Vale Kronau Project
Environmental Impact Statement Executive Summary
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Introduction

Vale is seeking approval to build a potash mine near the hamlet of Kronau, Saskatchewan, approximately 30 kilometres southeast of Regina.
If successfully launched, the Kronau mine would produce around 2.9 million tonnes of potash a year with significant employment and economic benefits to the local region, Saskatchewan and Canada.

Like many mining companies around the world, Vale is interested in potash. The world’s population is growing larger and gradually becoming more affluent. This means that, in the near future, we will see an ever-growing demand for food – both in terms of quantity and quality. Since potash is a key ingredient of the best fertilizers, it will play an indispensable role in feeding a hungry world.

Potash’s importance is good news for the province of Saskatchewan, which is home to roughly 40 per cent of the world’s potash.

Gaining approval for any sort of mine is not easy, nor should it be. Creating a mine inevitably provides challenges and opportunities for the local environment and infrastructure. There must be a thorough plan in place to minimize or, ideally, eliminate any adverse environmental effects and impact on the community. The governments of Saskatchewan and Canada have extensive regulations to ensure that resource development is done in an environmentally sustainable manner. Vale too has high corporate standards in this regard. We are committed to pursuing this project in a way that not only makes sense for Vale as a company but is sustainable and beneficial for the people of Kronau, Saskatchewan, and, ultimately, the world.

A central component of gaining government approval for a mine is the submission and approval of an environmental impact statement (EIS). This is a comprehensive technical document intended to demonstrate to regulators, engineers, geoscientists and other scientific experts that Vale has well-thought-out, scientifically based, effective plans for dealing with the potential effects of our proposed mine.

In order to make this information accessible to the general public, we have prepared this document which summarizes the key points of the EIS. We have also tried to anticipate some basic questions you may have about our company, the project or the potash mining process.

If, after reading this summary, you would like further detail about any aspect of our plan for the Kronau Project, please do not hesitate to ask questions or to examine the full EIS, which you can download from our website.

Kronau Project Location

You can send your questions and comments directly to Vale by:

Email: kronau.project@vale.com
Tel: 306-791-4510
Web: www.valepotashcanada.ca
Who Are We?

Today, Vale is the second largest mining company in the world but we started as a small mining company in Brazil. Our name in Portuguese literally means “the valley” in honour of Vale do Rio Doce (“the Fresh-water River Valley”), the area of one of our first mines.
Vale

While our headquarters remains in Brazil, we now have operations in over 30 countries. Vale employs around 140,000 people on five continents. In Canada, Vale employs over 6,000 full-time employees. We have offices and operations in Saskatchewan, Manitoba and Ontario, as well as Newfoundland and Labrador.

Vale discovers and transforms the minerals that are essential ingredients in the products people use every day. Our company operates by a simple set of values which we strive to carry through to everything we do.

Vale is the global leader in iron ore production and the second largest nickel producer in the world. We also have a wealth of experience extracting other minerals, including fertilizers. We bring over a century of experience in mineral exploration, mining, metals processing and mining waste management to the Kronau Project.

These years of experience have allowed Vale to develop global policies and standards that are consistent with our values. One of our most important policies, which applies to every Vale project – including Kronau – is our Sustainable Development Policy.
What is Vale’s Sustainable Development Policy?

Vale’s Sustainable Development Policy is founded on two key principles: Sustainable Development and Sustainability as a Legacy.
Sustainable Development
For Vale, sustainable development is achieved when its activities, particularly its mining operations, add value to its shareholders and stakeholders while contributing to social strengthening, economic development of regional vocations and environmental conservation and restoration, through a conscious and responsible management approach, voluntary corporate actions and the establishment of partnerships with governments, public institutions, the private sector and civil society.

Sustainability as a Legacy
Vale’s principle is to act with the objective of leaving a positive social, economic and environmental legacy in the areas where it operates, by encouraging social inclusion through work education and human development, economic growth and diversification and strengthening of local institutions (i.e., supporting the responsible public institutions with the planning of appropriate urban infrastructure, while contributing to the conservation and restoration of the ecosystems, biodiversity and cultural heritage of the region).

Mining is by nature a finite activity, limited to the life cycle of the mineral deposit. The sustainability legacy of Vale’s operations depends on the development of new economic vocations that may guarantee continued social well-being in balance with the environment and conservation.

