GALMOY MINES LTD

MIANAIGH GHABHALMHAIGH TEORANTA

Annual Environmental Report 2010

Glossary of Terms

AER	Annual Environmental Report
CCME	Canadian Council of Ministers of the Environment
CRAMP	Closure Rehabilitation Aftercare Management Plan
DCENR	Department of Communication, Energy & Natural Resources
DCS	Distributed Control System
ELV	Emission Limit Value
EMG	Environmental Monitoring Group
EMP	Environmental Management Programme
EMS	Environmental Management System
EPA	Environmental Protection Agency
EWC	European Waste Catalogue
IPPC	Integrated Pollution Prevention Control
List I	As listed in the EC Directives 76/464/EEC and 80/68/EEC and amendments.
List II	As listed in the EC Directives 76/464/EEC and 80/68/EEC and amendments.
MAC	Maximum Allowable Concentration
MCMP	Mine Closure Monitoring Programme
MRC	Model Review Committee
RWSS	Replacement Water Supply Scheme
TMF	Tailings Management Facility
UFPP	Underground Failure Prevention Plan

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Appendices

1. Annual Environmental Report

1. Background Information

1.1 Introduction

This document comprises the Annual Environmental Report (AER) for 2010 prepared by Galmoy Mines Ltd. (formerly known as Arcon Mines Ltd.). The AER has been prepared in accordance with the requirements of Condition No. 2.9.2 of the Integrated Pollution Prevention Control (IPPC) Licence No. P0517-01 issued by the Environmental Protection Agency (EPA) in 2002.

1.2 Location

The Mine is located within the townlands of Castletown, Whiteswall, Rathreagh, Garrylaun and Rathpatrick close to the village of Galmoy in North County Kilkenny. The surface facilities of the development are confined largely to the townland of Castletown on both sides of the Johnstown / Rathdowney road (R435).

1.3 Site Description

The Galmoy Mine plant site occupies an area of approximately sixteen hectares in the townland of Castletown. It is located to the east of the R435. The site contains the coarse ore stockpile building, the water treatment facilities, water holding ponds and ancillary facilities. Access from the surface is via a decline (mine portal) which was excavated to a point between the CW and G orebodies, where it splits into two arms, one continuing to the CW and R orebodies and the other continues into the G, K and K2 orebodies.

The tailings impoundment facility is located west of the R435. It is a lined earth fill structure currently covering an area of approximately thirty-two hectares in three phases. Phase I is approximately nine hectares in area and is now full and almost totally rehabilitated. Phase II, which covers an area of approximately fourteen and a half hectares is currently full and approximately eight hectares have been covered with compost. Rehabilitation is ongoing on Phase II. The third phase, which covers an area of approximately nine hectares, was constructed in 2006 and was the active phase for the deposition of tails up to May 2009. It now acts as an emergency reservoir for mine water and all surface water from the TMF. The water level in Phase 3 is managed by treating the water in the water treatment plant and discharging as part of the final discharge to the River Goul. Further information about the restoration and rehabilitation of the TMF can be found in section 16 *Tailings Management facility Restoration Report.*

1.4 Description of Process

Prior to May 2009 ore was processed in the mill to produce zinc and lead concentrates. This was achieved in three stages, crushing and grinding, flotation, and dewatering.

Since February 2010 ore has been mined and transported from underground to the surface on a covered conveyor belt. From here it is stockpile in a coarse ore shed (Tepee). The ore is temporarily stockpiled on the surface before being transported to a neighbouring mine located in County Tipperary.

1.5 Cessation of Mining

An announcement on the cessation of mining was made by the Lundin Board of Directors in January 2009, based on the economic climate and production ceased on 1st July 2009. The Mine Closure Plan was implemented and will continue on a phased basis. A Five-Month Mine and Backfill Plan (April 2009) was submitted to the authorities to enable orderly and stable closure of the mine. The Mine Closure Committee consisting of representatives from EPA, Kilkenny County Council, Dept. of Communications, Energy and Natural Resources, Laois County Council and the South Eastern Fisheries Board, was set up in 2008 to deal with any outstanding issues in relation to closure.

A Mine Closure Plan was completed and submitted to the Authorities in December 2010 in including a Rehabilitation and Closure Plan for the TMF at Galmoy Mines (Rehabilitation & Closure Plan Tailings Management Facility @ Galmoy Mines, Golder Associates January 2010).This incorporates best practise for restoration of the Mine's Tailings Management Facility.

Further to discussions with another neighbouring Irish mining company it became feasible to mine some ore reserves in the R-zone on a small scale during Mine Closure, and to transport that ore to the neighbouring mine for processing.

Galmoy Mine is currently in discussion with the Department of Communications, Energy and Natural Resources about extending its mine life by expanding mining into the G Orebody reserves. If approval is granted it is envisaged that mining will continue on a residual, small scale basis until the first quarter of 2012.

2. Environmental Management

2.1 Introduction

Galmoy Mines Ltd. is committed to achieving a high standard of environmental performance. The environmental performance of the Company is regulated under an Integrated Pollution Prevention Control Licence (IPPC) No P0517-01 which was issued by the Environmental Protection Agency (EPA) on the 4th of October 2002. There is an Environmental Policy, and Environmental Standard in place and the Company have an

Environmental Management System (EMS) to cover its operations which is constantly being updated. The EMS is based on the principles of the Environmental Management Standard, ISO 14001.

2.2 Environmental Management Plan and the Mine Closure Plan Schedule

An important element of the Company's EMS is an **E**nvironmental **M**anagement **P**lan (EMP). The EMP operates by encompassing the requirements of the:

- **IPPC** licence P0517-01 issued by the EPA
- **C**losure **R**ehabilitation and **A**ftercare **M**anagement **P**lan (CRAMP)
- **M**onitoring **P**rogramme Feb 2010 (App.10)

Each of these individual requirements is encompassed under the time frame of the **M**ine **C**losure **S**chedule (including Condition 14, *Site Closure, Decommissioning & Perpetual Aftercare* of IPPC licence P0 517-01) shown in Table 3-1 below.

The EMP is designed to fulfil the requirements of the IPPC licence which makes provision for management of the activity on a planned basis having regard for the desirability of ongoing assessment, recording and reporting of matters affecting the environment. Since entering the closure phase, the Mine Closure Plan Summary, including addenda and the Second Interim Mine Closure Plan (SIMCP, 2005) have under the experienced guidance of the Mine Closure Committee, been put into action.

The EMP will span the active closure period of 2010-2012 and is being implemented according to the Mine's CRAMP database. Any changes made to the EMP will be recorded in the CRAMP database. The CRAMP database is an appendix of the Mine Closure Plan Summary and it contains information outlining each area of the mine, the objectives for mine closure success criteria and the schedule for which these objectives are to be achieved.

The Monitoring Programme (Feb 2010) is an inherent part of the EMP and includes an important schedule for monitoring during the various stages of the closure and rehabilitation process. It has been designed in conjunction with Golder Associates to facilitate compliance with IPPC licence P0517-01, including Technical Amendment B and monitoring requirements from the Authorities. As outlined in Appendix 10 this guideline will take the format of nine distinct schedules:

1. Process Water
2. Surface Water
3. Production Wells
4. Rewatering Schedule
5. Well Monitoring Programme
6. Tailings Management Facility
7. Ambient Air Monitoring
8. Atmosphere Monitoring
9. Subsidence Monitoring
10 Noise/Vibration Monitoring

3. Mine Closure Programme

3.1 Introduction

A Mine Closure Programme has been developed to outline the ordered closure of the mine site and its ancillaries. This programme is broken down into three distinct areas (Tailings Management Facility, Underground, and Mine Site) with timeframes allocated

for each task. The time schedule for the closure programme is illustrated in Table 3-1 below.

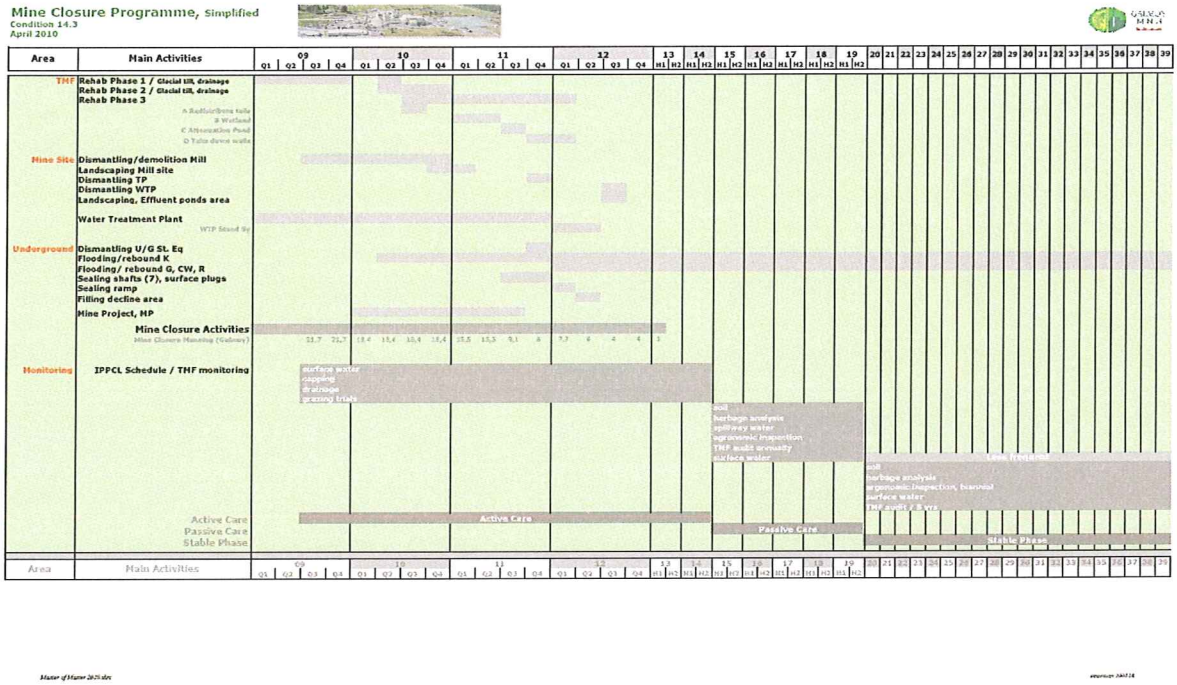


Table 3-1 Mine Closure Programme Time Schedule

3.2 TMF

Rehabilitation of Phase 1 will be completed in 2011 and used as a full scale trial area for the assessment of water quality emanating from the cap. Rehabilitation of Phase 2 has commenced and will be finalised in 2011. Rehabilitation of Phase 3 will commence in the early part of 2012 and will be finalised by in 2012. Provisions have been made for the construction of a passive wetland treatment system to the west side of the TMF, should it be needed to treat water from the TMF. The methodology and engineering are described in the Rehabilitation and Closure Plan for the TMF at Galmoy Mines (Golder, May 2010).

3.3 Mine Site

Dismantling of the Mill Area commenced during the second half of 2009. In the first quarter of 2011 the whole area, excluding mill offices and the Water Treatment Plant (WTP), have been dismantled down to the ground. The Water Treatment Plant will be dismantled once rehabilitation of Phase 3 has been completed and water quality for discharge to the environment is deemed by the authorities to be acceptable. It is anticipated that the Final Landscaping of the whole mine site will take place during 2012.

The Mine Closure Plan Summary states:

"Following the removal of all site structures, the site will be rehabilitated for the purpose of tree planting and development of woodland and this will be carried out as follows:

- Subsoil and topsoil from the site berms will be redistributed over the excavated areas
- The landscape will be contoured to facilitate drainage to the northern end of the site as existed prior to the development of the mine site
- Organic material such as compost will be used to improve soil fertility, where applicable
- Soil analysis will be carried out and appropriate fertilisers will be applied if necessary
- A reputable and qualified Third Party will be commissioned to do an assessment of the rehabilitated site and to recommended the tree planting that should take place
- The afforested site will be made stock proof"

There is currently commercial third party interest in the explosive magazine, industrial area and administration buildings. Galmoy Mine encourages such alternative enterprises for the site and to this end planning applications have been submitted to Kilkenny County Council for these alternative enterprises. The green field status originally outlined in the 1992 MCP may be superseded by a Centre of Excellence for Sport, Bio energy Plant and commercial Magazine.

3.4 Underground

Flood tests in the mine commenced during Q1 2010 with the flooding of the K orebody. Dismantling of fixed plant equipment and pump stations throughout the rest of the mine is projected to take place after Q1 2012, after which the remainder of the mine will be flooded. Backfilling of the decline/mine portal can then take place during the first half of 2012.

The Current and Post-Closure Stability of the Galmoy Underground Workings (Golder Associates Nov 2008), Surface Subsidence, Risk Management (Cantab, G Ferguson April 2009), Galmoy Mine, Revised Mining Plan and Underground Inspections December 2008 – June 2009 (Cantab) and the Five Month Backfill Mine Closure Plan (Galmoy Mines Ltd, March 2009) were submitted to the authorities as Addenda to the MCP to support the contention that there will be no surface stability issues post-closure.

4. Emissions to Atmosphere

4.1 Introduction

The requirements for monitoring emissions to atmosphere are specified in Condition 5, Schedule 1 (i) – (iii) of IPPC License 517-01. The schedule specifies the mine ventilation shafts and abatement areas to be monitored. A2-1, (East Ventilation Shaft) on the CW

Orebody was changed to down casting in September 2004 and continued to operate as a down casting vent to supply clean air to the mine during 2010.

Schedule 1(i) Emissions to Atmosphere of the License requires the parameters hydrogen sulphide gas and nitrogen oxides be monitored on a monthly basis and particulates on a quarterly basis at mine ventilation shafts. Carbon monoxide is also required to be monitored at each vent raise. In 2010 mining only took place in the R-zone of the mine. Although the R-zone ventilation shaft is currently an up-casting vent, monitoring is not possible as the air stream contains very high moisture levels due to groundwater entering the vent shaft below the surface.

The abatement area at the Concentrate Load out Building (A2-4) was monitored until May 2009, however, monitoring at this emission point did not continue beyond this date due to mine closure and the cessation of milling.

5. Ambient Air and Dust Monitoring Summary Report

5.1 Introduction

The requirements for ambient air and dust monitoring are specified in Condition 5, Schedule 1 (iv) – (vi). The stations to be monitored are outlined in Condition 5.7 and 5.8 for ambient air and dust deposition respectively. There are four ambient air monitoring stations (AA1 – AA4) and nine dust deposition stations (AA5 – AA13) surrounding the mine site.

5.2 Ambient Air

Table 5.1 shows a summary of ambient air results for 2010. All stations achieved one hundred percent compliance for all parameters monitored. It should be noted that in August the filter was discarded at AA2 because the lid of the apparatus restricted the air flow giving false results. There were no laboratory results available for AA4 in September.

	µg/m³				
Station	**Pb**	**Zn**	**As**	**Cd**	**Suspended Particulates**
AA1	0.027	0.078	0.00022	0.0011	5.55
AA2	0.005	0.004	0.00004	0.0001	1.81
AA3	0.003	0.007	0.00004	0.0002	3.96
AA4	0.005	0.009	0.00004	0.0002	2.53
ELV	*0.5*	*2*	*0.04*	*0.04*	*250*
% Compliance	100	100	100	100	100

Average monthly air volume used for some calculations; see 2010 Quarterly Reports for details

Table 5-1 Annual average metal analysis for ambient air stations 2010

5.3 Dust Deposition

With the exception of stations 6, 9 and 11, all dust deposition stations monitored each month during 2010. AA6 was not monitored from June to Sept. due to station damage each month by livestock; AA9 was not monitored at all during the year for the same reason. There were no results for AA11 in October, November and December because the station could not be accessed.

All parameters tested during 2010 were 100% compliant with the exception of undissolved solids. AA13 (Johnstown N.S) was non compliant in March; AA7 (NGR E228701 N173227) and AA11 (NGR E226487 N172712) were non compliant in September and AA12 (NGR E226891 N172979) was non compliant for undissolved solids in December.

Non-compliances for dust deposition are referred to in more detail in Section 19 – Incident Notification. Table 5-2 shows the average metal results recorded at each station throughout 2010.

	Monthly Average µg/m²/day				Monthly Average mg/ m²/day
Station	**Pb**	**Zn**	**Cd**	**As**	**Undissolved Solids**
AA5	7.90	31.46	0.14	0.55	4
% Compliance	***100***	***100***	***100***	***100***	***100***
AA6	2.37	9.45	0.06	0.24	32
% Compliance	***100***	***100***	***100***	***100***	***100.0***
AA7	1.48	7.91	0.07	0.20	62
% Compliance	***100***	***100***	***100***	***100***	***91.7***
AA8	1.15	4.79	0.05	0.16	42
% Compliance	***100***	***100***	***100***	***100***	***100.0***
AA9 *					
% Compliance					
AA10	1.00	3.14	0.02	0.21	13
% Compliance	***100***	***100***	***100***	***100***	***100.00***
AA11	2.41	12.82	0.58	0.83	563
% Compliance	***100***	***100***	***100***	***100***	***87.5***
AA12	100	100	100	100	77
% Compliance	***100***	***100***	***100***	***100***	***89.0***
AA13	4.22	21.53	0.11	0.59	93
% Compliance	***100***	***100***	***100***	***100***	***92***
ELV	*250*	*500*	*5*	*5*	*350*

*Station AA9 destroyed by livestock

Table 5-2 Annual average metal analysis results for dust deposition stations 2010

5.4 Truck Swabs

There was no milling in 2010 as a result of mine closure and therefore no transportation of concentrates by the Mine. No truck swabs were carried out in 2010.

6. Process Effluent Emissions

6.1 Introduction

The requirements for process effluent monitoring are set out in Condition 6, Schedule 2(i) – (ii) of the IPPC licence. There are six locations to be monitored as specified in Schedule 2(ii). These locations are as follows:

SW1	Discharge Effluent
PS8	Effluent Pond Discharge
PS1	Mine Water
PS3	Treated Mine Water
PS4	Reclaim Water
PS5	Treated Process Water

6.2 Discharge Effluent (SW1)

The Discharge Effluent is a combination of treated water from the PS8 and GW1 settlement ponds. It is discharged directly to the River Goul. Figure 6-1 shows the percentage rate of compliance for each of the parameters measured at SW1 from 2005 - 2010. The compliance rate is calculated based on the daily concentration for each parameter with respect to emission limit values as per licence conditions. Twelve out of sixteen parameters achieved one hundred percent compliance for 2010. Non-compliances for pH, suspended solids, total ammonia and zinc are detailed in Section 19 – Notification of Incidents.

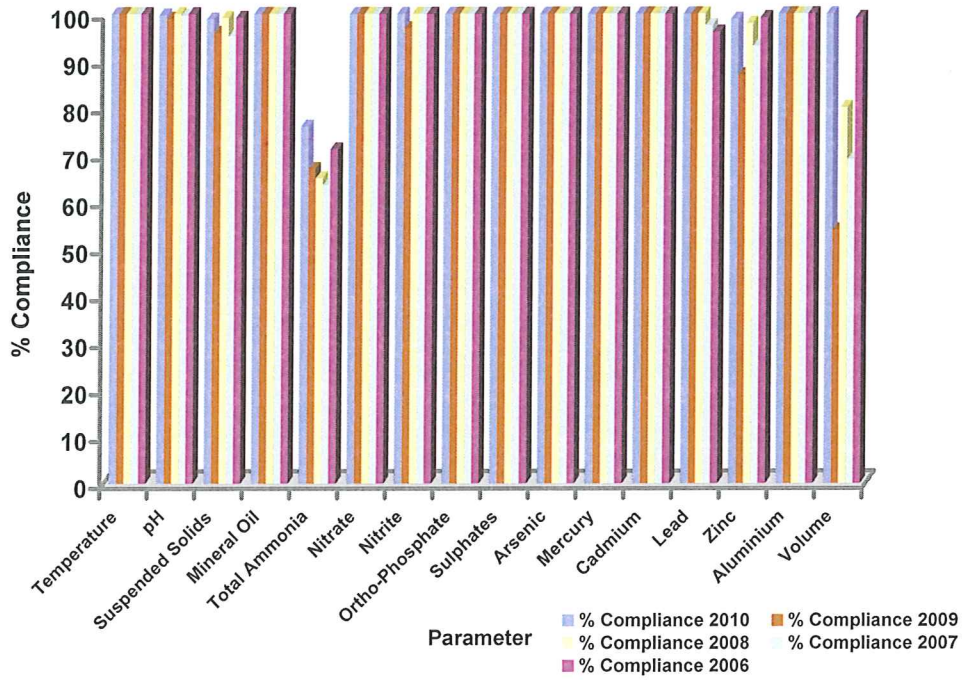


Figure 6-1 Rate of Compliance for Parameters Monitored at SW1 2005 - 2010

The total mine water make from the mine in 2009 was 5,198,131 m^3. A drop in water make occurred in 2010, with 4,349,802m^3 water being pumped to surface. The installation of the plugs in the K access drive in March 2010 was responsible for the reduction in mine water. The average daily volume of pumped mine water fell from 14,241 m^3/day in 2009, to 11,917 m^3/day in 2010. Total effluent discharge from the mine, including treated process water, was 4,550,676 in 2010 compared to 4,840,973 in 2009.

Due to excessive water volumes underground the mine requested a technical amendment to the IPPC licence in 2008. This was granted to Galmoy Mines Ltd. in November 2008 and this increased the maximum emission limit value at discharge to 22,000m^3 on any one day. Figure 6-2 shows the average monthly volume of water discharged at SW1, after treatment, for 2010, a steady state of pumping was maintained throughout the year.

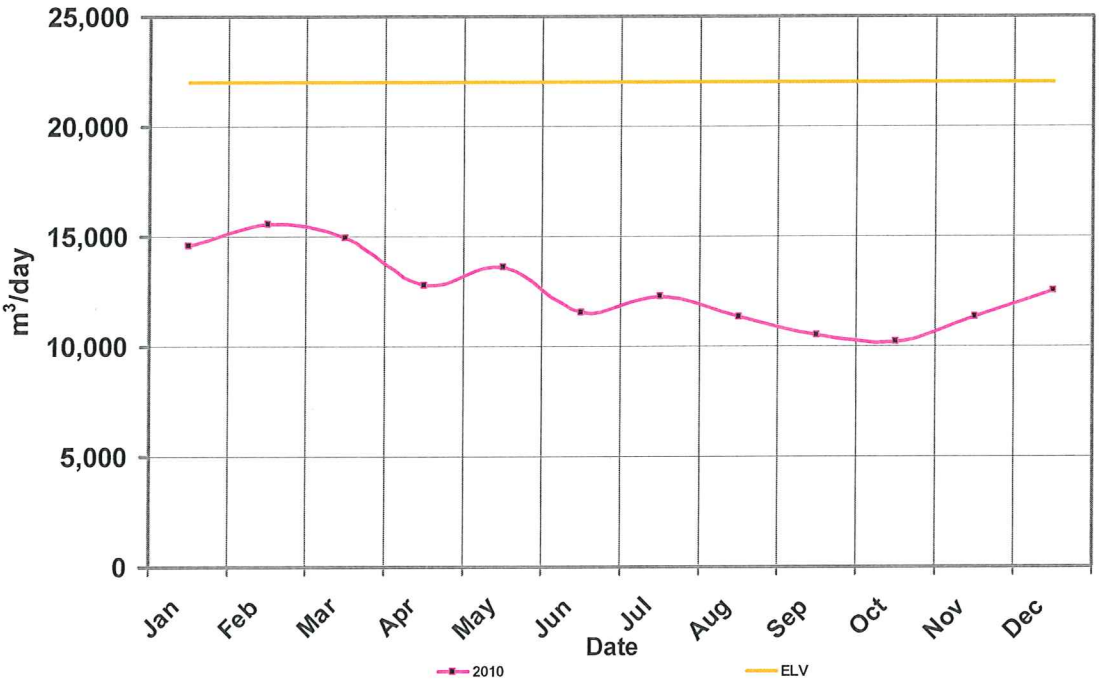


Figure 6-2 Average Monthly Volume Discharged at SW1 in 2010

Zinc compliance at SW1 increased from 87% in 2009 to 98.9% per cent in 2010 (Figures 6-3). Lead was 99.73% compliant compared to 100% compliance last year (Figure 6-5).Suspended solids compliance increased to 98.9% in 2010 up by almost three per cent from 2009 (Figure 6-7). Figure 6-9 shows ammonia compliance in 2010, an increase of 9% in compliance from the previous year's results. Figure 6-10 shows ammonia concentration at discharge through out 2010. The comparisons of the average monthly mass emissions for zinc, lead, suspended solids and ammonia in discharge effluent for 2010 versus 2009 are also illustrated below in Figures 6-3, 6-5, 6-7 and 6-9 respectively.

