to Ivanhoe.	1) FOLLOW-UP CLOSED: List of attendees not provided.
2965	E-mail	06/13/2012	Advisor (FMFN #468)	Consultation Coordinator (Ivanhoe)	1) CEO provided an electronic copy of the letter from the Chief appointing the new CEO (see ROC2961).	
3023	Phone Call	06/13/2012	Interim Director (FMFN #468 IRC)	Consultation Coordinator (Ivanhoe)	1) Discussed protocol details for the Chief-to-Chief meeting on 12/06/14.	
2991	Meeting	06/14/2012	Chief (FMFN #468) Interim Director (FMFN #468 IRC) Band Manager (FMFN #468) Advisor (FMFN #468) Student Employment and Training Coordinator (FMFN #468 IRC) Councillor 2 (FMFN #468) Councillor 1(FMFN #468)	Executive VP of Upstream (Ivanhoe) Director, HS&E Regulatory (Ivanhoe) Consultation Coordinator (Ivanhoe) President & COO (Ivanhoe) Director of Engineering & Subsurface (Ivanhoe) Manager, Corporate Communication (Ivanhoe) Executive VP of Corporate Development (Ivanhoe) CFO (Ivanhoe)	1) Ivanhoe Senior Management met with Chief & Council and band management to tour the Gregoire & Clearwater Reserves, and learn about FMFN #468 issues and priorities.	
2972	E-mail	06/18/2012	Band Manager (FMFN #468)	Consultation Coordinator (Ivanhoe)	1) Ivanhoe thanked FMFN #468 for the chief-to-chief meeting on 12/06/14 (see ROC2991). Also requested a meeting with FMFN #468 on 12/06/28 to discuss a process to remove the Statements of Concern	1) FOLLOW-UP CLOSED: No response received. Requested meeting on 12/07/05 instead. See follow-up in ROC3093.
2977	E-mail	06/19/2012	Interim Director (FMFN #468 IRC) Band Manager (FMFN #468)	Consultation Coordinator (Ivanhoe)	1) Ivanhoe provided the consultation logs for April-May 2012. Requested that any comments be provided by e-mail to ESRD and copied to Ivanhoe, and they will be included in the next bi-monthly report.	

Fort McMurray #468 First Nation (FMFN #468)						
ROC#	**Event Type**	**Event Date**	**Stakeholder List**	**Team List**	**Comments**	**Follow-Up and Outstanding Actions**
3011	Letter	06/26/2012	Band Manager (FMFN #468)	Director, HS&E Regulatory (Ivanhoe)	1) Ivanhoe provided responses to FMFN #468's SOC submitted March 2011 (see ROC1347).	
3093	Phone Call	06/26/2012	Band Manager (FMFN #468)	Consultation Coordinator (Ivanhoe)	1) Ivanhoe left a message requesting a meeting with FMFN #468 on 12/07/05 (see also ROC2972).	1) FOLLOW-UP COMPLETE: Meeting held (see ROC3191).
3009	E-mail	06/27/2012	Band Manager (FMFN #468)	Consultation Coordinator (Ivanhoe)	1) Ivanhoe e-mailed a copy of its letter (see ROC3011) with responses to FMFN #468's SOC (see ROC1347).	
3016	Letter	06/28/2012	Chief (FMFN #468)	President & COO (Ivanhoe)	1) Ivanhoe's President and COO thanked the Chief for their hospitality at the chief-to-chief meeting on 12/06/14 (see ROC2991). Ivanhoe looks forward to building a lasting relationship with FMFN #468.	
3026	E-mail	06/29/2012	Chief (FMFN #468)	Consultation Coordinator (Ivanhoe)	1) Ivanhoe provided an electronic copy of the letter from the President thanking FMFN #468 for the 12/06/14 meeting (see ROC3016).	
3027	E-mail	06/29/2012	Band Manager (FMFN #468)	Consultation Coordinator (Ivanhoe)	1) Meeting to discuss agreement to remove SOCs set for 12/07/05.	1) FOLLOW-UP COMPLETE: Meeting held on 12/07/05 (see ROC3191).
3033	E-mail	07/04/2012	Band Manager (FMFN #468)	Consultation Coordinator (Ivanhoe)	1) Ivanhoe requested confirmation if the Band Manager is available to meet for lunch before the 12/07/05 meeting (see also ROC3027).	1) FOLLOW-UP COMPLETE: Lunch availability confirmed on 12/07/04 (see ROC3180).
3180	Phone Call	07/04/2012	Band Manager (FMFN #468)	Consultation Coordinator (Ivanhoe)	1) Lunch and meeting for 12/07/05 confirmed, including attendees.	
3035	E-mail	07/05/2012	Band Manager (FMFN #468)	Consultation Coordinator (Ivanhoe)	1) FMFN #468 received the SOC response and is currently reviewing it.	1) FOLLOW-UP CLOSED: Consultation process is now underway with IRC Director to discuss and resolve issues identified in the SOCs.
3036	E-mail	07/05/2012	Band Manager (FMFN #468)	Consultation Coordinator (Ivanhoe)	1) Ivanhoe provided the shape files requested at the 12/07/05 meeting (see ROC3191).	

Fort McMurray #468 First Nation (FMFN #468)						
ROC#	**Event Type**	**Event Date**	**Stakeholder List**	**Team List**	**Comments**	**Follow-Up and Outstanding Actions**
3191	Meeting	07/05/2012	Band Manager (FMFN #468) Consultant 1 (Dillon) Consultant 2 (Dillon)	Executive VP of Upstream (Ivanhoe) Consultation Coordinator (Ivanhoe) Regulatory Affairs Consultant	1) Met with FMFN #468 and Dillon to discuss the process for addressing/removing FMFN #468's SOCs from the regulatory process. 2) Dillon provided an overview of the "workbook" process, and FMFN #468 the new process for engaging with developers. 3) Next meeting set for 12/07/09.	3) FOLLOW-UP COMPLETE: Meeting held on 12/07/09 (see ROC3188).
3043	E-mail	07/08/2012	Title Unknown (FMFN #468 IRC)	Director, HS&E Regulatory (Ivanhoe)	1) FMFN #468 provided details on their upcoming golf tournament.	
3044	E-mail	07/08/2012	Consultant 1 (Dillon) Consultant 2 (Dillon)	Executive VP of Upstream (Ivanhoe)	1) Dillon to contact Ivanhoe regarding the FMFN #468 workbook session with Dillon.	
3188	Meeting	07/09/2012	Consultant 2 (Dillon)	Executive VP of Upstream (Ivanhoe) Director, HS&E Regulatory (Ivanhoe)	1) Met with Dillon to discuss community priorities and issues, and options for removing the SOCs on the project. 2) Dillon noted that additional TLU may be required. FMFN #468 to review current TEK/TLU and provide any additional scope of work.	2) FOLLOW-UP COMPLETE: Follow up scope of work and budget provided by the TK Facilitator on 12/07/06 (see ROC3195).
3050	E-mail	07/10/2012	Consultant 2 (Dillon)	Consultation Coordinator (Ivanhoe)	1) Ivanhoe provided electronic copies of the requested consultation documents (see ROC3188).	
3051	E-mail	07/10/2012	Consultant 2 (Dillon)	Consultation Coordinator (Ivanhoe)	1) Ivanhoe provided copies of the notes from meetings with FMFN #468 (see ROC3188).	
3052	E-mail	07/10/2012	Consultant 2 (Dillon)	Director, HS&E Regulatory (Ivanhoe)	1) Meeting with Dillon set for 12/07/12.	1) FOLLOW-UP COMPLETE: Meeting held on 12/07/12 (see ROC3193).
3055	E-mail	07/10/2012	Band Manager (FMFN #468)	Consultation Coordinator (Ivanhoe)	1) Ivanhoe asked if FMFN #468 wanted hard copies and/or CD copies of the SIR2 responses; FMFN #468 would appreciate receiving both.	
3056	E-mail	07/10/2012	Band Manager (FMFN #468)	Consultation Coordinator (Ivanhoe)	1) Ivanhoe asked, and FMFN #468 provided info on, who else FMFN #468 would like to receive the SIR2 responses.	
3190	E-mail	07/10/2012	Consultant 2 (Dillon)	Director, HS&E Regulatory (Ivanhoe)	1) Dillon provided a copy of the workbook for Ivanhoe to include correspondence and regulatory timelines.	
3068	E-mail	07/11/2012	Consultant 2 (Dillon)	Director, HS&E Regulatory (Ivanhoe)	1) Ivanhoe provided comments/additions to the workbook for ongoing agreement discussions.	

Fort McMurray #468 First Nation (FMFN #468)						
ROC#	**Event Type**	**Event Date**	**Stakeholder List**	**Team List**	**Comments**	**Follow-Up and Outstanding Actions**
3103	Letter	07/12/2012	Band Manager (FMFN #468)	Director, HS&E Regulatory (Ivanhoe)	1) Ivanhoe provided a CD copy of the SIR2 responses filed with ESRD on 12/07/06 and noted the document is also available on their website. Asked that FMFN #468 contact them if they wish to receive additional CD copies or have any questions (see ROC3055).	
3193	Meeting	07/12/2012	Band Manager (FMFN #468) Consultants (Dillon)	Executive VP of Upstream (Ivanhoe) Director, HS&E Regulatory (Ivanhoe)	1) Workbook Update: Workbook will be prepared to assist both Ivanhoe and FMFN #468 in meeting their needs. Dillon will provide Ivanhoe with a copy of the Community Consultation Plan summary. Ivanhoe to provide a list of past regulatory milestones. 2) SIR Responses: Ivanhoe provided hard copies of the SIR2 responses. FMFN #468 requested funding for Dillon to review the responses. 3) CMAR Project: Discussed Ivanhoe's role in the bridge to the reserve and managing the access road. 4) TEK/TLU: FMFN #468 requested further TLU; Ivanhoe understood that current work was sufficient and requested costs, scope and timeline for any additional work before it is approved. 5) FMFN #468 Engagement Process: Reviewed the community's new process and how the Tamarack Project fits into it. 6) Issues: (a) Consultation process and FMFN #468 capacity. (b) Level of TLU is inadequate for signoff. (c) CMAR and Clearwater Reserve access. (d) Consultation funding.	1) FOLLOW-UP COMPLETE: CCP provided at the 12/08/02 meeting (see ROC3446).
3076	E-mail	07/16/2012	Consultant 2 (Dillon)	Director, HS&E Regulatory (Ivanhoe)	1) Ivanhoe requested the latest version of the workbook so that the regulatory history could be updated (see ROC3193). Dillon will send as soon as it is available.	1) FOLLOW-UP COMPLETE: Portion of the workbook for Ivanhoe to fill out provided on 12/07/16 by e-mail (see ROC3077).
3077	E-mail	07/16/2012	Consultant 2 (Dillon) Consultant 5 (Dillon)	Director, HS&E Regulatory (Ivanhoe)	1) Dillon provided the section of the workbook for Ivanhoe to fill in the regulatory details. Ivanhoe to fill out and return to Dillon.	1) FOLLOW-UP COMPLETE: Regulatory details provided on 12/07/19 (see ROC3083).

