



*A COMMERCIAL APPLICATION OF  
VIROSOIL™ TECHNOLOGY*

**CASE STUDY  
GLADSTONE PORT AUTHORITY**

*“The Virotec total solution proved to be innovative, efficient, effective and immediately applicable during the treatment of the accumulated sulphidic marine sediment...”*



*Gladstone Port Authority*

## PROBLEM

Gladstone Port Authority in Queensland, Australia, was experiencing problems with sulphidic marine clays (acid sulphate soils) resulting from its past dredging and land reclamation operations.

Due to a planned change in a railway siding and loop line approximately 30,000 cubic metres of this sulphidic marine sediment was excavated and stockpiled. This stockpiled material oxidized and became acidic, resulting in an ecological scald where no vegetation was possible.



*View of marine sediment*

## VIROTEC TOTAL SOLUTION

The Virotec total solution was successful in neutralising the acid generating capacity of the stockpile whilst at the same time preventing heavy metal leachate escaping into the nearby harbour. ViroSoil™ Technology was able to enhance nutrient retention, retain water and promote vigorous plant growth.

The Virotec total solution proved to be innovative, efficient, effective and immediately applicable during the treatment of the accumulated sulphidic marine sediment.

The Virotec ViroSoil™ Technology Total Solution components included design, engineering, application, monitoring and regulatory authority liaison.

## BACKGROUND

Virotec were contracted by the Gladstone Port Authority to remediate natural marine sediments (acid sulphate soils) excavated and stockpiled as a result of construction work associated with the rail loop project for the Barney Point terminal around the port of Gladstone.



*The site inspection team*

The objective of the project was to neutralise these sediments by increasing the pH from approximately 4 to between 6.5 & 7 and remove the acid generating potential. It was expected that the average soil pH would be increased from 4.04 to 6.81 and the Net Acid Generating Potential would be reduced to 0.02 mole/kg.

Approximately 30,000 cubic metres of marine sediments required remediation work. Virotec undertook the initial testing program to determine the appropriate ViroSoil™ reagent addition rates and submitted a field program to the Gladstone Port Authority.

Virotec were subsequently contracted to supply the ViroSoil™ Technology reagent and to manage the remediation work. The site work was performed in conjunction with the Gladstone Port

Authority. Virotec managed all technical aspects and implemented environmental controls for the use of ViroSoil™ Technology reagents on the site.

## TREATMENT METHODS

The program comprised of an initial soil characterisation study undertaken to determine the Net Acid Generating Potential (NAGP) and theoretical ViroSoil™ Technology reagent application rates. In addition, the soil was sampled on a 20 x 20 metre grid pattern and field paste-pH tests were measured to ascertain minor variations in soil acidity.

This work was used to vary the localised ViroSoil™ Technology reagent application rate to accommodate areas of high or low acidity. The resultant mix was analysed for NAGP with results plotted on the project plan. The field paste-pH gave a good indication of NAGP, with 80% of samples returning negative NAGP results. The areas with a positive NAGP were retreated.

Piezometers were bored at strategic locations around the site to monitor ground water seepage from the soil. Enough ViroSoil™ Technology reagent was added to sufficiently neutralise 100% of all sulphides present within the sediments.

The treatment program also comprised recommendations for revegetation of the treated soils. Virotec trials established the addition rates for phosphate fertilizer and organic matter required per hectare to produce an optimum rooting medium. The soil has a moderate salt content ( $EC\ 4,000\ \mu s\ cm^{-1}$ ) and as such the appropriate plant species were selected for planting. The revegetation will be monitored over a two-year period.

In summary, the ViroSoil™ Technology treatment consisted of the following:

- > The affected soil was levelled to a thickness of approximately one metre;
- > The required quantity of ViroSoil™ Technology reagent was spread over the surface;
- > The ViroSoil™ Technology reagent was blade mixed with the soil;
- > The remediated soil was dozed to the required shape to form a landscape buffer around a new project area; and,
- > Revegetation of remediated soil.



*Mixing ViroSoil™ Technology reagent into marine sediment.*



*Application of ViroSoil™ Technology reagent into marine sediment.*

## THE TABLE BELOW SUMMARISES THE TREATMENT RESULTS

ViroSoil™ Technology was successful in treating the marine sediments with the average soil pH being increased from 4.04 to 6.81 and the Net Acid Generating Potential being reduced to 0.02 moles/kg within 24 hours.

### RESULTS

Parameter	Before	1 Month After	2 Years After
Soil pH	4	6.5 - 7.5	6.5 - 7.5
Net Acid Generating Potential	High	0.02 moles/kg	0.02 moles/kg
Revegetation Potential	Extremely Low	High	High

### CONCLUSION

ViroSoil™ Technology has proven to be readily applicable and very successful in the treatment of acidity problems associated with the accumulation of sulphidic marine sediments. ViroSoil™ Technology was successful in long-term revegetation of treated excavated sediment.

### TESTIMONIAL

*“Virotec were consulted to perform remediation works on various areas affected by sulphidic marine sediment. In summary, the application of ViroSoil™ Technology was successful in neutralising pH, modifying soil properties and allowing a suitable base for re-vegetation to occur.*



*Revegetation of treated sediment. Photos taken four years after treatment.*

*Everyone at Gladstone Port Authority was very pleased with the outcome. ViroSoil™ Technology initially provided good results in regards to pH correction and after over two years of monitoring the results continue to be very good. Additionally, the leachate and runoff from the site has been of good quality since the application of ViroSoil™ Technology.*

*During the application of ViroSoil™ Technology reagents, the Virotec staff were diligent, efficient and adhered to all site safety requirements.*

*There has been no adverse affect or public comment from the ViroSoil™ Technology application. The ViroSoil™ Technology reagents have proven to blend well with the black marine clay to form a brown soil of a better appearance.*

*We will continue to liaise with Virotec during the ongoing vegetation programme”.*

Gladstone Port Authority

## REFERENCES

Bauxsol Technology Provides a New Approach to the Treatment and Management of Sulphidic Mine Tailings, Waste Rock and Acid Mine Drainage

D. McConchie, F. Davies-McConchie, M. Clark, T. Ryffel, W. Caldicott & S. Pope

Acid Sulphate Soils in Australia and China.

C. Lin, M.D. Melville and L.A. Sullivan, Science Press, Beijing, China, 2002.