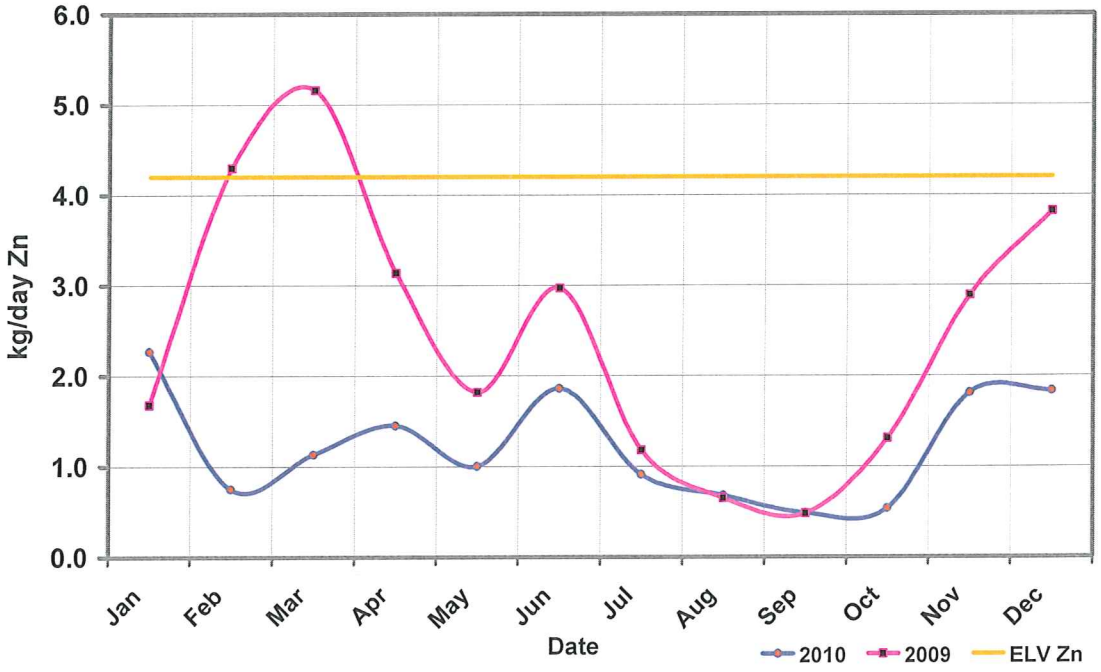


Figure 6-3 Average Monthly Mass Emission of Zinc at SW1 in 2009 and 2010

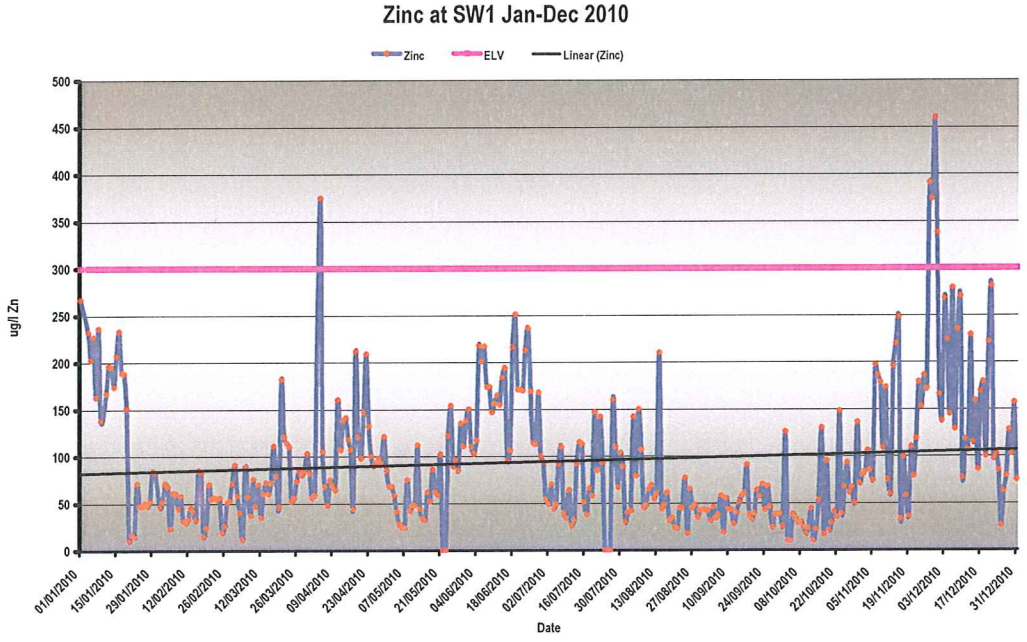


Figure 6-4 Zinc at Effluent Discharge 2010

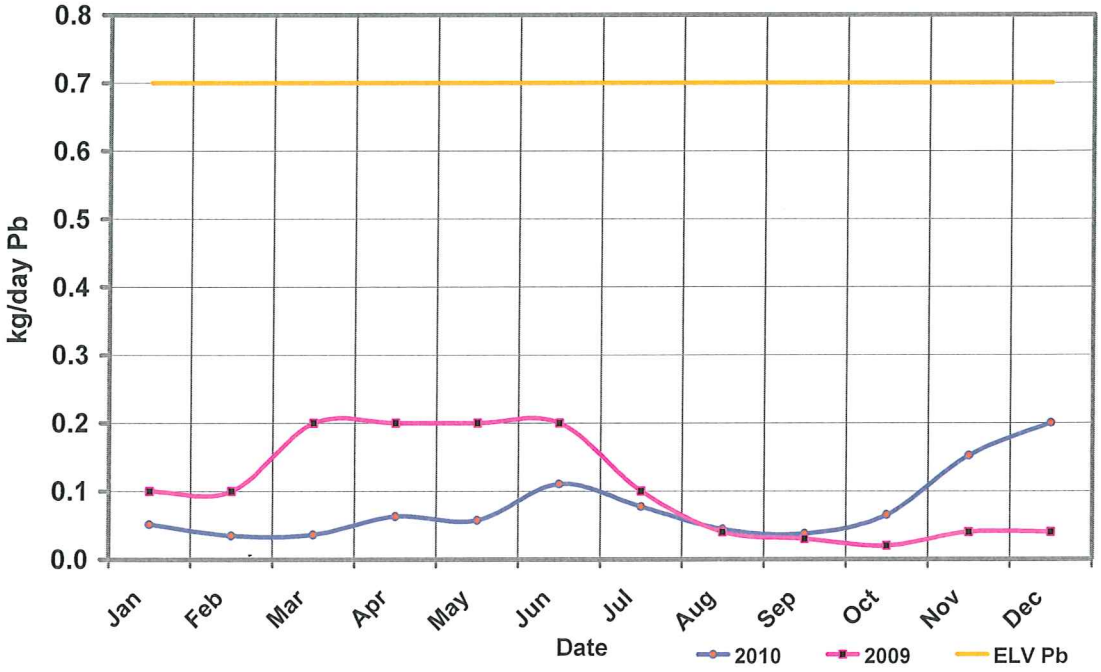


Figure 6-5 Average Monthly Mass Emission of Lead at SW1 in 2009 and 2010

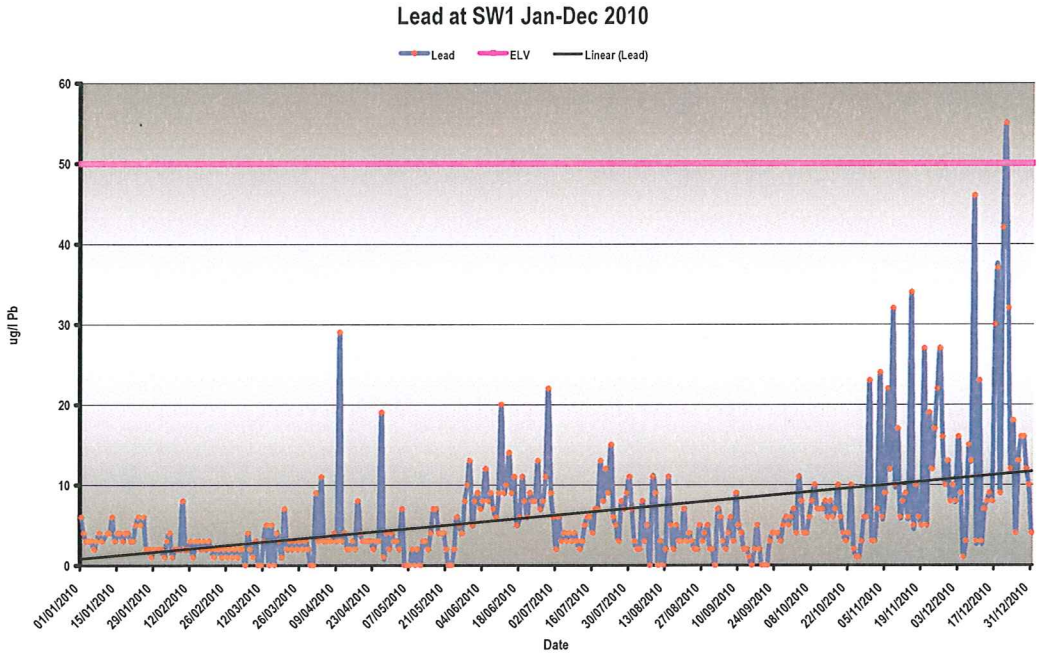


Figure 6-6 Lead at Effluent Discharge 2010

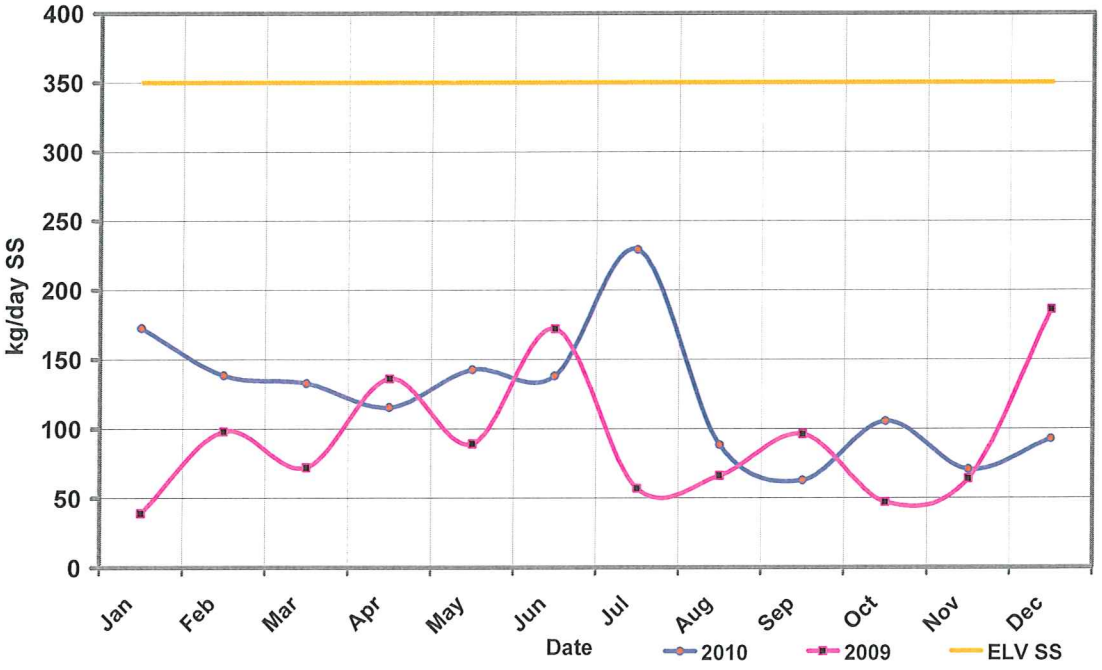


Figure 6-7 Average Monthly Mass Emission of Suspended Solids at SW1 in 2009 and 2010

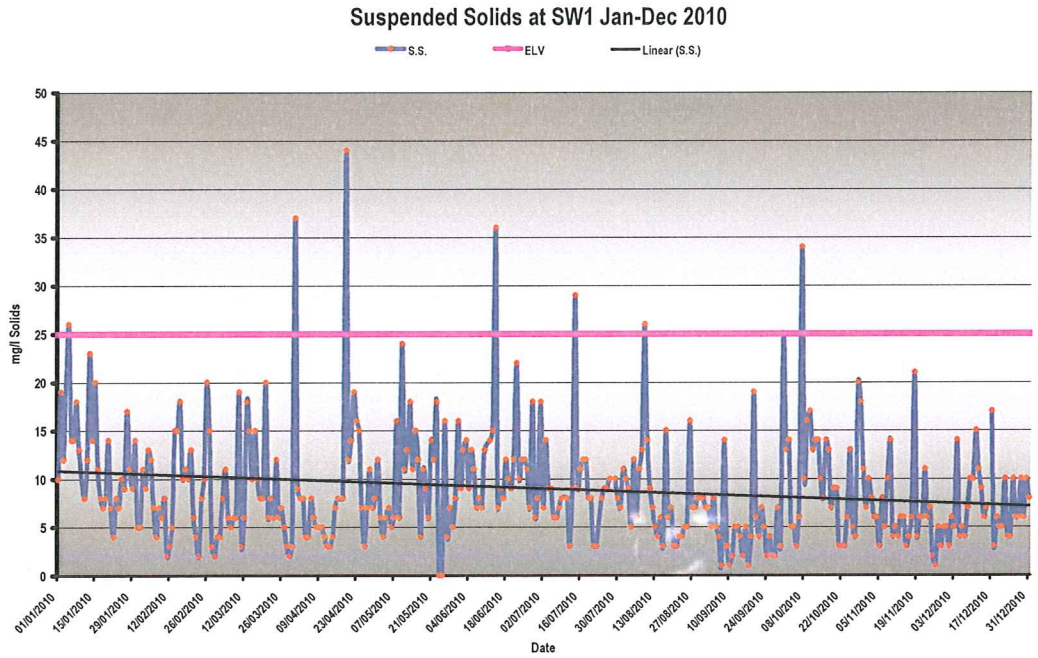


Figure 6-8 Suspended Solids at SW1 2010

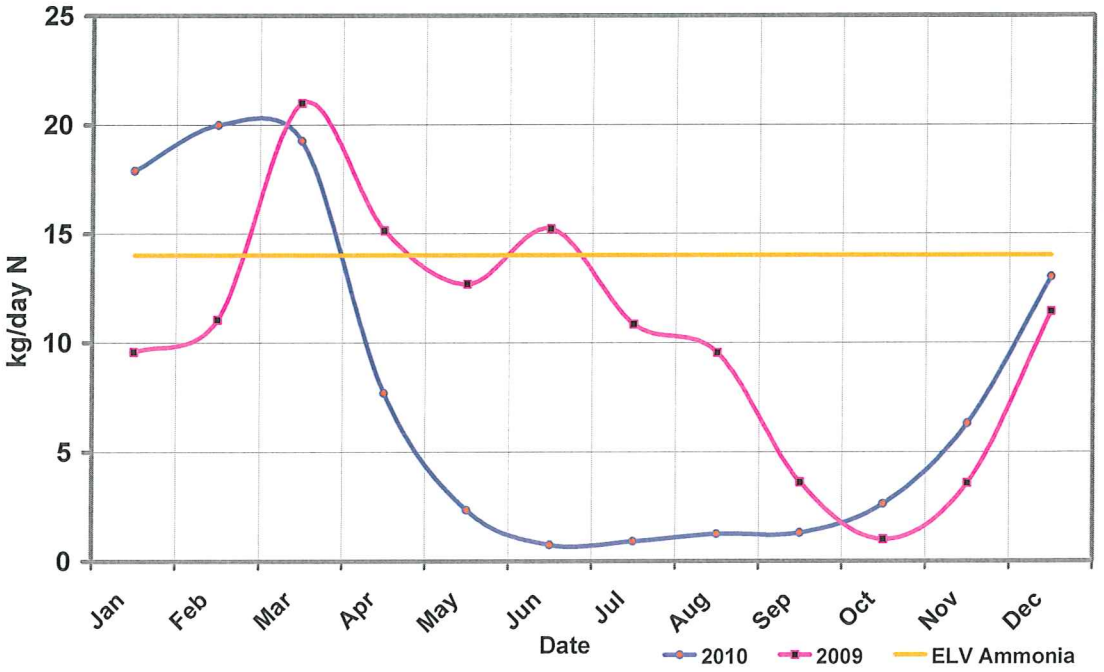


Figure 6-9 Average Monthly Mass Emission of Ammonia-N at SW1 in 2009 and 2010

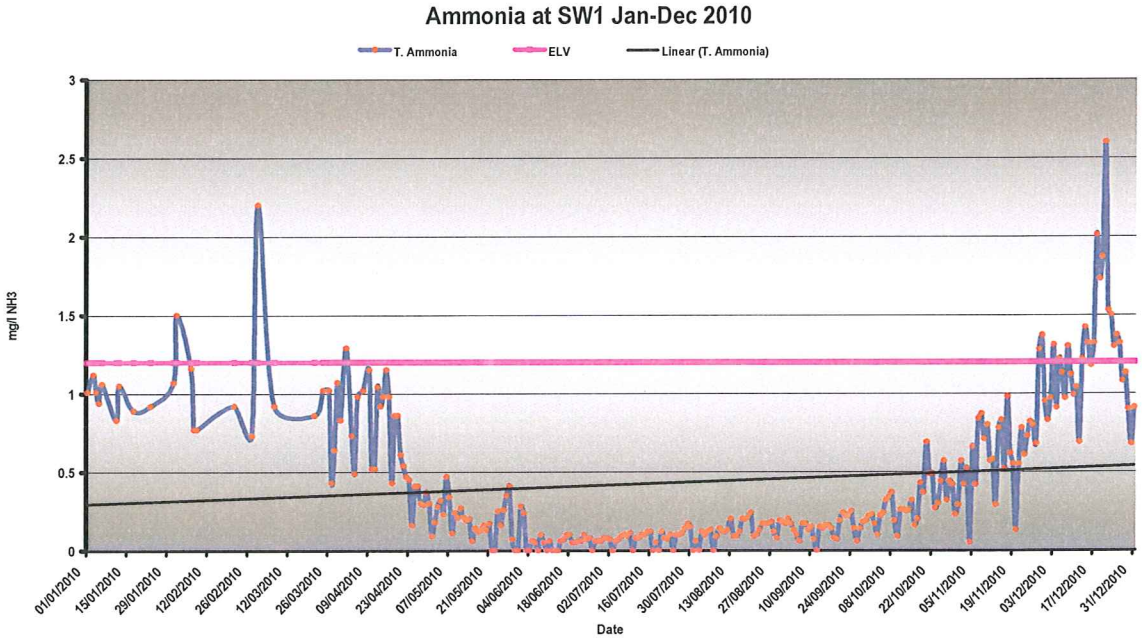


Figure 6-10 Ammonia at SW1 2010

6.3 Effluent Pond Discharge

Effluent Pond Discharge is a combination of the treated mine water from underground and treated reclaim water from the Mine's Tailings Management Facility (TMF). Figure 6-11 shows the percentage rate of compliance for each of the parameters measured at PS8 from 2005 - 2010. Twelve out of sixteen parameters were one hundred per cent compliant during 2010, however, pH was 99.73% (99.92% in 2009) compliant, suspended solids 93% (96% in 2009), ammonia 74% (90% in 2009) and lead was 99.73% compliant compared to 100% compliance in 2009.

The average monthly flow from effluent pond discharge is shown in Figure 6-12. The comparisons of the average monthly mass emissions for zinc, lead, suspended solids and ammonia in effluent pond discharge for 2010 versus 2009 are also illustrated below in Figures 6-13 through to 6-16.

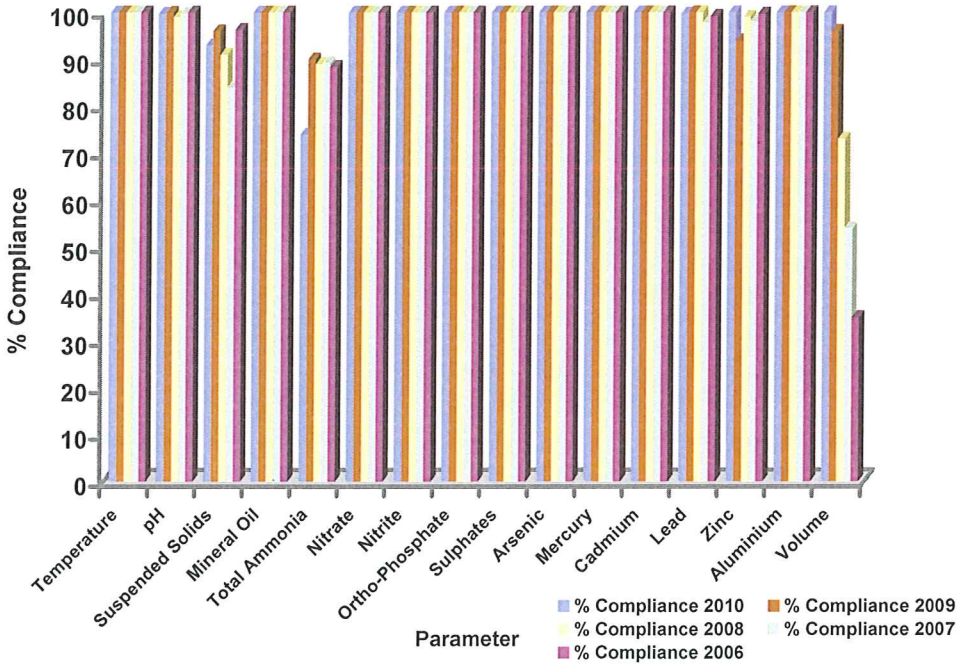


Figure 6-11 Rate of Compliance for Parameters Monitored at PS8, 2005 – 2010

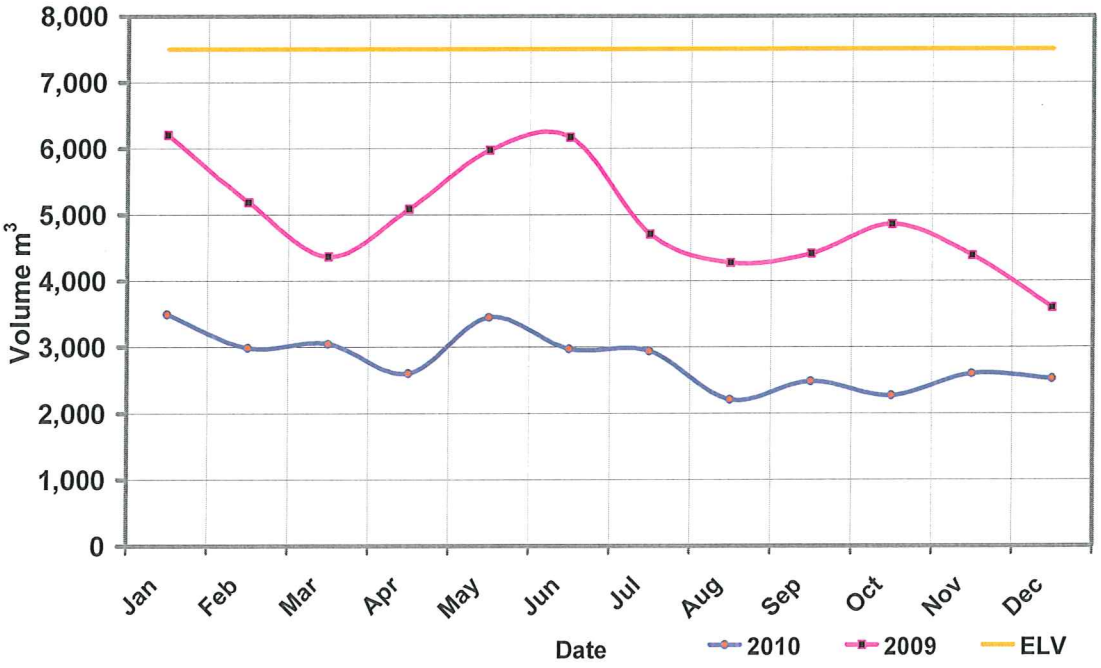


Figure 6-12 Average Volume Discharged at PS8 in 2009 and 2010

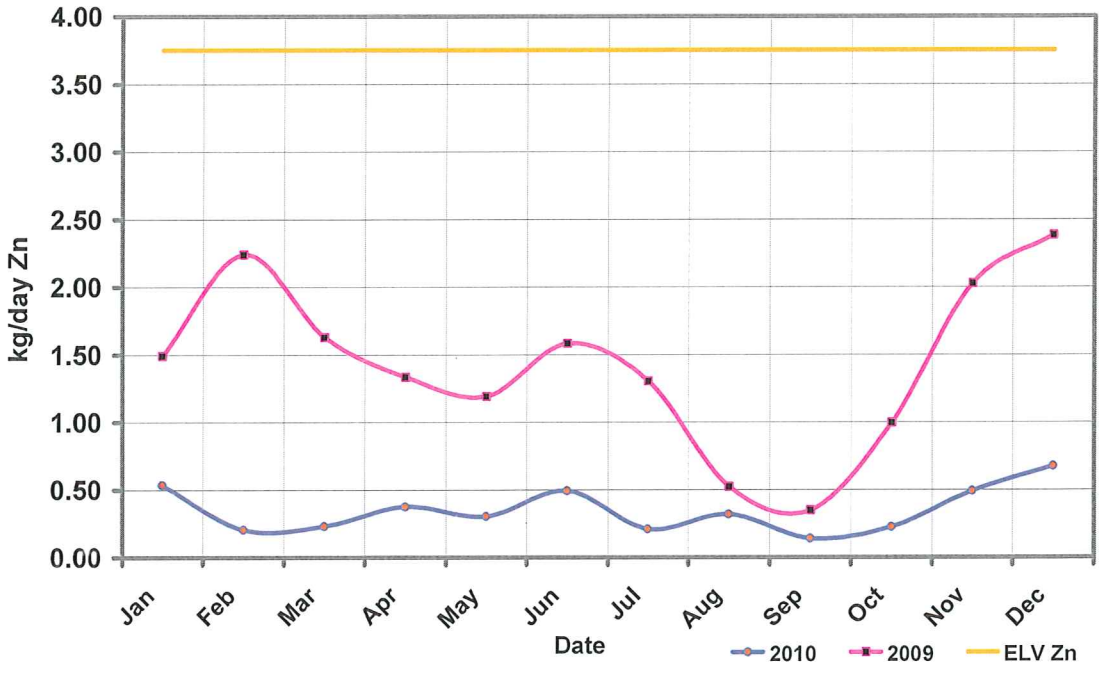


Figure 6-13 Average Monthly Mass Emission of Zinc at PS8 in 2009 and 2010

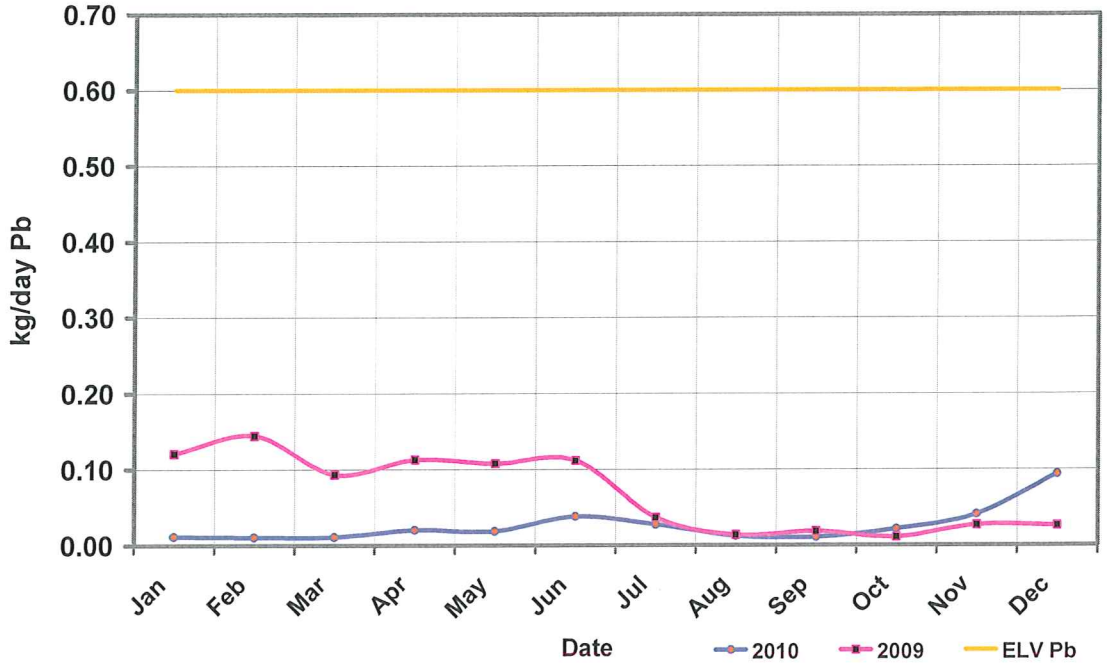


Figure 6-14 Average Monthly Mass Emission of Lead at PS8 in 2009 and 2010

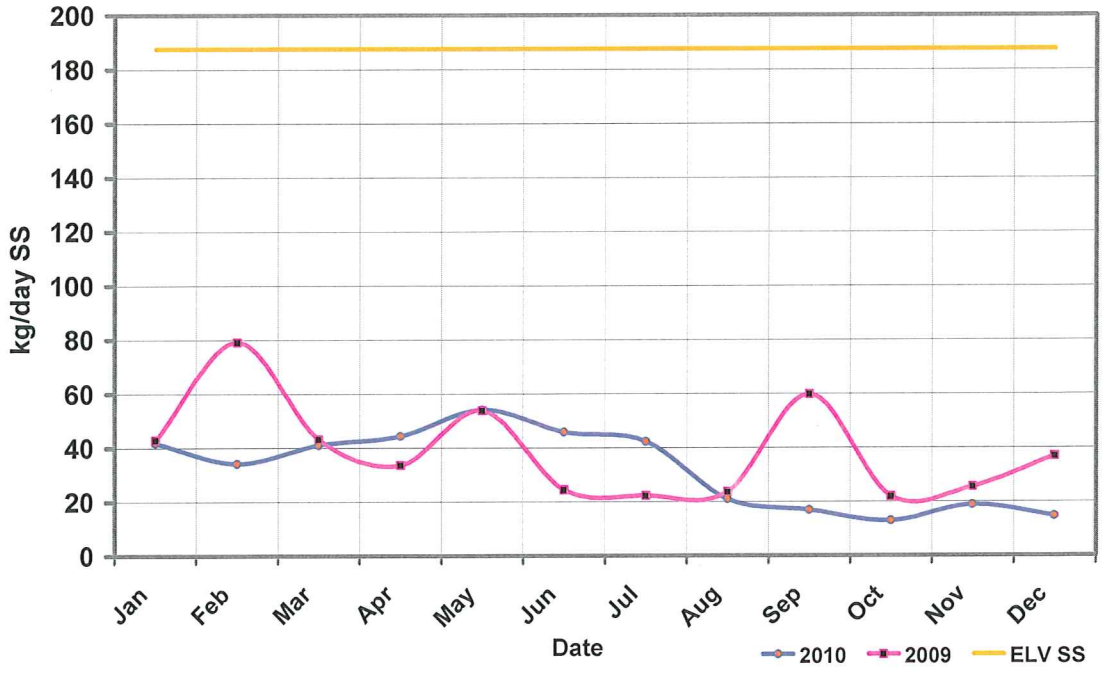


Figure 6-15 Average Monthly Mass Emission of Suspended Solids at PS8 in 2009 and 2010

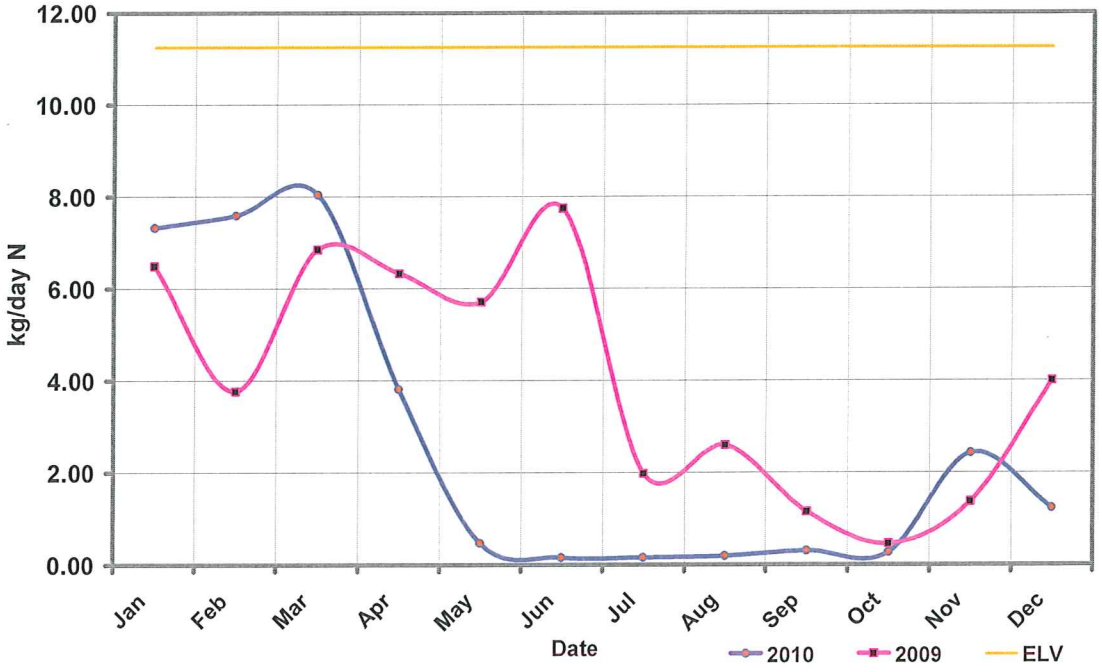


Figure 6-16 Average Monthly Mass Emission of Ammonia-N at PS8 in 2009 and 2010

6.4 Conditioned Well Water

Water from the Conditioned well water Pond, formerly used to retain clean water brought up from underground, is now a combination of treated process water from both the mine's tailings pond and treated mine water. Figures 6-17 to 6-19 show zinc, lead and suspended solids at GW1 in 2010 from January to August when analytical monitoring stopped with the permission of the EPA.

