

# LEGACY MINING CONTAMINATION AND RENEWABLE ENERGY DEVELOPMENT IN QUEENSLAND



# AN ANALYSIS OF HISTORIC GOLD MINING CONTAMINATION CASES IN QUEENSLAND AUSTRALIA



## Key Environmental Concerns - Mine Site Contamination

Queensland's gold and copper mines have had a considerable environmental impact, primarily due to inadequate waste management and historical mining practices that didn't account for long-term environmental health.

- **Acid Mine Drainage (AMD):** Caused by the exposure of sulfide minerals to air and water, producing sulfuric acid that leaches toxic metals into water sources.
- **Heavy Metal Contamination:** Mining processes release metals like lead, arsenic, and cadmium, which can contaminate soil and water and pose significant health risks.
- **Cyanide Use:** Employed in gold extraction, cyanide can spill and contaminate local ecosystems.
- **Tailings Dams:** Failures and leaks from these storage facilities can release hazardous materials.

While the state government and mining companies have made efforts to remediate these sites, the legacy of contamination remains a significant challenge. Ongoing monitoring and advanced remediation techniques are essential to mitigate these impacts and protect both environmental and public health.

# AN ANALYSIS OF HISTORIC MINING CONTAMINATION CASES: MOUNT MORGAN MINE – DEE RIVER



## Queensland's toxic Dee River reveals national mine waste problem

Ian Townsend

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Google satellite imagery of the Dee River near Mount Morgan, turned aquamarine by waste water contaminants. Locals say that since ex-cyclone Oswald the pollution has stretched even further down stream.

<https://www.abc.net.au/listen/programs/backgroundbriefing/toxic-mine-water/4518922>

# AN ANALYSIS OF HISTORIC MINING CONTAMINATION CASES: INTRODUCTION TO MOUNT MORGAN MINE



Queensland, a state in northeastern Australia, has a rich history of mining activities, particularly for gold and copper. However, these activities have occasionally led to significant environmental contamination issues.

Below, is a summary of some notable cases of significant contamination from mining of Gold and Copper:

## **Mount Morgan Mine**

- **Location:** Near Rockhampton, Queensland
- **History:** The Mount Morgan Mine operated from 1882 to 1981 and was one of the richest gold mines in the world. It also produced significant quantities of copper.

## **Contamination Issues:**

- **Acid Mine Drainage (AMD):** When the mine closed, large amounts of sulfide minerals were exposed to air and water, producing sulfuric acid. This acid then leached heavy metals such as arsenic, cadmium, and lead into the Dee River.
- **Water Quality:** The Dee River's water quality has been severely affected, making it unsuitable for agricultural and recreational use.
- **Remediation Efforts:** The Queensland Government has undertaken various remediation projects, including water treatment plants and containment of contaminated materials, but challenges remain.

**The Mount Morgan Gold Mine, located in Queensland, Australia, is one of the most historically significant mines in the country, having produced large quantities of gold, copper, and silver since its establishment in 1882.**

**However, its lengthy operational history has left behind a legacy of environmental degradation and toxic contamination.**

# AN ANALYSIS OF HISTORIC MINING CONTAMINATION CASES: MOUNT MORGAN MINE



## Toxic Contamination Overview

- The primary issue at the Mount Morgan Gold Mine includes the extensive contamination of soil and water due to the release of heavy metals and acidic drainage.
- **The main contaminants include arsenic, lead, cadmium, copper, and zinc.** These harmful substances have leached into the surrounding environment, causing widespread ecological damage and posing significant risks to human health.

## Site Specific Reasons for Contamination:

- **Acid Mine Drainage (AMD)** - Acid mine drainage is one of the most critical environmental challenges at Mount Morgan. It occurs when sulfide minerals, exposed during mining, react with air and water to produce sulfuric acid. This acidic water then leaches heavy metals from the surrounding rock, leading to highly toxic runoff that contaminates nearby water bodies. The open-cut mining operations and extensive underground workings have exacerbated this issue, providing numerous pathways for AMD to develop and spread.
- **Tailings Dams** - The mine's tailings dams, which hold the byproducts of mining operations, have been a significant source of contamination.
- **Over the years, these dams have accumulated large amounts of toxic sludge and mine waste. Poor management and structural failures have led to the seepage of contaminants into the groundwater and local waterways.**
- The old dams were not built to modern environmental standards, which has further contributed to their instability and leakage.