Fort McMurray #468 First Nation (FMFN #468)						
ROC#	**Event Type**	**Event Date**	**Stakeholder List**	**Team List**	**Comments**	**Follow-Up and Outstanding Actions**
3195	Phone Call	07/16/2012	TK Facilitator	Director, HS&E Regulatory (Ivanhoe)	1) Discussion on additional TEK/TLU work FMFN #468. TK Facilitator will send Ivanhoe a copy of the SOW and budget.	1) FOLLOW-UP COMPLETE: SOW and budget provided on 12/07/16 (see ROC3207).
3207	E-mail	07/16/2012	TK Facilitator	Director, HS&E Regulatory (Ivanhoe)	1) TK Facilitator provided a scope of work and budget for the proposed additional TEK work (see ROC3195).	
3083	E-mail	07/19/2012	Consultant 5 (Dillon)	Director, HS&E Regulatory (Ivanhoe)	1) Ivanhoe provided the regulatory milestones for the workbook (see ROC3077).	
3084	E-mail	07/19/2012	TK Facilitator Band Manager (FMFN #468)		1) TK Facilitator passed on e-mails between herself and Ivanhoe on the TEK budget and SOW to FMFN #468.	
3183	E-mail	07/19/2012	TK Facilitator	Director, HS&E Regulatory (Ivanhoe)	1) TK Facilitator provided explanation for some of the items in the TEK scope and budget (see ROC3207).	
3085	E-mail	07/20/2012	Advisor (FMFN #468)	Director, HS&E Regulatory (Ivanhoe) Consultation Coordinator (Ivanhoe)	1) FMFN #468 is exploring the possibility of establishing a medical services clinic on the FMFN #468 reserve to provide advanced care to project stakeholders south of Fort McMurray and service the Aboriginal communities in the surrounding area. Requested availability from industry the week of 12/08/12 to attend a meeting to discuss.	1) FOLLOW-UP COMPLETE: Availability provided on 12/07/22 (see ROC3226).
3226	E-mail	07/22/2012	Advisor (FMFN #468)	Consultation Coordinator (Ivanhoe)	1) Ivanhoe is available the week of 12/08/07 to meet to discuss the potential medical clinic (see ROC3085).	1) FOLLOW-UP CLOSED: Consultation process is now underway to IRC Director to discuss community investment opportunities.
3151	E-mail	07/30/2012	Consultant 2 (Dillon)	Director, HS&E Regulatory (Ivanhoe)	1) Dillon provided documents for review relating to FMFN #468's SOCs [details confidential].	
3156	E-mail	07/30/2012	Band Manager (FMFN #468)	Director, HS&E Regulatory (Ivanhoe)	1) Ivanhoe is willing to discuss the TEK/TLU proposal received by the TK Facilitator at the 12/08/02 meeting but would like a full picture of costs first. 2) Requested that FMFN #468 provide details on costs for ongoing consultation. 3) Ivanhoe requested confirmation of the 12/08/02 meeting.	2) FOLLOW-UP CLOSED: Costs discussed as part of the consultation process to discuss and resolve issues identified in the SOCs. 3) FOLLOW-UP COMPLETE: Meeting confirmed on 12/07/12 (see ROC3193).

Fort McMurray #468 First Nation (FMFN #468)						
ROC#	**Event Type**	**Event Date**	**Stakeholder List**	**Team List**	**Comments**	**Follow-Up and Outstanding Actions**
3160	E-mail	07/31/2012	Consultant 1 (Dillon)	Director, HS&E Regulatory (Ivanhoe)	1) Dillon provided the TK Master Agreement for Ivanhoe to review.	
3161	E-mail	07/31/2012	Consultant 2 (Dillon)	Director, HS&E Regulatory (Ivanhoe)	1) Ivanhoe agreed to wait for the IRC Director's return before sending the remaining requested documents (see ROC3151).	
3204	E-mail	07/31/2012	Consultant 2 (Dillon)	Director, HS&E Regulatory (Ivanhoe)	1) Ivanhoe is fine with receiving draft documents after the Band Manager's return, and the remaining information (see ROC3151) can be discussed at the next meeting.	
3217	E-mail	07/31/2012	Consultant 2 (Dillon)	Director, HS&E Regulatory (Ivanhoe)	1) Ivanhoe requested a Word version of the TK Master Agreement so they can provide comments.	1) FOLLOW-UP COMPLETE: Word version of file provided on 12/07/31 (see ROC3160).
3234	E-mail	08/01/2012	Director (FMFN #468) Consultant 2 (Dillon)	Director, HS&E Regulatory (Ivanhoe)	1) Meeting: Ivanhoe requested confirmation of the 12/08/02 meeting to discuss and resolve issues identified in the SOCs.	2) FOLLOW-UP COMPLETE: Meeting held on 12/08/02 (see ROC3446).
3236	Phone Call	08/01/2012	Consultant 2 (Dillon)	Director, HS&E Regulatory (Ivanhoe)	1) Discussion on agenda for the 12/08/02 meeting.	
3239	Phone Call	08/02/2012	Director (FMFN #468)	Director, HS&E Regulatory (Ivanhoe)	1) Discussed TEK/TLU funding and details around proposed 12/08/15 meeting.	
3300	Phone Call	08/02/2012	Director (FMFN #468) Consultant 2 (Dillon)	Director, HS&E Regulatory (Ivanhoe)	1) Further discussion on TEK/TLU funding and details around proposed 12/08/15 meeting.	
3446	Meeting	08/02/2012	Director (FMFN #468) Consultant 2 (Dillon)	Executive VP of Upstream (Ivanhoe) Director, HS&E Regulatory (Ivanhoe) Regulatory Consultant (JDEL)	1) Ivanhoe provided an update on changes in their organization. 2) Discussed mitigation and potential resolution of SOCs, including the FMFN #468 workbook process, TEK, potential community investment and the regulatory process. 3) FMFN #468 noted that the CMAR road and bridge, and reserve access is the biggest single community issue. 4) Issues: (a) access to the Clearwater Reserve, (b) need for additional TEK collection, (c) capacity funding.	
3240	E-mail	08/03/2012	Director (FMFN #468)	Director, HS&E Regulatory (Ivanhoe)	1) Ivanhoe sent a meeting invitation for the next negotiation session on 12/08/15 in Calgary.	1) FOLLOW-UP COMPLETE: Meeting held on 12/08/15 (see ROC3448).

Fort McMurray #468 First Nation (FMFN #468)						
ROC#	**Event Type**	**Event Date**	**Stakeholder List**	**Team List**	**Comments**	**Follow-Up and Outstanding Actions**
3244	E-mail	08/07/2012	Director (FMFN #468)	Director, HS&E Regulatory (Ivanhoe)	1) 12/08/15 Meeting: Ivanhoe agreed to fund another person to attend the meeting (see ROC3239). 2) Proposed Budgets: Ivanhoe requested that FMFN #468 provide the proposed budgets ASAP.	2) FOLLOW-UP CLOSED: Discussed further on 12/08/30 (see ROC3338).
3253	E-mail	08/13/2012	Director (FMFN #468) Consultant 2 (Dillon) Legal Representative (Ackroyd LLP) CEO (FMFN #468)	Executive VP of Upstream (Ivanhoe) Director, HS&E Regulatory (Ivanhoe) Associate General Counsel (Ivanhoe) Receptionist (Ivanhoe) Regulatory Consultant (JDEL)	1) Ivanhoe sent out an invitation to the 12/08/15 meeting with FMFN #468 (see also ROC3240).	1) FOLLOW-UP COMPLETE: Meeting held on 12/08/15 (see ROC3448).
3298	E-mail	08/13/2012	Director (FMFN #468) Consultant 2 (Dillon) Legal Representative (Ackroyd LLP) CEO (FMFN #468)	Regulatory Consultant (JDEL)	1) Regulatory Consultant provided additional information discussed at the meeting on 12/08/15.	
3448	Meeting	08/15/2012	Director (FMFN #468) Consultant 2 (Dillon) Consultant 1 (Dillon) CEO (FMFN #468)	Executive VP of Upstream (Ivanhoe) Director, HS&E Regulatory (Ivanhoe) Associate General Counsel (Ivanhoe) Regulatory Consultant (JDEL)	1) Discussed the process for mitigating and resolving the SOCs. 2) FMFN #468 to provide information on their annual budget.	2) FOLLOW-UP COMPLETE: Budget information provided on 12/08/23 (see ROC3312.
3271	Letter	08/16/2012	Chief (FMFN #468)	President & COO (Ivanhoe)	1) Ivanhoe's president noted that he is resigning from his position and that the current Executive VP of Upstream will be filling the position.	
3280	E-mail	08/17/2012	Land Use Manager (FMFN #468 IRC)	Director, HS&E Regulatory (Ivanhoe) Consultation Coordinator (Ivanhoe)	1) FMFN #468 Land Use Manager provided his new e-mail address.	

Fort McMurray #468 First Nation (FMFN #468)						
ROC#	**Event Type**	**Event Date**	**Stakeholder List**	**Team List**	**Comments**	**Follow-Up and Outstanding Actions**
3281	E-mail	08/17/2012	Director (FMFN #468) Land Use Manager (FMFN #468 IRC)	Consultation Coordinator (Ivanhoe)	1) Ivanhoe provided the bi-monthly consultation log for June-July. Requested that any comments be mailed to ESRD and copied to Ivanhoe; they will be included in the next bi-monthly report.	1) FOLLOW-UP CLOSED: No comments received.
3285	E-mail	08/17/2012	Director (FMFN #468)	Director, HS&E Regulatory (Ivanhoe) Consultation Coordinator (Ivanhoe)	1) FMFN #468 IRC Director provided her new e-mail address.	
3272	E-mail	08/21/2012	CEO (FMFN #468)	Consultation Coordinator (Ivanhoe)	1) Ivanhoe provided an electronic copy of Ivanhoe's president's letter to Chief and Council (see ROC3271).	
3295	E-mail	08/22/2012	Director (FMFN #468) Consultant 2 (Dillon)	President (Ivanhoe) Director, HS&E Regulatory (Ivanhoe) Regulatory Consultant (JDEL)	1) FMFN #468 asked that business that was to be conducted during the 12/08/23 meeting be conducted via phone and e-mail instead to stay on track for the 12/08/30 meeting.	1) FOLLOW-UP COMPLETE: Ivanhoe is ok with this (see ROC3311, 12/08/23).
3311	E-mail	08/23/2012	Director (FMFN #468) Consultant 2 (Dillon)	President (Ivanhoe) Director, HS&E Regulatory (Ivanhoe) Regulatory Consultant (JDEL)	1) Ivanhoe is ok with covering the 12/08/23 agenda items by phone (see ROC3295).	1) FOLLOW-UP CLOSED: Items not discussed; just brought up at the 12/08/30 meeting (see ROC3338).
3312	Letter	08/23/2012	Director (FMFN #468)	President (Ivanhoe) Director, HS&E Regulatory (Ivanhoe) Regulatory Consultant (JDEL)	1) Further to the 12/08/15 meeting (ROC3448), FMFN #468 provided information on the IRC 2012-13 annual budget.	
3338	Meeting	08/30/2012	Director (FMFN #468) Consultant 2 (Dillon) Consultant 1 (Dillon)	President (Ivanhoe) Director, HS&E Regulatory (Ivanhoe) Associate General Counsel (Ivanhoe) Regulatory Consultant (JDEL)	1) SOC discussions between FMFN #468 and Ivanhoe. 2) Chief-to-Chief meeting to be set up between FMFN #468 and Ivanhoe. 3) Ivanhoe to prepare a letter regarding TEK/TLU funding. 4) Issues: (a) employment and training; (b) business development and contracting; (c) TEK/TLU Study.	2) FOLLOW-UP OUTSTANDING: Set up Chief-to-Chief meeting. 3) FOLLOW-UP COMPLETE: Letter provided on 12/09/04 (see ROC3449).