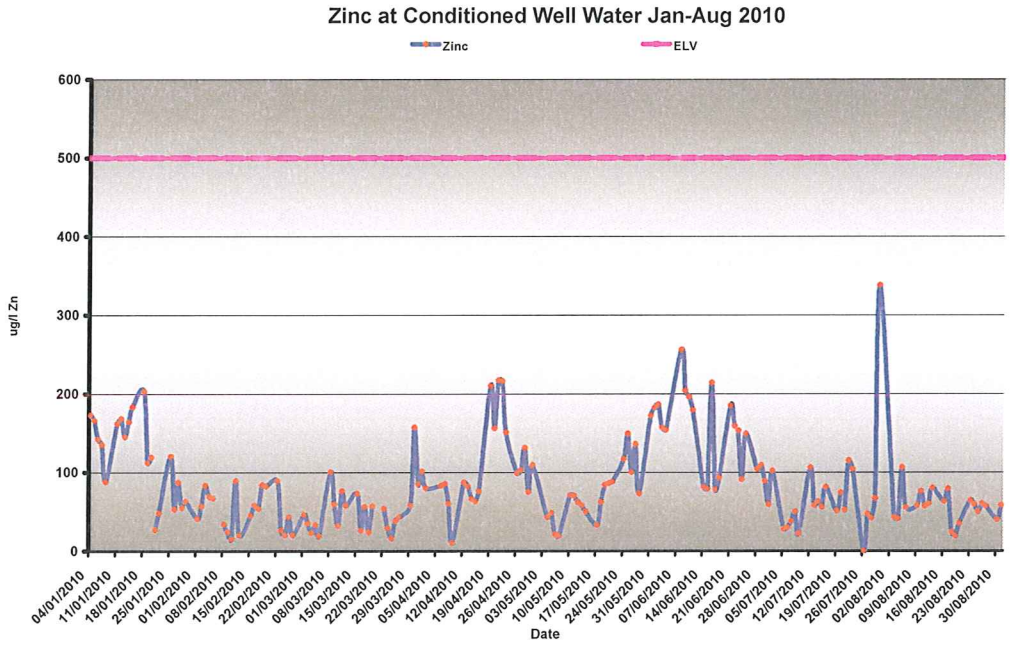


Figure 6-17 Zinc concentration in Conditioned Well Water 2010

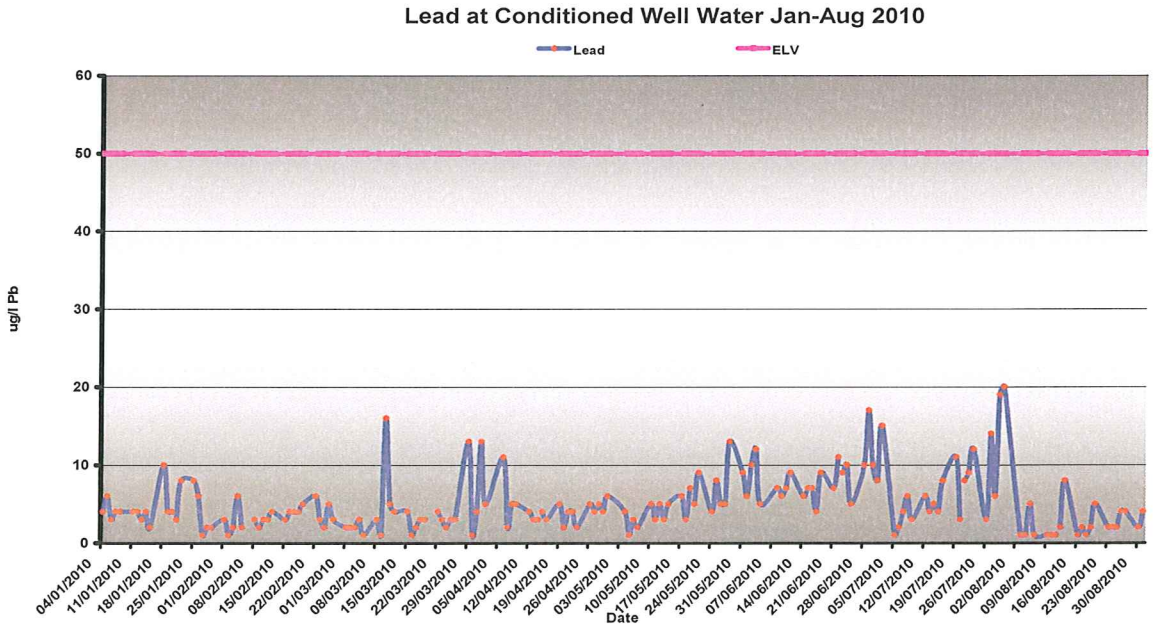


Figure 6-18 Lead concentration in Conditioned Well Water 2010

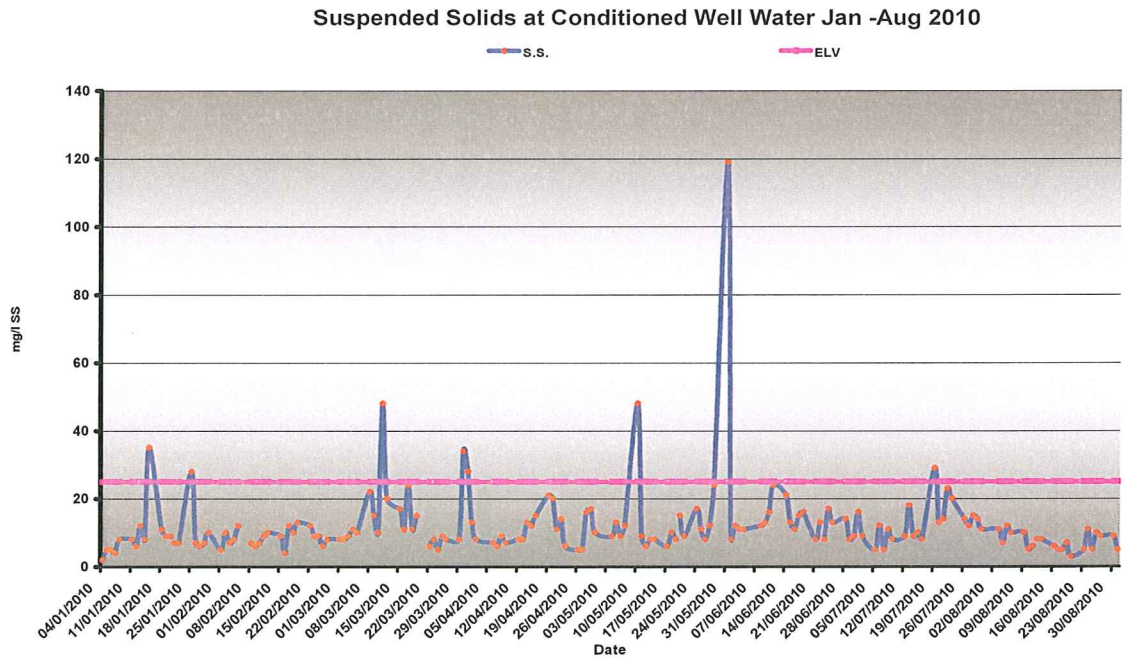


Figure 6-19 Suspended Solid concentration in Conditioned Well Water 2010

7. Surface Water Monitoring Summary Report

7.1 Introduction

The requirements for surface water monitoring are specified in Condition 9 and Schedule 4 (i) of the IPPC license. The water quality of the River Goul is monitored at two locations, upstream of discharge (ASW1) and downstream of discharge (ASW2). Temperature, pH, dissolved oxygen and conductivity are monitored continuously at both locations. Suspended solids, ammonia, nitrite, lead, zinc and sulphate are monitored weekly along with a visual inspection. Other parameters are monitored on a monthly basis as required by the licence.

7.2 Weekly and Monthly Monitoring

Table 7-1 and Figures 7-1 – 7-6 show the average water quality results both upstream and downstream of the discharge point (SW1) to the River Goul, during the monitoring period January – December 2010.

Parameter	Units	U/S Average	D/S Average	Salmonid Waters Regulations 1988/ Surface Water Regulations 2009*
Total Hardness	mg/l $CaCO_3$	352	358	n/a
Total Alkalinity	mg/l $CaCO_3$	302	282	n/a
S.S.	mg/l Solids	11	12	< 25
Ortho Phos.	mg/l P	<0.02	<0.02	< 0.035*
Nitrate	mg/L NO_3^-	13	13	n/a
Nitrite	mg/l NO_2^-	0.10	0.09	< 0.05
Sulphate	mg/l SO_4^{2-}	13	43	n/a
Total Ammonia	mg/l N	0.12	0.14	< 0.065*
Lead	µg/l Pb	10	10	7.2*
Zinc	µg/l Zn	30	57	100*
Cadmium	µg/l Cd	1	<1	0.25*
Copper	µg/l Cu	2	3	30*
Iron	µg/l Fe	97	104	n/a
Arsenic	µg/l As	3	3	25*
Sodium	mg/l Na	9.39	10.49	n/a
Magnesium	mg/l Mg	22	24	n/a
Aluminum	µg/l Al	46	38	n/a
Potassium	mg/l K	5.74	6.62	n/a

Table 7-1 Summary data for upstream and downstream River Goul 2010

Figure 7-1 compares the ammonia concentration of samples taken at the downstream monitoring point for 2009 and 2010. Efforts are constantly being made to improve ammonia compliance including in 2010 aeration of water in the active tailings pond before transfer to the Mine's process water treatment plant. Figure 7-2 shows the unionised ammonia concentration for 2010 at the downstream location. The maximum unionised ammonia concentration recorded was 9.23ug/l NH_3. The long term toxic effect limit was not breached. Figure 7-3 illustrates the concentration of ammonia present in the River Goul, upstream and downstream of the discharge point compared to the Salmonid Regulations 1988 and the Surface Water Regulations 2009.

Figure 7-4 illustrates the concentration of zinc monitored in the River Goul over the reporting period January – December 2010. The zinc levels downstream vary considerably but are significantly lower than the Salmonid Water Regulation 1988 limits. The limit for zinc in the Surface Water Regulations 2009 has been set at 100µg/l. The downstream samples have breached this limit on occasion.

Figure 7-5 illustrates the lead concentration in the River Goul, upstream and downstream of the discharge point for the reporting period January – December 2010. There was one anomalous result upstream for this parameter in March but throughout the year, results of grab samples, taken weekly, exceeded the Surface Water Regulations for lead for around nine months in total. This is comparable to 2009 figures when the regulation was exceeded for approximately eight months of the year. A comparison of the 2009 and 2010 lead concentrations downstream of the discharge point is illustrated in Figure 7-6.

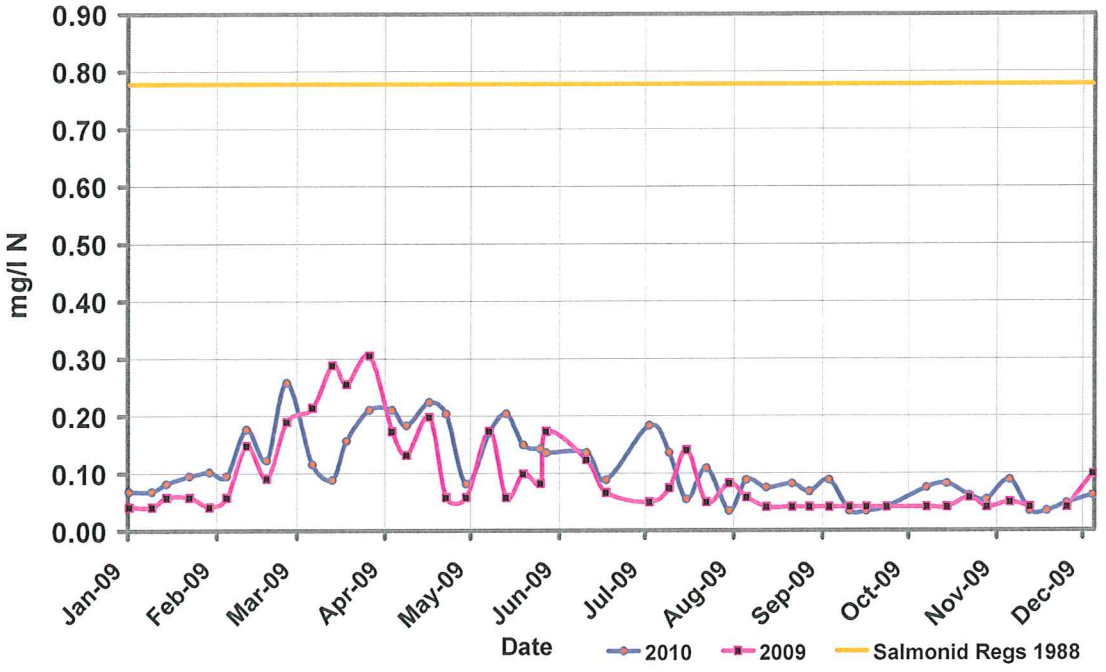


Figure 7-1 Ammonia concentration downstream River Goul in 2009 and 2010

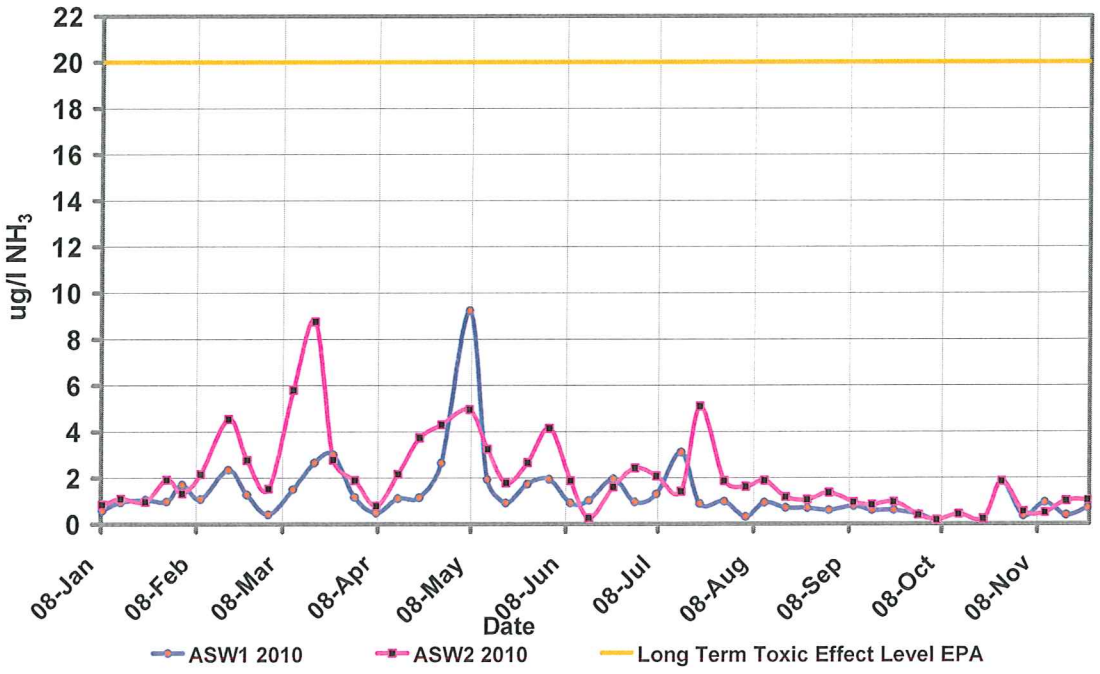


Figure 7-2 River Goul unionised ammonia concentration 2010

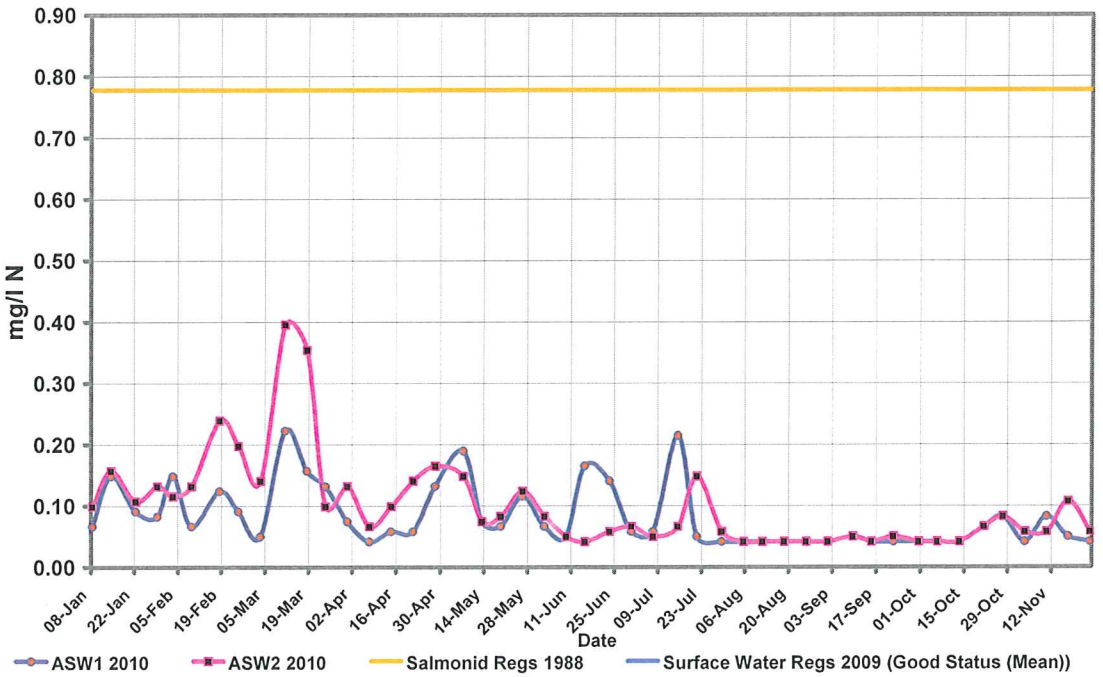


Figure 7-3 Ammonia concentration upstream and downstream River Goul 2010

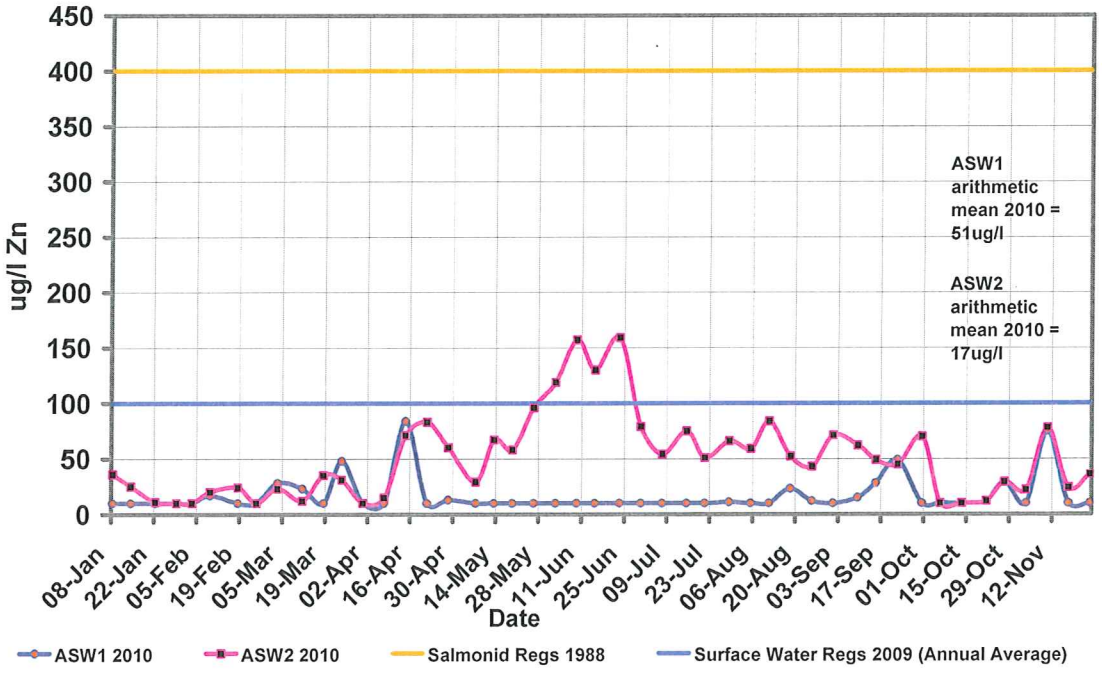


Figure 7-4 Zinc concentration upstream and downstream River Goul 2010

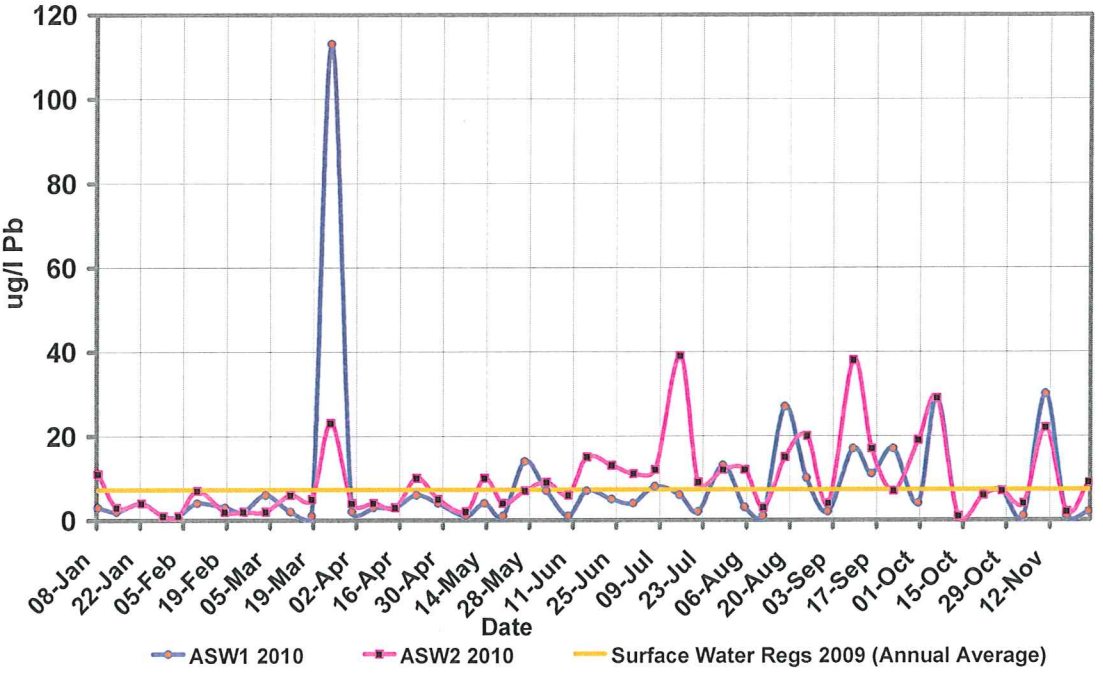


Figure 7-5 Lead concentration upstream and downstream River Goul 2010

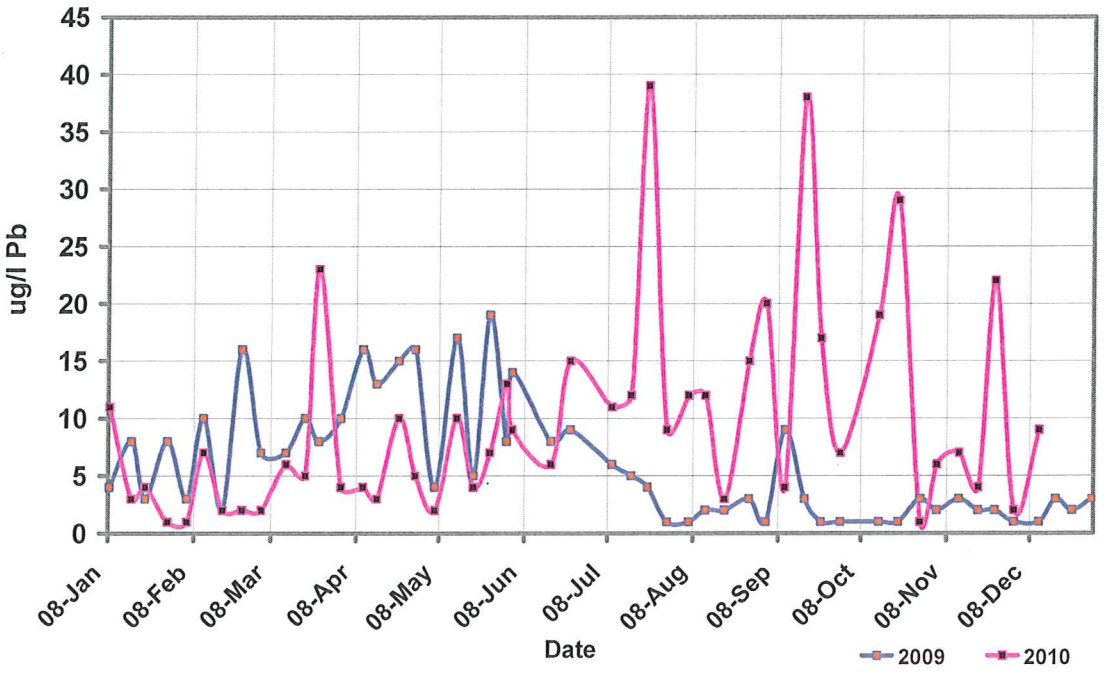


Figure 7-6 Lead concentration downstream River Goul in 2009 and 2010

7.3 Continuous Monitoring

Table 7-2 shows the maximum, minimum and average dissolved oxygen, pH, conductivity and temperature values recorded at the upstream and downstream *in situ* monitoring locations on the River Goul during 2010.

	Upstream				Downstream			
	pH	Temp	DO	Conductivity	pH	Temp	DO	Conductivity
Maximum	6.92	16.21	12.76	700	7.29	12.76	12.16	721
Minimum	6.41	8.54	7.83	499	6.77	8.76	7.49	471
Average	6.67	11.17	10.06	652	7.03	10.75	9.75	656

Table 7-2 Summary of continuous data recorded in the River Goul during 2010

8. Stream Augmentation Program Report

8.1 Introduction

The requirements for the monitoring of surface water augmentation are specified in Condition 9.1.1 and 9.1.2 of the IPPC Licence. Eight locations were augmented on a continuous basis. The hourly volume discharged to each augmentation point varied based on the size of the stream and the water usage. The augmentation water was supplied from the conditioned well water pond and the following points were augmented.

ASW3	Johnstown Road, Point 1
ASW4	Galmoy Stream, Point 2
ASW5/6	Whiteswall East, Point 3A/B
ASW7/8	Whiteswall West, Point 4A/B
ASW9/10	Coady's Castle, Point 6A/B
ASW11	Laherty's Lane, Point 7
ASW12	Whiteswall Bog, Point 8
ASW13	Goul Stream, Point 9

Following correspondence form the EPA dated the 13th of April 2010 the Mine ceased to augment streams around the mine site.

Galmoy Mine commissioned Aquens to examine eleven sites up and downstream of the augmentation points and a final group of four sites which looked at the longitudinal changes that occurred along the Glasha River in relation to the drainage from the augmentation sites originating from the augmentation points. The investigations included physical, chemical and biological surveys.

"The findings of the current macroinvertebrate surveillance showed that the macroinvertebrate communities of the augmentation sites and the remaining sites surveyed showed similarities in their composition. At the augmentation sites surveyed for macroinvertebrates no difference was found between the upstream and downstream sites in terms of pollution status, they both achieved the same Q-value.

With regard to the river sediment analyses, the results from the augmentation points indicated it was clear that there were exceedances at several points.

With regards to the longitudinal changes in the sediments in the Glasha River, there is no clear pattern as there are some accumulations in places further downstream of the augmentation points but they do not follow a gradient from the discharge point to further downstream. Levels of lead remain quite low with respect to the PEL limits but zinc does exceed these limits at two sites, GAC2 and GAC. However, EPA limits are not exceeded at any of the sites on the Glasha River, indicating that no significant detectable transfer of heavy metals are occurring."

Aquens findings may be referred to in the copy of *Environmental Monitoring of the Augmentation Points Discharging into Rivers in the Galmoy Area* sent to the Agency.

8.2 Water Quality & Augmentation Points Post-Closure

As part of the MCP, the sediments at each of the stream augmentation points will be removed and disposed of in the TMF. Table 8-1 is a summary of water quality used to augment streams up until April 2010.

Parameter	Species	Maximum	Minimum	Average
pH	pH Units	9.03	8.08	8.67
Cond	uS/cm	1054	493	709
Orthophosphate	mg/l P	<0.02	<0..02	
T. Hardness	mg/l CaCO3	422	364	396
T. Alkalinity	mg/l CaCO3	196	152	171
Chlorine	mg/L Cl2	0.01	<0.01	
S.S.	mg/L Solids	119	2	12
Nitrate	mg/L NO3-	19	9	13
Nitrite	mg/L NO2-	0.52	0.06	0.18
Sulphate	mg/L SO42-	348	169	257
T. Ammonia	mg/L NH3	2.20	0.19	0.81
Lead	µg/L Pb	20	1	5
Zinc	µg/L Zn	338	10	86
Iron	µg/L Fe	35	2	20
Arsenic	µg/L As	10	10	10
Sodium	mg/L Na	14.8	14.8	14.8
Magnesium	mg/L Mg	35	35	35
Mercury	µg/l Hg	<1	<1	
Nickel	µg/L Ni	66	66	66
Aluminum	µg/L Al	15	3	10
Potassium	mg/L K	14.8	14.8	14.8
Manganese	µg/L Mn	<10	<10	

Table 8-1 Summary of quality of water used to augment streams Jan-Apr 2010

8.3 Volumes Supplied

The monthly volume of water supplied to the augmentation points during 2010 is shown in Table 8-2. A total volume of 66,826 m^3 of water was pumped to the streams between January and April 13th compared to 249, 397 m^3 for the entire of 2009, 344,356 m^3 in 2008 and 282,189 m^3 in 2007.