Through social investments and public partnerships, Vale seeks to strengthen community social and economic development around the world. Our aim is to leave a sustainable legacy in the regions where we operate. Across the country, Vale is proud to partner with local and national organizations. We focus on developing innovative programs and initiatives that help to:

- improve the health, environmental, cultural and educational capacity in Canadian communities
- enhance national, provincial and regional programming
- create a community of engaged, civic-minded employees and friends
- build the infrastructure that the community needs to reach its full potential

Previous Page: Vale’s Copper Cliff Greenhouse. Seedlings are grown every year and used for re-greening efforts on Vale’s site and across the Greater Sudbury Area.

Above: Even in the early phases of the Kronau Project, we partnered with the Kronau Community Centre in 2011 to transform the local curling rink into a multi-purpose facility.
Back row, left to right: Don McMorris, Trevor Glas, Cameron Hoffart, Angel Ell, Matthew Wood. Front row, left to right: Lona Gervais, Dawn Leippi, Daniel Ell, Murray Leippi, Brad Schneider, Lianne Gooding.

Our Mission
Vale’s Mission is to transform mineral resources into prosperity and sustainable development.
What is Vale Proposing to Do?

We intend to complete a potash solution mine in the Kronau area. The mine would take approximately four years to build and would have an estimated productive life of 70 years.

During this time, we believe the mine will produce roughly 2.9 million tonnes of potash per year. At today’s world prices for potash (which are currently lower than in previous years), this would translate to approximately $1.2 billion per year of potash production. A substantial portion of this would flow back to the people of Saskatchewan and Canada through royalties, taxes, wages, supply purchases and other direct and indirect economic spinoffs.

Here are a few key facts about the Kronau Project:

• Vale started exploring the area in 2009
• the size of the discovery spans approximately 51,840 hectares
• the majority of the area is cultivated farmland with a few patches of marshland
• the discovery is part of the Prairie Evaporite Formation, a geological layer that is located at 1600 to 1750 metres underground at our project location
• the potash in the discovery is contained in a mineral bed about 55 metres thick
• the mineral bed is actually a mixture of potash and salt, with minor amounts of other minerals and clays

Did You Know?

Vale’s Kronau Project team is using cogeneration as a source of steam and power for the processing plant. By efficiently sourcing our energy, we’ll reduce our environmental footprint.
What is a Solution Mine?

How Does a Solution Mine Work?

Solution mining works by dissolving the mineral bed below the surface. Because this mining activity involves drilling a number of steel-cased wells to inject liquid and extract brine (the water with dissolved potash and salt), this area is called the wellfield.

During the life of the mine, the wellfield goes through four distinct phases:

1. Cavern Development
2. Cavern Mining
3. Secondary Mining
4. Cavern Closure

This type of mine works by pumping liquid into the mineral bed to dissolve the potash and salt, and then return salt- and potash-infused water – referred to as brine – to the surface for processing.

Evaporation (heating) and crystallization (cooling) are then used to recover the potash from the brine. We will talk in more detail about the operations of solution mines next, and the processing later in this document.

Solution mines are usually less expensive to build than conventional underground mines, provide greater production flexibility and cause less surface disturbance. Solution mines also eliminate the hazards that sometimes result from sending people to work underground.

Solution mines, however, do have particular challenges of their own. The main challenge is that they require large and constant supplies of nearby water and a significant amount of power to evaporate the water.

The source of water for the Kronau Project and the plan for dealing with the wastewater afterwards are major parts of the environmental plan we’ll discuss in this document.

When most people think of a mine, they typically think of a conventional underground mine – a hole in the ground with people inside chipping away at rock. Solution mines are a relatively new but well-researched form of mine. They have operated successfully in Saskatchewan for about 40 years. Solution mines can minimize surface disturbance.

In most cases, activities such as farming can continue on the majority of the land throughout the entire solution mining operation.
The Four Phases of a Wellfield

1. Cavern Development
Two deep wells are drilled to allow the operation to pump hot water underneath the potash deposit. Through a controlled injection process, the hot water creates large holes or caverns underneath the deposit. This long and painstaking set-up process takes about a year to complete.

2. Cavern Mining
The start of production. Water pumped down into the cavern dissolves both potash and salt from the mineral bed. The brine is then pumped back up to the surface for processing.

3. Secondary Mining
Later in the life of the mine, instead of injecting fresh water, the operation can inject a solution that is already saturated with salt. Chemically, this allows for further potash production with little additional salt production but this technique is typically used only after the initial phases of extraction are complete.

4. Cavern Closure
Decades in the future, when all of the potash has been extracted from the area – or if the mine closes for other reasons – the wellfield is returned as closely as possible to a natural state. To prevent deep groundwater from flowing back up the wells, the holes are plugged with concrete.
Cold Comfort – A Processing Plant Alternative

Who would have thought that cold Saskatchewan winters could actually be a good thing?