Fort McMurray #468 First Nation (FMFN #468)						
ROC#	**Event Type**	**Event Date**	**Stakeholder List**	**Team List**	**Comments**	**Follow-Up and Outstanding Actions**
3348	E-mail	09/04/2012	Director (FMFN #468)	President (Ivanhoe) Director, HS&E Regulatory (Ivanhoe) Regulatory Consultant (JDEL)	1) FMFN #468 is unable to make the 12/09/06 meeting; next meeting will still be on 12/09/13. FMFN #468 is reviewing the 12/09/04 letter on TK/TLU and related funding (see ROC3449).	1) FOLLOW-UP CLOSED: 12/09/13 meeting postponed by FMFN #468 (see ROC3464, 12/09/13).
3449	Letter	09/04/2012	Director (FMFN #468)	President (Ivanhoe)	1) Ivanhoe's letter suggested a capacity funding amount to cover TK/TLU studies, technical review and the process to discuss and resolve SOCs.	1) FOLLOW-UP CLOSED: FMFN #468 will provide feedback this week (12/09/04). See follow-up in ROC3348.
3450	Letter	09/11/2012	Director (FMFN #468)	President (Ivanhoe) Director, HS&E Regulatory (Ivanhoe) Regulatory Consultant (JDEL)	1) FMFN #468 responded to Ivanhoe's letter of 12/09/04 (see ROC3449). Response from Ivanhoe requested by 12/09/12, before proceeding with the 12/09/13 meeting.	1) FOLLOW-UP COMPLETE: Discussed further on 12/09/13 (see ROC3464).
3464	Phone Call	09/13/2012	Director (FMFN #468)	Associate General Counsel (Ivanhoe) Regulatory Consultant (JDEL)	1) Discussion on Ivanhoe's letter of 12/09/04 (see ROC3449) and FMFN #468's response on 12/09/11 (see ROC3550). Meeting on 12/09/13 postponed by FMFN #468.	
3410	Letter	09/19/2012	Director (FMFN #468)	President (Ivanhoe)	1) Further to discussions with Ivanhoe on 12/09/13 (see ROC3464), FMFN #468 provided FMFN #468 leadership comments on the process to identify and resolve SOCs.	
3414	Meeting	09/19/2012	Director (FMFN #468) Legal Representative (Ackroyd LLP)	Director, HS&E Regulatory (Ivanhoe) Associate General Counsel (Ivanhoe) Regulatory Consultant (JDEL)	1) Discussed the process to identify and resolve SOCs. 2) Reviewed past discussions on the Clearwater Reserve Access Road and a plan for moving forward. Ivanhoe will contact Industry to identify other parties to include in discussions. FMFN #468 to draft a letter agreement outlining a process for engaging industry funding for the access road. 3) Issues: (a) consultation, (b) CSF funding, (c) contracting, (d) TEK/TLU Study, (e) Clearwater Reserve.	1) FOLLOW-UP COMPLETE: Comments provided on 12/10/02. **2) FOLLOW-UP OUTSTANDING: Ivanhoe to contact Industry re: interest in funding the access road. Ongoing.** **2) FOLLOW-UP OUTSTANDING: FMFN #468 to draft a letter agreement outlining the process for engaging Industry.**
3415	E-mail	09/20/2012	Director (FMFN #468) Legal Representative (Ackroyd LLP)	Associate General Counsel (Ivanhoe)	1) Ivanhoe recapped the action items from the 12/09/20 meeting (see ROC3451).	

Fort McMurray #468 First Nation (FMFN #468)						
ROC#	**Event Type**	**Event Date**	**Stakeholder List**	**Team List**	**Comments**	**Follow-Up and Outstanding Actions**
3417	E-mail	09/21/2012	Land Use Manager (FMFN #468 IRC)	Consultation Coordinator (Ivanhoe)	1) Ivanhoe provided a copy of the Tamarack Project Executive Summary (see ROC3423).	
3423	Phone Call	09/21/2012	Land Use Manager (FMFN #468 IRC)	Consultation Coordinator (Ivanhoe)	1) FMFN #468 requested a high-level summary of the project to present at a meeting with their Elders.	1) FOLLOW-UP COMPLETE: Summary provided on 12/09/21 (see ROC3417).
3466	E-mail	09/27/2012	Director (FMFN #468 IRC)	Director, HS&E Regulatory (Ivanhoe)	1) Ivanhoe is unable to attend the meeting scheduled for 12/10/11 afternoon. Suggested changing to the morning or a different date. FMFN #468 is not available that afternoon. Ivanhoe to propose a different date.	1) FOLLOW-UP COMPLETE: Alternate date proposed on 12/10/01.

Fort McKay First Nation (Fort McKay FN)						
ROC#	**Event Type**	**Event Date**	**Stakeholder List**	**Team List**	**Comments**	**Follow-Up and Outstanding Actions**
3022	Phone Call	06/11/2012	Director (Fort McKay FN SD)	Consultation Coordinator (Ivanhoe)	1) Discussed process to discuss the removal the SOCs [details confidential].	
2970	E-mail	06/15/2012	Program Manager (Fort McKay FN SD) Community Liaison (Fort McKay FN SD)	Consultation Coordinator (Ivanhoe)	1) Ivanhoe inquired if the Senior Environmental Coordinator position is new. Also noted Ivanhoe will be at Treaty Days the following week.	
2975	E-mail	06/19/2012	Program Manager (Fort McKay FN SD) Senior Environmental Advisor (Fort McKay FN SD) Regulatory Coordinator (Fort McKay FN SD)	Consultation Coordinator (Ivanhoe)	1) Ivanhoe provided the consultation logs for April-May 2012. Requested that any comments be provided by e-mail to ESRD and copied to Ivanhoe, and they will be included in the next bi-monthly report.	
2980	E-mail	06/19/2012	Senior Environmental Advisor (Fort McKay FN SD)	Consultation Coordinator (Ivanhoe)	1) Ivanhoe provided a draft copy of the 12/05/01 meeting notes [see ROC2940]. Fort McKay FN provided comments and the final notes were provided.	
2987	E-mail	06/20/2012	Senior Environmental Advisor (Fort McKay FN SD)	Consultation Coordinator (Ivanhoe)	1) Fort McKay FN received the SIRs and responses to their SOC (see ROC2829). They will provide a SOW and budget for their consultants to review these documents. Fort McKay FN expects to have the review complete by 12/07/07.	1) FOLLOW-UP COMPLETE: SOW and budget provided on 12/06/20 (see ROC2992). 1) FOLLOW-UP CLOSED: See follow-up on review in ROC3053, 12/07/10.
2990	E-mail	06/20/2012	Program Manager (Fort McKay FN SD)	Director, HS&E Regulatory (Ivanhoe) Consultation Coordinator (Ivanhoe)	1) Fort McKay FN has to reschedule their CIS rollout and proposes 12/07/11. Ivanhoe is available that day.	
2992	E-mail	06/20/2012	Regulatory Coordinator (Fort McKay FN SD)	Consultation Coordinator (Ivanhoe)	1) Fort McKay FN provided a scope of work and budget to review the SOC response.	1) FOLLOW-UP CLOSED: Approval requested again on 12/07/03. See follow-up in ROC3031.
2993	E-mail	06/20/2012	Program Manager (Fort McKay FN SD)	Director, HS&E Regulatory (Ivanhoe) Consultation Coordinator (Ivanhoe)	1) Fort McKay FN sent a request on behalf of the Métis leadership that industry cc Métis Local 63 Executive Director as follow-up.	

Fort McKay First Nation (Fort McKay FN)						
ROC#	**Event Type**	**Event Date**	**Stakeholder List**	**Team List**	**Comments**	**Follow-Up and Outstanding Actions**
3004	E-mail	06/27/2012	Senior Environmental Advisor (Fort McKay FN SD) Regulatory Coordinator (Fort McKay FN SD)	Consultation Coordinator (Ivanhoe)	1) Ivanhoe asked questions, and Fort McKay FN provided answers, about the budget for the SOC review (see ROC2992).	
3209	Phone Call	06/27/2012	Senior Environmental Advisor (Fort McKay FN SD)	Director, HS&E Regulatory (Ivanhoe)	1) Fort McKay FN Senior Environmental Advisor called to follow up on questions regarding the budget to review the SOC responses (see ROC3004). Questions had already been answered by the Regulatory Coordinator (see ROC3004).	
3031	E-mail	07/03/2012	Senior Environmental Advisor (Fort McKay FN SD) Regulatory Coordinator (Fort McKay FN SD)	Consultation Coordinator (Ivanhoe)	1) Fort McKay FN requested confirmation of if the budget and SOW submitted to review the SOC response has been approved (see also ROCs 2992 and 3005).	1) FOLLOW-UP CLOSED: Budget has been submitted internally for approval (12/07/05). See follow-up in ROC3037.
3037	E-mail	07/05/2012	Regulatory Coordinator (Fort McKay FN SD)	Consultation Coordinator (Ivanhoe)	1) Ivanhoe has submitted for internal approval the SOW and budget for Fort McKay FN to review Ivanhoe's SOC response (see ROCs 2992, 3004, 3031).	1) FOLLOW-UP COMPLETE: Budget approved on 12/07/10 (see ROC3053).
3053	E-mail	07/10/2012	Senior Environmental Advisor (Fort McKay FN SD) Regulatory Coordinator (Fort McKay FN SD)	Consultation Coordinator (Ivanhoe)	1) Ivanhoe approved the SOW and budget for Fort McKay FN to review their SOC response letter (see ROCs 3031 and 3037).	1) FOLLOW-UP CLOSED: See follow-up in ROC3153.
3060	E-mail	07/10/2012	Program Manager (Fort McKay FN SD)	Director, HS&E Regulatory (Ivanhoe)	1) Fort McKay FN invited Ivanhoe to attend the CIS industry rollout meeting; Ivanhoe will attend.	1) FOLLOW-UP COMPLETE: Meeting held on 12/07/11; Ivanhoe attended (see ROC3211).
3098	Letter	07/10/2012	Director (Fort McKay FN SD)	Director, HS&E Regulatory (Ivanhoe)	1) Ivanhoe provided a CD copy of the SIR2 responses filed with ESRD on 12/07/06 and noted the document is also available on their website. Asked that Fort McKay FN contact them if they wish to receive additional CD copies or have any questions.	