Date	Monthly Volume Pumped (m^3)	Average Daily Flow (m^3/day)
Jan-09	20,847	672
Feb-09	17,824	637
Mar-09	20,214	652
Apr-09	7977	266
May-09		
Jun-09		
Jul-09		
Aug-09		
Sep-09		
Oct-09		
Nov-09		
Dec-09		

Table 8-2 Monthly volume of water supplied to augmentation points in 2010

9. Biological Monitoring Summary Report

9.1 Introduction

Environmental monitoring of rivers in the Galmoy area was undertaken between March and September 2010. The two rivers surveyed were, the Glasha and Goul. A total of six sites were incorporated. The investigations included physical, chemical and biological surveys.

As in previous years, the impacts of eutrophication were evident in the rivers surveyed as indicated by the macroinvertebrate community composition and the macrophyte flora. The macroinvertebrate survey indicated a slightly polluted water quality status (Q3-4) at all sites. The water quality ratings have slightly improved on the 2009 values.

The sediment results reflect similar trends from previous surveys and do not exceed EPA guidelines. Figures 9-1 and 9-2 compare the levels of lead and zinc at the same sites reported in the 2009 AER. All sites were assessed using EPA sampling and analytical methodology. Further information on this survey can be obtained

from the full report, *Environmental Monitoring of Rivers in the Galmoy Area*, sent to the EPA by Galmoy Mine Ltd.

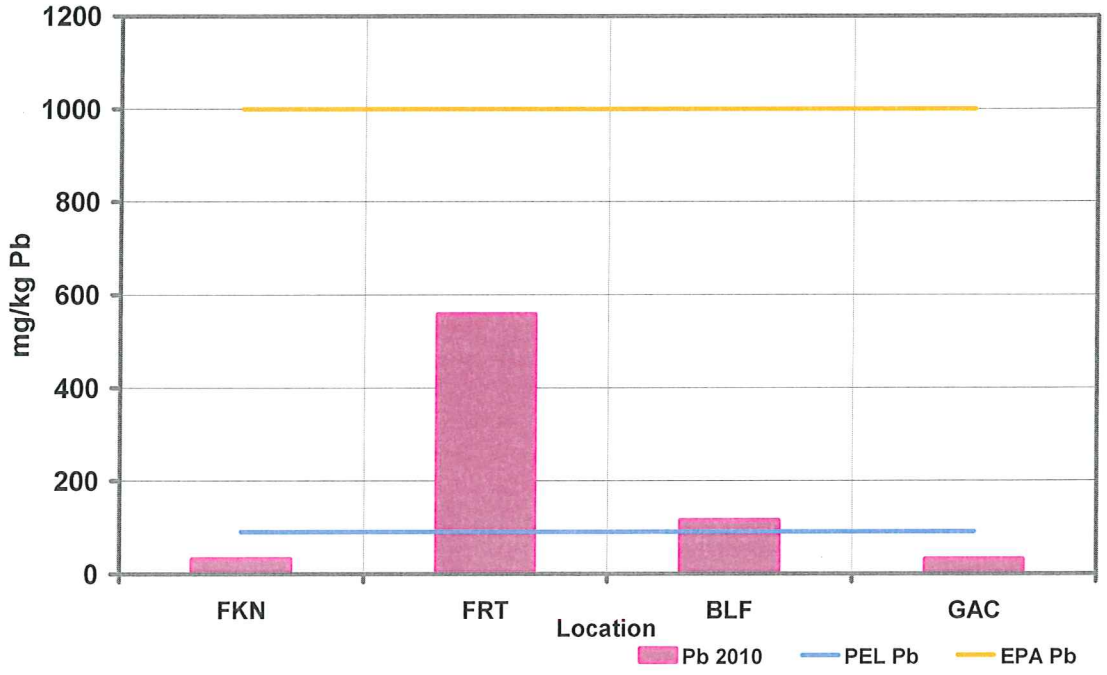


Figure 9-1 Concentration of lead in river sediments from the rivers Goul and Glasha, 2010

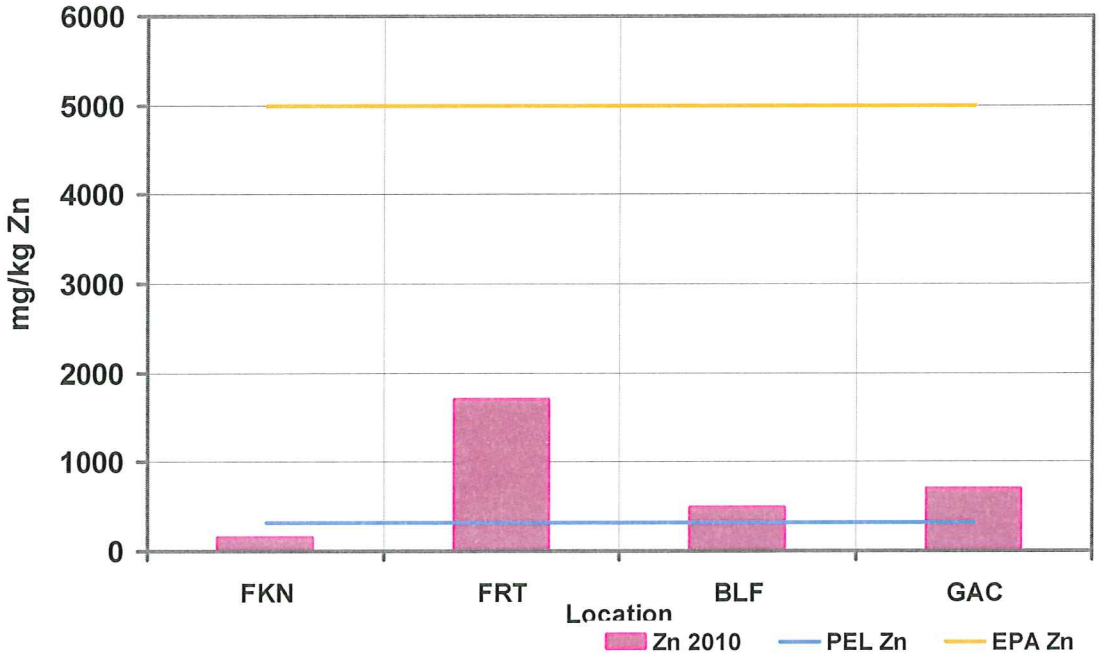


Figure 9-2 Concentration of zinc in river sediments from the rivers Goul and Glasha, 2010

10. Groundwater and Mine Clean Water Monitoring Summary Report

10.1 Introduction

The requirements for monitoring groundwater and mine-clean water are specified in Schedule 4(ii) of IPPC licence P0517-01. Five mine dewatering boreholes were installed and commissioned around the periphery of the CW orebody prior to production with the aim of extracting as much clean water as possible from the orebody. Dewatering boreholes have not been operational since 1997.

Groundwater is abstracted from 2 boreholes close to the mine site which form the source for the local Replacement Water Supply Scheme (RWSS), the Galmoy group scheme and for the town of Rathdowney. The RWSS more than adequately addresses the demand for water within the existing cone of depression and the town of Rathdowney with its extensive pipe network and high-yielding supply from the production well and stand-by well. As of February 2010, the scheme is ready to be handed over to and managed by, the local authorities.

10.2 Replacement Water Supply Scheme Well

Table 10-1 shows the monthly average results of chemical analyses on samples collected weekly at the production well (WW1A) Jan – Dec 2010. With the exception of one result, total ammonia values of <0.05 mg/L NH_3 were recorded each month along with ortho-phosphate values of <0.02 mg/L P for the same period. Lead levels were all below the Drinking Water Regulations (S.I. No. 106 of 2007) parametric value of 25µg/l.

Parameter	Units	Maximum	Minimum	Average
pH		7.94	6.96	7.41
Conductivity	µS/cm	795	534	673
Turbidity	NTU	1.44	0.12	0.32
Suspended Solids	mg/L Solids	26	<1	
C.O.D.	mg/L O_2	10	<5	
B.O.D.	mg/L O_2	3	<1	
Ortho-Phosphate	mg/L P	<0.02	<0.02	
Nitrite	mg/L NO^{2-}	0.03	<0.01	
Nitrate	mg/L NO_3^{2-}	26	22	24
Total Ammonia	mg/L NH_3	0.1	<0.05	
Sulphate	mg/L SO_4^{2-}	19	11	13
Lead	µg/L Pb	4	<1	
Zinc	µg/L Zn	353	10	79
Calcium	mg/L Ca	1118	47	191
Sodium	mg/L Na	9.98	3.31	8.1
Magnesium	mg/L Mg	43	18	33

Table 10-1 Summary of chemical analyses of WW1A 2010

Table 10-2 shows the microbiological results for the production well WW1A/WW2B. The Maximum Allowable Concentration (MAC) for the results is based on the Drinking Water Regulations 1998.

Date	TVC 22°C 72hr cfu/ ml	TVC 37°C 48hr cfu/ ml	Coliforms MPN/ 100ml	E. Coli MPN/ 100ml
Jan-10	0	0	0	0
Feb-10	0	0	0	0
Mar-10	>300	0	0	0
Apr-10	0	0	0	0
May-10	0	0	0	0
Jun-10	71	0	0	0
Jul-10	0	0	0	0
Aug-10	0	0	0	0
Sep-10	0	0	0	0
Oct-10	0	0	0	0
Nov-10	0	0	0	0
* MAC	100	20	0	0

Table 10-2 Microbiological results from WW1A 2010

*MAC – Maximum Allowable Concentration, based on the Drinking Water Standards 1998

10.3 Mine Clean Water

Clean water is no longer pumped from underground. Partitioning of the clean and dirty waters underground is no longer possible. All water pumped from underground is treated onsite and then pumped to the discharge ponds.

10.4 TMF Borehole Monitoring

All TMF monitoring boreholes are monitored monthly as per license requirements. There are no ELV limits imposed on these sampling points, however, this information is used by the TMF auditor in the annual TMF inspection. Borehole sample results are contained in Appendix 4 of this report.

11. Groundwater Model Review Committee Group Report

11.1 Introduction

The MRC was set up in 1995 to satisfy the requirements of Planning Condition No. 61. The role of the MRC is to review the ongoing process of developing models of the groundwater system which may affect or be affected by the Galmoy Mine. The planned MRC meeting did not take place in 2010.

The models are used to predict the impact of the mine development on the ground and surface waters with sufficient accuracy to allow implementation of mitigative or alternative measures before any unacceptable impacts occur.

The primary potential impact addressed by the models is the extent of the drawdown of the watertable, due to mine operations, and its impact on existing water wells. Other impacts include concomitant effects on surface streams and rivers, and possibly eventual solute transport of contaminated water after the mine is re-watered.

The MRC consists of representatives from the local planning authorities, Kilkenny and Laois County Councils, Eugene Daly Associates, the EPA, and GALMOY Mines Ltd. At each meeting the Committee:

i) Identifies and agrees to the purpose and functional requirements of the groundwater model.
ii) Reviews available information relevant to the model.
iii) Reviews the adequacy of the current model and agrees to any appropriate modifications if necessary.
iv) Reviews the current groundwater data acquisition programme.

The models are fed data from the programme of dipping water wells that GALMOY carries out on a monthly basis. The monthly data is then distributed to the members of the MRC in map format, displaying contours of the watertable at 1:10,560 and 1:25,000 scale, the drawdown cone verses October 1995, the difference between the current month

and the previous month, and a second drawdown cone verses the first dipping of the wells (figure 1).

11.2 Groundwater Issues 2010

The total volume of mine water pumped from the mine in 2010 was 4,349,802m^3. This is a 17% reduction on 2009. The principal reason for this reduction was the plugging of the K – Ore-body at the end of March 2010. The water pumped from the mine peaked at 20,004m^3 per day on January 22nd. The average daily mine water flow for the period preceding plugging of the K – Ore-body was 15,256m^3 per day while the average daily mine water flow for the period following plugging of the K – Ore-body was 10,940m^3 per day. The second reason for the reduced mine water volume was the lower level of rainfall in 2010. The total rainfall for 2010 was 774mm which is a 30% reduction on the 2009 level. All water pumped from the mine in 2010 was pumped as dirty mine water and directed to the water treatment plants, no water is collected as clean water.

The mine hydrographs and the modelling of the cone of depression (COD) indicate that the watertable has recovered by approximately 40 meters at the western side of the mine. This recovery is again due to the K – Ore-body being plugged and allowed to re-flood. The cone is again in a stable state and should only fluctuate due to seasonal variations in rainfall during 2011. No wells were added or lost during this time.

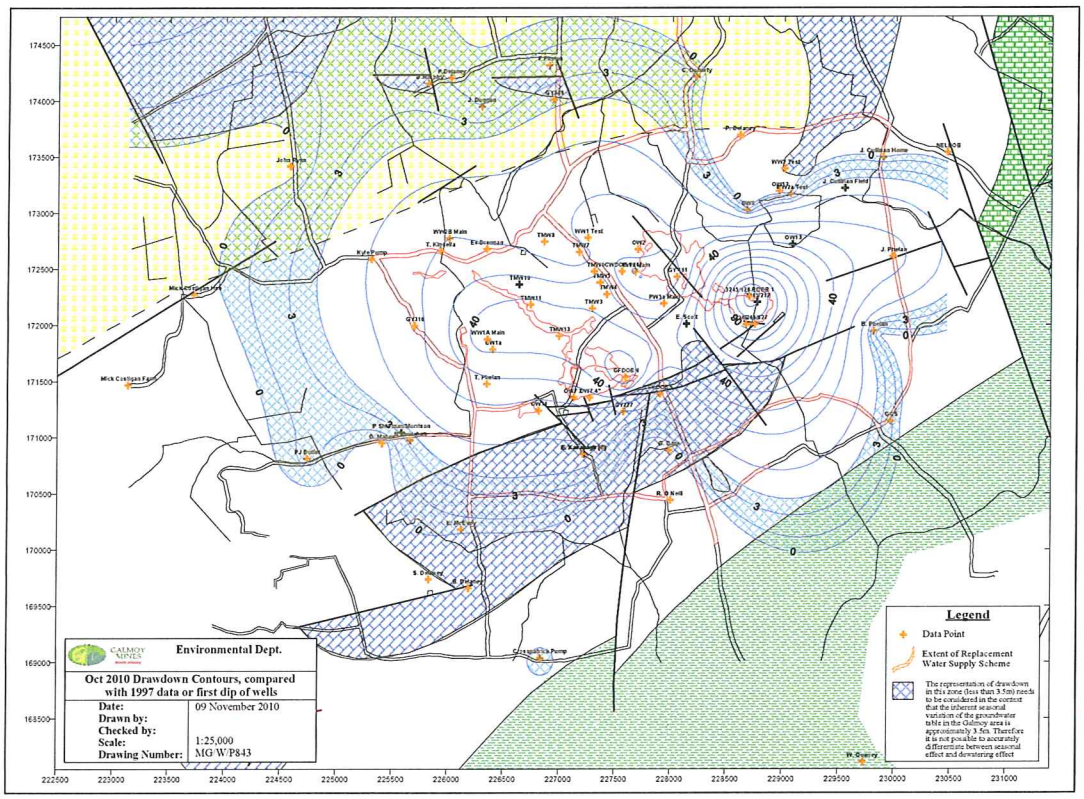


Figure 1 Drawdown Cone for October 2010

12. Noise Monitoring Report

12.1 Introduction

The requirements for noise monitoring are specified in Condition 8 of the IPPC licence. Noise levels are monitored continuously at three off-site locations – AN1, AN2, and AN3. The noise survey was carried out during April 2011 by Environmental Measurements, Unit 12 Tallaght Business Centre, Dublin 24. The report is included as Appendix 8 of this report.

The aim of the noise survey was to determine the noise levels at four points at the perimeter of the Galmoy Mine site through the Leq, L10, L90 and 1/3 octaves for daytime & night time.

12.2 Summary

In general the four locations around the site can be considered to be very quiet, this is highlighted in the L90 value (the value at which noise was above 90% of the time).
This is a good indicator of the background levels around the site.

13. Tailings Management Facility Monitoring Report

13.1 Introduction

The monitoring schedule of the TMF is specified in Condition 7.6.12 and Schedule 3(iii) Monitoring of Tailings Management Facility. Condition 7.6.13 outlines the requirements of the annual safety inspection by an independent All Reservoirs Panel Engineer or equivalent. This report deals specifically with the requirements of Schedule 3 (iii). The TMF audit report written by Golders Associates will accompany the AER. The review of the piezometer measurements including water quality and groundwater sampling and analysis of boreholes around the TMF are an integral part of the inspection carried out by Golders.

A "Groundwater Monitoring Location Proposal" as required by Condition 9.3.1, of IPPC licence P0517-01, was submitted to the Agency in November 2003. Galmoy Mines Ltd. continues to adhere to the proposal unless otherwise directed by the Agency. The extent and frequency of the monitoring is as specified in Schedule 3(iii) of the licence. A summary of the borehole water quality data is presented in Appendix 4. An updated monitoring schedule has been adopted at Galmoy, as submitted to the Mine Closure Committee.

Acid/ base counting as been addressed in the *'ARD Potential at Galmoy Briefing Paper for Galmoy Mine Closure Committee'* dated the 11th of November 2008. The document stated that:

"ARD is not an issue at Galmoy Mines" based on **"international accepted practice of acid/base accounting."**

In summary the paper states that:

- *100% of mine water samples pH7*
- *Neutral or alkaline conditions in all waters directly in contact with tails*
- *Absence of chemical indicators of ARD in water*
- *Acid/base counting demonstrates excess of base in the event of all sulphides being oxidised from pyrite , galena and sphalerite*
- *Acid/base test confirms overall high net neutralisation potential of tails*

Generation of acid to produce ARD conditions in long term at Galmoy is not an issue due to excess levels of calcium magnesium carbonates; consequently vegetation on the surface of the TMF will not be impacted"

13.2 Monitoring of the TMF

Monitoring of the TMF can be broken down into the following:

- Piezometer measurements including water quality
- Standard walk-over and stability checks, in which any evidence of seepage, spillage, bulges or cracks, are noted. Finger drains and drainage channels are checked for the presence of moisture.
- Tailings Chemistry
- Groundwater sampling and analysis of boreholes around the TMF.
- Two spillway (Phase I and Phase II spillways) samples are taken (when there is flow) to assess the quality of run-off water
- Surface Water Samples from Rehabilitated Phase I (discontinued due to change in final cap design).
- Underground Mining within a 70 metre radius of the TMF

The latter requirement for monitoring is dealt with in the underground failure prevention plan (see Appendix 3) and the TMF Audit 2010 (see Appendix 10)

13.3 Monitoring Results

The following results for 2010 are included in Appendix 4:

- A summary of the monitoring results of the piezometers and groundwater from the boreholes.
- Tailings water chemistry which is similar to the reclaim water PS4
- Surface Water samples from Phase 2 of TMF
- Spillway Results

14. Waste Management Summary Report

14.1 Introduction

The requirements for monitoring waste are specified in condition 7.7 and schedule 3(i)-(ii). Permission was received during 2007 to use specific waste materials (mill oversize material, filter plates, filter cloths, tyres and pallets) underground. These materials are used in the construction of backfill barricades in the mine. An effective system is in place for the approval and monitoring of material transferred underground

Industrial Sector NACE Code	
Reporting Period	January – December 2010
Total Tonnage of Waste Produced	860.11
Hazardous Quantity	66.15
Non-Hazardous Quantity	793.96
Total Tonnage of Waste Recovered	783.66
Hazardous Recovered	30.28
Non-Hazardous Recovered	753.38

Table 14-1 Industrial Sector NACE Code and Water Summary 2010

Contractor	WCP No.	Address
Ryan Brothers	WCP/OY/08/0597/01	St. Judes, Mill Road, Thurles, Co. Tipperary
Greenstar	WCP/KK/054(A)/05	Unit 6, Ballyogan Business Park, Ballyogan Road, Sandyford, Dublin 18
Enva Ireland Ltd	WCP/KK/059(A)/07	Clonminam Industrial Estate, Portlaoise, Co. Laois
C.J. Sheeran	WCP/KK/212(A)/06	Shannon Street, Mountrath, Co. Laois
HI-VOLT Ireland Ltd	WCP/KK/284/05	Ballyduff, Thurles, Co. Tipperary
Indaver Ireland Ltd.	WCP/KK/031(A)/07	4 Haddington Terrace, Dun Laoghaire, Co. Dublin
Irish Lamp Recycling Company Ltd	WCP/KK/030(A)/05	Blackpark, Kilkenny Road, Athy, Co. Kildare
JFC Manufacturing	CB/NN5475LM	Weir Road, Tuam, Co. Galway (Registration number)
Hegarty Metal Recycling/ Processors	WCP/KK012(A)/05	Ballysimon Road, Limerick
JP Ryan Ltd	WCP/KK/006(A)/05	Bond Drive Extension, Dublin Port, Dublin 3
Ormonde Organics	WCP/KK/306/06	Ballinalacken, Attanagh, Via Portlaoise, Co. Kilkenny
Johnston Logistics Ltd	WCP/KK/073(A)/05	Blackchruch, Rathcoole, Co. Dublin
Molloy Metal Recycling	WCP/KK/215/04	Ballycarney, Enniscorthy, Co. Wexford
Rilta Environmental Ltd	WCP/DC/09/11	Block 402, Greenogue Busines Park, Rathcoole, Co. Dublin
Trevor Ratcliffe Deliveries Ltd (TRDL)	WCP/KK/312/06	Ballystrahan, St. Margarets, Co. Dublin

Table 14-2 Waste Contractors employed by Galmoy Mines Ltd.

Waste Material	EWC Code	Source	t	On-Site Treatment	Waste Management Option							
					On-Site Recovery Method	t	Off-Site Recovery Method	t	On-Site Disposal Method	t	Off-Site Disposal Method	t
Batteries	160601*	Vehicles & machinery	0.66	Stored in dedicated battery bunds	-	-	Rilta Environmental	0.66	-	-	-	-
Waste Oil	130899*	Vehicles & machinery	0.8	Stored in dedicated waste oil tank	-	-	Recycled Enva Ireland	0.8	-	-	-	-
Solid Oil Contaminated Material	160508*	Vehicles & machinery	0	Stored in UN approved barrels	-	-	Recovered Indaver	0	-	-	-	-
Oil Filters	160107*	Vehicles & machinery	0	Stored in dedicated oil filter bin	-	-	Recycled Enva Ireland	0	-	-	-	-
Hydraulic Hoses	130899*	Vehicles & machinery	0.62	Stored in dedicated hose skip	-	-	Recycled Enva Ireland	0.62	-	-	-	-
Spoiled Chemical	160507*/ 150110*	Mill	0	Stored in chemical store	-	-	Indaver	0	-	-	-	-
Oil Contam. Water	130703*	Bund areas	29.48	None	-	-	Recycled Enva Ireland	29.48	-	-	-	-
Interceptor Sludge	130503*	Interceptor Unit	30	None	-	-	Enva Ireland	30	-	-	-	-
WEEE	16 02 13*	Site Wide	0	None	-	-	Recovered Indaver	0	-	-	-	-
Contam. Packaging	150110*	Mill Chemical Packaging	0	Baled & placed in UN approved FIBCs	-	-	Recovered Indaver	0	-	-	-	-
Oversize Material	010307*	Mill	0	Stored in dedicated skips	Reused underground	0	-	0	-	-	-	-
Filter Cloths	010307*	Mill	0	Stored in dedicated skips	Reused underground	1.12	-	0	-	-	-	-
Filter Plates	010307*	Mill	0	Stored on pallets	Reused underground	0	-	0	-	-	-	-
Aerosols	160504*	Mine	0	Stored in UN approved barrels	-	-	Recovered Indaver	0	-	-	-	-
Laboratory Waste	160506*/150110*	Water & Assay Labs	0.78	Stored in UN approved barrels	-	-	Recovered Indaver	0.78	-	-	-	-

Table 14-3 Annual hazardous waste 2010

Waste Material	EWC Code	Source	Weight Tonnes	On-Site Treatment	Waste Management Option							
					On-Site Recovery Method	t	Off-Site Recovery Method	t	On-Site Disposal Method	t	Off-Site Disposal Method	t
Municipal/ Commercial & Industrial Dry	200301	Offices, Kitchens	35.58	None	-	-	-	-	-	-	Landfill	35.58
Wood	170201	Goods deliveries	7.46	None	-	-	Recycled Greenstar	7.46	-	-	-	-
Cardboard	150101	Goods deliveries	0	Baled	-	-	Recycled Greenstar	0	-	-	-	-
Steel Drums	150104	Vehicle Maintenance	0	None	-	-	Recycled Castrol - Rialta	0	-	-	-	-
End of Life Vehicles	160104	Mining	0	Oil & fluid drained	-	-	Recycled Molloy Metals	0	-	-	-	-
Plastic Piping	170203	Carriage of liquids	6.32	None	-	-	Recycled JFC Manufacturing	6.32	-	-	-	-
Metal	200140	Various	744.6	None	-	-	Recycled Cork Metal/ Hegarty Metals	744.6	-	-	-	-

Table 14-4 Non-hazardous waste 2010

15. Environmental Complaints Summary

15.1 Introduction

The requirements for recording and reporting complaints are specified in Condition 12.3 and Schedule 5(i). The complaints are recorded and reported to the EPA monthly as they are received.

15.2 Complaints 2010

In 2010 there were 3 complaints received in total; two in relation to noise and one complaint related to procedure. Figure 15-1 is a summary of complaints made to the Mine from 2006 to 2010.

Sixty seven percent of complaints were in relation to noise. One was blast related, the other, after investigation, was attributed to a faulty diesel pump used on site to wash trucks.

E Measurements, an independent noise consultancy, were hired by Galmoy Mine to investigate the blast complaint. A blast monitored in the RD14e on the 30th of June under the direction of the consultancy confirmed that peak particle velocities were within licence limits.

The cause for the procedural complaint was due to the stockpiling of ore on the mine surface.

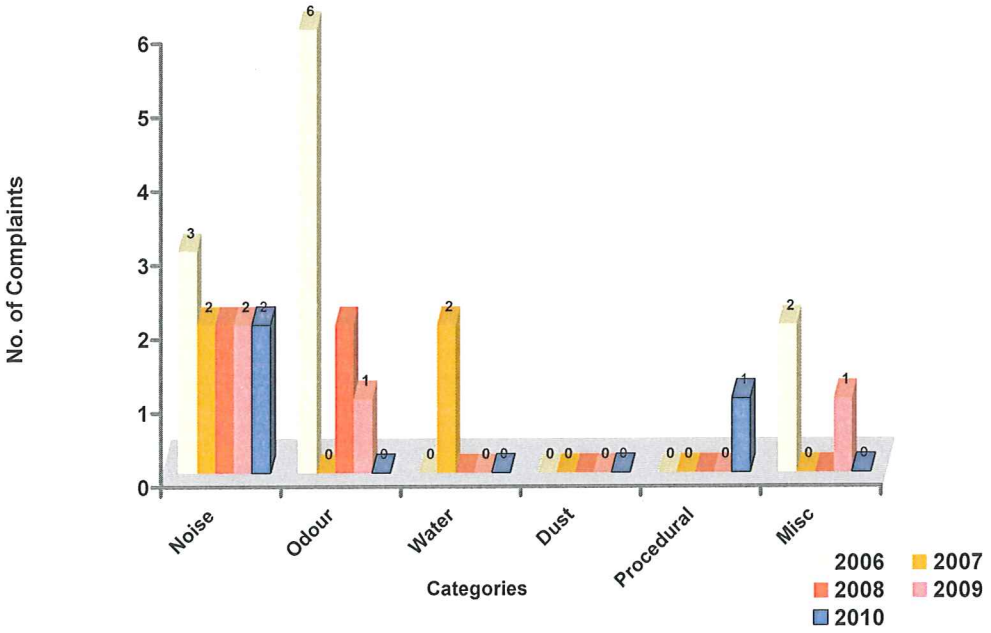


Figure 15-1 Summary of Environmental Complaints, 2006 – 2010

16. Tailings Management Facility Restoration Report

16.1 Introduction

Restoration of Phase 1 TMF recommenced in April 2010 as weather conditions improved. Additional glacial till material was imported from the donor area to form the final dome shape. In total approximately 58,000m3 of glacial till has been imported onto the surface of Phase 1 TMF for capping purposes. Contouring and preparation of Phase 1 TMF continued throughout June 2010, the glacial till material was ripped into the underlying compost and some topsoil was imported and spread to provide a suitable growing medium. The tails surface has been capped with organic and glacial till material to a depth ranging from 0.5m to 2m at the centre of the capped area. Photo No.1 below shows the capped area after ripping has been carried out. Photo No. 2 shows importation of topsoil. Grass-seeds were sown on the capped surface of Phase 1 TMF on the 28TH June 2010 (Photo No. 3). As is normal agricultural practice chemical fertiliser was applied on the Phase 1 grass-seeded area to provide the necessary nutrients. Due to the very dry weather conditions prior to sowing, the grass was slightly slow in becoming established. However, once sufficient rainfall/moisture became available growth began to flourish. As seen in Photo. No 4 below (taken 7th Oct. 2010) a good grass cover has been established and analysis results of a grass sample taken in late 2010 show levels of metals well within limits for feedstuff for animals.

Photo No. 1.

Photo No. 2.

Photo No. 3.

Photo No. 4.

16.2 Restoration Plans for Phase 1 TMF in 2011

As outlined above, the final cap/dome has now been achieved on Phase 1 TMF and a good grass cover has been established. In 2011 the perimeter drainage system incorporating 500mm twin drainage pipes, Terram 2000 and pea gravel surround will be put in place. The final spillway / weir will also be put in place to monitor the volume of runoff from Phase 1 cap into phase 3 of the TMF. The capped & grassed surface will be fenced to paddocks to allow for management of the grass cover by grazing with sheep. Hedging will also be sown on the perimeter of the paddocks to provide shelter and landscaping. A continuation of the sheep grazing trials undertaken in 2008 will be carried out on the rehabilitated Phase 1 TMF in 2011. A representative number of sheep will be blood tested prior to placement on the capped vegetated area followed by pre and post mortem examination of some of the carcasses at the end of the trail / grazing period. Monitoring points will be put in place to assess the stability of the cap and also to sample the water quality and level in the cap.