Vale is considering an alternative processing method that would involve transferring the hot brine to an external pond during the winter months. This could allow us to process the potash using much less energy, which would be better for the environment and better for our bottom line. The viability of a cooling pond has yet to be determined. We will make a final decision about this option as the project proceeds.

How is the Liquid Converted into Potash?

Brine Evaporation and Crystallization Facility
In the simplest terms, this is like a giant still. The brine is heated to separate out the salt. The potash remains dissolved in liquid and is delivered to another area where it is further separated through a cooling crystallization process.

Potash Drying, Screening and Compaction
The wet potash crystals are dried and prepared for storage and eventual delivery.

Potash Storage and Shipping
The potash is put in storage and eventually loaded on to railcars.

After the brine is pumped to the surface, it is piped underground to the process plant where it goes through several phases.

Tank Farm Facility
Large tanks hold both the injection liquids and the recovered brine.
Where is all this Water Coming From?

Vale has worked closely with Saskatchewan’s Water Security Agency (WSA) to find the best possible source of water to meet our needs and accommodate environmental and social concerns.

Water bodies (including underground sources) within a nearly 100-kilometre radius of the proposed mine site were considered. Most were found to be too unreliable (in terms of year-to-year variations in lake levels), too inaccessible or not suitable in other ways.

We have concluded that a water pipeline from Buffalo Pound Lake would be the best choice, even though it was the furthest away of all the options we examined. To assist in the planning and development of the project, the WSA has issued a conditional one-year term Water Rights Licence to Vale for the use of water from Buffalo Pound Lake. No renewal of the licence and no actual use of water will take place until any remaining environmental, regulatory or consultation requirements have been satisfied. The physical works to bring water to the site will be owned and operated by SaskWater, which will be responsible for addressing any environmental concerns associated with those works.

A key consideration for both Vale and WSA was how our operations would affect the lake's water levels. Buffalo Pound Lake was determined to be the most reliable and easily managed water source. Because it is the first major lake on the Qu'Appelle River system, located about 70 kilometres downstream of Lake Diefenbaker reservoir, it is the most easily managed of the potential source lakes in providing the required water volumes while maintaining lake water levels within the desired range for environmental protection and recreational use.

WSA has also completed a provincial water model that shows the water required for this project can be withdrawn from Buffalo Pound Lake using the current control structures with no significant change to the hydrology.
Water Use Definitions

Irrigation
Irrigation uses include the categories of agriculture (e.g. cereal crops), commercial gardens (e.g. greenhouses and nurseries) and parks (e.g. campgrounds, golf courses).

Municipal
Municipal uses include commercial (e.g. stores, restaurants), institutional (e.g. schools, hospitals), recreational (e.g. golf courses), industrial and domestic uses, where the water is supplied through a distribution system that is operated within the boundaries of an established municipality (e.g., cities, towns, villages, rural municipalities).

Industrial
Industrial uses include commercial construction, intensive livestock (e.g. cattle operations), mining (e.g. potash mines), manufacturing (e.g. pulp and paper) and oil recovery.

Domestic
Domestic use includes household and sanitary use, the watering of stock, spraying of crops and watering of non-commercial lawns and gardens. Private water sources are typically used in these instances (e.g. wells or dugouts).

The “other uses” category includes aquaculture (e.g. fish spawning), flood control (e.g. diversion works) and wildlife (e.g. waterfowl enhancement project). The “multiple uses” category includes all possible combinations of the above categories.

2011 Saskatchewan Water Use*

- **60%** Irrigation
- **16%** Municipal
- **12%** Multiple
- **9%** Industrial
- **2%** Domestic
- **1%** Other

*Water use data provided by the Water Security Agency.
We have a financial as well as social responsibility to minimize our water usage.

We estimate our water needs for an operational Kronau mine to be 21 million cubic metres per year. This raw water would be used for a wide range of activities:

- the solution mining process itself
- the processing plant
- cooling water
- fire suppression water
- potable water
- boiler feed water

We propose to store the water on site in a freshwater pond. Except for the relatively small amounts of water used for human needs, it won’t be necessary to treat the raw water.

Water is a natural resource that belongs to everyone in Saskatchewan. For this reason, control and regulation of the water for the Kronau Project will remain firmly in the hands of the provincial agency, WSA. If the Kronau Project is approved and becomes operational, SaskWater will construct, own and operate the pumphouse and pipeline, making SaskWater the water utility provider for the project.

Water Recycling

We have also made a commitment, which will be overseen by government regulators, to minimize the effects of our use of water over time. We have a plan in place for our proposed process plant to recycle and reuse stormwater, drainwater, wastewater and process water to reduce the amount of fresh water required.