Fort McKay First Nation (Fort McKay FN)						
ROC#	**Event Type**	**Event Date**	**Stakeholder List**	**Team List**	**Comments**	**Follow-Up and Outstanding Actions**
3211	Meeting	07/11/2012	Program Manager (Fort McKay FN SD) Director (Fort McKay FN SD) President (Métis Local 63) Regulatory Coordinator (Fort McKay FN SD) Councillor (Fort McKay FN) Consultant 4 (Integral Ecology Group) Consultant 5 (Integral Ecology Group) Others from industry	Consultation Coordinator (Ivanhoe)	1) Fort McKay FN provided an information session explaining the use of their new CIS system and how it will be used as a consultation tool. 2) An update was provided on current leadership for Fort McKay and available positions. 3) The SD is looking at doing a survey of funding members to get input on their performance. 4) Fort McKay FN would like to hold an industry tradeshow on 12/08/28-29 and is looking for volunteers to help organize it.	
3212	Casual Meeting	07/11/2012	Director (Fort McKay FN SD)	Consultation Coordinator (Ivanhoe)	1) Met following the CIS rollout session to discuss agreement for removal of Fort McKay FN's SOCs.	
3213	Casual Meeting	07/11/2012	Program Manager (Fort McKay FN SD) Regulatory Coordinator (Fort McKay FN SD)	Consultation Coordinator (Ivanhoe)	1) SIR2 Responses: Provided CD copies of the SIR2 responses for Fort McKay FN and their consultants. Ivanhoe requested that Fort McKay FN provide a list of consultants they give the CD copies to. 2) SOC Response: Fort McKay FN will not be able to meet to discuss Ivanhoe's response to Fort McKay FN's SOC until late August or September.	1) FOLLOW-UP COMPLETE: List of consultants receiving copies of the SIR2 responses provided on 12/07/23 (see ROC3148).
3072	E-mail	07/12/2012	Regulatory Coordinator (Fort McKay FN SD)	Consultation Coordinator (Ivanhoe)	1) Ivanhoe requested a list of those to send the SIR2 response CDs to.	1) FOLLOW-UP COMPLETE: Names provided on 12/07/23 (see ROC3228).
3148	E-mail	07/23/2012	Regulatory Coordinator (Fort McKay FN SD)	Consultation Coordinator (Ivanhoe)	1) Fort McKay FN provided names of their subconsultants to receive copies of the SIR2 responses (see ROC3072).	
3153	E-mail	07/30/2012	Senior Environmental Advisor (Fort McKay FN SD) Regulatory Coordinator (Fort McKay FN SD)	Consultation Coordinator (Ivanhoe)	1) Ivanhoe requested an update on Fort McKay FN's review of the SOC response (see also ROC3053).	1) FOLLOW-UP CLOSED: Update requested again on 12/07/31. See follow-up in ROC3223.
3157	E-mail	07/30/2012	Regulatory Coordinator (Fort McKay FN SD)	Consultation Coordinator (Ivanhoe)	1) Ivanhoe thanked Fort McKay FN for the list of people to send SIR2 responses to (see ROC3148).	

Fort McKay First Nation (Fort McKay FN)						
ROC#	**Event Type**	**Event Date**	**Stakeholder List**	**Team List**	**Comments**	**Follow-Up and Outstanding Actions**
3223	Phone Call	07/31/2012	Senior Environmental Advisor (Fort McKay FN SD)	Consultation Coordinator (Ivanhoe)	1) In follow-up to his 12/07/30 e-mail (see ROC3153), Ivanhoe inquired about the status of the SOC review (see also ROCs 3053, 3153). 2) Also requested that Fort McKay FN provide potential meeting dates to discuss (see ROC3213).	1) FOLLOW-UP CLOSED: Ivanhoe asked for dates again by phone on 12/08/14. See follow-up in ROC3302.
3256	E-mail	08/14/2012	Senior Environmental Advisor (Fort McKay FN SD)	Consultation Coordinator (Ivanhoe)	1) Fort McKay FN is reviewing responses from their consultants, after which Fort McKay FN would like to meet to discuss the areas that still need clarification and to resolve outstanding concerns.	1) FOLLOW-UP COMPLETE: Responses provided by Fort McKay FN on 12/08/21 (see ROC3293). 1) FOLLOW-UP CLOSED: Fort McKay FN will set up meeting soon (12/08/15). See follow-up in ROC3265.
3302	Phone Call	08/14/2012	Senior Environmental Advisor (Fort McKay FN SD)	Consultation Coordinator (Ivanhoe)	1) Ivanhoe left a voicemail, requesting a call back with an update on the status of the SOC review/potential meeting dates, and the status of the report from the spring 2012 community consultation sessions.	1) FOLLOW-UP CLOSED: Fort McKay FN will get back to Ivanhoe with a date (12/08/14). See follow-up in ROC3256. 1) FOLLOW-UP COMPLETE: Notes from the spring sessions provided on 12/09/28 (see ROC3443).
3265	E-mail	08/15/2012	Regulatory Coordinator (Fort McKay FN SD)	Consultation Coordinator (Ivanhoe)	1) Fort McKay FN requested a Word version of Ivanhoe's SOC responses to assist in compiling comments from their consultants.	1) FOLLOW-UP COMPLETE: Word version of SOC response document provided on 12/08/16 (see ROC3270).
3270	E-mail	08/16/2012	Regulatory Coordinator (Fort McKay FN SD)	Consultation Coordinator (Ivanhoe)	1) Ivanhoe provided a Word version of the SOC responses, per request (see ROC3265).	
3282	E-mail	08/17/2012	Program Manager (Fort McKay FN SD) Senior Environmental Advisor (Fort McKay FN SD) Regulatory Coordinator (Fort McKay FN SD)	Consultation Coordinator (Ivanhoe)	1) Ivanhoe provided the bi-monthly consultation log for June-July. Requested that any comments be mailed to ESRD and copied to Ivanhoe; they will be included in the next bi-monthly report. 2) Ivanhoe asked if consultation logs should be uploaded to Fort McKay FN; Fort McKay FN to confirm.	1) FOLLOW-UP CLOSED: No comments received. **2) FOLLOW-UP OUTSTANDING: Fort McKay FN to let Ivanhoe know if consultation logs should be uploaded to CIS.**

Fort McKay First Nation (Fort McKay FN)						
ROC#	**Event Type**	**Event Date**	**Stakeholder List**	**Team List**	**Comments**	**Follow-Up and Outstanding Actions**
3293	E-mail	08/21/2012	Regulatory Coordinator (Fort McKay FN SD)	Consultation Coordinator (Ivanhoe)	1) Fort McKay FN provided their comments on Ivanhoe's responses to their SOC (see ROC3256). Would like to discuss; provided potential meeting dates.	1) FOLLOW-UP COMPLETE: Ivanhoe is available on 12/09/17 (see ROC3296).
3296	E-mail	08/22/2012	Regulatory Coordinator (Fort McKay FN SD)	Consultation Coordinator (Ivanhoe)	1) Meeting to discuss Fort McKay FN's comments on Ivanhoe's responses to Fort McKay FN's SOC set for 12/09/17 (see ROC3293). Ivanhoe to confirm if Fort McKay FN should provide a budget to have their technical experts at the meeting.	1) FOLLOW-UP COMPLETE: Meeting held on 12/09/17 (see ROC3452). 1) FOLLOW-UP COMPLETE: Having technical experts at the meeting was discussed by phone on 12/08/22 (see ROC3366).
3366	Phone Call	08/22/2012	Regulatory Coordinator (Fort McKay FN SD)	Consultation Coordinator (Ivanhoe)	1) Discussed the SOC review meeting scheduled for 12/09/17 and reviewed budget items relating to the meeting (see ROC3296). Also confirmed who would be attending from Fort McKay FN and Ivanhoe.	
3367	Phone Call	08/22/2012	Regulatory Coordinator (Fort McKay FN SD)	Consultation Coordinator (Ivanhoe)	1) Discussed the SOC review document provided by Fort McKay FN on 12/08/21 (see ROC3293). Fort McKay FN will get feedback from their consultants on the remaining SOCs not commented on before the meeting.	1) FOLLOW-UP COMPLETE: Feedback provided at 12/09/17 meeting (see ROC3452).
3320	E-mail	08/27/2012	Senior Environmental Advisor (Fort McKay FN SD) Director (Fort McKay FN SD)	Consultation Coordinator (Ivanhoe)	1) Ivanhoe requested a status update on the community consultation session report (see also ROC3302).	1) FOLLOW-UP COMPLETE: Report provided by Fort McKay FN on 12/09/28 (see ROC3443)..
3327	E-mail	08/28/2012	Program Manager (Fort McKay FN SD)	Director, HS&E Regulatory (Ivanhoe) Consultation Coordinator (Ivanhoe)	1) Fort McKay FN provided the invitation to their 12/09/19 sustainability/industry tradeshow.	1) FOLLOW-UP COMPLETE: Ivanhoe is unable to attend (see ROC3329, 12/08/29).
3329	E-mail	08/29/2012	Program Manager (Fort McKay FN SD) Director (Fort McKay FN SD)	Director, HS&E Regulatory (Ivanhoe) Consultation Coordinator (Ivanhoe)	1) Ivanhoe thanked Fort McKay FN for the invitation to the sustainability/industry tradeshow; Ivanhoe is unable to attend (see ROC3327).	
3334	E-mail	08/29/2012	Regulatory Coordinator (Fort McKay FN SD)	Consultation Coordinator (Ivanhoe)	1) Ivanhoe provided information on the location for the 12/09/17 meeting.	