16.3 Rehabilitation of Phase 2 TMF in 2010

Prior to 2010 the rehabilitation of Phase 2 TMF involved the placement of a compost cap over the exposed tailings surface. The method of rehabilitation has now been altered to include the use of glacial till into the cap. To allow for incorporation of glacial till into the Phase 2 composted area, approximately 35,000m3 of compost was stripped from the original compost capped area and redistributed to extend the compost cap to approximately 8 hectares. Prior to the redistribution of the compost any standing surface water on Phase 2 was pumped to Phase 3, this coupled with very favorable weather conditions provided a stable, level surface on which to work. Notwithstanding this, PB 120 Terram was also used to minimize any disturbance of the cap and any loss of capping material into the tails. Photograph No. 5 below shows the placement of PB 120 Terram and the redistribution of compost on Phase 2 TMF. This work was carried out throughout June 2010. Photo No. 6 below shows the composted area after redistribution of compost.

Photo. No 5.

Photo. No 6.

Preparation of the borrow area adjacent to the Tailings Management Facility (Drennan's farm) was carried out in July 2010. A large number of archaeological features were uncovered during the stripping of topsoil from the borrow area. These features were surveyed and logged by Archaeological Development Services Ltd who supervised the excavation works. Excavation and importation of glacial till from this borrow area to Phase 2 TMF commenced on 27th July 2010. As with the redistribution of the compost, PB 120 Terram was also used in the placement of the glacial till over the exposed tailings surface. Photos No 7 & 8 below show the removal of glacial till from the borrow area and subsequent placement on Phase 2 TMF. Capping of Phase 2 TMF with the glacial till started from the western ramp and advanced to meet the compost capped area. Glacial till was then distributed over the composted area.

Importation of glacial till onto Phase 2 TMF continued throughout August and September 2010. Rehabilitation works were discontinued in October 2010 due to wet weather conditions causing a reduction in trafficability on the TMF surface. A topographical survey of the borrow area was carried out and approximately 112,000m3 of glacial till is estimated to have been removed from and spread on Phase 2 TMF. The topsoil stockpiled at the borrow area will be redistributed in 2011 when weather conditions are suitable and the area will then be re-seeded.

Photo No 7.

Photo No 8.

16.4 Rehabilitation of Phase 3 TMF in 2010

Phase 3 TMF is still in operation as an emergency reservoir for mine water, surface water from Phase 1 and 2 also reports to Phase 3 via their respective spillways. Following a topographical survey of Phase 3 TMF and in line with the mine closure plan the final surface of the tails within phase 3 of the TMF had to be graded so that all surface water would report to the western perimeter walls post rehabilitation. L&M Keating Ltd Civil Engineering Contractors came on-site in September 2010 to carry out dredging works on Phase 3 of the TMF. The dredging and redistribution of the tailings will provide a level and stable surface on which to commence rehabilitation in due course. While carrying out this dredging work approximately 30,000m3 of tailings were pumped from Phase 3 to a low area on Phase 2 TMF. As outlined above, this will allow for a more stable solid

surface on which to place capping material. Photo No 9 below shows the dredging in Phase 3. Photo No 10 shows the pumping of the tailings slurry to Phase 2.

Photo No. 9.

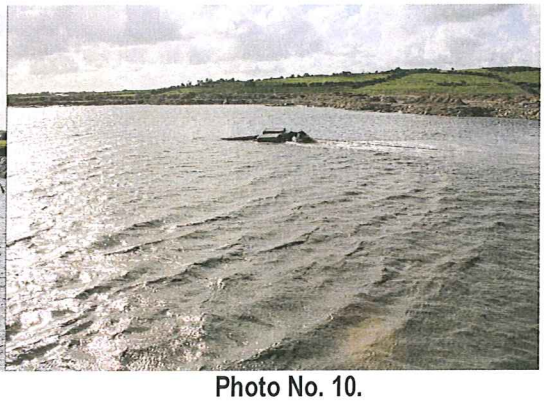


Photo No. 10.

16.5 Restoration Plans for Phase 2 in 2011

At the end of 2010 approximately 10.7 hectares of Phase 2 TMF has now been capped with compost and glacial till material. Some glacial till stockpiled on the capped area remains to be utilized, this will be carried out in 2011 when weather conditions allow for safe stable access on the tailings surface. A further topographical survey will be carried out on the surface of Phase 2 in 2011 to estimate the remaining amount of glacial till required to bring the cap to the final dome shaped profile. This material will then be sourced and placed to the required elevations to form the dome shape. Any necessary topsoil or organic material will also be placed to provide the optimum seedbed for sowing of grass-seed on the capped surface.

17. Backfill Program Progress Report

17.1 RD4² Project (Dec 2009 – Ongoing)

Galmoy resumed production in December 2009 on a limited project in partnership with a neighbouring mine. As part of this project the company is backfilling various panels in the R Orebody with waste rock (RF) and cemented waste rock (CRF). 62,534 DMT of RF and 32,189 DMT of CRF were placed in 2010.

18. Underground Failure Prevention Plan (UFPP) Report

18.1 Introduction

The Underground Failure Prevention Plan Feb 2010 (UFPP) continues to be part of the mine department's method of operating (Appendix 3).

18.2 Pillar Monitoring

The last full survey of the pillars was carried out in December 2010. No areas of concern were noted but some individual pillars were selected for follow up.

18.3 Subsidence Monitoring

Two surveys were carried out in 2010, one in July and the other in December. In neither survey did observations exceed the maximum permissible values and no further action was taken. Ten new stations were installed to bedrock, as agreed with the Department of Communications, Energy and Natural Resources.

The TMF continues to be included in the subsidence monitoring network. In neither the July nor December surveys did the observations exceed the maximum permissible values and no further action was taken.

18.4 Backfill

See section 17.

19. Notification of Incidents and Non-Compliances

19.1 Introduction

The requirements for notification of incidents and non-compliances are specified in Condition 4 of the IPPC License. All incidents and non-compliances are recorded and reported to the EPA as they occur.

19.2 Incidents

On the 23rd of February 2010 the EPA were informed by fax of a fire in the SAG Mill in the Mill building at 14.30 that afternoon. Eleven rubber liners caught fire during the mill dismantling process. The fire was brought under control using water and ALCOSEAL foam which is readily biodegradable. Apart from the smoke from the burning rubber, there were no uncontrollable emissions to the environment. A letter was sent to the Agency outlining the incident in detail.

19.3 Non-Compliances & IPPC Licence Breaches

Heavy rainfall in the autumn of 2009 resulted in the Mine experiencing a higher water make underground up until the spring of 2010 (Fig. 19-3). Large volumes of dirty water from underground were pumped to the on site Water Treatment Plant (WTP), which compromised its efficiency to remove zinc. Consequently, mine water was diverted to Cell 3 of the Tailings Management Facility (TMF). This transfer, in conjunction with the heavy rainfall seen and reduced volumes of water from Cell 3 being reclaimed, due to high ammonia concentrations, resulted in a breach of *Condition 7.6.15 of IPPC P0517-*

01. Failure to maintain a minimum of 1 meter free board in active Cell 3 continued until Feb. 2010. The EPA was informed in writing of the breach.

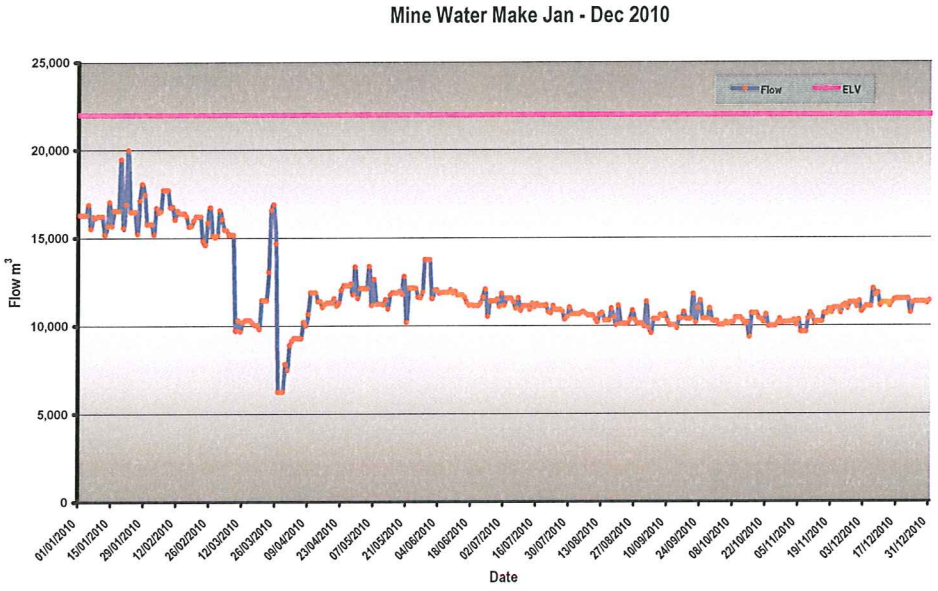


Figure 19-3 Mine Water Make January – December 2010

On the 13th April 2010 the EPA instructed the Mine to discontinue stream augmentation which was adhered to immediately, however, difficulties with high water make and optimising water treatment saw this order being breached on some occasions from January – May 2010. Augmentation is Area 32 of CRAMP, with recovery of sediment from these points and the R. Goul discharge point scheduled for when river conditions are favourable.

A summary of non-compliances and licence breaches 2010 are shown in Table 19-1 and 19-2 respectively.

Parameter	ELV	Location	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec	Total
Suspended Solids	<25mg/l	SW1	1	0	1	1	0	1	2	1	0	0	0	0	7
Ammonia	1.2 mg/l	SW1	20	23	23	4	0	0	0	0	0	0	2	16	88
Zinc	300 µg/l	SW1	3	0	0	1	0	0	0	0	0	0	4	0	8
Lead	50µg/l	SW2	0	0	0	0	0	0	0	0	0	0	0	1	
Nitrite	1.3mg/l	SW1	0	0	0	0	1	0	0	0	0	0	0	0	1
pH	6 - 9	SW1	0	0	0	0	0	0	0	0	0	0	0	0	0
Volume	22,000m³	SW1	0	0	0	0	0	0	0	0	0	0	0	0	0
Suspended Solids	<25mg/l	PS8	2	1	4	6	4	3	2	1	2	0	0	0	25
pH	6 - 9	PS8	0	0	0	0	0	0	0	0	0	0	0	0	0
Ammonia	1.8mg/l	PS8	21	28	27	14	0	0	0	0	0	0	9	0	99
Zinc	500µg/l	PS8	0	0	0	0	0	0	0	0	0	0	2	0	2
Volume	7,500m³	PS8	0	0	0	0	0	0	0	0	0	0	0	0	0
Zinc	500µg/m²/d	AA5	0	0	0	0	0	0	0	0	0	0	0	0	0
Arsenic	5µg/m²/d	AA5	0	0	0	0	0	0	0	0	0	0	0	0	0
Undissolved Solids	350mg/m²/d	AA5	0	0	0	0	0	0	0	0	0	0	0	0	0
Undissolved Solids	350mg/m²/d	AA6	0	0	0	0	0	-	-	-	-	-	0	0	0
Undissolved Solids	350mg/m²/d	AA7	0	0	0	0	0	0	0	0	1	0	0	0	1
Undissolved Solids	350mg/m²/d	AA8	0	0	0	0	0	0	0	0	0	0	0	0	0
Undissolved Solids	350mg/m²/d	AA10	0	0	0	0	0	0	0	0	0	0	0	0	0
Undissolved Solids	350mg/m²/d	AA12	-	0	0	0	-	-	0	0	0	0	0	1	1
Total			47	52	55	26	5	4	4	2	3	0	17	18	232

Table 19-1 Summary of Non-Compliances for 2010

- Stations inaccessible or damaged

Breach	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct*	Nov	Dec	Total
1m Freeboard	✓	✓	None	None	None	None	None	None	None	None	None	None	2
Discharge licence	✓	✓	✓	✓	✓	None	None	None	None	None	None	None	5

19-2 Summary of IPPC Licence Breaches 2010

20. Use of Resources

20.1 Introduction

The requirements for the conservation of natural resources and energy are specified in Condition 10. This condition outlines the requirements for reporting water and energy consumption, studies to be undertaken, energy and water efficiency and the use of raw materials.

20.2 Energy Use

The use of electricity and fossil fuels is recorded in kWh. As the electricity is supplied from the national grid we are unable to specify the amount of renewable energy used at the site. The energy used is outlined in table 20-1 below:

Energy use	2007	2008	2009	2010
Total energy use (kWh)	35,476,263	57,226,258	41,544,598	15,836,237
Electricity use (kWh)	23,260,545	43,011,272	35,247,060	10,695,523
Fossil fuels (kWh)	12,215,718	14,214,986	6,297,538	5,140,714
Renewable energy use (kWh)	0	0	0	0

Table 20-1 Energy Consumption from 2007 to 2010

20.3 Water Consumption

The mine discharged 4,550,676m^3 of treated water, from the mine to the River Goul and augmentation streams in 2010 to ensure a safe working environment. This was a decrease from 5,090,370m^3 in 2009. While a considerable amount of energy is required to displace this volume of water, the transfer of water from underground to surface is not considered as consumption of water.

With the onset of mine closure the on site WTPs are now used to treat dirty water from underground and water from the tailings pond.

Potable water is also used on site for the forty-eight employees and is derived from the Replacement Water Supply Scheme (RWSS).

Appendix 1
Health, Safety and Environment Policy

Health, Safety and Environment Policy Statement

At Galmoy Mine, Safety, Health and Environmental responsibilities are an integral part of the way we do business. We are committed to continual improvement in our performance, efficient use of resources and expect zero harm to people and the environment.

The Galmoy Mines Board assigns accountability for health, safety and environment to the Managing Director. The MD will ensure the necessary controls and programs are developed implemented and followed up to enable compliance with legislation as well as Lundin Mining standards.

The responsibility for the working as well as the external environment rests with the line organisation. Galmoy Mines will address all health, safety and environmental issues in an open, fair and cooperative manner during interaction with all company stakeholders. To achieve this commitment Galmoy Mines Ltd. has implemented Health, Safety, and Environmental management systems. Key features and requirements of these systems are:

- Galmoy Mines shall meet all relevant regulatory requirements and will strive, where relevant, to achieve leading industry practice
- All employees have to prioritise health, safety and environment when performing duties. Instructions have to be followed and any incident/accident has to be reported as soon as possible
- Risks to employees, contractors, visitors, the environment and local communities will be identified, assessed and managed
- All accidents and incidents will be investigated to ensure that the root causes are identified and reoccurrence minimised
- Procedures and work practices will be further developed to minimise risk. The application of procedures will be monitored to ensure that all employees and contractors comply with such measures
- Galmoy Mines will maintain procedures, train individuals and teams capable of dealing with emergency situations.
- Annual action plans will be in force and progress continuously monitored with the aim of reducing and preventing incidents, accidents and pollution
- Auditing programs will be used to determine and measure the effectiveness of the health and safety and environmental management plans
- Galmoy Mines will conduct relevant training in order to enable personnel working on site to actively participate in the implementation of this policy

Galmoy Mines Ltd

Stefan Månsson
Managing Director
June 2006

Appendix 2
Environmental Monitoring Group Meeting Agenda 2010

Agenda for Environmental Monitoring Group Meeting 3rd Jan 2010 (10:00 AM)

- Compliance with Discharge Emission Limits
- Ammonia Compliance Issue
- River Goul Monitoring
- TMF Update
- Grass Trials update
- Compost / IBC trials
- Mine Closure Data Jan - Dec 2009
- Underground Sampling Programme/K Vent Shaft
- AOB

Appendix 3
Underground Failure Prevention Plan

Underground Failure Prevention Plan

December 2002	– C.J.P & DW
Revised September 2003	– C.J.P & DW
Revised December 2003	– C.J.P & DW
Revised July 2007	– R.R, B.E.O & DW
Revised August 2009	– PMcD, BEO & SM
Revised February 2010	– PMcD, BEO & SM

Underground Failure Prevention Plan

As required by:

1. Integrated Pollution Control Licence

Licence Register No. 517

Licensee: Galmoy Mines Ltd

Dated: 04/10/02

Condition 13. Accident and Emergency Response

13.3 Underground Failure Prevention Plan

13.3.1 As part of the Accident Prevention Policy and Emergency Response Procedure, the licensee shall, within 4 months of date of grant of this licence, establish, operate, monitor, and maintain a plan to mitigate against subsidence. The licensee shall consult with The Department of Marine & Natural Resources, The Local Authority and The Health & Safety Authority with regard to the scope and content of this plan. An annual summary report on the operation of the plan (including incidents) shall be included in the AER.

13.3.2 The objectives and scope of the Plan referred to in Condition 13.3.1 shall inter alia include

(i) Ensuring that all underground working are undertaken without causing subsidence sufficient to damage any environment critical surface structures or features.

2. Kilkenny County Council

Local Government (Planning and Development) Acts, 1963 - 1999

Conditions of Permission *P99 - 1371*

Dated *27/03/02*

Condition 2 (a) All underground working shall be carried out with the objective of ensuring that there is no subsidence sufficient to cause damage to any surface structure such as the Tailings Impoundment facility, the explosives magazine, public roads, or buildings not the property of the developer.

13.3.2 (ii) establishment and maintenance of a database for previous and future underground monitoring (pillar dimension, width: height ratios, void closure etc).

2 (b) A database for previous and future underground monitoring shall be established to provide measurements of pillar dimensions, width/height ratios, void closure and other critical features as considered appropriate.

GALMOY MINE PILLAR DATABASE

- Galmoy mine will operate a database containing each pillar in the underground mine.
- The database will contain the following data fields.
  - Stope name
  - Pillar identification number - a unique i.d. for each pillar.
  - Pillar area
  - Pillar height
  - Height/width ratio
  - Depth below surface
  - Comments on stope conditions
  - Percentage extraction for the stope
  - Description
  - Pillar condition evaluation - using the classification scheme (set out below)
  - Date of classification
  - Backfill status

- A pillar condition evaluation survey will be carried out by a competent person (mining engineer and/or geologist) every month in the R Orebody and quarterly for the rest of the mine on each accessible pillar.
- The database will be updated by a competent person who will include all new pillars created during the previous three months.
- The database will be held electronically.
- The following table describes the classification system that will be employed:

Class	Type	Description	Colour
I	Intact Pillar	No cracks developed or loose rock after blasting is complete. Good load bearing capacity.	Yellow
II	Intact Pillar	Minor spalling or slabbing of rock around the roof/pillar corners. Small discontinuous cracks on the face of the pillar.	Green
III	Yielding Pillar	Significant spalling around the roof/pillar corners. Open vertical continuous cracks in the pillar face.	Blue
IV	Failing Pillar	Spalling of thin slabs of rock from the face of the pillar. Reduced load bearing capacity.	Magenta
V	Failing Pillar	Progressive spalling of thin slabs of rock, often curved, from the middle of the pillar. Hourglass pillar with low load bearing capacity.	Orange
VI	Collapsed Pillar	Pillar with very narrow neck or completely broken through. No load-bearing capability.	Red

- The value of the pillar classification will be plotted on the Stability Assessment Plans as a colour code on each pillar.
- The plan will be held electronically in AutoCAD format.

- Where a pillar changes classification to a higher class, indicating deterioration, the following actions will be triggered:
  - The mine Project Manager shall immediately be made aware of the deterioration by the competent person carrying out the evaluation.
  - An assessment of the pillar/s and any factors influencing them shall be completed by the mine technical and production staff.
  - The assessment will identify if any action is required in the affected area. These actions may include, but shall not be limited to:
    - More frequent monitoring of the pillar/s
    - Additional support, and change of type of support, to the affected pillar/s
    - Packing of the affected area with fill
    - Isolation of the affected area
    - Cessation of mining in the area
    - No additional action
  - An instruction sheet shall be issued by the mine technical department to the mine production department recommending the action required.
  - These instruction sheets will be kept on file by the Mine Technical Department.

13.3.2 (iii) establishment and maintenance of a surface monitoring database.

2 (c) A similar database for surface monitoring to demonstrate that the developer is controlling subsidence in the mine area is to be established. An installation and monitoring protocol for additional surface beacons in the vicinity of the proposed mine extension shall be prepared to include three-dimensional co-ordination of each point and inbuilt redundancy.

GALMOY SUBSIDENCE MONITORING PROGRAMME.

- Galmoy will establish a grid of surface subsidence monitoring stations over and adjacent to all mined orebodies.
- The subsidence monitoring stations will be established, located and elevated prior to mining.
- The subsidence monitoring stations will be laid out with a spacing of 100 metres where possible, with due regard given to surface features and/or landowner issues.

- The location, coordinates and initial elevation of each station will be held on the surface subsidence master drawing by a competent person.

- Each subsidence monitoring station shall consist of a column of concrete with a minimum depth of 1.5m (or to bedrock), 100-150mm diameter containing a brass register point.

- The competent person will arrange for all subsidence monitoring points to be elevated every six months, or more frequently if circumstances dictate.

- A dedicated MS Excel database of all subsidence monitoring points and measurements will be maintained by the competent person and will contain the following:
    - Station I.D.
    - Date of installation, initial measurement.
    - Eastings (IG75)
    - Northings (IG75)
    - Orebody
    - Description of station location
    - Station in bedrock or not
    - Elevation above Ordnance Survey Malin Datum and date of measurement.
    - Status of stope mining below the station - % extraction
    - Status of stope mining below the station – Primary/Secondary/Backfilled
    - Estimated maximum survey error.
    - Indicate if additional monitoring was taken.
    - The sequential survey differences
    - The total station movement since installation

The subsidence monitoring data will be analysed graphically for each station to monitor for anomalies.

<u>Action on a Potential Incident</u>

Where a subsidence monitoring station changes measurably in elevation and or when a potential subsidence incident is suspected or occurs, the following actions will be triggered:

- The mine Project Manager and Mine Manager shall immediately be made aware of the elevation change by the competent person.
- An assessment of the movement and any factors influencing it shall be completed by the mine technical and production staff.

- A grid of local survey stations shall be established above and adjacent to the site of the incident. This local network shall be the subject to more frequent measurements, case specific to the incidents requirements.
- Underground geological and geotechnical assessments.
- A visual inspection of the surface features.
- Prioritisation of backfilling of the affected area
- Isolation of the affected area.
- Cessation of mining in the affected area.
- Reporting to statutory authorities.

13.3.2 (iv) establishment and maintenance of "Caution Zones" around key surface and underground structures.

2 (d) Unless agreed otherwise, working within the Caution Zone – defined as "encompassing all underground workings which fall within a 60^0 angle of potential influence of the base and walls of the tailings impoundment" – shall include at least the precautions against subsidence set out in the complete planning application documents.

2 (f) Unless otherwise agreed, cautions zones similar to that around the Tailings Impoundment facility shall be set up around other surface structures. Similar mining and backfill methods as in the caution zone for the Tailings Impoundment facility shall be used in these zones to ensure their stability.

PROTOCOL FOR WORKING WITHIN THE CAUTION ZONE

The caution zone is defined as an area within a 60 degree angle of influence from the base of the surface structure in question. These structures include the Tailings Management Facility, houses, roads and other surface structures not owned by Galmoy Mines Limited.

The caution zones will be clearly identified by the surveyor on the Galmoy underground survey master plans.

None of the mining planned for the RD4[2] Project lies within a cautionary zone.

Method of Working within the Caution Zone.

1. Probe Drilling.

- The standard Probe hole shall be defined by the geology department.
- Where a diamond drill hole has been drilled, and is at least 10m ahead of the face on the same bearing and elevation, this hole shall be deemed to be a probe hole.
- The probe driller shall record ground conditions and the quantity of water made by each hole on the Probe Hole Record Sheet (Appendix 3).
- All holes will be plotted by the mine geologists on a Probe Cover Plan located in the mine technical office.
- Should water or weathered ground be intersected:
    - No further advance shall be undertaken until an assessment has been completed by mine technical and production staff and a suitable mining method established to ensure that stability and control be maintained.
    - Where weathered fissures or structural features are encountered, a competent person will determine the required support works.

2. Pillars

- Pillars shall be designed to provide permanent support to the hanging wall
- Minimum pillar size will be sufficient to provide long term support.
- Where the ore thickness exceeds 6m the pillar dimensions shall be designed to provide effective support to the hanging wall with a factor of safety of 1.6.
- Pillar design shall encompass geological information and support requirements as per the "Development Support Category" table in the Extraction Protocol.
- Pillars shall be monitored and their category assessed as per the Pillar Classification System as set out in Galmoy Mine Pillar Database.

3. Stope layout.

- The maximum width of the rooms shall be 9m or less in room and pillar areas, as determined from the hangingwall rock mass characteristics.

4. Support

- Roof support shall be installed to within 9m of the face at all times.
- The type of support will be in accordance with the support category as defined in the "Support Category Table" below, or additional support as deemed necessary.
- The selection of support category shall be by the mining engineer on information from geology and mine production staff. See the Extraction Protocol, Support Review.

5. Backfilling

- Stopes required for mining or stability will be backfill as soon as practical.
- Where pillar deterioration is detected or suspected, backfilling facilities shall be in place to fill the stope as fast as practicable.
- Backfill will be placed to maximise the tight filling of the mined voids where required for stability reasons.
- Tight filling is defined as within 0.5m of the back.

6. Subsidence Monitoring

- Surface subsidence monitoring will be carried out within the caution zone as described in the Galmoy Subsidence Monitoring Programme.

7. Long Term Monitoring

- A long term monitoring programme will be implemented including:
    - Pillar assessments as described in the Galmoy Mine Pillar Database protocol
    - Surface subsidence monitoring as described in the Galmoy Subsidence Monitoring Programme
    - Draw down of the ground water table as routinely carried by Galmoy Mines staff and reviewed by the groundwater Model Review Committee.
    - Stope stability assessments will be carried out as described in the Protocol for all Extraction Procedures.

Support Category Table

Support Type	Ground Description	Q Value	Q Classification	Minimum Ground Control Required	Additional Controls
A	Strong, massive to moderately fractured, wide to medium joint sets, medium block sizes.	10-100	Good	Bolts (expandable or grouted 2.4m long bolts in a 1.5m diamond pattern) a maximum distance of 9m from the face.	Additional ground support methods are: increased density of bolting, extended bolts, fibre shotcrete, meshing, roping.
B	Bedded, moderately weathered, closely spaced joint sets or blocky ground	1.0-10	Fair	Average of 50mm of fibre shotcrete on the back and 1.5m down the sidewalls every round. Bolts (expandable or grouted 2.4m long bolts in a 1.5m diamond pattern) a maximum distance of 6m from the face.	Additional ground support methods are: increased density of bolting, extended bolts, increased thickness of fibre shotcrete, meshing, roping.
C	Friable material, weathered ground, highly weathered or very blocky material	0-1.0	Poor	Average of 75mm of fibre shotcrete on the back and the sidewalls every round. Bolts (expandable 2.4m long bolts in a 1.5m diamond pattern) every round.	Additional ground support methods are: increased density of bolting, extended bolts, increased thickness of fibre shotcrete, meshing, spilling, roping, steel arch

13.3.2 (v) establishment and maintenance of rock extraction protocols in areas of weak ground or water bearing strata.

2 (e) A protocol for all extraction procedures shall be prepared. This shall include measures to identify areas of weak ground or water bearing strata. The protocols shall particularly address underground works in any such areas, both during development and production, together with the means by which changes in geological conditions are fed back into mine design.

PROTOCOL FOR ALL EXTRACTION PROCEDURES

1. Design Phase

a. Geological assessment of the ground conditions

- The mine geological department shall assess the rock mass characteristics, including the contact between the orebody and the hangingwall and footwall in any extraction area or stope. The objective will be:
  - To identify areas of weak ground.
  - To identify water bearing strata.
- Information will be taken from:
  - Surface and underground diamond drilling.
  - Geophysical data
  - Mapping of principal geological features.
  - Underground probe drilling
  - Information from adjacent mining.
  - Q value plots for hanging wall and the orebody.
  - The orebody inclination, thickness and depth below surface.

b. Mining Layout Design

- The mine engineer will design the layout for extraction of the orebody based on the geological and geotechnical information above.
  The objective will be:
  - To maximise the recovery of the ore.
  - To produce a stope and pillar layout that maintains the stability of the underground workings.
- The stope design shall work within the maximum unsupported span as assessed from the Q values, for all person entry mining.
- The support categories above will be used to define the support required for mining.

2. Support Review

- The support standard for all development excavations shall be reviewed at regular production meeting, attended by both technical and production staff.
- The support requirements for each workplace will be reviewed. Where ground conditions have changed or deteriorated then the support requirement shall be re-assessed by a competent person.
- Where category 'C' is repeatedly the required support, then the mining layout and extraction ratio shall be re–assess by a mining engineer.
- All rock mechanics related incidents (rock falls, support failures, noises etc) shall be recorded in File Maker Pro, with remedial actions identified and acted on. It is the duty of the Project Manager to ensure appropriate works are carried out.

3. Post Extraction Stope Assessment – Extraction Sequence

- On completion of the primary extraction sequence in a stope and prior to any secondary mining (footwall mining or boundary pillar mining) the stope shall be assessed and ranked according to the following Stope Classification System (Appendix 4).
- Criteria:
  - Quality of the rock conditions in and above the ore zone.
  - Conditions in adjacent stopes
  - Presence of backfill in the stope
  - Presence of major faults/ fissures
  - Area extent – distance to abutments
- Ranking 1 = Positive 5 = Negative
- The ranking of the stope will determine the degree and timing of any secondary extraction and the priority of backfilling.