Stormwater run-off will be directed to one side of the freshwater pond and will be kept separate from the fresh water. This will allow stormwater to be clarified before it is sent to the freshwater side of the pond.

This design not only allows reuse of stormwater but it also provides a buffer in the case of a water pipeline outage. Since the stormwater side is empty most of the time, this space can be used to allow for an additional two days of freshwater storage when necessary.

Even the salty brine – a waste byproduct from the earlier phases of the potash processing – will be recovered and reused where it is suitable to do so.

Exactly How Much Water Does Vale Need?

We have a financial as well as social responsibility to minimize our water usage.

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4% is the percentage of the province’s water used by the entire Saskatchewan mining sector in 2011.
Won’t All this Salt Ruin the Soil?

Operations of the Tailings (Waste) Management Area

The solution mining process leaves behind a great deal of briny water as well as a certain amount of solid salt waste. Over the years, operators of potash solution mines have developed effective measures for dealing with these issues.

In designing the Kronau Project, Vale has gone above and beyond in drawing on the best practices from around the world.

Wastewater Disposal

As with the majority of the operating potash mines in Saskatchewan, we will use deep well injection methods to dispose of the wastewater. Vale has conducted an evaluation of the capacity of potential deep injection locations and has identified the Winnipeg/ Deadwood Formations to be suitable for brine disposal. The Winnipeg/ Deadwood Formations are also used by a number of the operating potash mines and are approximately 2200 metres beneath the surface. The exact number of wells required will be determined based on observed performance during operations. Injection wells will be spaced at a minimum distance of 500 metres to prevent excessive interference between wells. The injection wells will be cased with steel like the operating wells and are regulated by the Saskatchewan Ministry of Energy and Resources.

Waste Salt Storage

The waste salt storage pile will be enclosed by a dyke to keep it separated from the surrounding area.

Brine Reclaim Pond

The brine liquids will be diverted to a reclaim pond where they will be kept until they can be reused in the mine or processing plant. The pond will be designed to provide protection against storm events to further ensure that the brine does not spill over into surrounding soils.

Containment

The containment systems for both the solid and liquid wastes will be designed to work vertically as well as horizontally to ensure that the waste does not contaminate groundwater or surrounding soil. We will use the geological or chemical qualities of the immediate area to help contain the waste.

All these systems will be monitored to ensure they are operating properly and that potential problems will be detected early on.
Won’t the Mine Leave Behind Other Types of Waste?

All domestic wastes from the mine site (including food wastes and wastes from construction, operations and administration offices) will be collected and transferred to appropriate off-site disposal facilities by a licensed contractor.

What other buildings will be at the mine site?
The site will also contain administration buildings, a warehouse and maintenance building, a combined heat and power plant, a potable water treatment plant, a sewage treatment plant, a large product storage building (capable of holding 28 days of production) and a rail loading facility.

What will be the mine’s transportation needs?
Road access will be provided primarily from Highway 33. Potash will be shipped to port via covered railcars.

What additional infrastructure will Vale need to run the mine?
Support infrastructure for the Kronau Project will include water, power, natural gas, communications, road access and rail access.

As discussed previously, SaskWater will be the water utility provider for the Kronau Project. The water would be delivered to the main facility through a pipeline from Buffalo Pound Lake.

SaskPower, TransGas and SaskTel will provide power, natural gas and telecommunication services for the Kronau Project.

All storage and handling of hazardous materials and hazardous waste will meet legal requirements.

This includes employee training, storage facility design and operation, labelling and material control.

Our Environmental, Health and Safety Management System will include procedures for all of these activities.
How Long will This Take?

The Kronau Project can be broken down into three phases: Construction, Operations, and Decommissioning and Reclamation.

Construction

Construction will take about four years. That includes building the site facilities, tailings management area and the wellfield.

We will not be building worker accommodations on site. Because the project is located near Regina, we expect workers will live in the city or nearby communities.

Operations

We estimate that the mine will remain in operation for about 70 years. During that time, around 350 people will work on site and be responsible for producing 2.9 million tonnes of potash per year.

Decommissioning and Reclamation

In modern mine development, no mine can be built unless there is a long-term “end of life” plan in place for the mine. Throughout our design of the Kronau Project, Vale has been thinking about how we will go about closing the mine (decommissioning) and returning the area as closely as possible to its original condition (reclamation). We estimate that it will take about a year to complete this phase of the mine’s life.

Our duty to the environment and the community will not end when the mine is formally closed. Following cessation of operations, Vale will ensure that lands disturbed by Kronau Project activities are returned to a condition that is physically stable, safe and environmentally sustaining in keeping with the land use and landscape of the day.