Fort McKay First Nation (Fort McKay FN)						
ROC#	**Event Type**	**Event Date**	**Stakeholder List**	**Team List**	**Comments**	**Follow-Up and Outstanding Actions**
3337	E-mail	08/30/2012	Regulatory Coordinator (Fort McKay FN SD)	Consultation Coordinator (Ivanhoe)	1) Ivanhoe requested clarification on some of Fort McKay FN's comments on the SOC responses (see ROC3293).	1) FOLLOW-UP COMPLETE: Clarification provided by e-mail on 12/09/11 (see ROC3380).
3349	E-mail	09/04/2012	Regulatory Coordinator (Fort McKay FN SD)	Consultation Coordinator (Ivanhoe)	1) Discussion on start time for 12/09/17 meeting.	
3353	E-mail	09/06/2012	Consultant 2 (Pravid Environmental Inc.) (Fort McKay FN SD)	(Ivanhoe)	1) Fort McKay FN's consultant requested clarification on one of the SOC responses. Ivanhoe to provide.	1) FOLLOW-UP COMPLETE: Answers provided via e-mail on 12/09/12 (see ROC3386).
3375	E-mail	09/10/2012	Program Manager (Fort McKay FN SD)	Director, HS&E Regulatory (Ivanhoe) Consultation Coordinator (Ivanhoe)	1) Fort McKay FN provided further information on their sustainability/industry tradeshow.	
3380	E-mail	09/11/2012	Consultant 1 (Lagimodiere & Associates) Regulatory Coordinator (Fort McKay FN SD)	Consultation Coordinator (Ivanhoe)	1) Fort McKay FN provided responses to some of the SOC responses.	
3381	E-mail	09/12/2012	Consultant 1 (Lagimodiere & Associates) Senior Environmental Advisor (Fort McKay FN SD) Regulatory Coordinator (Fort McKay FN SD)	Consultation Coordinator (Ivanhoe)	1) Fort McKay FN provided their SOC response review with the socio-economic items addressed.	
3385	E-mail	09/12/2012	Regulatory Coordinator (Fort McKay FN SD)	Consultation Coordinator (Ivanhoe)	1) Discussion on items for the 12/09/17 meeting.	
3386	E-mail	09/12/2012	(Pravid Environmental Inc.)	(Ivanhoe)	1) Ivanhoe provided a response to Fort McKay FN's concern regarding odor (SOC 12). Will discuss further at the meeting next week.	
3388	Phone Call	09/13/2012	Regulatory Coordinator (Fort McKay FN SD)	Consultation Coordinator (Ivanhoe)	1) Discussion related to 12/09/17 meeting logistics. Ivanhoe confirmed that the meeting is to review and discuss outstanding SOCs only.	
3391	E-mail	09/13/2012	Regulatory Coordinator (Fort McKay FN SD)	Consultation Coordinator (Ivanhoe)	1) Ivanhoe provided responses to Fort McKay FN's questions about the SOC responses (see ROCs 3380 and 3381).	

Fort McKay First Nation (Fort McKay FN)						
ROC#	**Event Type**	**Event Date**	**Stakeholder List**	**Team List**	**Comments**	**Follow-Up and Outstanding Actions**
3395	E-mail	09/14/2012	Program Manager (Fort McKay FN SD) Senior Environmental Advisor (Fort McKay FN SD) Regulatory Coordinator (Fort McKay FN SD)	Consultation Coordinator (Ivanhoe)	1) Ivanhoe provided an agenda for the 12/09/17 meeting to discuss SOC responses.	
3452	Meeting	09/17/2012	Consultant 1 (Lagimodiere & Associates) Consultant 2 (Pravid Environmental) Consultant 3 (Gould Environmental Ltd.) Senior Environmental Advisor (Fort McKay FN SD) Regulatory Coordinator (Fort McKay FN SD)	Project Manager (AMEC) VP, Engineering, Upstream & Integration (Ivanhoe) Director, HS&E Regulatory (Ivanhoe) Consultation Coordinator (Ivanhoe) Air Specialist (AMEC) Regulatory Consultant (JDEL) Senior Soil Scientist (AMEC) Wildlife Biologist (AMEC)	1) Discussed the various SOCs with which Fort McKay FN had concerns. Topics covered included water, fish, vegetation, wetlands, wildlife, conservation and reclamation, monitoring plans, air quality, emissions, noise, access management, cumulative effects, health, TK/TLU, socio-economics and the Terrestrial Thresholds Study. Another meeting will be set up to finalize environmental issues and commitments. 2) Commitments made by Ivanhoe: (a) Allow Fort McKay FN to review and comment on water and wildlife monitoring plans. (b) Ivanhoe to review alternatives to barley for seed mixes, and to discuss further. (c) Ivanhoe to review the Fort McKay FN Air Quality Objectives when available. 3) Ivanhoe to contact the Fort McKay FN trapper coordinator to identify the locations of the trapper cabins on RFMA 2453.	**1) FOLLOW-UP OUTSTANDING: Ivanhoe to set up another meeting to continue discussions by 12/10/05.** 3) FOLLOW-UP COMPLETE: Received Trapper Coordinator contact info on 12/10/11
3404	E-mail	09/18/2012	Regulatory Coordinator (Fort McKay FN SD)	Consultation Coordinator (Ivanhoe)	1) Fort McKay FN provided their invoice for the SOC review.	
3412	E-mail	09/19/2012	Regulatory Coordinator (Fort McKay FN SD)	Consultation Coordinator (Ivanhoe)	1) Ivanhoe thanked Fort McKay FN for the invoice and noted that notes from the last meeting will be provided soon.	
3428	E-mail	09/24/2012	Program Manager (Fort McKay FN SD) Administration/ Bookings (Fort McKay FN)	Director, HS&E Regulatory (Ivanhoe) Consultation Coordinator (Ivanhoe)	1) Budget meeting set for 12/10/03 in Calgary.	FOLLOW-UP COMPLETE: Meeting attended on 12/10/03.

Fort McKay First Nation (Fort McKay FN)						
ROC#	**Event Type**	**Event Date**	**Stakeholder List**	**Team List**	**Comments**	**Follow-Up and Outstanding Actions**
3430	E-mail	09/25/2012	Program Manager (Fort McKay FN SD) Administration/ Bookings (Fort McKay FN)	Director, HS&E Regulatory (Ivanhoe) Consultation Coordinator (Ivanhoe)	1) Fort McKay FN provided details for the 12/10/03 budget meeting.	
3436	E-mail	09/26/2012	Senior Environmental Advisor (Fort McKay FN SD) Regulatory Coordinator (Fort McKay FN SD)	Consultation Coordinator (Ivanhoe)	1) Ivanhoe will provide notes for the SOC meeting next week.	1) FOLLOW-UP COMPLETE: Notes provided on 12/10/05.
3451	E-mail	09/26/2012	Regulatory Coordinator (Fort McKay FN SD)	Consultation Coordinator (Ivanhoe)	1) Fort McKay FN's water concerns have been adequately addressed.	
3443	E-mail	09/28/2012	Regulatory Coordinator (Fort McKay FN SD)	Consultation Coordinator (Ivanhoe)	1) Fort McKay FN provided notes from their spring community consultation session (see ROC3302).	

Mikisew Cree First Nation (MCFN)						
ROC#	**Event Type**	**Event Date**	**Stakeholder List**	**Team List**	**Comments**	**Follow-Up and Outstanding Actions**
2952	E-mail	06/04/2012	TEK Coordinator (MCFN GIR)	Consultation Coordinator (Ivanhoe)	1) Ivanhoe is not available on 12/06/08. MCFN suggested rescheduling to 12/06/28. Agenda to include a regulatory update and discussion on the project description.	1) FOLLOW-UP COMPLETE: Availability confirmed on 12/06/19 (see ROC2985).
2982	E-mail	06/19/2012	Regulatory Affairs Coordinator (MCFN GIR) Director (MCFN GIR)	Consultation Coordinator (Ivanhoe)	1) Ivanhoe provided the consultation logs for April-May 2012. Requested that any comments be provided by e-mail to ESRD and copied to Ivanhoe, and they will be included in the next bi-monthly report.	
2985	E-mail	06/19/2012	TEK Coordinator (MCFN GIR)	Consultation Coordinator (Ivanhoe)	1) Ivanhoe confirmed the Advisory Committee meeting for 12/06/28. MCFN will send a list of attendees to Ivanhoe by 12/06/22. Honorariums will be administered by MCFN and invoiced to Ivanhoe.	1) FOLLOW-UP CLOSED: List of meeting attendees not received before the meeting.
2988	E-mail	06/20/2012	Regulatory Affairs Coordinator (MCFN GIR) Director (MCFN GIR)	Consultation Coordinator (Ivanhoe)	1) MCFN reviewed the bi-monthly consultation log (see ROC298) and noted that some important items remain outstanding: community engagement, review of the SIRs, technical workshop to discuss Ivanhoe's responses to their SOC and a site visit. They will have more comments in the next few weeks.	1) FOLLOW-UP CLOSED: No additional comments received.
2995	E-mail	06/21/2012	Director (MCFN GIR)	Consultation Coordinator (Ivanhoe)	1) Ivanhoe thanked MCFN for their comments on the bi-monthly report (see ROC2988).	
3014	E-mail	06/27/2012	TEK Coordinator (MCFN GIR)	Consultation Coordinator (Ivanhoe)	1) Further to the earlier call (see ROC3094), Ivanhoe will not cover costs for the AC member to travel from Lac La Biche for the meeting.	
3094	Phone Call	06/27/2012	TEK Coordinator (MCFN GIR)	Consultation Coordinator (Ivanhoe)	1) MCFN requested coverage of travel costs for an AC member from Lac la Biche; Ivanhoe will confirm if this is possible. Confirmed the number of people who will be attending the 12/06/28 meeting.	1) FOLLOW-UP CLOSED: Ivanhoe will not cover costs (see ROC3014, 12/06/27).

Mikisew Cree First Nation (MCFN)						
ROC#	**Event Type**	**Event Date**	**Stakeholder List**	**Team List**	**Comments**	**Follow-Up and Outstanding Actions**
2981	Meeting	06/28/2012	TEK Coordinator (MCFN GIR)	Consultation Coordinator (Ivanhoe)	1) Ivanhoe provided an overview of the Tamarack Project, integrated SAGD/HTL development, regulatory process, project layout and constraints mapping, and consultation and relationship building. 2) There was discussion on these topics, as well as MCFN traditional territory, cumulative effects, teaching MCFN more about the SAGD/HTL processes, water sources, reclamation, emissions, traditional use and effects on plants and hunting. 3) MCFN wishes to have a flyover of the area as a site visit is not possible. 4) Issues: (a) Traditional Territory for MCFN extends beyond Fort Chip and Fort McMurray. (b) Tamarack Project is within the MCFN Traditional Territory. (b) Cumulative impacts of oil sands development. (c) Mentorship Program for community members to understand SAGD development. (d) Incorporation of TEK into development and management. (e) Water withdrawals from rivers and lakes (particularly Athabasca and Clearwater). (f) Backup water sources. (c) Arsenic contamination in groundwater. (g) MCFN involvement in the Regulatory Process and the following of MCFN Protocol and laws. (h) MCFN involvement in regional infrastructure planning. (i) MCFN involvement in Pre-Disturbance Assessment of area.	<NOTE: This summary not provided in the last report> **3) FOLLOW-UP OUTSTANDING: Ivanhoe to determine if a flyover for MCFN members is possible.**
3018	E-mail	06/29/2012	Director (MCFN GIR)	Consultation Coordinator (Ivanhoe)	1) Ivanhoe e-mailed a copy of its letter (see ROC3017) with responses to MCFN's SOC (see ROC 1417).	
3048	E-mail	07/09/2012	Office Manager (MCFN GIR)	Consultation Coordinator (Ivanhoe)	1) Ivanhoe is unable to participate in the cultural camp this year, but is willing to provide door prizes.	
3229	E-mail	07/09/2012	Office Manager (MCFN GIR)	Consultation Coordinator (Ivanhoe)	1) MCFN accepted Ivanhoe's offer of door prizes for their cultural retreat.	

