A COMMERCIAL APPLICATION
OF VIROMINE™ TECHNOLOGY

# CASE STUDY: QUEENSLAND QUARRY

*"This application showed that ViroMine™ Technology is a superior technique to traditional treatments for removing metals and neutralising acid in AMD water in shallow water bodies flowing into natural wetland ecosystems..."*

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## PROBLEM

Virotec was contracted by a large quarrying company in South East Queensland, Australia to treat heavily contaminated acid mine drainage water stored in the Western Holding Dam with the intention of releasing the treated water into the local wetland environment.

The Western Holding Dam is used as an additional storage area for run-off collected from the quarry pit in times of heavy rainfall. However, due to the presence of acid generating rock in the quarry, the water is very acidic, with an initial pH of 2.3 and a high metal content; particularly iron, aluminium and copper, the latter being extremely toxic to aquatic fauna and bacteria.

*The Western Holding Dam located in a pre-existing wetland area.*

## VIROTEC TOTAL SOLUTION

The Virotec total solution proved to be an innovative, efficient, effective and immediately applicable means of treating the contaminated water in the Western Holding Dam.

Application of the Virotec solution resulted in water with a metal concentrations below the threshold values specified in the stringent ANZECC water quality guidelines. The ViroMine™ Technology reagent used in this treatment was Acid B Extra™ reagent, and it was designed to neutralise acidity in the water and bind metals in non-bioavailable, chemically inert forms without producing the large volumes of unstable sludge that are typically associated with lime-based treatments.

The ViroMine™ Technology solution components included design, engineering, application and ongoing monitoring. The solution was ideally applicable to the Western Holding Dam; providing both an ongoing treatment for process water and a simple, rapid response to storm water build up in the quarry pit.

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*Contaminated water generated in the quarry pit was pumped to the Western Holding Dam.*

### BACKGROUND

The client is one of Australia's leading quarry operators with sand pit and gravel operations, producing sands and gravels for a wide range of applications. The client produces high quality concrete and asphalt aggregates, road base and sub base for roads, civil and site works as well as specific landscape products based on the type of source rock available.

The client has operated the quarry for over ten years but operations produce waste rock that has a high sulphur content and is capable of generating significant quantities of acid.

To control the acid mine drainage (AMD), which contains toxic concentrations of heavy metals, contaminated water generated in the quarry pit was pumped to the Western Holding Dam. Over the years this has led to a build-up in contaminant levels within the dam as water evaporated and more water flowed in. The client was in need of a cost-effective and sustainable solution to this problem.

*Photo showing acid generating rock in the quarry pit.*

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*Acid B Extra™ reagent was applied as a slurry mixture and sprayed onto the surface of the dam.*

### TREATMENT METHODS

After extensive testing and monitoring of the holding dam water quality, a suitable reagent was developed and applied. ViroMine™ Technology Acid B Extra™ reagent, was chosen for this treatment.

Virotec undertook treatment of the Western Holding Dam over a four-week period.

Due to the difficult treatment conditions presented by the Western Holding Dam (i.e. very high acidity combined with a low water level and the presence of a large number of reeds resulting in numerous dead spots), it was decided that the best method of treatment would be to install a series of sprinklers on the surface of the dam, enabling a larger area to be covered and assisting with the dispersion of Acid B Extra™ reagent. Additionally, a series of aerators were used to ensure effective mixing of the Acid B Extra™ reagent.

The Acid B Extra™ reagent product was transported to site and applied to the Western Holding Dam in a slurry form. This approach provided an *in-situ* method that involved no expensive capital infrastructure and a simple application procedure.

*Because of the low water level aerators were used to ensure effective mixing of the Acid B Extra™ reagent.*

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## RESULTS

Table 1 shows the initial and final characterisation of water quality in the Western Holding Dam. These results show that ViroMine™ Technology is effective for both neutralising acidity and removing heavy metals from water.

*TABLE 1. HEAVY METAL AND ACIDITY LEVELS BEFORE AND AFTER TREATMENT WITH VIROMINE™ TECHNOLOGY (all metal concentrations in mg/L)*

| | Before ViroMine™ Technology treatment | After ViroMine™ Technology treatment | % of Metals removed |
|---|---|---|---|
| pH | 2.5 | 8.5 | - |
| Al | 154 | 0.067 | 99.96 |
| As | 0.017 | 0.001 | 94.12 |
| Cd | 0.036 | 0.001 | 97.21 |
| Cr | 0.183 | <0.001 | >99.45 |
| Cu | 68 | 0.884 | 99.87 |
| Fe | 232 | <0.01 | >99.99 |
| Pb | 0.006 | <0.001 | NA |
| Mn | 4.61 | 0.287 | 93.77 |
| Hg | <0.001 | <0.001 | NA |
| Ni | 3.223 | 0.119 | 96.31 |
| Ag | <0.001 | <0.001 | NA |
| Zn | 3.89 | 0.043 | 98.89 |

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*Photo showing Acid B Extra™ reagent mixing and dosing plant and aerators in the foreground.*

### CONCLUSION

ViroMine™ Technology has proven to be applicable for the treatment of heavy metal and acidity problems associated with acid mine drainage.

This application showed that ViroMine™ Technology, using the Acid B Extra™ reagent, is a superior technique to traditional treatments for removing metals and neutralising acid in AMD water in shallow water bodies flowing into natural wetland ecosystems.

The treatment technique used by Virotec was easy to set up and operate. Furthermore, no unstable sludge was produced and sediment from the application of ViroMine™ Technology can now be reused as an effective soil conditioner to assist revegetation programs.

Treatment of the contaminated water has allowed the client to reclassify the Western Holding Dam as an uncontaminated water body – therefore minimising the threat of a potential environmental incident.