What happens if Vale goes out of business? Will taxpayers be stuck paying for decommissioning?

Provincial regulations require that a credible decommissioning and reclamation plan accounts for changes in ownership or financing of the mine. In essence, Vale would have to post a type of bond or carry a form of insurance to limit the financial risk to society for the costs of all decommissioning and reclamation activities.

Vale Project Development Schedule

- **2010**
  - Begin baseline environmental studies
- **2011**
  - Begin EIS preparation and submission
- **2013**
  - EIS review period and approval
- **2014**
  - Begin Kronau Project detailed engineering
- **2015**
  - Start construction and drilling
- **2016**
  - Begin solution mining activities
- **2018-19**
  - Begin processing plant production
How Much Input will the Public have in the Mine Development?

Vale is committed to fair and responsible development and, with this in mind, has sought community input from the very earliest stages of the Kronau Project.

Through collaborative efforts, we will continue to consult with stakeholder groups and consider community recommendations.

To Vale, a thorough, healthy discussion involves three key characteristics:

• scientifically sound facts
• diverse perspectives
• transparent processes

These discussions will evolve along with the stages of the project development.

Pre-Project Proposal
The concept of the mine is introduced and discussed at the very highest level. Broad comments and concerns are taken into consideration to help Vale continue to develop the project.

Project Proposal Discussion
The contents of the project proposal are shared and discussed. At this point, both broad and specific comments and concerns are taken into consideration.

Pre-Environmental Impact Statement Submission
We continue to talk and listen to people through more discussion opportunities. As we wrap up this stage, Vale will summarize the general themes of interest and concern that we have heard from all stakeholders. This information will form the basis for the environmental impact statement.

Environmental Impact Statement Discussion
The contents of the environmental impact statement are shared and discussed at length.

Post-Environmental Impact Statement Follow-up
The engagement process does not end with the submission of the environmental impact statement. It will continue to evolve with the development of the project and the life of the proposed mine.

No matter what stage we are at, Vale is committed to ongoing discussion with all stakeholder groups.

Major Stakeholder Groups have been Identified:
First Nations and Métis Communities, the Public, Government and Regulatory Agencies.
What is the Government’s Role?

Saskatchewan's environmental assessment process is designed to evaluate the potential environmental effects of developments so the real costs and trade-offs at stake in a particular situation can be fully understood.

Vale submitted a project proposal to the Saskatchewan Ministry of Environment in August 2011 for the development of the Kronau Project. The Saskatchewan Ministry of Environment determined that the Kronau Project was a "development" as defined by section 2(d) of the Saskatchewan Environmental Assessment Act. In accordance with section 9 of the Saskatchewan Environmental Assessment Act, Vale must submit an environmental impact statement to the provincial Ministry of Environment. Should the environmental impact statement sufficiently demonstrate that the Kronau Project is environmentally acceptable, then and only then will the provincial government consider Vale’s applications for the necessary provincial approvals, permits and licences that regulate construction and operation.

In some cases, the federal government is also involved in regulating mine projects, but this is not the case with the Kronau Project. In accordance with the Canada-Saskatchewan Agreement on Environmental Assessment Cooperation (2005), the Canadian Environmental Assessment Agency completed a survey of federal departments to see if any of them had jurisdiction regarding the Kronau Project.

Based on the responses to this survey the Canadian Environmental Assessment Agency has determined that the Canadian Environmental Assessment Act does not apply to the Kronau Project.
The Saskatchewan Environmental Assessment Process

1. **Proponent interested in proposed project**
   - **Development?**
     - yes or not sure
     - Proponent submits application to EAB, prepares and submits Technical Proposal
     - Ministerial determination provided as to whether or not project is a development under 2(d) of EAA
     - Proponent proceeds with the development

2. **development**
   - EIS and TRCs released for 30 day public review period*
   - Public comments received by EAB
   - EAB submits EIS, TRCs, public comments and any inquiry findings and their recommendations to the minister**
   - Minister decides to either approve or not approve the development
     - approved with or without conditions
     - Proponent may proceed with the development subject to the minister’s approval and any other provincial and federal legislative or permitting requirements
   - not approved
     - Proponent may not proceed with development

3. **not a development**
   - Proponent proceeds with required licences and permits
   - **Development?**
     - yes or not sure
     - Proponent submits application to EAB, prepares and submits Technical Proposal
     - Ministerial determination provided as to whether or not project is a development under 2(d) of EAA
     - Proponent proceeds with required licences and permits

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**Key**
- TPG – Technical Proposal Guidelines
- EAB – Environmental Assessment Branch
- EAA – The Environmental Assessment Act
- SEARP – Saskatchewan Environmental Assessment Review Panel
- EIA – Environmental Impact Assessment
- EIS – Environmental Impact Statement
- TRCs – Technical Review Comments

**Notes**
* Any person may: make a written submission to the minister within 30 days from the date when the minister first gives notice or if the minister considers it appropriate, within an additional period of 30 days.
** Minister may require public meetings or public inquiries into all or any aspect of the development at any time prior to making a decision about the development.
How was the Environmental Assessment Done?

