Acid Solutions®
Contaminated Water Treatment Services
FIXING THE ENVIRONMENT

65 megalitres of low pH Metal contaminated water treated for irrigation disposal.

November 2008

Name	Xstrata / Umwelt Consultants
Site Location	Mid eastern NSW
Site Problem	pH, Metal and Ferrous Iron Contamination
Water Volume	65 Megalitres
Water pH	2.95 pH
Acidity	295-465 Mg/L
Suspended Solids	Above license limits
Treatment Objective	Environmental Protection/irrigation Release
What is causing the problem	Contamination from Adit Leachate
Dams/Pits	1
Length of water body	160 metres
Width of Water body	85 metres
Water Depth	To 7 metres
Bottom Type	Constructed dam with trees and snags
Aquatic Flora	Yes
Vehicle Access and Flora	Road access no Flora
Environmental Sensitivity	Contained and Controlled without rainfall
Aquatic Life	None
Drains or Streams nearby	Yes – environmental risk
Regulatory requirements	Yes - discharge
Urgency level	Urgent

1 INTRODUCTION

Acid Solutions was requested to provide treatment of contaminated leaching Adit water in a remediated coal mine in New South Wales for Xstrata Coal.
The contaminated Adit water was pumped from the leachate catchment pond to a 65 megalitre holding dam and required treatment to allow irrigation release on site. The water contained in this dam did not meet irrigation quality and required treatment to allow disposal.

2 SITE INSPECTION AND SURVEY

The site layout showed no problem for treatment but the water collected had extreme contamination.
The samples taken and tested from the leachate seeping from beside the Adit showed a ph of 3.26 with a conductivity of 6.38ms/cm. The total Actual Acidity (TAA) measured 1530 Mg/l and Total Potential Acidity (TPA) of 1580 Mg/L with extremely high levels of Ferrous Iron apparent.
Samples taken from the holding dam had a ph of between 2.95 and 3.44 with a conductivity of 3.59 to 4.16ms/cm. The Total Potential Acidity (TPA) measured between 295 to 465Mg/L with high ferrous Iron levels.

Contaminated Water leaching from side of Adit seal

Holding Dam - 65 Megalitres

The holding dam showed stratification with high ferrous iron and a mild smell of hydrogen sulphide in the deeper water when raised to the surface.

3 WATER QUALITY OBJECTIVES

The water quality was improved to neutralise Acidity, raise pH and reduce metal contaminants to allow licensed irrigation disposal

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4 TREATMENT METHODS USED

The Dam was treated insitu using *Acid Solutions* Patented Treatment system called the C.R.A.B. and 3 different specialized applicators.
C.R.A.B. Calibrated Reagent Applicating Blender. www.ACIDsolutions.com
Initially reagent was applied evenly to the surface to provide a blanketing effect to initiate precipitation of ferric Hydroxides and Oxyhydroxides.
The reagents were then applied to the mid depth range. Our processes improve the speed of treatment and ensure accurate neutralization and oxidation.
After the surface and mid depth ranges were initialized with reagent we then applied reagent to the lower depths using our "stratification buster". This applicator applies reagent accurately to the lower depths and ensures the reagent penetrates the stratification and helps to oxidize the ferrous iron to speed treatment and prevent future re-acidification.

5 TREATMENT REAGENTS

The Treatment Reagents used were Calcium Hydroxide (Ca(OH)2) supplied in Bulk 500 Kg Bags and two other specialized reagents.
The accurate application of these reagents provides neutralization of pH and Acidity with very good metal and other contaminant reduction. The high iron levels present in this water greatly benefit metal load reduction during treatment.
Reagent (Calcium Hydroxide) was applied at controlled rates of between 250 and 850 kilograms per hour depending on the applicator, depth and area/site treated.
The other reagents were applied throughout the treatment at rates relative to depth and metal loads.

6 DAILY WATER ANALYSIS

Water testing was conducted prior to daily reagent application.

Date	Depth	pH	Acidity TPA	Conductivity
10/11/08	Surface	2.95	295	4.16
10/11/08	3.5 M	2.89	310	4.03
10/11/08	Bottom - 7.5M	3.44	465	4.00
11/11/08	Surface	3.48	210	3.92
11/11/08	Bottom - 7.5M	3.58	460	4.01
12/11/08	Surface	6.02	16	3.92
12/11/08	2.5 M	6.12	18	3.94
12/11/08	3.5 M	6.07	25	3.95
12/11/08	4.5 M	5.16	45	3.98
12/11/08	5.5 M	4.65	120	4.01
12/11/08	6.5 M	4.61	270	4.00
12/11/08	Bottom - 7.5M	4.69	350	3.99
13/11/08	Surface	8.9	0	3.95
13/11/08	3 M	9.01	0	3.86
13/11/08	5 M	9.14	0	3.90
13/11/08	7.5 M	9.01	0	3.91