4. Annual Audit

- The mine manager shall arrange for an independent annual audit by a competent qualified rock mechanics specialist.
- The audit shall review all the underground excavations, pillars and support installations.
- The audit shall review the operation of all mining, support and subsidence related protocols.
- The auditor will issue a summary report following his inspection.

13.3.2 (vi) ensuring that the backfill programme is operated such that post-fill ground movements are limited.

(vii) Identification of voids that require "tight filling"

(vii) Certification of successful "tight filling" where considered necessary

2 (g) A review of backfill design, production and placement shall be undertaken together with an assessment of the impact of backfill on the long term stability of the workings, on the lateral restraint offered to pillars and the means by which tight fill will be achieved. This review shall include the development of production and placement protocols and the Construction Quality Assurance systems for as placed backfill characteristics.

2 (h) All underground workings shall be backfilled to the optimum extent feasible to ensure that post-fill ground movements are minimised.

BACKFILL PROTOCOL

1. Backfill Philosophy Statement

Galmoy recognises that backfill enhances the long term stability of the underground workings by providing confinement to the pillars and to the roof of the excavations and thereby limiting post fill ground movements.

2. Placement Programme

A backfill plan will be produced annually as part of the mine production plan.

- Stopes that require backfill for mining and/or geotechnical reasons shall be backfilled as soon as practicable.
- Backfill will be placed to maximise the tight filling of the mined voids where necessary.
- Where pillar deterioration is detected or suspected, backfilling facilities shall be in place to fill the stope if required, as soon as practical in conjunction with direct support of the pillars in question.

3. Filling Procedure

Prior to backfilling a stope or area a fill check list will be followed by the shift supervisor.

- All recoverable broken ore removed from the area.
- All recoverable materials salvaged.
- All safety procedures put in place, including stop blocks, bunds, and signage.

Having established that all of the above is in place filling can begin.

- The fill will be monitored to confirm it is curing.
- Samples of CRF will be taken regularly from the mixing area after mixing and strength tested after 7 days curing.
- All reasonable efforts will be made to ensure the stope/area is filled as planned.

4. Target Backfill Strength

For mining areas the following backfill strengths are required.

- In open stopes against which blasting is required, cemented rockfill (CRF) will be placed in the open stope, prior to blasting, to a significant strength to be free standing and self supporting.
- Where voids require filling for production purposes but are not directly adjacent to blasting, these voids will be filled with un-cemented rockfill with no inherent strength.

5. Operating Parameters

- Un-cemented rockfill will consist of "quarry run" material 0 – 1m in size, containing no organic material.
- Rockfill for CRF will be 0 - 75mm with c.20-30% of the material passing 8mm, containing no organic material.
- The rockfill and cement slurry will be mixed underground or on surface and transported to the stope.

6. Backfill Quality Control

Testing shall be done on a regular basis, with at least one set of samples per week during periods of using CRF and at least one sample from each area filled.
In the event that a fill sample fails to achieve the design strength, the mine engineer shall investigate. Mining methods or planning may be changed to minimise the risk from low strength backfill.

7. Recording the Areas Backfilled

The areas backfilled are recorded on the Mine Survey Master Plans and show the date filled and the % cement/recipe.

8. Backfill Completion Certificate

When a stope has been filled to the required standards as set by the mining engineer a certificate of completion will be issued and signed by the Project manager. The certificate will be accompanied by any associated backfill strength tests together with the binder used.

9. High Strength Pillars

Owning to the high strength pillars in place in the RD and RE stopes no additional high strength pillars are planned, unless required for production purposes.

APPENDICIES

Appendix 1 Pillar Database
- a) Pillar Classification System
- b) CW Stope and Pillar Stability Assessment Plan
- c) 'F' Stope Pillar Instruction Sheet

Appendix 2 Subsidence Protocol
- a) Galmoy Subsidence Monitoring Stations Plan CW , G, K , R ore-bodies
- b) Subsidence Data base – sample sheet

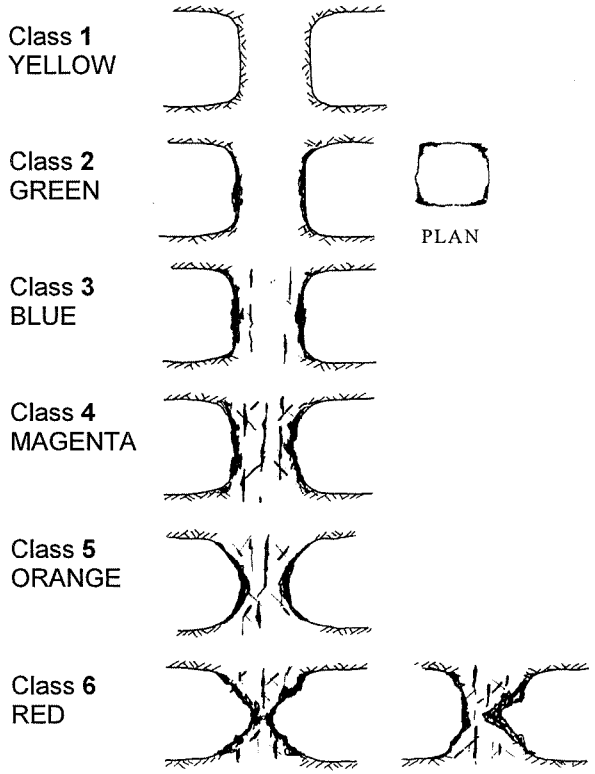
Appendix 3 Working within a Caution Zone
- a) Probe drilling Record Sheet

Appendix 4 Extraction Protocol
- a) Stope Assessment example.

Galmoy Mines Ltd

Galmoy Mine

PILLAR CLASSIFICATION SYSTEM



1.

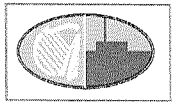
2. CORNER SPALLING, MINOR VERTICAL CRACKS

3. MODERATE SPALLING, OPEN VERTICAL CRACKS

4. FACE SPALLING, THIN FLAT SLABS

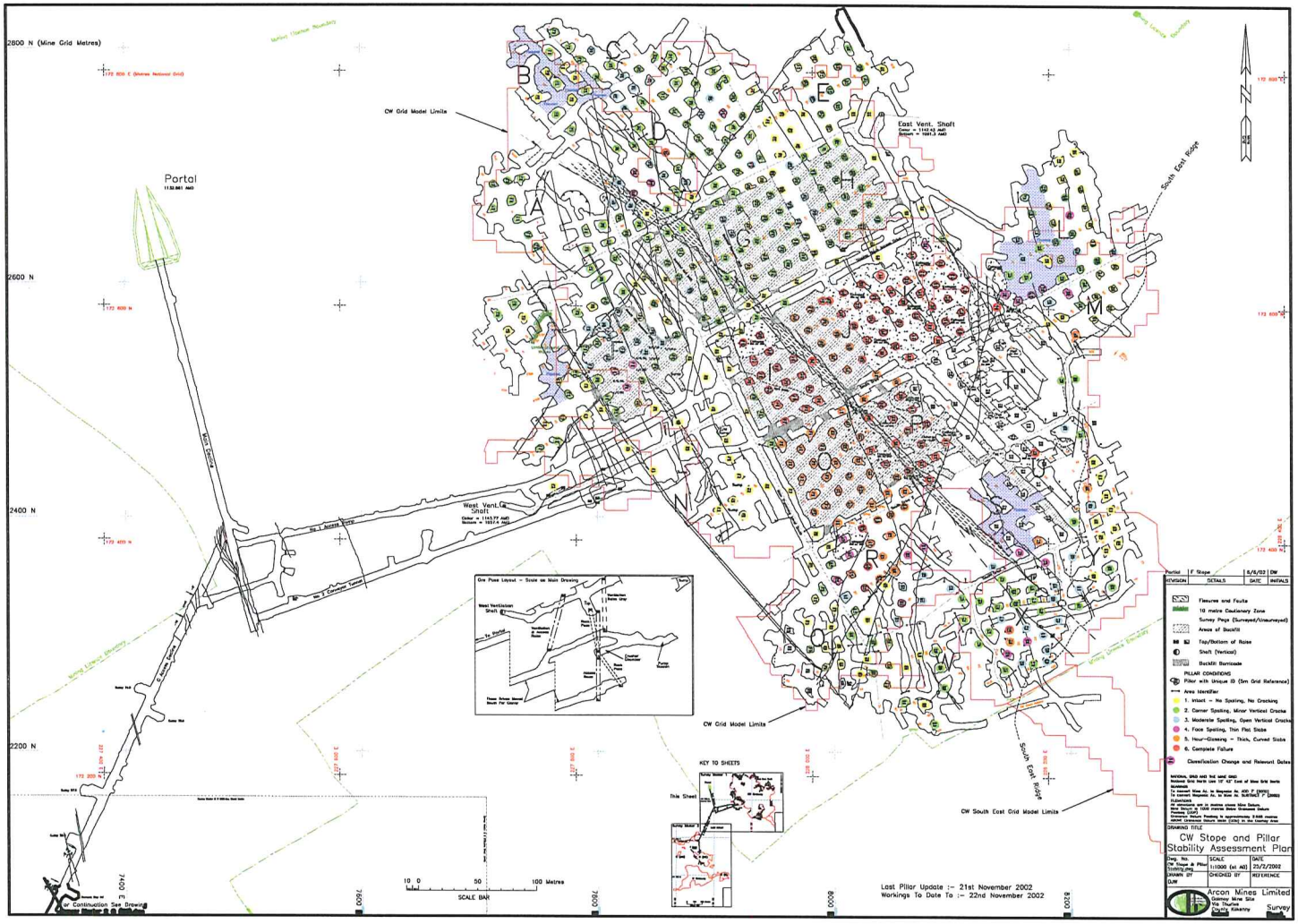
5. HOUR-GLASSING - THICK, CURVED SLABS

6. COMPLETE FAILURE



Underground Failure Prevention Plan

Underground Failure Prevention Plan Appendix 1(b)



Underground Failure Prevention Plan - Appendix 1 (c)

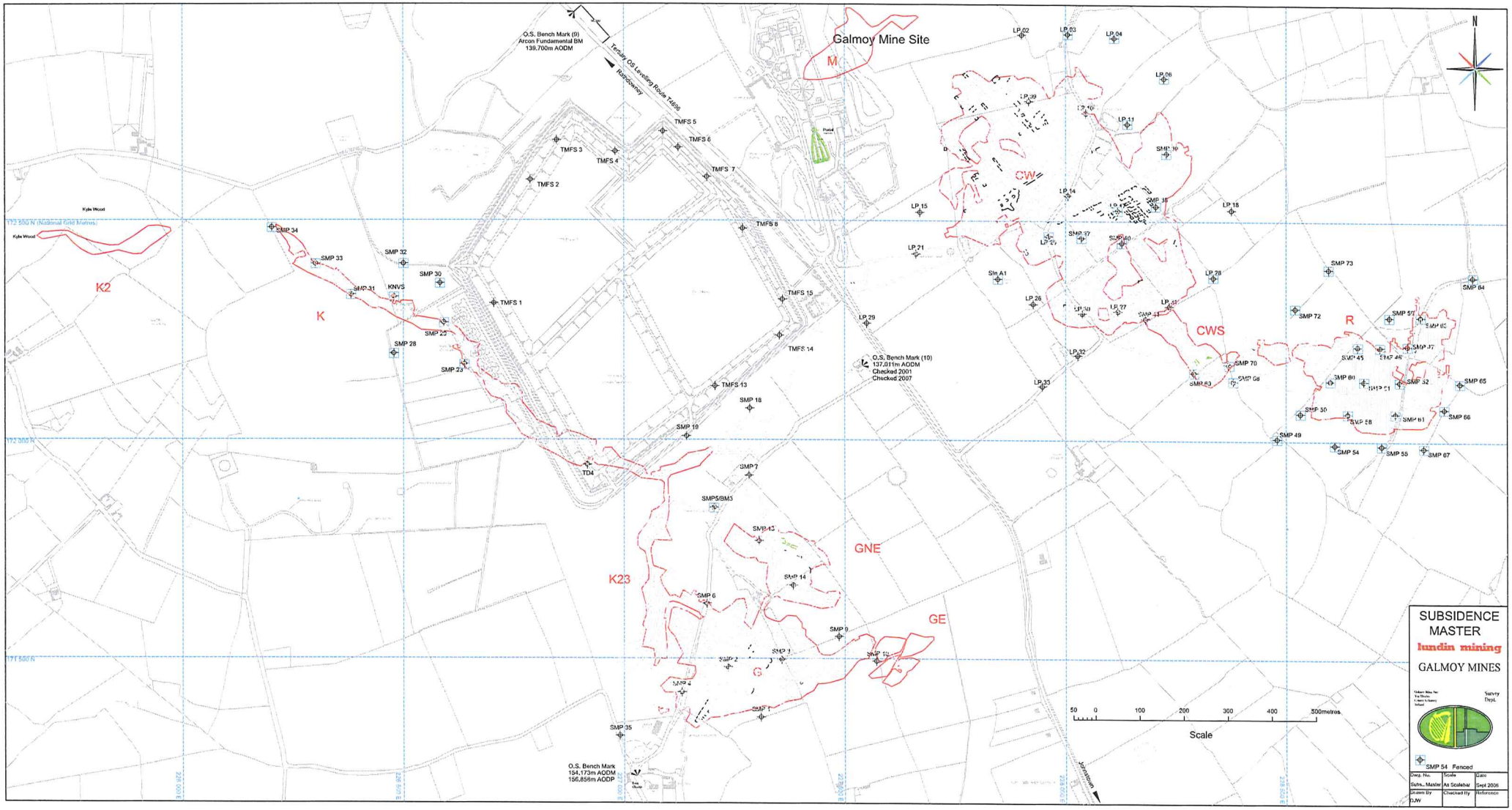
GALMOY MINES LTD
GALMOY MIINE
PILLAR SURVEY CLASSIFICATION

'F' stope Pillars
surved 02.7.2002
16.7.2002
Action Required:
Support pillars:
782 252
782 251
783 253

Backfill
immediately

PILLAR CONDITIONS
- Pillar with Unique ID (5m Grid Reference)
- Area Identifier
- 1. Intact – No Spalling, No Cracking
- 2. Corner Spalling, Minor Vertical Cracks
- 3. Moderate Spalling, Open Vertical Cracks
- 4. Face Spalling, Thin Flat Slabs
- 5. Hour-Glassing – Thick, Curved Slabs
- 6. Complete Failure
- Classification Change and Relevant Dates

Underground Failure Prevention Plan - Appendix 2(a)
Galmoy Subsidence Monitoring Plan



Subsidence Observations -

Station ID	Date	Bedrock	NG	NG	Ore-body	Description	Lost	Elevation
A1								
	01-Jun-01		227846.410	172367.060	CW	Surface Baseline Station		159.320
	01-Aug-02		227846.410	172367.060	CW	Surface Baseline Station		159.316
	23-Apr-03		227846.410	172367.060	CW	Surface Baseline Station		159.332
GPSBM								
	23-Dec-97		227970.578	172511.254	CW	Center Whiteswall Road over K Collapse		148.095
	24-Mar-98		227970.578	172511.254	CW	Center Whiteswall Road over K Collapse		148.089
	31-Jul-98		227970.578	172511.254	CW	Center Whiteswall Road over K Collapse		148.087
	18-Dec-98		227970.578	172511.254	CW	Center Whiteswall Road over K Collapse		148.087
	21-May-99		227970.578	172511.254	CW	Center Whiteswall Road over K Collapse		148.089
	17-Feb-00		227970.578	172511.254	CW	Center Whiteswall Road over K Collapse		148.078
	01-Aug-01		227970.578	172511.254	CW	Center Whiteswall Road over K Collapse		148.064
	01-Feb-02		227970.578	172511.254	CW	Center Whiteswall Road over K Collapse		147.722
	04-Feb-02		227970.578	172511.254	CW	Center Whiteswall Road over K Collapse		147.629
	05-Feb-02		227970.578	172511.254	CW	Center Whiteswall Road over K Collapse		147.613
	06-Feb-02		227970.578	172511.254	CW	Center Whiteswall Road over K Collapse		147.602
	07-Feb-02		227970.578	172511.254	CW	Center Whiteswall Road over K Collapse		147.587
	08-Feb-02		227970.578	172511.254	CW	Center Whiteswall Road over K Collapse		147.588
	11-Feb-02		227970.578	172511.254	CW	Center Whiteswall Road over K Collapse		147.573
	12-Feb-02		227970.578	172511.254	CW	Center Whiteswall Road over K Collapse		147.566
	13-Feb-02		227970.578	172511.254	CW	Center Whiteswall Road over K Collapse		147.566
	15-Feb-02		227970.578	172511.254	CW	Center Whiteswall Road over K Collapse		147.558
	18-Feb-02		227970.578	172511.254	CW	Center Whiteswall Road over K Collapse		147.550
	22-Feb-02		227970.578	172511.254	CW	Center Whiteswall Road over K Collapse		147.546
	28-Feb-02		227970.578	172511.254	CW	Center Whiteswall Road over K Collapse		147.539
	14-Mar-02		227970.578	172511.254	CW	Center Whiteswall Road over K Collapse		147.530
	28-Mar-02		227970.578	172511.254	CW	Center Whiteswall Road over K Collapse		147.524
	11-Apr-02		227970.578	172511.254	CW	Center Whiteswall Road over K Collapse		147.519

Undeground Failure Prevention Plan – Appendix 3

GALMOY MINES	MINING DEPARTMENT
	PROBE AND COVER RECORD

LOCATION / FACE	G1 STH		FACE SKETCH
FACE POSITION IN METERS FROM SURVEY PEG	21 m	Peg Number 1699	
DRILLER	J. Ryan		
DATE	12-12-2002		
SHIFT	DAY SHIFT		

PROBE HOLE 1			
DIRECTION OF HOLE straight	ANGLE OF HOLE 0	LENGTH OF HOLE 21.7 m	TOTAL WATER 200m3/day

STEEL NUMBER	STEEL LENGTH (METERS)	GROUND CONDITIONS
1	3.1	Good
2	6.2	good
3	9.3	Slight slip at 10 meters
4	12.4	Good
5	15.5	Good
6	18.6	Water and bad ground
7	21.7	good

PROBE HOLE 2			
DIRECTION OF HOLE +15	ANGLE OF HOLE +15	LENGTH OF HOLE 21.7m	TOTAL WATER 50m3/day

STEEL NUMBER	STEEL LENGTH (METERS)	GROUND CONDITIONS
1	3.1	Good
2	6.2	Good
3	9.3	Rubble/hard to drill
4	12.4	Good
5	15.5	Slip making water
6	18.6	Steels getting stuck in face/hard drilling
7	21.7	Cavity?? Large slip or 3 meters

PROBE HOLE 3			
DIRECTION OF HOLE +15	ANGLE OF HOLE +15	LENGTH OF HOLE 21.7m	TOTAL WATER 50m3/day

STEEL NUMBER	STEEL LENGTH (METERS)	GROUND CONDITIONS
1	3.1	Good
2	6.2	Good
3	9.3	Poor ground
4	12.4	Water and poor ground
5	15.5	Good
6	18.6	Good
7	21.7	Good

Shift Boss Signature

k.Lonergan

Galmoy Mines Ltd. Underground Failure Prevention Plan - Appendix 4

Stope Assessment Date: **26/05/2009**

Orebody	Stope Name	A Roof/Pillar conditions	B Conditions in adjacent stopes	C Backfill in stope	D Vertical Faults Oxidation	E Distance to abutment	Index	Access	Backfilled	Assessors 26/05/2009
CW	A	3	3	2	3	1	2.2			BEO/PMcD
CW	B	2	3	3	2	1	1.4			BEO/PMcD
CW	C	3	4	2	2	1	1.9			BEO/PMcD
CW	D	4	4	2	4	2	10.2			BEO/PMcD
CW	E	1	2	3	2	1	0.5		started Dec02	BEO/PMcD
CW	F main	4	2	2	4	1	2.6	no access	yes	BEO/PMcD
CW	F west	2	1	3	3	1	0.7			BEO/PMcD
CW	G West	2	5	1	4	3	4.8	no access	yes	BEO/PMcD
CW	G East	1	4	1	2	3	1.0		yes	BEO/PMcD
CW	H	1	3	1	1	1	0.1		yes	BEO/PMcD
CW	I	5	5	2	4	3	24.0	no access	yes	BEO/PMcD
CW	J	5	5	2	4	5	40.0	no access	yes	BEO/PMcD
CW	K	5	5	2	4	2	16.0	no access		BEO/PMcD
CW	L	2	2	3	2	1	1.0			BEO/PMcD
CW	M	3	2	3	3	1	2.2			BEO/PMcD
CW	N	1	3	5	3	1	1.8	no access		BEO/PMcD
CW	O	4	5	1	4	3	9.6	no access	yes	BEO/PMcD
CW	P	5	5	3	4	5	60.0	no access	yes	BEO/PMcD
CW	Q	2	4	4	4	1	5.1	limited		BEO/PMcD
CW	R	5	4	4	4	3	38.4	no access	started Dec02	BEO/PMcD
CW	S	5	4	4	5	4	64.0	no access	yes	BEO/PMcD
CW	T	5	5	3	5	4	60.0	no access		BEO/PMcD
CW	U	5	5	3	5	4	60.0			BEO/PMcD
CW	W	2	2	4	3	1	1.9			BEO/PMcD
CW	X	4	3	4	4	1	7.7	(shotcreted Jan03)		BEO/PMcD
CW	Y	2	4	3	2	1	1.9			BEO/PMcD
G	GNE	2	1	2	2	3	1.0		yes	BEO/PMcD
G	G8 area	1	1	3	2	1	0.2			BEO/PMcD
G	G11 area	2	1	3	3	2	1.4			BEO/PMcD
G	G17	1	1	1	2	2	0.2			BEO/PMcD
G	GE27	2	1	2	2	1	0.3			BEO/PMcD
G	GA	2	1	5	2	1	0.8			BEO/PMcD
G	GB	2	1	4	2	1	0.6			BEO/PMcD
G	GC	1	1	2	2	1	0.2			BEO/PMcD
G	GD	3	2	2	2	3	2.9			BEO/PMcD
G	GH	2	1	5	3	1	1.2			BEO/PMcD
G	GI	1	1	2	2	1	0.2			BEO/PMcD
G	GJ	1	1	2	2	1	0.2			BEO/PMcD
G	GL	1	1	3	2	1	0.2			BEO/PMcD
G	GM	2	1	4	2	1	0.6			BEO/PMcD
G	GN	4	1	3	4	1	1.9			BEO/PMcD
G	GO	3	1	2	3	2	1.4			BEO/PMcD
G	GW	2	1	2	2	2	0.6			BEO/PMcD
G	G East	4	1	1	5	1	0.8			BEO/PMcD
CWS	CWS	3	1	3	3	1	1.1			BEO/PMcD
R	RA	2	1	5	2	2	1.6			BEO/PMcD
R	RB	2	2	2	2	1	0.6			BEO/PMcD
R	RC	2	1	3	3	1	0.7			BEO/PMcD
R	RD	1	1	2	2	3	0.5			BEO/PMcD
R	RE	2	2	2	2	2	1.3			BEO/PMcD
R	RF	2	2	5	2	2	3.2			BEO/PMcD
R	RG	4	2	3	3	2	5.8	Bolted with spot Shotcrete		BEO/PMcD
R	RGS	2	1	5	2	2	1.6			BEO/PMcD
R	RH	2	2	3	2	2	1.9			BEO/PMcD
R	RJ	4	2	5	3	2	9.6	Bolted with spot Shotcrete		BEO/PMcD
R	RL	2	1	3	2	2	1.0			BEO/PMcD
K	K23 D&F	2	2	2	2	2	1.3			BEO/PMcD
K	K23 R&P	2	1	5	2	4	3.2			BEO/PMcD
K	KSW	2	1	3	2	1	0.5			BEO/PMcD
K	K1	2	1	5	2	1	0.8			BEO/PMcD
K	K5e-K5r	2	1	2	2	1	0.3			BEO/PMcD
K	K5s-K5ac	2	1	3	3	1	0.7		In Caut. zone only	BEO/PMcD
K	K19	2	1	2	3	1	0.5		Yes	BEO/PMcD
K	K5al-K25	2	1	5	2	1	0.8			BEO/PMcD

5 CRITERIA

A Roof/Pillar conditions

1 excellent
2 Good
3 Average
4 Poor
5 very Poor

B Conditions in adjacent Stopes

1 Good / backfilled / none
2 Reasonable / not filled
3 Poor / not filled
4 Poor/ not filled /transfering load
5 Collapsed / not filled / load transferred

C Backfill

1 Completed- tight filled
2
3 Part filled not tight
4
5 Not filled

D Vertical Faults

1 None
2 Few/Tight
3 Several / moderate/oxidised
4 Many / large/ oxidised
5 Many / large / heavily oxidised

E Distance to abutment

1 Small / abutment close
2
3 Moderately large
4
5 Large / Very large

RISK Ranking	Magnitude of Problem
0 - 5	minor- good conditions
5 - 15	Moderate - initial signs of deterioration - local support required.
15 - 35	Significant - Requires immediate action, ie. Backfilling
35 - 125	Major - Potential failure area.

Formula Ranking=(A x B x C x D x E)/25

Appendix 4
Tailings Management Facility Data 2010

Piezometer Data 2010

Piezometer No. 04
Installation Depth: 9.93m
AOD:
133.47m

Parameter	Units	Maximum	Minimum	Average
Water level	m	8.38	8.25	8.33
pH	pH units	7.91	7.04	7.33
Cond.	µS/cm	3540	2840	3300
Chlorine	mg/L Cl_2	0.02	0.02	0.02
Sulphate	mg/L SO_4^{2-}	1976	1159	1644

Piezometer No. 25
Installation Depth: 7.92m
AOD:
135.35m

Parameter	Units	Maximum	Minimum	Average
Water level	m	6.80	5.37	6.60
pH	pH units	7.55	6.76	7.07
Cond.	µS/cm	1753	522	1286
Chlorine	mg/L Cl_2	0.04	0.02	0.03
Sulphate	mg/L SO_4^{2-}	396	14	226
Lead	µg/L Pb	20	2	11
Zinc	µg/L Zn	383	168	276
Cadmium	µg/L Cd	<1	<1	
Copper	µg/L Cu	7	5	6
Iron	µg/L Fe	974	163	568.5
Arsenic	µg/L As	7	4	5.5
Magnesium	mg/L Mg	49	28	38.5
Mercury	µg/L Hg	<1	<1	
Nickel	µg/L Ni	111	55	83
Cobalt	µg/L Co	19	12	16
Manganese	µg/L Mn	3840	3510	3675

Piezometer No. 30
Installation Depth: 5.35m
AOD:
133.14m

Parameter	Units	Maximum	Minimum	Average
Water level	m	4.24	4.00	4.06
pH	pH units	7.68	7.11	7.40
Cond.	µS/cm	526	383	446
Chlorine	mg/L Cl_2	0.02	0.01	0.02
Sulphate	mg/L SO_4^{2-}	13	1	8
Lead	µg/L Pb	3	<1	
Zinc	µg/L Zn	71	60	66
Cadmium	µg/L Cd	<1	<1	
Copper	µg/L Cu	3	2	3
Iron	µg/L Fe	105	<1	
Arsenic	µg/L As	3	<1	
Magnesium	mg/L Mg	11	9	10
Mercury	µg/L Hg	<1	<1	
Nickel	µg/L Ni	16	4	10
Cobalt	µg/L Co	5	<1	
Manganese	µg/L Mn	574	<10	

Piezometer No. 34
Installation Depth:
6.66m
AOD: 130.61m

Parameter	Units	Maximum	Minimum	Average
Water level	m	11.90	11.80	11.85
pH	pH units	7.14	7.10	7.12
Cond.	µS/cm	623	534	579
Sulphate	mg/L SO_4^{2-}	112	108	110

Piezometer No. 56
Installation
Depth:13.53m
AOD: 143.72 m

Parameter	Units	Maximum	Minimum	Average
Water level	m	13.50	13.30	13.40
pH	pH units	11.26	10.62	10.94
Cond.	µS/cm	570	455	513
Sulphate	mg/L SO_4^{2-}	266	170	218

Borehole Data 2010

Borehole No 05 Elevation AOD: 136.13m Depth: 70m

Parameter	Units	Maximum	Minimum	Average
Water Level	m	62.89	59.48	60.81
pH	pH units	8.67	6.92	7.51
Conductivity	µS/ cm	918	596	730
Chlorine	mg/L Cl_2	0.06	0.01	0.03
Ortho Phos.	mg/L P	<0.02	<0.02	
Nitrate	mg/L NO_3^{2-}	21	17	20
Nitrite	mg/L NO^{2-}	0.02	<0.01	
Sulphate	mg/L SO_4^{2-}	52	31	43
Total Ammonia	mg/L NH_3 as N	<0.04	<0.04	
Lead	µg/L Pb	45	4	17
Zinc	µg/L Zn	371	41	227
Cadmium	µg/L Cd	<1	<1	
Copper	µg/L Cu	36	3	14
Iron	µg/L Fe	16	<10	12
Arsenic	µg/L As	67	<1	26
Calcium	mg/L Ca	121	2	59
Magnesium	mg/L Mg	85	41	64
Mercury	µg/L Hg	<1	<1	
Nickel	µg/L Ni	32	2	18
Cobalt	µg/L Co	8	<1	
Manganese	µg/L Mn	18	<10	11