Our environmental assessment approach considered ecological, cultural, social and economic principles.
One best practice that has become widely accepted in Canada – and which we will use for the Kronau Project – is the concept of valued environmental components. For any given piece of land, the number of biological, physical and human aspects associated with that land is infinite. However, our capacity as human beings to consider those aspects is limited. Since it would be impossible to study every aspect of the environment in the same level of detail, the environmental assessment process focuses on some key aspects that are considered especially important – the valued environmental components.

Coming up with this list of valued components is an interactive process that involves many people. Scientific experts and government regulators have a large say in how we assemble this list but we also take into consideration the concerns and comments we receive from the public and other stakeholders. We will look at the concept of valued environmental components in more detail later in this document.

The environmental assessment looks at the impact of the mine at all phases of its life, from construction through to decommissioning and reclamation. In the assessment, we also try to account for the effects of accidents, malfunctions and other unplanned events.

The overall environmental assessment approach progresses through five steps:

- establishing boundaries (i.e., how much space and time are involved in the assessment)
- describing existing conditions as a yardstick against which we can measure changes that happen as a result of the project
- identifying how the project may affect the environment, society and the economy, and proposing ways to mitigate or minimize those effects
- analyzing the environmental, social and economic effects
- determining the significance of these effects

Environmental Assessment Methodology
What are the Valued Environmental Components for the Kronau Project?

The key factors that we have examined in our environmental impact statement are:

- air quality and noise
- groundwater
- hydrology (i.e., surface water quantity)
- surface water quality
- soil
- vegetation
- wildlife
- heritage resources
- employment and the economy
- community services and infrastructure
- traffic and transportation infrastructure

The following subsections briefly describe our analysis of the potential effects of the Kronau Project on these valued environmental components. We also provide some examples of our mitigation measures through engineering design features and proposed mitigation strategies. For the full technical details of all specific mitigation features, please refer to the full version of the EIS.

Pathway VECs
Atmospheric Environment
Groundwater
Hydrology
Surface Water Quality

Biophysical and Cultural VECs
Soils
Vegetation
Wildlife
Heritage Resources

Socio-economic VECs
Employment and Economy
Community Services and Infrastructure
Traffic and Transportation Infrastructure
Air Quality and Noise

Engineering design features have been included in the Kronau Project to reduce the effects of increased air emissions, dust, noise levels and greenhouse gas emissions.

Some examples of these design features include:
• dust from the process plant will be collected in baghouses to limit its release
• the use of paved roads on site, as much as possible, will reduce dust generated by vehicles and equipment
• construction activities will be limited, where practical, to daytime hours

As a result of these plans, the overall effects from the Kronau Project on air quality and noise are not significant. Vale will continue to monitor weather, air quality and noise levels to test our prediction models.

Hydrology

The hydrology analysis examines the Kronau Project’s effects on surface water quantity and availability. Engineering design features have been included in the development of the Kronau Project to reduce the effects on the local water supply.

Some examples of these design features include:
• the compact layout of the core mine facilities area will limit the area that is disturbed by the project
• pillars will be left between the mine caverns to increase stability during solution mining and limit any potential adverse effects on the surface water quantity and availability

As a result of these design features, the hydrological effects are not significant. Vale will continue monitoring local surface water. We will also continue to work closely with provincial regulators to evaluate the effectiveness of our measures.

Groundwater

The groundwater analysis examines effects on groundwater quality and quantity. Engineering design features have been included in the Kronau Project to reduce effects on groundwater from the project in general as well as from unplanned events such as a non-hazardous or hazardous chemical spill, fuel or chemical containment failure, above ground and underground pipeline leak, tailings containment failure, and brine containment failure.

Some examples of these design features include:
• encasing all wells in steel to eliminate interaction between the caverns and groundwater
• disposing of excess brine by injecting it into deep wells, a proven practice used to manage brine and prevent release to surface waters and freshwater aquifers
• designing a containment system to control both deep migration of brine to underlying aquifers and horizontal migration of brine, as required

As a result of these and other plans, the overall environmental effects from the Kronau Project on groundwater are not significant. Vale will monitor and inspect the tailings management area. We will develop strict thresholds so that, if required, further measures can be taken in a timely manner.

