

SOIL

Study geographic boundaries: PDA, PEAA, RADEAA (Regional Acid Deposition Effects Assessment Area, in Kitimat terminal area), and in Agricultural Land Reserve areas in BC, the REAA (Regional Effects Assessment Area)

Study time boundaries: Construction, operations and decommissioning phases.

Project works and activities considered in the study*: Construction – surface and subsurface disturbance; RoW and site preparation; temporary workspace, staging lay down areas, temporary and permanent facilities and road development;

power line development; infrastructure construction; construction equipment and traffic; pipeline construction. Operations – RoW maintenance. Decommissioning – RoW and facility site reclamation; site restoration; road removal.

Study methods: In Alberta, agricultural soil capability was assessed in the area defined as the White Zone by the Province. In Alberta, all of the East Alberta Plains and the eastern part of the Southern Alberta Uplands consist of farmland. This agricultural area extends from KP 0 to the Whitecourt area. In British Columbia, agricultural soil capability was assessed in areas

defined by the Province as Agricultural Land Reserve (ALR). The Right-of-Way (RoW) primarily crosses forested areas, with the exception of small areas of ALR lands, which occur in the Ft. St. James, Burns Lake and other areas.

A baseline soil survey was completed for the PEAA and the RADEAA. For Agricultural Soil, the agricultural suitability rating was determined using the Canada Land Inventory system. Changes in soils resulting from admixing, compaction, erosion, changes in moisture conditions, and from soil burial were assessed. Mitigation measures for these changes were evaluated,

and an overall effect on soil was predicted. For Non-Agricultural Soils, change in quality of soil was assessed by evaluating changes in the same way as for Agricultural soils. A second effect for Non-Agricultural soils concerned the possibility of deposition of acidic substances emitted at the Kitimat Terminal. The sensitivity of soils to changes due to acidic inputs was evaluated. Data for potential acid input to the soils was obtained from the Air Quality assessment, and the possibility of change was based on whether or not the potential acid input was higher than the critical load for different sensitivity classes of soils.

VEC	Key Issues	KIR	Baseline Results	Measurable Parameter	Potential Project Effects**	Proposed Mitigation	Residual Effects	Cumulative Effects
Agricultural Soil	Reduced capability to support growth of crops and forests Acidifying emissions	n/a	Agricultural soils in the Bruderheim region are highly productive, with farming of cereal grains and oilseed crops being prevalent. Toward Whitecourt, the soils gradually change to soils that originally formed under forests. They have gray topsoils and a hardpan layer just below the topsoil. Cereals such as oats and barley, oilseeds, and forages are most commonly produced on these soils. In some areas, soils have lower capability for crop production because they are poorly drained, consist of peat deposits (organics), have soft rock close to the surface, are gravelly or sandy, have salts at or close to the surface, have no topsoil or little soil development, or consist of soils with hardpans and salts in the subsoil. In the BC Agricultural Land Reserve (ALR) lands, poorly drained, clayey, agricultural soils are common, and crop types are limited to forages and some cereals. The main existing disturbances of soils along the pipeline RoW consist of the rural road network. Pipelines are also common, with relatively high density in some areas.	Canada Land Inventory soil capability rating Soil admixing Soil compaction, rutting and puddling Soil erosion and soil loss Soil moisture changes	Project activities can result in alteration of soil physical, chemical and biological properties. Changes in agricultural soils can occur as a result of site clearing, soil stripping, stockpiling, construction activities and when the soil is replaced after installing the pipeline. Physical changes can result from mixing of topsoil and subsoil; compaction, rutting and puddling; or change in soil moisture conditions. Alteration of soil chemical properties and biological characteristics can occur during stockpiling of soil or as a result of small spills of oil, diesel and other substances. Topsoil quantity can be affected through wind and water erosion, and from tracking topsoil into work areas and burying it into subsoil.	Many of the effects on agricultural soils can be managed through project design and environmental protection measures. The effects of the project on agricultural soils will be minor because all soil disturbances will be managed, or mitigated, such that the basic soil properties and the ability of the soil to grow vegetation will not be affected when it is replaced. during pipeline construction, several techniques will be used to preserve the soil material, especially during construction. Monitoring is recommended to confirm that substantial changes to soil quality have not occurred.	Environmental effects are not expected to result in changes in soil capability for agriculture.	Cumulative effects are not expected to result in changes in soil capability for agriculture.

*Refer to Figure 3.1 in section 3, Project description, for the full list of physical works and activities. **The effects of spills and malfunctions will be included in the update for the supplemental filing.

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VEC	Key Issues	KIR	Baseline Results	Measurable Parameter	Potential Project Effects**	Proposed Mitigation	Residual Effects	Cumulative Effects
Non-Agricultural Soil	<p>Reduced capability to support forest ecosystems due to physical disturbance</p> <p>Reduced capability to support forest ecosystems due to acidifying emissions</p>	n/a	<p>Non-agricultural soils are found in the Rocky Mountain foothills, Rocky Mountains, BC Interior Plateau, and Coast Mountains. The Rocky Mountain foothills comprise the western part of the Southern Alberta Uplands and the Alberta Plateau. Luvisols are the most extensive soils, with Gleysols, Organics, Brunisols and Regosols occurring as well. The BC Interior Plateau region is also characterized by these soils, but bare rock ridges and outcrops are more common in some places. The Rocky Mountains and the Coast Mountains also have this group of soils, but rocky terrain without soils is common. Podzolic soils also occur in the mountain regions. These are soils that have formed in high precipitation areas and have a layer of iron and humus accumulation below the topsoil. Soils of all these regions are generally undisturbed, except for some areas related to forestry, pipeline and industries.</p>	Soil quality	<p>Project activities can result in alteration of soil physical chemical, and biological properties.</p> <p>Changes in non-agricultural soils can occur as a result of site clearing, soil stripping, stockpiling, construction activities and when the soil is replaced after installing the pipeline.</p> <p>Physical changes can result from mixing of topsoil and subsoil; compaction, rutting and puddling; or change in soil moisture conditions.</p> <p>Alteration of soil chemical properties and biological characteristics can occur during stockpiling of soil or as a result of small spills of oil, diesel and other substances.</p> <p>Topsoil quantity can be affected through wind and water erosion, from tracking topsoil into work areas and burying it into subsoil.</p> <p>Soil acidification is a concern only near Kitimat terminal where some acidic air emissions could be produced under certain conditions. Small amounts of acid substances over a limited geographic area may interact with acidity effects from other existing industries in the region.</p>	<p>Many of the effects on non-agricultural soils can be managed through project design and environmental protection measures.</p> <p>The effects of the project on non-agricultural soils will be minor because all soil disturbances will be managed, or mitigated, such that the basic soil properties and the ability of the soil to grow vegetation will not be affected when it is replaced. The pipeline and the Kitimat terminal area will apply several techniques to preserve the soil material, especially during construction.</p> <p>Monitoring is recommended to confirm that substantial changes to soil quality have not occurred</p>	<p>For the physical disturbance effect, environmental effects are not expected to result in changes in soil capability.</p> <p>For the acid deposition effect, environmental effects are expected to result in site-specific changes in the quality of nearby forest soils, in the immediate vicinity of the tank terminal. Use of low sulphur fuel, as is expected by 2012, will reduce the potential for acidification.</p>	<p>For the physical disturbance effect, cumulative effects are not expected to result in changes in soil capability.</p> <p>For the acid deposition effect, cumulative effects of existing acid deposition with the effect from the project will result in site-specific changes in the quality of nearby forest soils, in the immediate vicinity of the Kitimat terminal.</p>