Mikisew Cree First Nation (MCFN)						
ROC#	**Event Type**	**Event Date**	**Stakeholder List**	**Team List**	**Comments**	**Follow-Up and Outstanding Actions**
3054	E-mail	07/10/2012	Regulatory Affairs Coordinator (MCFN GIR) Director (MCFN GIR)	Consultation Coordinator (Ivanhoe)	1) Ivanhoe asked if MCFN would like hard copies and/or CD copies of the SIR2 responses.	1) FOLLOW-UP COMPLETE: Response provided on 12/07/11 (see ROC3069).
3067	E-mail	07/10/2012	Legal Representative (JFK Law Corporation)	Regulatory Affairs Consultant	1) MCFN's legal representative and Regulatory Affairs Consultant discussed having a meeting to talk about the SOCs in early August. MCFN's legal representative to confirm date and who will attend.	1) FOLLOW-UP COMPLETE: Meeting held on 12/08/09.
3097	Letter	07/10/2012	Director (MCFN GIR)	Director, HS&E Regulatory (Ivanhoe)	1) Ivanhoe provided a CD copy of the SIR2 responses filed with ESRD on 12/07/06 and noted the document is also available on their website. Asked that MCFN contact them if they wish to receive additional CD copies or have any questions.	
3069	E-mail	07/11/2012	Regulatory Affairs Coordinator (MCFN GIR) Director (MCFN GIR)	Consultation Coordinator (Ivanhoe)	1) MCFN only requires a CD copy of the SIR2 responses (see ROC3054).	
3017	Letter	07/18/2012	Director (MCFN GIR)	Director, HS&E Regulatory (Ivanhoe)	1) Ivanhoe responded to MCFN's SOC on the project (see ROC1417).	
3227	Letter	07/18/2012	Director (MCFN GIR) to Section Leader, In Situ Oilsands Applications (Energy Resources Conservation Board)		1) Further to their SOC filed on 11/03/11 [see ROC1417], MCFN filed a formal Letter of Objection with respect to ERCB Application No. 1665921 (Tamarack Project). The letter outlined their concerns with the regulatory and consultation process, as well as potential effects on their rights and interests in the project area.	
3152	Letter	07/19/2012	Section Leader, In Situ Oilsands Applications (Energy Resources Conservation Board) to Director (MCFN GIR)		1) ERCB noted receipt of MCFN's letter of objection dated 12/07/18 (see ROC3227) and requested that Ivanhoe contact MCFN to discuss their concerns.	1) FOLLOW-UP COMPLETE: Ivanhoe contacted MCFN on 12/07/30 to request a meeting (see ROC3154).
3154	E-mail	07/30/2012	Director (MCFN GIR)	Consultation Coordinator (Ivanhoe)	1) Ivanhoe requested a meeting with MCFN to discuss Ivanhoe's response to their SOCs and the Letter of Objection provided to the ERCB.	1) FOLLOW-UP COMPLETE: Meeting to discuss SOCs set for 12/10/11 (see ROC3315, 12/08/27).

Mikisew Cree First Nation (MCFN)						
ROC#	**Event Type**	**Event Date**	**Stakeholder List**	**Team List**	**Comments**	**Follow-Up and Outstanding Actions**
3220	Phone Call	07/30/2012	TEK Coordinator (MCFN GIR)	Consultation Coordinator (Ivanhoe)	1) TEK Coordinator requested a copy of the Tamarack project description. Ivanhoe noted that this information was provided in the Application for the Tamarack Project previously provided to MCFN. Ivanhoe agree to provide this information in the form of the executive summary.	1) FOLLOW-UP COMPLETE: Copy of the executive summary from the application provided on 12/07/31 (see ROC3221).
3162	E-mail	07/31/2012	Director (MCFN GIR)	Consultation Coordinator (Ivanhoe)	1) In follow-up to ROC3154, Ivanhoe also requested a budget for MCFN to review the SOC response, as well as a budget to hold the meeting to review.	1) FOLLOW-UP CLOSED: MCFN will work on a budget and get back to Ivanhoe (12/08/07). See follow-up in ROC3243.
3164	E-mail	07/31/2012	TEK Coordinator (MCFN GIR)	Consultation Coordinator (Ivanhoe)	1) Ivanhoe provided a project summary for the Tamarack Project and noted that MCFN should have received the updated application, EIA and SIRs (see ROC3220). Asked that MCFN let Ivanhoe know if the CD had not been received, and also provided a link to the electronic version.	
3243	E-mail	08/07/2012	Director (MCFN GIR)	Consultation Coordinator (Ivanhoe)	1) MCFN will provide a draft budget and dates for reviewing the SOC. 2) Ivanhoe would like to arrange a chief-to-chief meeting between Ivanhoe senior management and MCFN Chief and Council.	1) FOLLOW-UP CLOSED: Ivanhoe requested an update on 12/08/27. See follow-up in ROC3321. 2) FOLLOW-UP COMPLETE: Protocol discussed at 12/10/11 meeting.
3245	E-mail	08/08/2012	Land Use Coordinator (MCFN GIR) TEK Coordinator (MCFN GIR)	Consultation Coordinator (Ivanhoe)	1) Ivanhoe requested an update on the status of the IK report (a draft was due 12/06/15 and final report was due 12/07/31).	1) FOLLOW-UP COMPLETE: Will provide by mid-October (see ROC3279, 12/08/17).
3279	E-mail	08/17/2012	Land Use Coordinator (MCFN GIR)	Director, HS&E Regulatory (Ivanhoe) Consultation Coordinator (Ivanhoe)	1) MCFN will provide the IK report by mid-October (see ROC3245). Ivanhoe asked if a draft would be provided before that time.	1) FOLLOW-UP CLOSED: Ivanhoe asked again about the IK Report on 12/08/29. See follow-up in ROC3330.
3284	E-mail	08/17/2012	Regulatory Affairs Coordinator (MCFN GIR) Director (MCFN GIR)	Consultation Coordinator (Ivanhoe)	1) Ivanhoe provided the bi-monthly consultation log for June-July. Requested that any comments be mailed to ESRD and copied to Ivanhoe; they will be included in the next bi-monthly report.	

Mikisew Cree First Nation (MCFN)						
ROC#	**Event Type**	**Event Date**	**Stakeholder List**	**Team List**	**Comments**	**Follow-Up and Outstanding Actions**
3315	E-mail	08/27/2012	Director (MCFN GIR) Agreement Coordinator (MCFN GIR)	Director, HS&E Regulatory (Ivanhoe)	1) MCFN requested a meeting on 12/10/11. Ivanhoe to confirm.	1) FOLLOW-UP COMPLETE: Meeting confirmed on 12/08/28 (see ROC3328).
3321	E-mail	08/27/2012	Director (MCFN GIR)	Consultation Coordinator (Ivanhoe)	1) Ivanhoe requested dates for the SOC meeting. Also asked if a budget for the SOC review had been prepared.	1) FOLLOW-UP COMPLETE: SOC budget provided on 12/09/07 (see ROC3359).
3328	E-mail	08/28/2012	Agreement Coordinator (MCFN GIR)	Consultation Coordinator (Ivanhoe)	1) Meeting to discuss SOCs set for 12/10/11.	1) FOLLOW-UP COMPLETE: Meeting held on 12/10/11.
3370	Phone Call	08/28/2012	Agreement Coordinator (MCFN GIR`)	Consultation Coordinator (Ivanhoe)	1) Called following an email sent to Ivanhoe on 12/08/27 (see ROC3315). Meeting with MCFN GIR staff and advisors set for 12/10/11 in Fort Chipewyan (see also ROC3328).	1) FOLLOW-UP COMPLETE: Meeting held on 12/10/11.
3330	E-mail	08/29/2012	Land Use Coordinator (MCFN GIR) TEK Coordinator (MCFN GIR)	Consultation Coordinator (Ivanhoe)	1) Ivanhoe expressed concern that the information from MCFN's IK report will not be included in a timely way if not received before October (see ROC3279). MCFN to let Ivanhoe know if a draft report can be made available before October.	
3359	E-mail	09/07/2012	Regulatory Affairs Coordinator (MCFN GIR) Director (MCFN GIR)	Consultation Coordinator (Ivanhoe)	1) MCFN provided a scope of work to review the SOC responses.	
3360	E-mail	09/10/2012	Land Use Coordinator (MCFN GIR)	Consultation Coordinator (Ivanhoe)	1) MCFN will check with their subconsultants to see if a draft of the IK report can be provided before October (see ROC3330).	
3361	E-mail	09/10/2012	Land Use Coordinator (MCFN GIR) Consultant (Firelight Group)	Consultation Coordinator (Ivanhoe)	1) IK report will be ready for MCFN review after 12/09/18. Suggested a call to discuss what information is needed for the application when the Land Use Coordinator returns from holidays. MCFN's consultant requested clarification on source water and waste disposal.	1) FOLLOW-UP COMPLETE: Delivery of IK report discussed further by e-mail on 12/09/12 (see ROC3384).
3374	E-mail	09/10/2012	Regulatory Affairs Coordinator (MCFN GIR)	Consultation Coordinator (Ivanhoe)	1) Ivanhoe confirmed receipt of the scope of work to review the SOC response, and will get back to MCFN after reviewing it.	1) FOLLOW-UP COMPLETE: Reviewed on 12/09/14 (see ROC3396).