# AN ANALYSIS OF HISTORIC MINING CONTAMINATION CASES: MOUNT MORGAN MINE



## Heap Leaching Practices

- Heap leaching, a process used to extract precious metals from ore, involves piling crushed ore and applying a cyanide solution to leach out the metals.
- At Mount Morgan, this practice has resulted in cyanide and heavy metal residues being left behind in the heaps.
- **Rainwater can percolate through these heaps, picking up contaminants and carrying them into the surrounding environment.**

## Poor Waste Management

- Historically, waste management practices at the Mount Morgan site were inadequate.
- Large volumes of waste rock and tailings were often dumped without proper containment measures. This has led to the widespread dispersal of contaminants through wind and water erosion.
- The lack of proper capping and containment for these waste materials has allowed ongoing exposure and leaching of toxic substances.

## Decommissioning and Abandonment

- After the cessation of mining activities, the site was not properly rehabilitated, leaving a legacy of contamination.
- Abandoned infrastructure, such as old processing plants and equipment, continues to leak toxic substances. The incomplete decommissioning process has left the site vulnerable to environmental damage, with no active measures in place to mitigate the ongoing contamination.

# AN ANALYSIS OF HISTORIC MINING CONTAMINATION CASES: MOUNT MORGAN MINE



## Environmental and Health Impacts

The contamination from the Mount Morgan Gold Mine has had severe environmental impacts, including the degradation of local waterways, soil contamination, and loss of biodiversity.

The acidic waters and heavy metals have rendered many streams and rivers in the area lifeless, affecting aquatic ecosystems and the species that depend on them.



Human health is also at risk, particularly for communities living downstream of the site. Contaminated water sources can lead to serious health issues, including heavy metal poisoning, which can cause neurological damage, kidney failure, and other chronic illnesses.

The toxic contamination at Mount Morgan Gold Mine is a complex issue stemming from a combination of historical mining practices, inadequate waste management, and the natural propensity for acid mine drainage. Addressing the contamination requires comprehensive remediation efforts, including the stabilization of tailings dams, treatment of contaminated water, and proper rehabilitation of the site to prevent further environmental and health impacts.

# AN ANALYSIS OF HISTORIC MINING CONTAMINATION CASES: RAVENSWOOD MINE



## Ravenswood Mine

- Location: Ravenswood, Queensland
- History: Gold mining in Ravenswood dates back to 1868, with modern operations continuing intermittently.

## Contamination Issues:

- **Cyanide Spills:** The use of cyanide in gold extraction has led to several spills, contaminating local waterways.
- **Tailings Dams:** Failures and leaks from tailings dams have released toxic substances into the environment.
- **Remediation Efforts:** Measures have included the treatment of contaminated water and the stabilization of tailings dams.

**The Ravenswood mine, located in Queensland, Australia, has had environmental impacts on several water bodies due to contamination. Notable rivers and creeks affected by contamination from the Ravenswood mine include:**

- **Sandy Creek:** This creek has been reported to have experienced contamination issues related to the mining activities.
- **Burdekin River:** As one of the significant rivers in the region, the Burdekin River's catchment area has been impacted by runoff and discharges from the mining operations.
- **Elphinstone Creek:** This waterway is another example of a creek affected by contaminants from the mining activities in the area.

**These water bodies have undergone varying levels of contamination, from heavy metals, sediments, and other pollutants that stem from the mining processes. Efforts to mitigate and manage these environmental impacts have failed to return these water bodies to their former safe levels.**

# AN ANALYSIS OF HISTORIC MINING CONTAMINATION CASES: RAVENSWOOD GOLD MINE



**The Ravenswood Gold Mine, specifically the Sarsfield Pit, has been a subject of environmental concern due to contamination issues.**

Located in Queensland, Australia, this mine has faced scrutiny over the years for the impact of its operations on the surrounding ecosystem.