Borehole No 06 Elevation AOD: 137.35m Depth: 70m

Parameter	Units	Maximum	Minimum	Average
Water Level	m	49.72	47.71	48.67
pH	pH units	8.03	6.87	7.29
Conductivity	µS/ cm	972	747	867
Chlorine	mg/L Cl_2	0.02	0.01	0.01
Ortho Phos.	mg/L P	<0.02	<0.02	
Nitrate	mg/L NO_3^{2-}	19	15	18
Nitrite	mg/L NO^{2-}	0.02	0.01	0.02
Sulphate	mg/L SO_4^{2-}	129	83	94
Total Ammonia	mg/L NH_3 as N	<0.04	<0.04	
Lead	µg/L Pb	43	3	14
Zinc	µg/L Zn	193	21	112
Cadmium	µg/L Cd	<1	<1	
Copper	µg/L Cu	19	2	10
Iron	µg/L Fe	17	<10	
Arsenic	µg/L As	26	3	13
Calcium	mg/L Ca	138	3	71
Magnesium	mg/L Mg	135	42	88
Mercury	µg/L Hg	3	<1	
Nickel	µg/L Ni	39	4	22
Cobalt	µg/L Co	9	<1	
Manganese	µg/L Mn	135	42	88

Borehole No 07 Elevation AOD: Depth: 70m

Parameter	Units	Maximum	Minimum	Average
Water Level	m	47.23	43.93	45.39
pH	pH units	7.82	6.94	7.32
Conductivity	µS/ cm	1042	650	798
Chlorine	mg/L Cl_2	0.02	0.02	0.02
Ortho Phos.	mg/L P	<0.02	<0.02	
Nitrate	mg/L NO_3^{2-}	19	13	17
Nitrite	mg/L NO^{2-}	0.02	0.01	0.02
Sulphate	mg/L SO_4^{2-}	100	26	58
Total Ammonia	mg/L NH_3 as N	<0.04	<0.04	
Lead	µg/L Pb	18	2	10
Zinc	µg/L Zn	90	19	61
Cadmium	µg/L Cd	<1	<1	
Copper	µg/L Cu	74	2	26
Iron	µg/L Fe	15	<10	
Arsenic	µg/L As	23	1	10
Calcium	mg/L Ca	121	4	43
Magnesium	mg/L Mg	133	31	99
Mercury	µg/L Hg	7	<1	
Nickel	µg/L Ni	33	11	24
Cobalt	µg/L Co	5	<1	
Manganese	µg/L Mn	19	<10	

Borehole No 08 Elevation AOD: **Depth: 70m**

Parameter	Units	Maximum	Minimum	Average
Water Level	m	49.83	46.47	47.41
pH	pH units	7.49	6.98	7.25
Conductivity	µS/ cm	773	608	689
Chlorine	mg/L Cl_2	0.02	<0.01	
Ortho Phos.	mg/L P	<0.02	<0.02	
Nitrate	mg/L NO_3^{2-}	16	11	15
Nitrite	mg/L NO^{2-}	0.01	<0.01	
Sulphate	mg/L SO_4^{2-}	40	18	33
Total Ammonia	mg/L NH_3 as N	<0.04	<0.04	
Lead	µg/L Pb	14	4	8
Zinc	µg/L Zn	124	16	59
Cadmium	µg/L Cd	<1	<1	
Copper	µg/L Cu	16	<1	
Iron	µg/L Fe	14	<10	
Arsenic	µg/L As	9	<1	
Calcium	mg/L Ca	125	2	64
Magnesium	mg/L Mg	100	41	71
Mercury	µg/L Hg	<1	<1	
Nickel	µg/L Ni	30	4	18
Cobalt	µg/L Co	6	<1	
Manganese	µg/L Mn	13	<10	

Borehole No 11 Elevation AOD: Depth: 70m

Parameter	Units	Maximum	Minimum	Average
Water Level	m	69.35	45.84	50.44
pH	pH units	7.91	6.85	7.28
Conductivity	µS/ cm	883	611	751
Chlorine	mg/L Cl_2	0.07	0.02	0.04
Ortho Phos.	mg/L P	<0.02	<0.02	
Nitrate	mg/L NO_3^{2-}	11	8	10
Nitrite	mg/L NO^{2-}	0.02	<0.01	
Sulphate	mg/L SO_4^{2-}	138	57	111
Total Ammonia	mg/L NH_3 as N	<0.04	<0.04	
Lead	µg/L Pb	6	1	4
Zinc	µg/L Zn	323	12	137
Cadmium	µg/L Cd	<1	<1	
Copper	µg/L Cu	3	2	2
Iron	µg/L Fe	15	<10	
Arsenic	µg/L As	11	8	10
Calcium	mg/L Ca	148	6	94
Magnesium	mg/L Mg	120	42	68
Mercury	µg/L Hg	2	<1	
Nickel	µg/L Ni	30	5	15
Cobalt	µg/L Co	8	<1	
Manganese	µg/L Mn	21	<10	

Borehole No 13 Elevation AOD: Depth: 132.54m

Parameter	Units	Maximum	Minimum	Average
Water Level	m	55.05	48.50	50.09
pH	pH units	7.72	7.01	7.21
Conductivity	µS/ cm	899	515	765
Chlorine	mg/L Cl_2	0.01	0.01	
Ortho Phos.	mg/L P	<0.02	<0.02	
Nitrate	mg/L NO_3^{2-}	19	16	17
Nitrite	mg/L NO^{2-}	0.02	<0.01	
Sulphate	mg/L SO_4^{2-}	100	24	80
Total Ammonia	mg/L NH_3 as N	<0.04	<0.04	
Lead	µg/L Pb	29	2	10
Zinc	µg/L Zn	1290	23	918
Cadmium	µg/L Cd	<1	<1	
Copper	µg/L Cu	9	1	
Iron	µg/L Fe	1	<10	
Arsenic	µg/L As	8	3	6
Calcium	mg/L Ca	133	2	68
Magnesium	mg/L Mg	65	46	56
Mercury	µg/L Hg	<1	<1	
Nickel	µg/L Ni	29	23	26
Cobalt	µg/L Co	<1	<1	
Manganese	µg/L Mn	4	<10	

Reclaim Water Summary Data 2010

Parameter	Species	Maximum	Minimum	Average
pH	pH units	11.55	7.54	8.60
Cond	mS/cm	2030	723	1586.40
DO	mg/l O_2	13.42	6.98	10.14
S.S.	mg/L Solids	678	9	72
C.O.D.	mg/L O_2	179	75	120
Nitrate	mg/L NO_3^-	68	17	30
Nitrite	mg/L NO_2^-	24.53	0.03	4.15
Sulphate	mg/L SO_4^{2-}	1111	177	784
T. Ammonia	mg/L NH_3 as N	20.72	<0.04	
Lead	µg/L Pb	722	6	128
Zinc	µg/L Zn	2920	23	820
Cadmium	µg/L Cd	2	1	1
Copper	µg/L Cu	125	26	58
Iron	µg/L Fe	182	29	84
Arsenic	µg/L As	19	7	12
Magnesium	µg/L Mg	100	45	65
Mercury	µg/L Hg	<1	<1	
Chromium	µg/L Cr	2	1	2
BOD	mg/L O_2	8	3	5
Aluminum	µg/L Al	183	8	34

Tailings Management Facility Surface Water Results 2010 (Phase 2)

Date	Location	Sulphate mg/l	Lead ug/l	Zinc ug/l
28/07/2010	Phase 2 Surface	2040	87	19000

Note: Collection of surface water samples from Phase 1 TMF was discontinued as the design of the cap is changing to that of a dome shape. In September 2009 the importation of glacial till onto the surface of Phase 1 commenced. This glacial till will be incorporated into the organic layer and the dome shape will be formed. Further surface water samples may be taken when the final profile has been established.

Tailing Management Facility Spillway Sample Results 2010

Phase 1 – 3 Spillways

Parameter	Units	Maximum	Minimum	Average
Flow	m^3/hr	10	<1	
pH	pH units	8.8	7.43	7.85
Conductivity	µS/cm	8700	875	3426
Lead	µg/L Pb	775	21	146
Zinc	µg/L Zn	5060	48	566
Nitrate	mg/L NO_3^-	49	1	15
Total Ammonia	mg/l NH_3	780.80	7.71	101.72
Sulphate	mg/L SO_4^{2-}	5062	62	1734
Arsenic	µg/L As	1099	17	192.438
Cadmium	µg/L Cd	8	<1	
O-Phos	mg/l P	6.8	<0.02	
Potassium	mg/l K	664.0	3.7	92.4
BOD	mg/l O_2	209	3	57
COD	mg/l O_2	6900	63	608

Phase 2 – 3 Spillways

Parameter	Units	Maximum	Minimum	Average
Flow	m^3/hr	No Flow	No Flow	No Flow
pH	pH units	9.16	7.18	8.03
Conductivity	µS/cm	4020	904	2087
Lead	µg/L Pb	1964	22	478
Zinc	µg/L Zn	7270	47	2077
Nitrate	mg/L NO_3^-	124	1	28
Total Ammonia	mg/l NH_3	252.95	0.87	93.85
Sulphate	mg/L SO_4^{2-}	2442	17	1007
Arsenic	µg/L As	209	10	67
Cadmium	µg/L Cd	11	<1	
O-Phos	mg/l P	<0.02	<0.02	
Potassium	mg/l K	157	<1	36
BOD	mg/l O_2	178	4	57
COD	mg/l O_2	6700	80	1146

Appendix 5
Agronomic Report 2010

1. Context

The agronomy report of the mine closure plan for Galmoy Mines included as a recommendation the following: -

> The ongoing annual chemical and physical monitoring of the grass and grassland by an agronomist. This monitoring stipulated 2 annual physical inspections – one summer and one winter, annual soil analysis of the rooting layer at the rate of one composite sample per ha and biannual forage analyses – late spring and winter at the same rate. In addition a minimum 30% of grazed sheep should be subject to post mortem investigation for cadmium, lead, zinc and arsenic accumulation in selected tissues. This annual monitoring should be reported to the local authority and the EPA.

The review of the fifth year of such monitoring was carried out by EAEC Ltd, an independent firm of agronomists based in Portlaoise. The report was concluded in December 2010.

2. Background

The overall objectives of the TMF rehabilitation are to provide physical, chemical and biological stability and to provide a landuse of some merit. The landuse considered appropriate and locally compatible is low intensity agricultural grassland.

The 2009 agronomy report noted that a new approach had been agreed by all involved parties to TMF rehabilitation. The amended process is to lay a cover of local glacial till material over the TMF including areas that were under established grassland, to effect a mixing of organic and inorganic materials where organic material is in place and to sow and establish a grass clover sward of some agronomic merit in this new medium.

In addition to covering the TMF in this manner, a domed effect is considered required to be achieved and perimeter drains will be installed around each TMF. These drains are designed to accommodate a 1 in 150 year storm event. Drainage waters thus collected will be directed to the treatment lagoon.

This new process, with the exception of the drainage works, has been completed on TMF 1 in 2010. A grass clover mixture was sown on the entire area in June 2010. The sward has established well. One set of vegetation samples have been collected and chemically analysed. These will be commented on later in this report.

It is proposed to construct livestock fencing and to sow hedgerows on TMF 1 in 2011. Grazing with sheep or cattle is also proposed.

TMF 2 comprises about 14.5 ha and importation of glacial till is ongoing here. About 70% of the area here is covered at the time of inspection.

As part of the annual review the original rehabilitation trial plot was also examined. Grass cover remains well established on trial areas containing an introduced growing medium. Uncapped trial plots remain unvegetated and tailings are exposed.

Given that the TMF rehabilitation methodology is now agreed the merit of continuing this trial is open to question.

3. Forage Analyses for 2010

In 2010 arising from the change in rehabilitation approach, a set of forage sample were collected for analysis in May 2010 from the original trial area and a small area of TMF 2 which can also be considered as a trial.

A second set of forage sample were collected from the original trial area and the newly established grass on TMF 1.

Both sets of forage analyses are appended.

3.1 Spring Forage Analyses

A total of 14 forage samples were analysed for arsenic, cadmium, potassium, Kjeldahl nitrogen, phosphorous, lead and zinc across the various trial plots in May 2010.

N, P and K forage values were found to be consistent with ranges found in low intensity agricultural grassland.

All analysis reports with the exception of that from Trial Cell 9 comply with the thresholds for arsenic and lead. Cadmium levels accord with background levels present in the EIS for this development.

Zinc levels in the forage are not a concern.

Trial Cell 9 has a very shallow covering of growing medium over raw tailings and was flooded for part of the year. These factors may explain the arsenic and lead levels found.

3.2 Autumn Forage Analyses

Four forage samples were collected and analysed in early November 2010. The samples were from the new grass on phase 1 of the TMF and trial cell 5, 8 and 11.

The results of the analyses show acceptable levels in all parameters and do not raise any concerns.

4. Comments and Recommendations

The change in the rehabilitation methodology here is a work in progress. However the end use envisaged remains low intensity agricultural grassland. To this end it is proposed that the section of phase 1 of the TMF will be lightly grazed with sheep in the 2011 grazing season.

The monitoring of soil, forage and livestock across the range of parameters carried out heretofore should be continued.

The original trial plots are no longer valid comparisons and future data collected is therefore of little value. The merit in continuing the trial is low and it should be discontinued subject to the agreement of all the parties involved.

This monitoring should continue to be subject to independent agronomic reporting.

Andy Dunne – December 2010

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Analytical Report

Client ID	: ARCO.M1		
	GALMOY MINES LTD MOSSBOROUGH HOUSE GALMOY VIA THURLES CO. KILKENNY.	**Card No**	: 21042/9
		Report No	: 5706E
		No. Of Samples	: 1
		Sample Condition	: Acceptable
Agent/IC	: IAS1	**Received**	: 07/05/10
Sampler	:	**Analysis Commenced**	: 07/05/10
Reference	:	**Issued**	: 24/05/2010
Delivery Mode	: Customer	**Page**	: 1 of 1

Sample No : 5706E1
Sample Description : CELL 1

Test Description	Test Result	Unit	Method
Arsenic	0.81	mg/kg	ICP-MS Analysis LPM 6.10.4
Cadmium	0.18	mg/kg	ICP-MS Analysis LPM 6.10.4
Potassium	20050	mg/kg	ICP-MS Analysis LPM 6.10.4
Kjeldahl Nitrogen	3.7	%	Kjeldahl Nitrogen LPM 6.11.2
Phosphorus	3400	mg/kg	ICP-MS Analysis LPM 6.10.4
Lead	14.7	mg/kg	ICP-MS Analysis LPM 6.10.4
Zinc	144.6	mg/kg	ICP-MS Analysis LPM 6.10.4

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		Sample Condition	: Acceptable
Agent/IC	: IAS1	**Received**	: 07/05/10
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Reference	:	**Issued**	: 24/05/2010
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Sample No : 5706E2
Sample Description : CELL 2

Test Description	Test Result	Unit	Method
Arsenic	0.75	mg/kg	ICP-MS Analysis LPM 6.10.4
Cadmium	0.16	mg/kg	ICP-MS Analysis LPM 6.10.4
Potassium	9690	mg/kg	ICP-MS Analysis LPM 6.10.4
Kjeldahl Nitrogen	2.0	%	Kjeldahl Nitrogen LPM 6.11.2
Phosphorus	2170	mg/kg	ICP-MS Analysis LPM 6.10.4
Lead	17.4	mg/kg	ICP-MS Analysis LPM 6.10.4
Zinc	60.3	mg/kg	ICP-MS Analysis LPM 6.10.4

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Analytical Report

Client ID : ARCO.M1

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MOSSBOROUGH HOUSE
GALMOY
VIA THURLES
CO. KILKENNY.

Agent/IC : IAS1
Sampler :
Reference :
Delivery Mode : Customer

Card No : 21042/9
Report No : 5706E
No. Of Samples : 1
Sample Condition : Acceptable
Received : 07/05/10
Analysis Commenced : 07/05/10
Issued : 24/05/2010

Sample No : 5706E3
Sample Description : CELL 3

Test Description	Test Result	Unit	Method
Arsenic	1.11	mg/kg	ICP-MS Analysis LPM 6.10.4
Cadmium	0.19	mg/kg	ICP-MS Analysis LPM 6.10.4
Potassium	10950	mg/kg	ICP-MS Analysis LPM 6.10.4
Kjeldahl Nitrogen	1.9	%	Kjeldahl Nitrogen LPM 6.11.2
Phosphorus	2490	mg/kg	ICP-MS Analysis LPM 6.10.4
Lead	24.9	mg/kg	ICP-MS Analysis LPM 6.10.4
Zinc	65.4	mg/kg	ICP-MS Analysis LPM 6.10.4

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Analytical Report

Client ID	: ARCO.M1		
	GALMOY MINES LTD MOSSBOROUGH HOUSE GALMOY VIA THURLES CO. KILKENNY.	**Card No**	: 21042/9
		Report No	: 5706E
		No. Of Samples	: 1
		Sample Condition	: Acceptable
Agent/IC	: IAS1	**Received**	: 07/05/10
Sampler	:	**Analysis Commenced**	: 07/05/10
Reference	:	**Issued**	: 24/05/2010
Delivery Mode	: Customer	**Page**	: 1 of 1

Sample No : 5706E4
Sample Description : CELL 4

Test Description	Test Result	Unit	Method
Arsenic	0.61	mg/kg	ICP-MS Analysis LPM 6.10.4
Cadmium	0.15	mg/kg	ICP-MS Analysis LPM 6.10.4
Potassium	12790	mg/kg	ICP-MS Analysis LPM 6.10.4
Kjeldahl Nitrogen	2.0	%	Kjeldahl Nitrogen LPM 6.11.2
Phosphorus	3200	mg/kg	ICP-MS Analysis LPM 6.10.4
Lead	17.4	mg/kg	ICP-MS Analysis LPM 6.10.4
Zinc	50.9	mg/kg	ICP-MS Analysis LPM 6.10.4

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Analytical Report

Client ID : ARCO.M1

GALMOY MINES LTD
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GALMOY
VIA THURLES
CO. KILKENNY.

Agent/IC : IAS1
Sampler :
Reference :
Delivery Mode : Customer

Card No : 21042/9
Report No : 5706E
No. Of Samples : 1
Sample Condition : Not Acceptable
Received : 07/05/10
Analysis Commenced : 07/05/10
Issued : 24/05/2010

Sample No : 5706E5
Sample Description : CELL 5

Test Description	Test Result	Unit	Method
Arsenic	0.56	mg/kg	ICP-MS Analysis LPM 6.10.4
Cadmium	0.17	mg/kg	ICP-MS Analysis LPM 6.10.4
Potassium	8240	mg/kg	ICP-MS Analysis LPM 6.10.4
Kjeldahl Nitrogen	1.7	%	Kjeldahl Nitrogen LPM 6.11.2
Phosphorus	2150	mg/kg	ICP-MS Analysis LPM 6.10.4
Lead	18.6	mg/kg	ICP-MS Analysis LPM 6.10.4
Zinc	47	mg/kg	ICP-MS Analysis LPM 6.10.4

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Analytical Report

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	GALMOY MINES LTD MOSSBOROUGH HOUSE GALMOY VIA THURLES CO. KILKENNY.	**Card No**	: 21042/9
		Report No	: 5706E
		No. Of Samples	: 1
		Sample Condition	: Acceptable
Agent/IC	: IAS1	**Received**	: 07/05/10
Sampler	:	**Analysis Commenced**	: 07/05/10
Reference	:	**Issued**	: 24/05/2010
Delivery Mode	: Customer	**Page**	: 1 of 1

Sample No : 5706E6
Sample Description : CELL 6A

Test Description	Test Result	Unit	Method
Arsenic	0.89	mg/kg	ICP-MS Analysis LPM 6.10.4
Cadmium	0.21	mg/kg	ICP-MS Analysis LPM 6.10.4
Potassium	8470	mg/kg	ICP-MS Analysis LPM 6.10.4
Kjeldahl Nitrogen	1.8	%	Kjeldahl Nitrogen LPM 6.11.2
Phosphorus	1780	mg/kg	ICP-MS Analysis LPM 6.10.4
Lead	21.3	mg/kg	ICP-MS Analysis LPM 6.10.4
Zinc	82.7	mg/kg	ICP-MS Analysis LPM 6.10.4

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Analytical Report

Client ID	: ARCO.M1		
	GALMOY MINES LTD MOSSBOROUGH HOUSE GALMOY VIA THURLES CO. KILKENNY.	**Card No**	: 21042/9
		Report No	: 5706E
		No. Of Samples	: 1
		Sample Condition	: Acceptable
Agent/IC	: IAS1	**Received**	: 07/05/10
Sampler	:	**Analysis Commenced**	: 07/05/10
Reference	:	**Issued**	: 24/05/2010
Delivery Mode	: Customer	**Page**	: 1 of 1

Sample No : 5706E7
Sample Description : CELL 6B

Test Description	Test Result	Unit	Method
Arsenic	1.33	mg/kg	ICP-MS Analysis LPM 6.10.4
Cadmium	0.21	mg/kg	ICP-MS Analysis LPM 6.10.4
Potassium	14210	mg/kg	ICP-MS Analysis LPM 6.10.4
Kjeldahl Nitrogen	2.5	%	Kjeldahl Nitrogen LPM 6.11.2
Phosphorus	2410	mg/kg	ICP-MS Analysis LPM 6.10.4
Lead	15.5	mg/kg	ICP-MS Analysis LPM 6.10.4
Zinc	167.2	mg/kg	ICP-MS Analysis LPM 6.10.4

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Analytical Report

Client ID	: ARCO.M1		
	GALMOY MINES LTD MOSSBOROUGH HOUSE GALMOY VIA THURLES CO. KILKENNY.	**Card No**	: 21042/9
		Report No	: 5706E
		No. Of Samples	: 1
		Sample Condition	: Acceptable
Agent/IC	: IAS1	**Received**	: 07/05/10
Sampler	:	**Analysis Commenced**	: 07/05/10
Reference	:	**Issued**	: 24/05/2010
Delivery Mode	: Customer	**Page**	: 1 of 1

Sample No : 5706E8
Sample Description : CELL 7

Test Description	Test Result	Unit	Method
Arsenic	1.12	mg/kg	ICP-MS Analysis LPM 6.10.4
Cadmium	0.15	mg/kg	ICP-MS Analysis LPM 6.10.4
Potassium	5900	mg/kg	ICP-MS Analysis LPM 6.10.4
Kjeldahl Nitrogen	1.3	%	Kjeldahl Nitrogen LPM 6.11.2
Phosphorus	1330	mg/kg	ICP-MS Analysis LPM 6.10.4
Lead	18.60	mg/kg	ICP-MS Analysis LPM 6.10.4
Zinc	48.8	mg/kg	ICP-MS Analysis LPM 6.10.4

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Kilcarrig Street, Bagenalstown, Co. Carlow.
Phone: (059)9721022/9721079. Fax: (059)9721897

Analytical Report

Client ID	: ARCO.M1		
	GALMOY MINES LTD MOSSBOROUGH HOUSE GALMOY VIA THURLES CO. KILKENNY.	**Card No**	: 21042/9
		Report No	: 5706E
		No. Of Samples	: 1
		Sample Condition	: Acceptable
Agent/IC	: IAS1	**Received**	: 07/05/10
Sampler	:	**Analysis Commenced**	: 07/05/10
Reference	:	**Issued**	: 24/05/2010
Delivery Mode	: Customer	**Page**	: 1 of 1

Sample No : 5706E9
Sample Description : CELL 8

Test Description	Test Result	Unit	Method
Arsenic	1.67	mg/kg	ICP-MS Analysis LPM 6.10.4
Cadmium	0.26	mg/kg	ICP-MS Analysis LPM 6.10.4
Potassium	7770	mg/kg	ICP-MS Analysis LPM 6.10.4
Kjeldahl Nitrogen	1.5	%	Kjeldahl Nitrogen LPM 6.11.2
Phosphorus	1700	mg/kg	ICP-MS Analysis LPM 6.10.4
Lead	35.4	mg/kg	ICP-MS Analysis LPM 6.10.4
Zinc	72.2	mg/kg	ICP-MS Analysis LPM 6.10.4

W. McCall

WENDY McCALL
LABORATORY MANAGER

Independent Analytical Supplies Ltd.

Kilcarrig Street, Bagenalstown, Co. Carlow.
Phone: (059)9721022/9721079. Fax: (059)9721897

Analytical Report

Client ID : ARCO.M1

GALMOY MINES LTD
MOSSBOROUGH HOUSE
GALMOY
VIA THURLES
CO. KILKENNY.

Agent/IC : IAS1
Sampler :
Reference :
Delivery Mode : Customer

Card No : 21042/5
Report No : 5707E
No. Of Samples : 1
Sample Condition : Acceptable
Received : 07/05/10
Analysis Commenced : 07/05/10
Issued : 24/05/2010

Sample No : 5707E1
Sample Description : CELL 9

Test Description	Test Result	Unit	Method
Arsenic	2.18	mg/kg	ICP-MS Analysis LPM 6.10.4
Cadmium	0.36	mg/kg	ICP-MS Analysis LPM 6.10.4
Potassium	9370	mg/kg	ICP-MS Analysis LPM 6.10.4
Kjeldahl Nitrogen	1.8	%	Kjeldahl Nitrogen LPM 6.11.2
Phosphorus	2520	mg/kg	ICP-MS Analysis LPM 6.10.4
Lead	46.1	mg/kg	ICP-MS Analysis LPM 6.10.4
Zinc	107.9	mg/kg	ICP-MS Analysis LPM 6.10.4

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Analytical Report

Client ID	: ARCO.M1		
	GALMOY MINES LTD MOSSBOROUGH HOUSE GALMOY VIA THURLES CO. KILKENNY.	**Card No**	: 21042/5
		Report No	: 5707E
		No. Of Samples	: 1
		Sample Condition	: Acceptable
Agent/IC	: IAS1	**Received**	: 07/05/10
Sampler	:	**Analysis Commenced**	: 07/05/10
Reference	:	**Issued**	: 24/05/2010
Delivery Mode	: Customer	**Page**	: 1 of 1

Sample No : 5707E2
Sample Description : CELL 10

Test Description	Test Result	Unit	Method
Arsenic	0.48	mg/kg	ICP-MS Analysis LPM 6.10.4
Cadmium	0.1	mg/kg	ICP-MS Analysis LPM 6.10.4
Potassium	14560	mg/kg	ICP-MS Analysis LPM 6.10.4
Kjeldahl Nitrogen	1.9	%	Kjeldahl Nitrogen LPM 6.11.2
Phosphorus	2600	mg/kg	ICP-MS Analysis LPM 6.10.4
Lead	18	mg/kg	ICP-MS Analysis LPM 6.10.4
Zinc	48.7	mg/kg	ICP-MS Analysis LPM 6.10.4

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Phone: (059)9721022/9721079. Fax: (059)9721897

Analytical Report

Client ID	: ARCO.M1		
	GALMOY MINES LTD MOSSBOROUGH HOUSE GALMOY VIA THURLES CO. KILKENNY.	**Card No**	: 21042/5
		Report No	: 5707E
		No. Of Samples	: 1
		Sample Condition	: Acceptable
Agent/IC	: IAS1	**Received**	: 07/05/10
Sampler	:	**Analysis Commenced**	: 07/05/10
Reference	:	**Issued**	: 24/05/2010
Delivery Mode	: Customer	**Page**	: 1 of 1

Sample No : 5707E3
Sample Description : CELL 11

Test Description	Test Result	Unit	Method
Arsenic	0.97	mg/kg	ICP-MS Analysis LPM 6.10.4
Cadmium	0.17	mg/kg	ICP-MS Analysis LPM 6.10.4
Potassium	11130	mg/kg	ICP-MS Analysis LPM 6.10.4
Kjeldahl Nitrogen	1.8	%	Kjeldahl Nitrogen LPM 6.11.2
Phosphorus	2250	mg/kg	ICP-MS Analysis LPM 6.10.4
Lead	28.4	mg/kg	ICP-MS Analysis LPM 6.10.4
Zinc	76.7	mg/kg	ICP-MS Analysis LPM 6.10.4

W. McCall

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Kilcarrig Street, Bagenalstown, Co. Carlow.
Phone: (059)9721022/9721079. Fax: (059)9721897

Analytical Report

Client ID : ARCO.M1

GALMOY MINES LTD
MOSSBOROUGH HOUSE
GALMOY
VIA THURLES
CO. KILKENNY.

Agent/IC : IAS1
Sampler :
Reference :
Delivery Mode : Customer

Card No : 21042/5
Report No : 5707E
No. Of Samples : 1
Sample Condition : Acceptable
Received : 07/05/10
Analysis Commenced : 07/05/10
Issued : 24/05/2010

Sample No : 5707E4
Sample Description : CELL 12

Test Description	Test Result	Unit	Method
Arsenic	1.3	mg/kg	ICP-MS Analysis LPM 6.10.4
Cadmium	0.23	mg/kg	ICP-MS Analysis LPM 6.10.4
Potassium	13690	mg/kg	ICP-MS Analysis LPM 6.10.4
Kjeldahl Nitrogen	2.1	%	Kjeldahl Nitrogen LPM 6.11.2
Phosphorus	2680	mg/kg	ICP-MS Analysis LPM 6.10.4
Lead	28.7	mg/kg	ICP-MS Analysis LPM 6.10.4
Zinc	109.6	mg/kg	ICP-MS Analysis LPM 6.10.4

W. McCall

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Independent Analytical Supplies Ltd.

Kilcarrig Street, Bagenalstown, Co. Carlow.
Phone: (059)9721022/9721079. Fax: (059)9721897

Analytical Report

Client ID : ARCO.M1

GALMOY MINES LTD
MOSSBOROUGH HOUSE
GALMOY
VIA THURLES
CO. KILKENNY.