7 TREATMENT WATER ANALYSIS

Contaminants	Units	Pre Treatment	Post Treatment
Suspended Solids	mg/L	130	11
Aluminium (Soluble)	mg/L	<0.01	<0.01
Arsenic (Soluble)	mg/L	<0.005	<0.005
Boron (Soluble)	mg/L	0.55	0.22
Calcium (Soluble)	mg/L	630	600
Cadmium (Soluble)	mg/L	<0.01	<0.01
Chloride	mg/L	420	270
Cobalt (Soluble)	mg/L	0.25	<0.01
Copper (Soluble)	mg/L	<0.01	<0.01
Chromium (Soluble)	mg/L	<0.01	<0.01
Iron (Soluble)	mg/L	340	0.42
Lead (Soluble)	mg/L	0.02	<0.01
Lithium (Soluble)	mg/L	0.24	0.2
Magnesium (Soluble)	mg/L	72	57
Manganese (Soluble)	mg/L	11	0.3
Mercury (Soluble)	µg/L	<0.001	<0.001
Molybdenum (Soluble)	mg/L	<0.01	<0.01
Nickel (Soluble)	mg/L	0.65	<0.01
Selenium (Soluble)	mg/L	<0.01	<0.01
Sulphate (Soluble)	mg/L	2820	2040
Uranium(Soluble)	mg/L	<0.01	<0.01
Vanadium (Soluble)	mg/L	<0.1	<0.01
Zinc (Soluble)	mg/L	47	0.07

8 FERROUS IRON

During initial analysis it was established that high Ferrous Iron (un-oxidized) existed. The oxidized Iron species (Ferric) precipitates at around 3.4 to 3.6 pH but the un-oxidized Ferrous Iron species precipitates at around 8.4 to 8.6 pH.
The use of our specialized application systems and several reagents ensures this Ferrous Iron is oxidized to Ferric Iron during treatment.

9 FLOC ANALYSIS

Floc was also sampled from the bottom when testing water quality. This floc showed the normal coloration of precipitated Ferric (oxidised) Hydroxide.
The water/Floc did not drop in pH when Tested with hydrogen Peroxide
which indicates (if endpoint pH is over 8.7) that the initial Ferrous Iron has been converted to Ferric Iron.

10 DAM RELEASE POINT QUALITY.

A dam drain point exists in the lower dam wall. It is understood that this extracts water from the lower level of the dam. Water was tested at this point and showed a ph of 8.82 and no Ferrous iron after flushing upon completion of the treatment process.

11 ONSITE WATER QUALITY ANALYSIS

The dam was tested at specific levels on the 13/11/08 to ensure Acidities and pH were neutralised and ferrous iron was completely oxidised. Sampling was conducted at 5 sites over the dam at various depths to gain an average quality before stabilisation.

Site	Depth	pH	Conductivity	Acidity
1	Surface	8.90	3.90	0
1	3 M	9.33	3.86	0
1	5 M	9.17	3.93	0
2	Surface	9.0	3.95	0
2	3 M	9.34	3.86	0
2	5 M	9.16	3.90	0
2	7.5 M	9.21	3.91	0
3	Surface	9.01	3.93	0
3	3 M	9.21	3.85	0
3	5 M	9.40	3.87	0
3	Bottom -Floc	8.40		
4	Surface	7.69	3.88	7
4	3 M - bottom	6.88	3.79	11
5	Surface	6.01	3.88	18
5	Bottom 1.5 M	5.88	3.79	24

12 AREA OF LOW PH

Site 5 was at the southern end of the dam in waters up to a maximum depth of 1.5 metres. This area was the last treated and showed the lowest ph levels when tested.
This area was small, contained several trees and snags and the volume was estimated to be less than 1 Megalitre.
Due to the low volume <2% of the entire dam, and excess alkalinity existing in the rest of the dam, it was decided not to re-treat this area.
This lower pH of 5.88 to 6.01 is close to normal dam ph levels and due to the high flora and Fauna in this area it was decided to allow this area to slowly and naturally raise in ph to match the greater volume of the dam. This pH stabilised with the rest of the dam within a few days.

13 TREATMENT STAGES


Initial Stages with high Ferric Hydroxide formation and precipitation.


Mid stages with Aluminium precipitation starting.


Final stages of treatment after neutralisation and metal precipitation is almost complete.

14 RESULTS

Acid Solutions provided a fast, efficient and cost effective service to treat this otherwise difficult water problem. Treatment took 4 days and the water quality remained within license levels after treatment even though the ferrous Iron levels before treatment were extremely high.

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