Surface Water Quality

Engineering design features have been included in the Kronau Project to reduce effects on surface water quality.

Some examples of these design features include:
• all run-off within the site will be contained so it is not released into the environment. It will be directed to the brine pond for deep well injection
• erosion control measures such as silt fences, sediment stops and settling ponds will be implemented to prevent sediment from entering watercourses during construction of the project

As a result of these design features, effects from the Kronau Project on surface water quality are not significant. Vale will monitor soil erosion, air quality and tailings management to ensure surface water quality is not adversely affected.
Soils

The soils effects analysis examines soil quality, soil types and soil distribution. Engineering design features have been included in the Kronau Project to reduce the effects of loss or alteration of soils, changes in soil capability to support agriculture and any other aspects of the soil ecosystem.

Some examples of the design features we would implement include:
- placing the waste (tailings) in an area where natural soil conditions inhibit the absorption of salt or brine
- disposing of excess brine by injecting it into deep wells, a proven practice used to manage brine and prevent release to surface waters and freshwater aquifers

As a result of these and other design features, the effect of the Kronau Project on the local soil is not significant. Vale will monitor for subsidence (e.g., sinking or settling) and soil erosion and regularly inspect pipelines and the tailings management area.

Vegetation

Our vegetation analysis examines effects on plant populations and communities, government-listed plant species (i.e., species-at-risk) and traditional use plants.

Engineering design features have been included in the Kronau Project to reduce loss of traditional use plants and changes in vegetation quality that might result from the project.

Some examples of these design features include:
- existing public roads will be used where possible to provide access to the mine wellfield, which will reduce the amount of new road construction required for the project
- railroads and utility lines (gas, water and power) will be routed along existing utility corridors to reduce disturbance to undisturbed areas, where possible

As a result of these design features, the effects of the Kronau Project on vegetation are not significant. In addition to the previously discussed monitoring programs, Vale will also have an equipment maintenance and cleaning program that adheres to the provincial *Weed Control Act (2010)*. We will conduct additional site assessments, as required prior to construction, to identify listed plant species and develop a revegetation monitoring program as part of the decommissioning and reclamation plan.

Wildlife

Our wildlife analysis examines effects on wildlife habitat, the relative abundance and distribution of wildlife species and government-listed wildlife species (i.e., species-at-risk).

Engineering design features have been included in the Kronau Project to reduce the effects associated with wildlife habitat loss and fragmentation, sensory disturbance, nuisance wildlife, mortality of wildlife, and decrease in habitat quality that may result from the project.

Some examples of these design features include:
- the process plant and administration buildings will be fenced to deter entry by non-employees and prevent most wildlife from entering these areas
- food wastes will be collected in suitable receptacles that limit attraction or impact to wildlife
- littering and feeding of wildlife will be prohibited

As a result of these design features, the effects of the Kronau Project on wildlife are not significant. Vale will conduct additional wildlife surveys prior to construction. If additional listed wildlife are identified, appropriate measures will be discussed with the Ministry of Environment before any construction activities are started.
Heritage Resources
Our heritage resources analysis examines effects on archaeological and sacred sites located within the project area. Work was conducted using both western science and applied traditional knowledge.

Engineering design features have been included in the development of the Kronau Project to reduce the loss or alteration of heritage resources.

Some examples of these design measures include:
• keeping the size of the core mine facilities as small as possible to limit the area disturbed during construction
• using existing roads as much as possible to reduce the need for new road construction
• creating an acceptable policy for dealing with archaeological or heritage materials that may be discovered during construction or operation of the mine

As a result of these and other design features, the effects on heritage resources are not significant.

Employment and Economy
The employment and economy analysis examines effects on the number and types of jobs available, sources of skilled labour, changes in agricultural land use and extent of economic benefits.

The negative effects from the Kronau Project on employment and economy are not significant. In fact, we believe there will be a number of positive effects, including:
• primary and secondary job creation
• tax and royalty revenue
• increased training opportunities
Vale will continue to hold discussions with all stakeholder groups to consider any other employment and economic effects which may have been overlooked.

Community Services and Infrastructure
Our community services and infrastructure analysis examines effects on housing, accommodations, social, health, emergency and protective services, and physical infrastructure.

The effects of the Kronau Project on community services and infrastructure will be significant. The mine is a major undertaking which will employ many people who will require community services.

Vale is committed to continue to engage with all stakeholder groups to develop plans for these changes.

Traffic and Transportation Infrastructure
Our traffic and transportation infrastructure analysis examines effects on traffic patterns and volume, traffic safety and infrastructure such as road quality.