## **Arsenic Contamination:**

- One of the primary contaminants associated with the Sarsfield Pit is arsenic.
- Arsenic occurs naturally in the gold-bearing ore and can be released into the environment during mining and processing activities.
- When arsenic-bearing minerals are exposed to air and water, they can oxidize and leach into surrounding soil and water bodies, posing significant risks to both human health and the environment.

## **Cyanide Contamination:**

- **Cyanide is commonly used in the gold extraction process.** While cyanide is highly effective in separating gold from ore, it is also highly toxic.
- **Improper handling, storage, or accidental spills can lead to cyanide contamination of local water sources,** which can have devastating effects on aquatic life and potentially harm local communities.



# AN ANALYSIS OF HISTORIC MINING CONTAMINATION CASES: RAVENSWOOD MINE



## Heavy Metal Contamination:

- **Heavy metals such as lead, mercury, and cadmium** can also be released during mining operations. These metals can accumulate in the environment, leading to long-term contamination of soil and water, and posing health risks to humans and wildlife.
- **Erosion and sedimentation** from the mine site can further exacerbate contamination issues. Sediments can carry contaminants into nearby rivers and streams, affecting water quality and aquatic habitats. This can disrupt local ecosystems and impact species that rely on clean water sources.
- Efforts to mitigate these contamination issues include implementing stringent environmental management plans, regular monitoring of water and soil quality, and adhering to regulatory standards.
- However, the legacy of contamination from past operations can be challenging to fully remediate, and ongoing vigilance is required to minimize the environmental impact of the Ravenswood Gold Mine's Sarsfield Pit.

**Overall, while gold mining is an important economic activity, it is crucial to balance it with responsible environmental stewardship to protect the health and well-being of the surrounding communities and ecosystems.**

# AN ANALYSIS OF HISTORIC MINING CONTAMINATION CASES: KIDSTON MINE



The Kidston Gold Mine (Queensland, Australia) has had various impacts on local waterways throughout its operational and post-operational phases. Specific creeks and rivers affected by the Kidston Gold Mine include:

- **Einasleigh River:** This river is one of the primary waterways in the region and has experienced changes in water quality and flow patterns due to mining activities.
- **Copperfield River:** Another significant river in the area, the Copperfield River has also been impacted by the discharge of mine effluents and alterations in its ecosystem.
- **Kidston Creek:** This creek runs close to the mine site and has been directly affected by mining operations, including contamination from tailings and runoff.
- **Lynd River:** Located downstream from the mine, the Lynd River experiences secondary effects from sediment and chemical runoff carried by tributaries and connected waterways.
- **Gilberton Creek:** This smaller creek in the vicinity of the Kidston Gold Mine is also subject to contamination and changes in hydrology due to mining activities.

The Kidston Mine contamination serves as a stark reminder of the potential long-term environmental and health risks associated with mining activities. Effective & proactive regulation, ongoing monitoring, and comprehensive rehabilitation efforts are essential to mitigate these impacts and protect both the environment and the health of local communities.

# AN ANALYSIS OF HISTORIC MINING CONTAMINATION CASES: KIDSTON MINE



## The Contamination:

- **Tailings Storage Facility (TSF) Issues:**
  - **Leakage:** One of the primary sources of contamination has been the tailings storage facility (TSF). Tailings, the byproducts of the mining process, often contain toxic heavy metals and chemicals. At Kidstone, there have been instances of leakage from the TSF, leading to the release of contaminants into nearby waterways.
  - **Structural Integrity:** Over time, the structural integrity of the TSF can deteriorate, and any failure could result in a significant spill of contaminated materials.
- **Acid Mine Drainage (AMD):**
  - **Chemical Reactions:** When sulfide minerals in the waste rock and tailings are exposed to air and water, they can produce sulfuric acid. This acid then leaches out heavy metals such as arsenic, lead, and mercury from the surrounding rock, creating highly acidic and toxic runoff.
  - **Water Contamination:** This acidic runoff can contaminate local rivers, streams, and groundwater, posing a severe risk to aquatic life and potentially affecting the quality of drinking water for nearby communities.
- **Heavy Metals and Chemical Pollutants:**
  - **Soil and Water Contamination:** The heavy metals and chemicals used in the mining process, such as cyanide for gold extraction, can persist in the environment, contaminating soil and water long after the mine has ceased operations.