Mikisew Cree First Nation (MCFN)						
ROC#	**Event Type**	**Event Date**	**Stakeholder List**	**Team List**	**Comments**	**Follow-Up and Outstanding Actions**
3384	E-mail	09/12/2012	Director (MCFN GIR) Consultant (Firelight Group)	Consultation Coordinator (Ivanhoe)	1) MCFN will have a final copy of the IK report available for Ivanhoe in October; a draft will not be provided for inclusion in the regulatory process. Noted that it took Ivanhoe a year to respond to their SOC, and that the deadline changes for the IK report have been beyond their control.	
3390	E-mail	09/13/2012	Director (MCFN GIR)	Consultation Coordinator (Ivanhoe)	1) Ivanhoe thanked MCFN for their response regarding the IK report (see ROC3384), and looks forward to receiving the report when it is available.	
3396	E-mail	09/14/2012	Regulatory Affairs Coordinator (MCFN GIR) Director (MCFN GIR)	Consultation Coordinator (Ivanhoe)	1) Discussion on budget for the SOC review.	1) FOLLOW-UP CLOSED: MCFN asked Ivanhoe for input on where to reduce the budget (12/09/17). See follow-up in ROC3398.
3398	E-mail	09/17/2012	Regulatory Affairs Coordinator (MCFN GIR) Director (MCFN GIR) Project Lead (ACFN IRC)	Consultation Coordinator (Ivanhoe)	1) Discussion on the budget for the SOC review (see also ROC3396). ACFN will participate with MCFN in the SOC review.	1) FOLLOW-UP COMPLETE: New budget provided on 12/09/21 (see ROC3240).
3413	E-mail	09/19/2012	Agreement Coordinator (MCFN GIR)	Consultation Coordinator (Ivanhoe)	1) MCFN requested, and was provided with, a copy of the Ivanhoe logo for the 12/10/11 meeting agenda. MCFN will forward the draft agenda to Ivanhoe for review when it is ready. Ivanhoe requested a list of people to attend the meeting.	1) FOLLOW-UP OUTSTANDING: MCFN to send draft agenda for 12/10/11 meeting and list of attendees to Ivanhoe.
3420	E-mail	09/21/2012	Regulatory Affairs Coordinator (MCFN GIR)	Consultation Coordinator (Ivanhoe)	1) MCFN provided a revised budget to review the SOC responses. Ivanhoe to review.	1) FOLLOW-UP COMPLETE: Discussed by phone on 12/09/27 (see ROC3442).
3439	E-mail	09/26/2012	Agreement Coordinator (MCFN GIR) TEK Coordinator (MCFN GIR)	Consultation Coordinator (Ivanhoe)	1) Ivanhoe provided draft notes from the 12/06/28 meeting (see ROC2981) and ask that any comments be provided by 12/10/17.	**1) FOLLOW-UP OUTSTANDING: MCFN to review meeting notes.**
3442	Phone Call	09/27/2012	Regulatory Affairs Coordinator (MCFN GIR)	Consultation Coordinator (Ivanhoe)	1) Ivanhoe left a message, requesting a call back to discuss the SOC review meeting.	1) FOLLOW-UP CLOSED: Ivanhoe called again on 12/10/01.

Métis Local 63						
ROC#	**Event Type**	**Event Date**	**Stakeholder List**	**Team List**	**Comments**	**Follow-Up and Outstanding Actions**
3122	Letter	07/17/2012	Executive Director (Métis Local 63)	Director, HS&E Regulatory (Ivanhoe)	1) Ivanhoe provided a CD including the SIRs, and noted that the SIR2 responses are available on their website. Asked that Métis Local 63 contact them if they wish to receive an additional CD copy or have any questions.	
3126	Letter	07/17/2012	President (Métis Local 63)	Director, HS&E Regulatory (Ivanhoe)	1) Ivanhoe provided a copy of the application and SIRs, and noted that the SIR2 responses are available on their website. Asked that Métis Local 63 contact them if they wish to receive additional CD copies or have any questions.	

Métis Local 125						
ROC#	**Event Type**	**Event Date**	**Stakeholder List**	**Team List**	**Comments**	**Follow-up and Outstanding Actions**
3110	Letter	07/16/2012	President (Métis Local 125)	Director, HS&E Regulatory (Ivanhoe)	1) Ivanhoe noted that the SIR2 responses are available on their website. Asked that Métis Local 125 contact them if they wish to receive a CD copy or have any questions.	
3288	Letter	08/16/2012	President (Métis Local 125)	Director, HS&E Regulatory (Ivanhoe)	1) Métis Local 125 provided information about Métis Local 125 and requested that Ivanhoe engage in consultation and negotiation with them.	1) FOLLOW-UP COMPLETE: Ivanhoe responded on 12/08/27 (see ROC3316).
3289	E-mail	08/20/2012	Legal Counsel (Métis Local 125)	Director, HS&E Regulatory (Ivanhoe)	1) Métis Local 125 provided a revised letter (see ROC3288) as the first version contained errors; Ivanhoe acknowledged receipt. Métis Local 125 asked for information on who at the ERCB to send their letter of concern to; Ivanhoe will get back to them with this information.	1) FOLLOW-UP COMPLETE: Information provided on 12/08/21 (se ROC3462).
3462	E-mail	08/21/2012	Legal Counsel (Métis Local 125)	Consultation Coordinator (Ivanhoe)	1) Further to Métis Local 125's request (see ROC3289), Ivanhoe provided contact information for the ERCB to whom their letter of concern should be sent (see ROC3289). 2) Ivanhoe will respond formally to Métis Local 125's draft letter of concern.	1) FOLLOW-UP COMPLETE: Ivanhoe responded on 12/08/27 (see ROC3316).
3316	Letter	08/27/2012	President (Métis Local 125)	Director, HS&E Regulatory (Ivanhoe)	1) Ivanhoe responded to Métis Local 125's letter (see ROC3288). Ivanhoe summarized consultation to date on the project. Noted that Ivanhoe has not been provided with any information that would establish that Métis Local 125 members have traditional uses in the area, and therefore is not prepared to negotiate an agreement at this time. Ivanhoe will, however, continue to include Métis Local 125 in the consultation process.	
3317	E-mail	08/27/2012	President (Métis Local 125) Legal Counsel (Métis Local 125)	Consultation Coordinator (Ivanhoe)	1) Ivanhoe provided an electronic copy of the 12/08/27 letter to Métis Local 125 (see ROC3316). Will send a CD copy of the latest Tamarack Project submission by postal mail.	
3347	E-mail	09/04/2012	Consultant (Métis Local 125)	Director, HS&E Regulatory (Ivanhoe)	1) Meeting with Métis Local 125 and their consultant to discuss their SOC set for 12/09/26.	1) FOLLOW-UP CLOSED: Meeting postponed by Métis Local 125 (see ROC3383, 12/09/12).

Métis Local 125						
ROC#	**Event Type**	**Event Date**	**Stakeholder List**	**Team List**	**Comments**	**Follow-up and Outstanding Actions**
3351	Phone Call	09/04/2012	Consultant (Métis Local 125)	Director, HS&E Regulatory (Ivanhoe)	1) TK Facilitator is representing Métis Local 125. Would like to set up meeting with Ivanhoe and the Local to discuss the Tamarack Project.	
3355	E-mail	09/06/2012	Consultant (TK Facilitator)	Consultation Coordinator (Ivanhoe)	1) Ivanhoe asked for the number of people to attend the 12/09/26 meeting so that lunch arrangements can be made.	1) FOLLOW-UP COMPLETE: Numbers provided on 12/09/06 (see ROC3355).
3358	E-mail	09/07/2012	Consultant (TK Facilitator)	Consultation Coordinator (Ivanhoe)	1) Consultant provided numbers for the 12/09/26 meeting. Noted that the meeting may be pushed to the first week of October.	
3383	E-mail	09/12/2012	Consultant (TK Facilitator)	Consultation Coordinator (Ivanhoe)	1) Métis Local 125 would like to meet the week of 12/10/08 instead; Ivanhoe to confirm availability.	1) FOLLOW-UP COMPLETE: Date provided by e-mail on 12/09/18 (see ROC3403).
3403	E-mail	09/18/2012	Consultant (TK Facilitator)	Consultation Coordinator (Ivanhoe)	1) Meeting with Métis Local 125 and their consultant set for 12/10/09.	1) FOLLOW-UP CLOSED: Meeting held on 12/10/09.
3408	E-mail	09/19/2012	Consultant (TK Facilitator)	Consultation Coordinator (Ivanhoe)	1) Discussion on logistics for the 12/10/09 meeting. Ivanhoe would like to do a presentation to provide information to Métis Local 125 about the Project.	

Métis Local 193						
ROC #	**Event Type**	**Event Date**	**Stakeholder List**	**Team List**	**Comments**	**Follow-Up and Outstanding Actions**
3,116	Letter	07/16/2012	President (Conklin Métis Local 193)	Director, HS&E Regulatory (Ivanhoe)	1) Ivanhoe noted that the SIR2 responses are available on their website. Asked that Métis Local 193 contact them if they wish to receive a CD copy or have any questions.	

Métis Local 214						
ROC#	**Event Type**	**Event Date**	**Stakeholder List**	**Team List**	**Comments**	**Follow-Up and Outstanding Actions**
3,140	Letter	07/23/2012	President (Chard Métis Local 214)	Director, HS&E Regulatory (Ivanhoe)	1) Ivanhoe provided a CD of the updated application and SIRs, and noted that the SIR2 responses are available on their website. Asked that Métis Local 214 contact them if they wish to receive additional CD copies or have any questions.	

Métis Local 780						
ROC#	**Event Type**	**Event Date**	**Stakeholder List**	**Team List**	**Comments**	**Follow-Up and Outstanding Actions**
3,145	Letter	07/17/2012	President (Willow Lake Métis Local 780)	Consultation Coordinator (Ivanhoe)	1) Métis Local 780 invited Ivanhoe to participate in their upcoming Métis Festival and also requested that Ivanhoe sponsor the event.	**1) FOLLOW-UP OUTSTANDING: Ivanhoe to confirm if they will sponsor and attend the event.**
3,138	Letter	07/23/2012	President (Willow Lake Métis Local 780)	Director, HS&E Regulatory (Ivanhoe)	1) Ivanhoe provided a CD of the updated application and SIRs, and noted that the SIR2 responses are available on their website. Asked that Métis Local 780 contact them if they wish to receive additional CD copies or have any questions.	

Métis Local 1935						
ROC#	**Event Type**	**Event Date**	**Stakeholder List**	**Team List**	**Comments**	**Follow-up and Outstanding Actions**
3095	Letter	07/10/2012	Administrative Assistant - O&G (Métis Local 1935)	Director, HS&E Regulatory (Ivanhoe)	1) Ivanhoe provided a CD copy of the SIR2 responses filed with ESRD on 12/07/06 and noted the document is also available on their website. Asked that Métis Local 1935 contact them if they wish to receive additional CD copies or have any questions.	
3146	Letter	07/18/2012	President (Métis Local 1935)	Consultation Coordinator (Ivanhoe)	1) Métis Local 1935 provided information on their new General Manager.	
3147	E-mail	07/18/2012	Administrative Assistant - O&G (Métis Local 1935)	Consultation Coordinator (Ivanhoe)	1) Métis Local 1935 provided an electronic copy of the letter from Métis Local 1935 on their new General Manager.	
3155	E-mail	07/30/2012	Administrative Assistant - O&G (Métis Local 1935)	Consultation Coordinator (Ivanhoe)	1) Ivanhoe thanked Métis Local 1935 for the update on their new General Manager.	
3249	E-mail	08/09/2012	Unknown (Métis Local 1935)	Consultation Coordinator (Ivanhoe)	1) Ivanhoe provided Métis Local 1935 with their mailing address.	
3379	E-mail	09/11/2012	Administrative Assistant - O&G (Métis Local 1935)	Consultation Coordinator (Ivanhoe)	1) Métis Local 1935 provided an update on their activities for the 2011-12 fiscal year.	
3431	E-mail	09/25/2012	Administrative Assistant - O&G (Métis Local 1935)	Consultation Coordinator (Ivanhoe)	1) Métis Local 1935 announced their new Senior Administrator, Oil & Gas - Negotiations.	
3440	Community Event	09/28/2012	Métis Local 1935	Consultation Coordinator (Ivanhoe)	1) Ivanhoe attended the celebration for the "Mark of the Métis" Project. Ivanhoe was provided with a copy of the report.	