Vale has developed plans to minimize our effect on traffic and transportation infrastructure. Some examples include:
• shipping product by rail, which will reduce traffic on roads
• seeking input on proposed road modifications/closures, new roads, transportation routes and travel times from local municipalities and the Saskatchewan Ministry of Highways and Infrastructure
• examining options for mass transportation for workers, such as busing or carpooling, to reduce commuter traffic
• timely snow removal and sanding during the winter

As a result of these and other measures, the effects from the Kronau Project on traffic and transportation infrastructure are not significant. Nonetheless, Vale will continue to discuss these issues with all stakeholder groups.
Environment, Health and Safety Management System

Vale manages all projects worldwide in a proactive manner to create a safe work environment for humans and to protect the natural environment.


The EH&S Management System will be used as the basis to develop site-specific occupational health and safety plans and environmental management plans. The development of such plans will be based on:

- the adverse environmental effects identified in the environmental impact statement
- hazards and risks identified for the Vale Kronau Project throughout the planning stages
- regulatory requirements

The Vale EH&S plans will be updated on a regular basis and at important milestones in the Kronau Project life, as the scope and content of the EH&S plans will vary according to the phase of development.
The EH&S plans include:

- environmental protection plan
- occupational health and safety plan
- human resources plan
- emergency response and contingency plan
- decommissioning and reclamation plan
- environmental, health and safety training plan
- community relations plan
- monitoring and follow-up plan
- auditing and continuous improvements plan
Conclusions

Based on the analysis provided in this environmental impact statement and the engineered design features aimed at reducing negative effects, Vale believes that the Kronau Project, from construction through to decommissioning and reclamation, is not likely to cause significant adverse environmental effects. There are some potential social and economic effects, both positive and negative, as detailed below.

The environmental assessment has demonstrated there are likely benefits associated with the project. Vale believes local and regional economies will benefit in many ways from a world-class potash deposit with a potential mine life of 70 years. These benefits would include job creation, purchase of local supplies and services, taxes paid to municipalities and potential road improvements.

Once mining commences, the benefits will also include royalty payments to the Government of Saskatchewan. This is all in addition to Vale’s already proven commitment to help local communities through sponsorships and community investment.

Our analysis also shows there is the potential for the Kronau Project to adversely affect community services and infrastructure. As project development progresses, Vale will continue to engage with all stakeholders to create and examine options that reduce and further mitigate all potential adverse effects.
Committed to building a sustainable future, Vale, as a leading global mining company, embeds its values in everything it does. We take our commitments to you very seriously. With your support, we propose to build a solution potash mine in the most responsible manner so that together we will leave a sustainable legacy that benefits future generations. Vale will comply with all legal and legislative obligations related to construction and operations as well as decommissioning and reclamation. The commitments below are in addition to legal requirements.

1. Vale will undertake further stakeholder engagement during and after the environmental impact statement review period, for the life of the mine.

2. Vale will continue to investigate the possibility of secondary mining to reduce the amount of salt stored on surface.

3. Vale will develop an Environmental, Health and Safety Management System to ensure all commitments are completed, including appropriate monitoring programs, environmental protection plans and emergency response plans.

4. Vale will ensure that the tailings management area will be monitored for slope stability, groundwater chemistry and hydraulic head. Additionally, downhole geophysical electromagnetic surveys and terrain conductivity surveys will also be completed.

5. In conjunction with regulators, Vale will develop a subsidence (ground shifting) monitoring program.

6. Vale will ensure the weather tower and the on-site air quality monitoring station will continue to collect data.

7. Groundwater models will be updated, on an as-needed basis, using newly collected data.

8. In conjunction with regulators, Vale will develop a surface water quality monitoring program.

9. Vale will continue the local surface water level monitoring program that was established in 2010 within the local subwatersheds in the area.

10. Vale will develop a detailed closure plan consistent with provincial requirements.

11. Vale will work with the relevant provincial ministries to develop and maintain an appropriate level of financial security for the project.

12. Vale will leave pillars between the mine caverns to increase stability during solution mining and subsidence.

13. Vale will ensure fresh water will be routed around the site and returned to pre-development watercourses to reduce the amount of water entering the core facilities area.

14. All run-off within the core facilities area will be collected and contained within a storm water pond for re-use within the process.

15. Vale will implement design features to prevent lateral long-term seepage of brine from the tailings management area.

16. Vale will undertake investigations in subsequent design phases of the tailings management area to further delineate the hydrogeology.

17. Vale is committed to developing local employment and contractor and procurement strategies, where possible.
Feedback

If you would like further details, please do not hesitate to ask questions or to examine the full EIS. Send your questions and comments directly to Vale.

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