# AN ANALYSIS OF HISTORIC MINING CONTAMINATION CASES: KIDSTON MINE



## Assessment of Consequences:

### **Environmental Impact:**

- **Ecosystem Disruption:** The contamination has led to the degradation of local ecosystems. Aquatic life is particularly vulnerable, with fish and other organisms suffering from the toxic effects of heavy metals and acidic water.
- **Biodiversity Loss:** The alterations in the chemical composition of soil and water can lead to a decline in biodiversity, affecting both plant and animal life in the area.

### **Human Health Risks:**

- **Water Quality:** Contaminated water sources pose a direct threat to human health. People relying on these sources for drinking water may be exposed to harmful chemicals and heavy metals, leading to various health issues such as gastrointestinal problems, neurological disorders, and cancers.
- **Food Safety:** The contamination of soil and water can affect agriculture, leading to the uptake of toxins by crops, which then enter the food chain.

### **Economic Consequences:**

- **Agriculture and Fisheries:** The degradation of natural resources can impact local agriculture and fisheries, leading to economic losses for communities dependent on these industries.
- **Property Values:** Environmental contamination can lead to a decline in property values in the affected areas, making it difficult for residents to sell their homes and relocate.

# AN ANALYSIS OF HISTORIC MINING CONTAMINATION CASES: KIDSTONE MINE



## Regulatory and Rehabilitation Efforts:

- **Cleanup Costs:** Addressing the contamination requires significant financial resources for cleanup and rehabilitation efforts. This includes treating contaminated water, stabilizing and covering tailings storage facilities, and restoring affected ecosystems.
- **Long-Term Monitoring:** Continuous monitoring is necessary to ensure that the contamination is being effectively managed and to prevent future environmental damage.

The permanent damage caused by acid mine drainage has a lasting impact on water quality, ecosystems, and local communities. Cleanup efforts face numerous hazards, including health risks to workers, environmental risks during remediation, and complex regulatory challenges.

Addressing AMD requires careful planning, resources, and ongoing commitment to minimize both environmental harm and public health risks.



# AN ANALYSIS OF HISTORIC MINING CONTAMINATION CASES: MOUNT ISA



## Mount Isa Mine

- Location: Mount Isa, Queensland
- History: Mount Isa Mines began operations in 1924 and is one of the world's largest mining complexes, producing copper, lead, zinc, and silver.

## Contamination Issues:

- **Heavy Metals:** The mining and smelting processes have released substantial amounts of lead, cadmium, and zinc into the environment.
- **Air and Soil Pollution:** Elevated levels of lead in the soil and air have been linked to health issues in the local population, particularly affecting children.
- **Water Contamination:** Tailings and waste rock have contributed to the contamination of local water sources.
- **Remediation Efforts:** Extensive air quality monitoring, soil remediation, and community health programs have been initiated to mitigate these impacts.



# AN ANALYSIS OF HISTORIC MINING CONTAMINATION CASES: MOUNT ISA



## Rehabilitating abandoned mines could create thousands of 'badly needed' jobs, report says

By the National Reporting Team's Mark Willacy

Mining Environmental Issues

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After rain, rivers around the Mt Oxide mine turned sky blue. River near the Mount Oxide copper mine, north of Mount Isa, which turned blue. The Mount Oxide mine was abandoned in 1971. (Supplied)

<https://www.abc.net.au/news/2016-10-23/rehabilitating-abandoned-mines-could-fill-mining-boom-job-void/7949778>