Métis Local 2020						
ROC#	**Event Type**	**Event Date**	**Stakeholder List**	**Team List**	**Comments**	**Follow-Up and Outstanding Actions**
3,144	Letter	07/16/2012	President (Métis Local 2020)	Director, HS&E Regulatory (Ivanhoe)	1) Ivanhoe provided a CD of the updated application and SIRs, and noted that the SIR2 responses are available on their website. Asked that Métis Local 2020 contact them if they wish to receive additional CD copies or have any questions.	

Métis Nation of Alberta						
ROC#	**Event Type**	**Event Date**	**Stakeholder List**	**Team List**	**Comments**	**Follow-Up and Outstanding Actions**
3,142	Letter	07/23/2012	President (Métis Nation of Alberta)	Director, HS&E Regulatory (Ivanhoe)	1) Ivanhoe provided a CD of the updated application and SIRs, and noted that the SIR2 responses are available on their website. Asked that MNA Region 1 contact them if they wish to receive additional CD copies or have any questions.	
3,176	Letter	07/31/2012	Manager of Industry Relations (Métis Nation of Alberta)	Director, HS&E Regulatory (Ivanhoe)	1) Ivanhoe provided a CD copy of the application and SIRs, and noted that the SIR2 responses are available on their website. Asked that MNA contact them if they wish to receive additional CD copies or have any questions.	

Athabasca Tribal Council						
ROC#	**Event Type**	**Event Date**	**Stakeholder List**	**Team List**	**Comments**	**Follow-Up and Outstanding Actions**
2806	*E-mail*	*05/08/2012*	*CEO (Athabasca Tribal Council)*	*Director, HS&E Regulatory (Ivanhoe)*	*1) ATC and CPDFN requested sponsorship for the third ATC First Nation Regional Gathering in mid-August 2012 at CPDFN (Janvier).*	*1) FOLLOW-UP COMPLETE: Ivanhoe is unable to participate (see ROC2969, 12/06/07).*
2,969	Letter	06/07/2012	CEO (Athabasca Tribal Council)	Manager, Corporate Communication (Ivanhoe)	1) Ivanhoe is unable to participate in the ATC First Nation Regional Cultural Gathering this year (see ROC2806).	

Trappers						
ROC#	**Event Type**	**Event Date**	**Stakeholder List**	**Team List**	**Comments**	**Follow-up and Outstanding Actions**
3134	Letter	07/23/2012	RFMA 273 (Trapper)	Director, HS&E Regulatory (Ivanhoe)	1) Ivanhoe provided a CD of the updated application and SIRs, and noted that the SIR2 responses are available on their website. Asked that the trapper contact them if they wish to receive additional CD copies or have any questions.	
3137	Letter	07/23/2012	RFMA 1582 (Trapper)	Director, HS&E Regulatory (Ivanhoe)	1) Ivanhoe provided a CD of the updated application and SIRs, and noted that the SIR2 responses are available on their website. Asked that the trapper contact them if they wish to receive additional CD copies or have any questions.	
3143	Letter	07/23/2012	RFMA 2422 (Trapper)	Director, HS&E Regulatory (Ivanhoe)	1) Ivanhoe provided a CD of the updated application and SIRs, and noted that the SIR2 responses are available on their website. Asked that the trapper contact them if they wish to receive additional CD copies or have any questions.	
3460	Phone Call	09/25/2012	RFMA 2422 (Trapper)	Consultation Coordinator (Ivanhoe)	1) Arranged a meeting with the trapper on 12/09/28. 2) Issues: (a) Holes in area of Ivanhoe's gravel exploration last winter not filled correctly.	1) FOLLOW-UP COMPLETE: Meeting held on 12/09/28 (see ROC3465).
3465	Meeting	09/28/2012	RFMA 2422 (Trapper)	Consultation Coordinator (Ivanhoe)	1) Ivanhoe provided an update on the project; Ivanhoe will provide further information on winter work once the scope has been determined. Further discussion on the holes the trapper believes were not filled correctly (see ROC3460). Reviewed pictures taken of last year's reclamation work.	**1) FOLLOW-UP OUTSTANDING: Ivanhoe to contact trapper to discuss winter work.**

Other Aboriginal Organizations						
ROC#	**Event Type**	**Event Date**	**Stakeholder List**	**Team List**	**Comments**	**Follow-Up and Outstanding Actions**
3,111	Letter	07/16/2012	Honorary Chief (Wood Buffalo First Nations Elder's Society)	Director, HS&E Regulatory (Ivanhoe)	1) Ivanhoe noted that the SIR2 responses are available on their website. Asked that Wood Buffalo First Nations Elders' Society contact them if they wish to receive a CD copy or have any questions.	

List of Participants

Organization	Name	Title
Athabasca Chipewyan First Nation (ACFN) Industrial Relations Corporation (IRC)	Amanda Annand	Land Use Coordinator
ACFN IRC	Doreen Somers	Project Lead
ACFN IRC	Krissie Anderson	Title Unknown
ACFN IRC	Lisa King	Director
AMEC Environment & Infrastructure (AMEC)	Clarisse Thornton	Wildlife Biologist
AMEC	David Lamontage	Air Specialist 2
AMEC	Deo Heeraman	Senior Soil Scientist
AMEC	Drew Fischer	Air Specialist 3
AMEC	Rob Kemp	Air Specialist 1
AMEC	Eric Hartman	Project Manager
Athabasca Tribal Council	Roy Vermillion	Chief Executive Officer
Chipewyan Prairie Dene First Nation (CPDFN) IRC	Shaun Janvier	Executive Director
Fort McMurray #468 First Nation (FMFN #468)	Bernadette Dumais	Councillor 2
FMFN #468	Bernice Cree	Student Employment and Training Coordinator
FMFN #468	Brad Callihoo	CEO
FMFN #468	Brad Callihoo	Advisor (past)
FMFN #468 IRC	Cleo Reece	Councillor
FMFN #468 IRC	Harry Cheecham	Land Use Manager
FMFN #468 IRC	Harry Cheecham	Interim Director (past)
FMFN #468 IRC	Marie Buffy Cheecham	Title Unknown
FMFN #468	Nicholle Louvelle	Director
FMFN #468	Nicholle Louvelle	Band Manager (past)
FMFN #468	Ronald Kreutzer	Chief
FMFN #468	Sherri Labour	TK Facilitator
FMFN #468	Aaron Aubin	Consultant 1 (Dillon Consulting)
FMFN #468	Barb Samuels	Consultant 5 (Dillon Consulting)
FMFN #468 IRC	Bill McElhanney	Legal Representative (Ackroyd LLP Barristers & Solicitors)
FMFN #468	David Gould	Consultant 2 (Dillon Consulting)
FMFN #468	Karla Ressor	Consultant 4 (Moving Forward)
FMFN #468	Kerry Brown	Consultant 3 (Moving Forward)
FMFN #468	Neil Reddekopp	Legal Representative (Ackroyd LLP Barristers & Solicitors)
FMFN #468	Viktor Wierucki	Consultant 1 (Dillon Consulting)

Organization	Name	Title
Fort McKay First Nation (Fort McKay FN) Sustainability Dept. (SD)	Alvaro Pinto	Director
Fort McKay FN SD	Christine Flett	Community Liaison
Fort McKay FN SD	Dan Stuckless	Program Manager
Fort McKay FN SD	Eddison Johnson	Senior Environmental Advisor
Fort McKay FN SD	Krystaline Kaskamin	Administration/Bookings
Fort McKay FN SD	Margaret Luker	Regulatory Coordinator
Fort McKay FN	Raymond Powder	Councillor
Fort McKay FN SD	Bill Farrant	Consultant 5 (Integral Ecology)
Fort McKay FN SD	David Spink	Consultant 2 (Pravid Environmental)
Fort McKay FN SD	Lorne Gould	Consultant 3 (Gould Environmental)
Fort McKay FN SD	Marie Lagimodiere	Consultant 1 (Lagimodiere & Associates)
Fort McKay FN SD	Towage Behr	Consultant 4 (Integral Ecology)
Ivanhoe	David Dyck	President and COO (past)
Ivanhoe	Ed Veith	Executive VP of Upstream (past)
Ivanhoe	Ed Veith	President
Ivanhoe	Greg Phaneuf	Executive VP of Corporate Development
Ivanhoe	Hilary McMeekin	Manager, Corporate Communications
Ivanhoe	Jeff Winsor	Consultation Coordinator
Ivanhoe	Jeremy Hrdlicka	Director, HS&E Regulatory
Ivanhoe	Jerry Schiefelbein	CFO
Ivanhoe	Joe Kuhach	VP, Engineering, Upstream & Integration
Ivanhoe	Mike Boutette	Director of Engineering & Subsurface
Ivanhoe	Samantha Woznow	Receptionist
Ivanhoe	Suzzi Sethi	Associate General Counsel
Ivanhoe	Terry Bachynski	Regulatory Consultant (JDEL Associates Ltd.)
Mikisew Cree First Nation Government and Industry Relations (MCFN GIR)	Cathleen O'Brien	Regulatory Affairs Coordinator
MCFN GIR	Ivy Wigmore	Office Manager
MCFN GIR	Linda Aidnell	Land Use Coordinator
MCFN GIR	Matthew Whitehead	TEK Coordinator
MCFN GIR	Melody Lepine	Director
MCFN GIR	Sally Whiteknife	Agreement Coordinator
MCFN GIR	Craig Candler	Consultant (Firelight Group)
MCFN GIR	Robert Freedman	Legal Representative (JFK Law Corp.)

Organization	Name	Title
Métis Local 63	Jeffrey O'Donnell	Executive Director
Métis Local 63	Ron Quintal	President
Métis Local 125	Fred Fraser	President
Métis Local 125	Cynthia Bertolin	Legal Counsel
Métis Local 125	Sherri Labour	Consultant (TK Facilitator)
Métis Local 193	Shirley Tremblay	President
Métis Local 214	Raoul Montgrand	President
Métis Local 780	Elaine Hurley	President
Métis Local 1935	James Dragon	President
Métis Local 1935	Kaleena Loehr	Administrative Assistant – O&G
Métis Local 1935	Renee Unknown	Unknown
Métis Local 2020	Glen Tremblay	President
Métis Nation of Alberta	Melanie Daniels	Manager of Industry Relations
Métis Nation of Alberta	William Landstrom	President
Wood Buffalo First Nations Elders' Society	John Malcolm	Honorary Chief
RFMA 273	Bernice Cree	Trapper
RFMA 1582	Doug Golosky	Trapper
RFMA 2422	Richard Golosky	Trapper

Covers ROCs 2950–3466.

Ivanhoe Energy

Appendix SIR3 B

Updated Geosim Model

Ivanhoe Energy

Because of the file type, these files were provided directly to the ERCB