Agent/IC : IAS1
Sampler :
Reference :
Delivery Mode : Customer

Card No : 21042/5
Report No : 5707E
No. Of Samples : 1
Sample Condition : Acceptable
Received : 07/05/10
Analysis Commenced : 07/05/10
Issued : 24/05/2010

Sample No : 5707E5
Sample Description : PHASE 2 ORMONDE CELL

Test Description	Test Result	Unit	Method
Arsenic	0.25	mg/kg	ICP-MS Analysis LPM 6.10.4
Cadmium	0.09	mg/kg	ICP-MS Analysis LPM 6.10.4
Potassium	19920	mg/kg	ICP-MS Analysis LPM 6.10.4
Kjeldahl Nitrogen	3.4	%	Kjeldahl Nitrogen LPM 6.11.2
Phosphorus	2340	mg/kg	ICP-MS Analysis LPM 6.10.4
Lead	4	mg/kg	ICP-MS Analysis LPM 6.10.4
Zinc	157.3	mg/kg	ICP-MS Analysis LPM 6.10.4

W. McCall

WENDY McCALL
LABORATORY MANAGER

IAS LABORATORIES

Independent Analytical Supplies

Test Report

Lab Report Number:	**7207E02**	**Analysis Number:**	**99A/50789**

Customer ID:	ARCO.M1	**Analysis Type:**	Misc. Tests (99A)
Contact Name:	CORMAC LLOYD	**Delivery By:**	Customer
Company Name:	GALMOY MINES LTD	**Sample Card Number:**	26536/5
Address:	MOSSBOROUGH HOUSE GALMOY VIA THURLES CO. KILKENNY.	**Sample Condition:**	Acceptable
Sample Type:	Grass	**Date Sample Received:**	02/11/2010
Sample Reference:		**Date Analysis Commenced:**	02/11/2010
Sample Description:	PHASE 1	**Date Certificate Issued:**	18/11/2010

Parameter	Method	Result	Unit
Arsenic	ICP-MS	0.1	mg/kg
Cadmium	ICP-MS	0.6	mg/kg
Potassium	ICP-MS	32000	mg/kg
Kjeldahl Nitrogen	Kjeldahl Nitrogen	4.70	%
Phosphorus	ICP-MS	4800	mg/kg
Lead	ICP-MS	2.1	mg/kg
Zinc	ICP-MS	64	mg/kg

Signed: W. McCall Date: 18/11/10

Wendy McCall - Laboratory Manager

^ = Subcontracted

IAS LABORATORIES

Independent Analytical Supplies

Test Report

Lab Report Number:	**7207E03**	**Analysis Number:**	**99A/50790**

Customer ID:	ARCO.M1	**Analysis Type:**	Misc. Tests (99A)
Contact Name:	CORMAC LLOYD	**Delivery By:**	Customer
Company Name:	GALMOY MINES LTD	**Sample Card Number:**	26536/5
Address:	MOSSBOROUGH HOUSE GALMOY VIA THURLES CO. KILKENNY.	**Sample Condition:**	Acceptable
Sample Type:	Grass	**Date Sample Received:**	02/11/2010
Sample Reference:		**Date Analysis Commenced:**	02/11/2010
Sample Description:	CELL 5	**Date Certificate Issued:**	18/11/2010

Parameter	Method	Result	Unit
Arsenic	ICP-MS	0.1	mg/kg
Cadmium	ICP-MS	<0.1	mg/kg
Potassium	ICP-MS	9700	mg/kg
Kjeldahl Nitrogen	Kjeldahl Nitrogen	1.4	%
Phosphorus	ICP-MS	2100	mg/kg
Lead	ICP-MS	7.4	mg/kg
Zinc	ICP-MS	20.2	mg/kg

Signed: W. McCall Date: 18/11/10

Wendy McCall - Laboratory Manager

^ = Subcontracted

IAS LABORATORIES

Independent Analytical Supplies

Test Report

Lab Report Number:	7207E04	Analysis Number:	99A/50791

Customer ID:	ARCO.M1	**Analysis Type:**	Misc. Tests (99A)
Contact Name:	CORMAC LLOYD	**Delivery By:**	Customer
Company Name:	GALMOY MINES LTD	**Sample Card Number:**	26536/5
Address:	MOSSBOROUGH HOUSE GALMOY VIA THURLES CO. KILKENNY.	**Sample Condition:**	Acceptable
Sample Type:	Grass	**Date Sample Received:**	02/11/2010
Sample Reference:		**Date Analysis Commenced:**	02/11/2010
Sample Description:	CELL 8	**Date Certificate Issued:**	18/11/2010

Parameter	Method	Result	Unit
Arsenic	ICP-MS	0.1	mg/kg
Cadmium	ICP-MS	<0.1	mg/kg
Potassium	ICP-MS	7300	mg/kg
Kjeldahl Nitrogen	Kjeldahl Nitrogen	0.98	%
Phosphorus	ICP-MS	1500	mg/kg
Lead	ICP-MS	7.4	mg/kg
Zinc	ICP-MS	19	mg/kg

Signed: W. McCall Date: 18/11/10

Wendy McCall - Laboratory Manager

^ = Subcontracted

IAS LABORATORIES

Independent Analytical Supplies

Test Report

Lab Report Number:	**7207E05**	**Analysis Number:**	**99A/50792**

Customer ID:	ARCO.M1	**Analysis Type:**	Misc. Tests (99A)
Contact Name:	CORMAC LLOYD	**Delivery By:**	Customer
Company Name:	GALMOY MINES LTD	**Sample Card Number:**	26536/5
Address:	MOSSBOROUGH HOUSE GALMOY VIA THURLES CO. KILKENNY.	**Sample Condition:**	Acceptable
Sample Type:	Grass	**Date Sample Received:**	02/11/2010
Sample Reference:		**Date Analysis Commenced:**	02/11/2010
Sample Description:	CELL 11	**Date Certificate Issued:**	18/11/2010

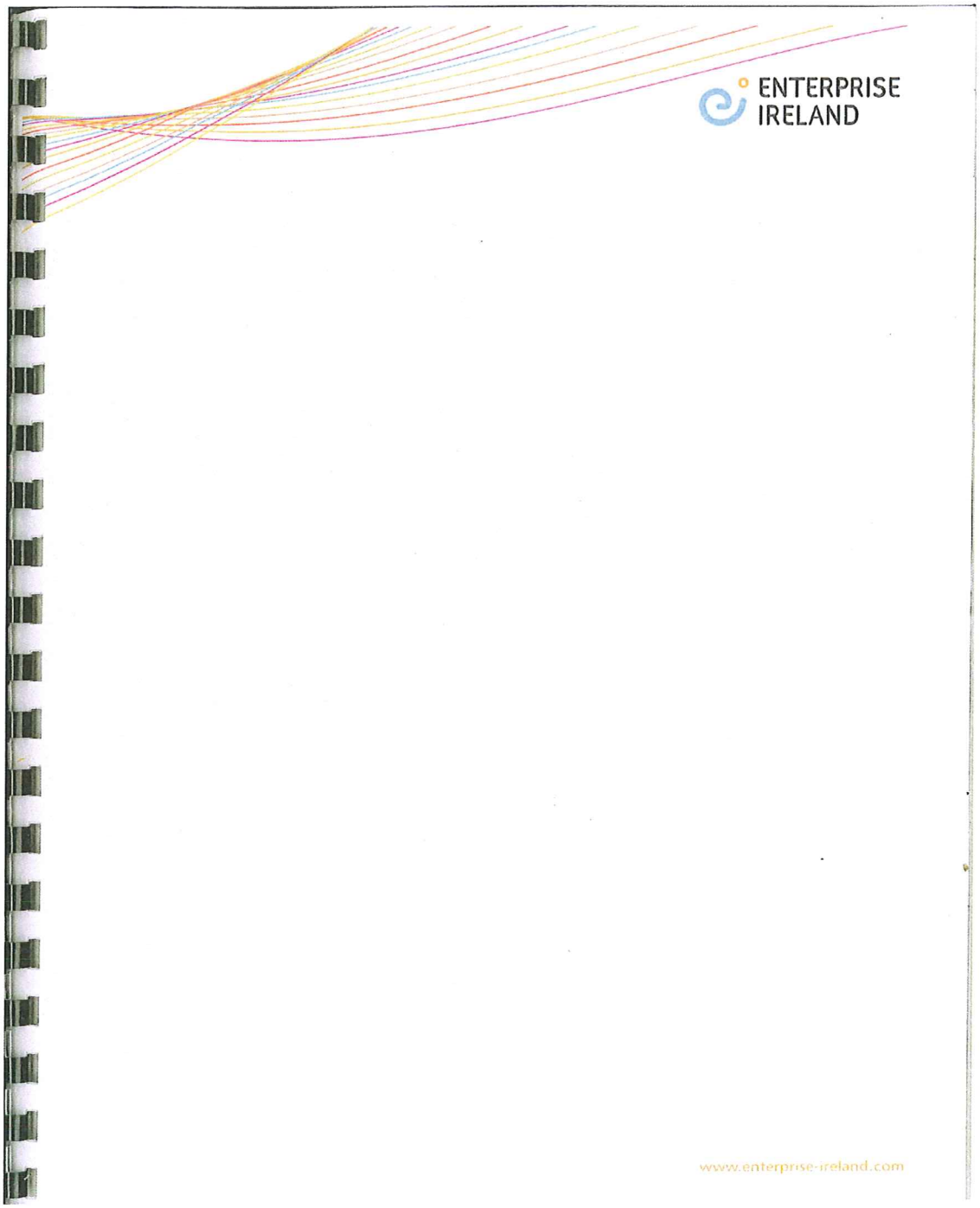
Parameter	Method	Result	Unit
Arsenic	ICP-MS	0.1	mg/kg
Cadmium	ICP-MS	0.1	mg/kg
Potassium	ICP-MS	12500	mg/kg
Kjeldahl Nitrogen	Kjeldahl Nitrogen	1.57	%
Phosphorus	ICP-MS	2300	mg/kg
Lead	ICP-MS	7.1	mg/kg
Zinc	ICP-MS	27	mg/kg

Signed: W. McCall Date: 18/11/10

Wendy McCall - Laboratory Manager

^ = Subcontracted

Appendix 6
Toxicity Report 2010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ENTERPRISE IRELAND

CONFIDENTIAL REPORT
SHANNON AQUATIC TOXICITY LABORATORY

Front Cover Report Sheet

Dept. Toxicity
Sheet no. 1 of 3 sheets

Tox F020 Ver. 2.2

Customer
Galmoy Mines Ltd
Galmoy
Via Thurles
Co. Kilkenny

Title
Toxicological analysis of an effluent sample

Attn: Mr. Cormac Lloyd

Report reference: 10T042

Order no.: 48470

Report by: Robert Hernan

Date received: 20.04.10

Approved by: Kathleen O' Rourke
Toxicologist

Copies to: R.6. Files

Date of issue: 04.05.10

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4. Payment for work carried out shall be in accordance with the terms stated on Enterprise Ireland's invoices
5. No action or legal proceeding shall be taken (except in the case of wilful neglect or default) against Enterprise Ireland or the Board or any member of the Board or any committee appointed by the Board or any officer or servant of Enterprise Ireland by reason of or arising out of the carrying out of research, investigation, test or analysis or the publication of the results thereof in the name of Enterprise Ireland.
6. Enterprise Ireland will not release any information received from or provided to the client in relation to this report except as may be required by law, including the Freedom of Information Act 1997, or as specified by the client.
7. This contract is governed by the laws of Ireland whose courts shall have exclusive jurisdiction.

Test report relates only to the sample(s) tested

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SHANNON AQUATIC TOXICITY LABORATORY

ENTERPRISE IRELAND

TOXICOLOGICAL ANALYSIS REPORT Form No.: ToxF035-2 Ver 2.2

SAMPLE INFORMATION

	SATL	Customer	Other
Sampled by:	☐	☑	☐
Collected by:	☐	☑	☐

Tox Ref. No.	10T042
Sampling procedure	n/a
Date of analysis	20.04.10
Storage conditions (°C)	3±3
Temperature (°C)	16.5
pH (at 17.4 °C)	8.0
Dissolved oxygen (mg/l)	9.7
Dissolved oxygen (% saturation)	103
Conductivity (µS/cm at 25°C)	922
Salinity (ppt at 20°C)	<1

Toxicity Test Methods and Procedures

1. Freshwater Crustacean
Method 6.1 based on ISO 6341:1996/Cor.1:1998: 'Water quality – Determination of the inhibition of the mobility of *Daphnia magna* Straus (Cladocera, Crustacea) – Acute toxicity test'

2. Marine Bacterium
Method 6.2 based on BS EN ISO 11348-3:1999: 'Water quality – Determination of the inhibitory effect of water samples on the light emission of *Vibrio fischeri* (Luminescent bacteria test) – Part 3: Method using freeze-dried bacteria'

3. Marine Copepod
Method 6.3 based on ISO 14669:1999: 'Water quality – Determination of acute lethal toxicity to marine copepods (*Copepoda, Crustacea*)'

4. Marine Algae
Method 6.4 based on ISO 10253:2006: 'Water quality – Marine algal growth inhibition test with *Skeletonema costatum* and *Phaeodactylum tricornutum*'

5. Freshwater Algae
Method 6.5 based on ISO 8692:2004 : 'Water quality – Freshwater algal growth inhibition test with unicellular green algae' [*Pseudokirchneriella subcapitata*]

6. Freshwater Plant
Method 6.6 based on ISO 20079:2005: 'Water quality – Determination of the toxic effect of water constituents and waste water to duckweed (*Lemna minor*) – Duckweed growth inhibition test'

7. Marine Fish
Method 6.7 based on OECD 1992: Guideline 203: – 'Fish, acute toxicity test'

8. Freshwater Fish
Method 6.8 based on OECD 1992: Guideline 203: – 'Fish, acute toxicity test'

9. Estuarine Crustacean
Method 6.9 based on MAFF SOP No. BEG/030:1996: 'Brown Shrimp (*Crangon crangon*) 96 h acute toxicity for liquid effluents and wastes'

10. Marine Amphipod
Method 6.10 based on ICES, No. 28, 2001: 'Biological effects of contaminants: *Corophium* sp. sediment bioassay and toxicity test'

11. Eluate Generation
Procedure 4.7.8. "Eluate Generation" based on DIN 38 414 part 4, 1984: – 'Sludge and Sediments (Group S) – Determination of leachability by water (S4)'

Appendix 7
Pollution Release and Transfer Register 2010

Environmental Protection Agency

| PRTR# : P0517 | Facility Name : Galmoy Mines Limited | Filename : p0517_2010.xls | Return Year : 2010 |

Guidance to completing the PRTR workbook

AER Returns Workbook

Version 1.1.11

REFERENCE YEAR	2010

1. FACILITY IDENTIFICATION

Parent Company Name	Galmoy Mines Limited
Facility Name	Galmoy Mines Limited
PRTR Identification Number	P0517
Licence Number	P0517-01

Waste or IPPC Classes of Activity

No.	class_name
1.3	##

Address 1	Galmoy
Address 2	Via Thurles
Address 3	Co Kilkenny
Address 4	
Country	Ireland
Coordinates of Location	-7.59531 52.8069
River Basin District	IESE
NACE Code	0729
Main Economic Activity	Mining of other non-ferrous metal ores
AER Returns Contact Name	John Stapleton
AER Returns Contact Email Address	cora.devoy@galmoy.ie
AER Returns Contact Position	Environmental Superintendent
AER Returns Contact Telephone Number	056-8837140
AER Returns Contact Mobile Phone Number	
AER Returns Contact Fax Number	056-8837105
Production Volume	155627.0
Production Volume Units	DMT
Number of Installations	1
Number of Operating Hours in Year	0
Number of Employees	45
User Feedback/Comments	
Web Address	

2. PRTR CLASS ACTIVITIES

Activity Number	Activity Name
3(a)	Underground mining and related operations

3. SOLVENTS REGULATIONS (S.I. No. 543 of 2002)

Is it applicable?	No
Have you been granted an exemption ?	
If applicable which activity class applies (as per Schedule 2 of the regulations) ?	
Is the reduction scheme compliance route being used ?	

4.2 RELEASES TO WATERS

Link to previous years emissions data

| PRTR# : P0517 | Facility Name : Galmoy Mines Limited | Filename : p0517_2010.xls | Return Year : 2010 | 08/04/2011 16:32

SECTION A : SECTOR SPECIFIC PRTR POLLUTANTS

Data on ambient monitoring of storm/surface water or groundwater, conducted as part of your licence requirements, should NOT be submitted under AER / PRTR Reporting as this only con

RELEASES TO WATERS					Please enter all quantities in this section in KGs				
POLLUTANT								QUANTITY	
			Method Used		Discharge Effluent	Stream Augmentation			
No. Annex II	Name	M/C/E	Method Code	Designation or Description	Emission Point 1	Emission Point 2	T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
22	Nickel and compounds (as Ni)	M	OTH	Std methods 3110 A -Ni Atomic Absorption Spectrometry Method: 1995 19th Edition APHA	258.0	4.039	262.039	0.0	0.0
23	Lead and compounds (as Pb)	M	OTH	Std methods 3110 A -Pb Atomic Absorption Spectrometry Method: 1995 19th Edition APHA	28.0	0.246	28.246	0.0	0.0
24	Zinc and compounds (as Zn)	M	OTH	Std methods 3500 -Zn C Inductively Coupled Plasma Method: 1995 19th Edition APHA	448.0	4.493	452.493	0.0	0.0
17	Arsenic and compounds (as As)	M	OTH	Std methods 3110 A -As Atomic Absorption Spectrometry Method: 1995 19th Edition APHA	36.0	0.612	36.612	0.0	0.0
20	Copper and compounds (as Cu)	M	OTH	Std methods 3110 A -Cu Atomic Absorption Spectrometry Method: 1995 19th Edition APHA	29.0	0.0	29.0	0.0	0.0
18	Cadmium and compounds (as Cd)	M	OTH	Std methods 3110 A -Cd Atomic Absorption Spectrometry Method: 1995 19th Edition APHA	0.0	0.0	0.0	0.0	0.0

* Select a row by double-clicking on the Pollutant Name (Column B) then click the delete button

SECTION B : REMAINING PRTR POLLUTANTS

RELEASES TO WATERS					Please enter all quantities in this section in KGs				
POLLUTANT								QUANTITY	
			Method Used		Discharge Effluent	Stream Augmentation			
No. Annex II	Name	M/C/E	Method Code	Designation or Description	Emission Point 1	Emission Point 2	T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
21	Mercury and compounds (as Hg)	M	OTH	Std Methods 3112 B Cold Vapour Atomic Absorption Spectrometric Method 1995, 19th Edition APHA	0.0	0.031	0.031	0.0	0.0

* Select a row by double-clicking on the Pollutant Name (Column B) then click the delete button

SECTION C : REMAINING POLLUTANT EMISSIONS (as required in your Licence)

RELEASES TO WATERS					Please enter all quantities in this section in KGs				
POLLUTANT								QUANTITY	
			Method Used		Discharge Effluent	Stream Augmentation			
Pollutant No.	Name	M/C/E	Method Code	Designation or Description	Emission Point 1	Emission Point 2	T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
303	BOD	M	OTH	Std Methods 5210 B 5-Day BOD Test 1995, 19th Edition APHA	6169.0	0.0	6169.0	0.0	0.0
306	COD	M	OTH	Std Methods 5220 D COD Test 1995, 19th Edition APHA	52314.0	0.0	52314.0	0.0	0.0
351	Total Organic Carbon (as C)	M	EN 1484:1997		17483.0	0.0	17483.0	0.0	0.0

355	Aluminium	M	OTH	Std methods 3110 A -Al Atomic Absorption Spectrometry Method: 1995 19th Edition APHA	68.0	2.228	70.228	0.0	0.0
238	Ammonia (as N)	M	OTH	Std methods 4110 Determination of Anions by Ion Chromatography: 1995 19th Edition APHA	2815.0	54.862	2869.862	0.0	0.0
373	Barium	M	OTH	Std methods 3110 A -Ba Atomic Absorption Spectrometry Method: 1995 19th Edition APHA	1336.0	0.0	1336.0	0.0	0.0
356	Cobalt	M	OTH	Std methods 3110 A -Co Atomic Absorption Spectrometry Method: 1995 19th Edition APHA	77.0	0.0	77.0	0.0	0.0
314	Fats, Oils and Greases	M	OTH	Std methods 5520 D -Oil and Grease Soxhlet Extraction Method: 1995 19th Edition APHA	0.0	0.0	0.0	0.0	0.0
357	Iron	M	OTH	Std methods 3110 A -Fe Atomic Absorption Spectrometry Method: 1995 19th Edition APHA	88.0	0.836	88.836	0.0	0.0
320	Magnesium	M	OTH	Std methods 3500 -Mg C Inductively Coupled Plasma Method: 1995 19th Edition APHA	188889.0	2142.0	191031.0	0.0	0.0
321	Manganese (as Mn)	M	OTH	Std methods 3500 -Mn C Inductively Coupled Plasma Method: 1995 19th Edition APHA	0.0	0.306	0.306	0.0	0.0
327	Nitrate (as N)	M	OTH	Std methods 4110 Determination of Anions by Ion Chromatography: 1995 19th Edition APHA	13544.0	178.55	13722.55	0.0	0.0
372	Nitrite (as N)	M	OTH	Std methods 4500-NO2- B Nitrite Colorimetric Method: 1995 19th Edition APHA	407.0	2.21	409.21	0.0	0.0
343	Sulphate	M	OTH	Std methods 4110 Determination of Anions by Ion Chromatography: 1995 19th Edition APHA	1135201.0	17132.0	1152333.0	0.0	0.0
240	**Suspended Solids**	M	OTH	Std methods 2540 -D Total Suspended Solids Dried at 103 - 105oC: 1995 19th Edition APHA	45249.0	725.0	45974.0	0.0	0.0

* Select a row by double-clicking on the Pollutant Name (Column B) then click the delete button

5. ONSITE TREATMENT & OFFSITE TRANSFERS OF WASTE

| PRTR# : P0517 | Facility Name : Galmoy Mines Limited | Filename : p0517_2010.xls | Return Year : 2010 |

08/04/2011 16:32

Please enter all quantities on this sheet in Tonnes

0

Transfer Destination	European Waste Code	Hazardous	Quantity (Tonnes per Year)	Description of Waste	Waste Treatment Operation	Method Used		Location of Treatment	Haz Waste : Name and Licence/Permit No of Next Destination Facility Non Haz Waste: Name and Licence/Permit No of Recover/Disposer	Haz Waste : Address of Next Destination Facility Non Haz Waste: Address of Recover/Disposer	Name and License / Permit No. and Address of Final Recoverer / Disposer (HAZARDOUS WASTE ONLY)	Actual Address of Final Destination i.e. Final Recovery / Disposal Site (HAZARDOUS WASTE ONLY)
						M/C/E	Method Used					
Within the Country	16 06 01	Yes	0.66	lead batteries	R4	M	Weighed	Offsite in Ireland	Hi Volt Ireland Ltd. ,WCP/KK/284/05	Ballyduff,,,Thurles Co. Tipperary,NA,Ireland	Hi Volt Ireland Ltd,WCP/KK/284/05,Ballyduff,,,Thurles Co Tipperary,NA,Ireland	Ballyduff,,,Thurles Co Tipperary,NA,Ireland
Within the Country	13 08 99	Yes	0.8	wastes not otherwise specified	R9	M	Weighed	Offsite in Ireland	Enva Ireland ,WCP/KK/059(A)/07	Clonminham Ind Est,,,Portlaoise,NA,Ireland	Enva Ireland . Portlaoise Co. Laois . Ireland,WCP/KK/059(A)/07,Clonminam Industrial Estate,,,Portlaoise,NA,Ireland	Clonminam Industrial Estate,,,Portlaoise,NA,Ireland
Within the Country	16 01 07	Yes	0.86	oil filters	R9	M	Weighed	Offsite in Ireland	Enva Ireland ,WCP/KK/059(A)/07	Clonminham Ind Est,,,Portlaoise,NA,Ireland	Enva Ireland . Portlaoise Co. Laois . Ireland,WCP/KK/059(A)/07,Clonminam Industrial Estate,,,Portlaoise,NA,Ireland	Clonminam Industrial Estate,,,Portlaoise,NA,Ireland
To Other Countries	13 08 99	Yes	0.62	wastes not otherwise specified	R9	M	Weighed	Abroad	Enva Ireland ,WCP/KK/059(A)/07	Clonminham Ind Est,,,Portlaoise,NA,Ireland	Lindenschmidt KG,E9Z095037,Krombacker StraBe 42/46,D - 57223 Kreuztal,Krombach,NA,Germany	Krombacker StraBe 42/46,D - 57223 Kreuztal,Krombach,NA,Germany
Within the Country	13 07 03	Yes	29.48	other fuels (including mixtures)	R9	M	Weighed	Offsite in Ireland	Enva Ireland ,WCP/KK/059(A)/07	Clonminham Ind Est,,,Portlaoise,NA,Ireland	Enva Ireland . Portlaoise Co. Laois . Ireland,WCP/KK/059(A)/07,Clonminam Industrial Estate,,,Portlaoise,NA,Ireland	Clonminam Industrial Estate,,,Portlaoise,NA,Ireland
To Other Countries	16 05 06	Yes	0.78	laboratory chemicals, consisting of or containing dangerous substances, including mixtures of laboratory chemicals	D10	M	Weighed	Abroad	Indaver Ireland Ltd,WCP/KK/031(A)/07	4 Haddington Terrace,,Dun Laoghaire Co Dublin,NA,Ireland	AVG Borsigstrasse 2,107ZEB002,AVG Borsigstrasse 2,D 22113 ,Hamburg,D22113,Germany	AVG Borsigstrasse 2,D 22113 ,Hamburg,D22113,Germany
Within the Country	20 03 01	No	35.58	mixed municipal waste	D1	M	Weighed	Onsite in Ireland	Greenstar,WCP/KK/054(A)/05	Ballyogan Business Park Ballyogan Rd,Unit 6,Sandyford ,Dublin 18,Ireland		
Within the Country	17 02 01	No	7.46	wood	R3	M	Weighed	Onsite in Ireland	Greenstar,WCP/KK/054(A)/05	Ballyogan Business Park Ballyogan Rd,Unit 6,Sandyford ,Dublin 18,Ireland		
Within the Country	17 02 03	No	6.32	plastic	R5	M	Weighed	Offsite in Ireland	JFC Plastics,CB/NN5475LM	Goldicote Business Park Ettington,Unit 6,Near Stratford Upon Avon Warwickshire,CV37 7NB,United Kingdom		
Within the Country	20 01 40	No	744.6	metals	R4	M	Weighed	Offsite in Ireland	Hegarty Metals Recycling,WCP/KK/012(A)/05	Ballysimon Road ,,Limerick,NA,Ireland		
Within the Country	13 05 03	Yes	33.18	interceptor sludges	D1	M	Weighed	Onsite in Ireland	Ormonde Organics,WCP/KK/306/06	Ballinalacken,,Attanagh Via Portlaoise,NA,Ireland	Galmoy Mines Ltd,P0517-01,Galmoy via Thurles,,Co. Kilkenny,NA,Ireland	Galmoy via Thurles,,Co. Kilkenny,NA,Ireland

* Select a row by double-clicking the Description of Waste then click the delete button

Appendix 8
Noise Survey 2011

REPORT

Prepared for

The Galmoy Mine.

ENVIRONMENTAL NOISE SURVEY

Survey Undertaken and Summary Report Prepared by

Environmental Measurements

Unit 12 Tallaght Business Centre
Whitestown Business Park
Dublin 24
Phone: 01-4149445
Fax: 01-4057917

April 2011.

1.0 Introduction

An Environmental Noise Survey was carried out at the Galmoy Mine in Galmoy Co. Kilkenny.

The survey was undertaken on the morning of 7th April 2011 & the late evening of 7th April 2011.

The purpose of this survey was:

(a) To determine the noise levels generated at 4 monitoring points at the perimeter of the Mine.
(b) To assess the hourly Leq, L10 & L90 both day & night at these monitoring points.
(c) To assess 1/3 octave band analysis at each monitoring point both day & night.

For this purpose:-

- Noise levels were measured under good weather conditions.
- The monitors were positioned at four locations during the survey.

  Monitoring Point 1. Tailings Dam./Main Site Entrance

  Monitoring Point 2. Castletown Hill.

  Monitoring Point 3. DG5.

  Monitoring Point 4. Noise Station 3.

2.0 INSTRUMENTATION

1. Larson Davis Model 824 Type 1 precision integrating sound level & frequency analyser with Model 902 Pre-amplifier and 1/2" condenser microphone type 2540.

2. Wind Shields Type: Larson Davis windshield

3. Calibration Type: Larson Davis precision acoustic calibrator model CA200.

3.0 MEASUREMENT PROCEDURE

Monitoring was carried out for a duration of 1hour at each monitoring point (both day and night) using an environmental integrating sound level & frequency analyser with data logging facilities set on real time, with the logged data downloaded via a personal computer using Larson Davis software.

All instrumentation was calibrated before and after the survey and no drift of calibration was observed.

4.0 RESULTS and COMMENTARY

Monitoring Points (Daytime)	***Leq dbA***	***L10 dbA***	***L90 dbA***	***Notes (Daytime)***
1. Tailings Dam/Main Site Entrance	45.5	46.3	35.3	Very Quiet
2. Castle Town Hill	49.4	51.4	25.7	Intermittent Road Traffic/otherwise very quiet
3. DG5.	53	50.3	34.9	A number of Cars passed by
4. Noise Station 3	43.7	36.3	27.4	Very Quiet

Monitoring Points (Night Time)	***Leq dbA***	***L10 dbA***	***L90 dbA***	***Notes (Night Time)***
1. Tailings Dam	46.9	49	37.5	Very Quiet
2. Castle Town Hill	38.6	40	25.1	Extremely quiet
3. DG5	45	38.9	25.6	Very Quiet
4. Noise Station 3	36.5	36.3	27.4	Extremely Quiet

The aim of the noise survey was to determine the noise levels at four points at the perimeter of the Galmoy Mine site through the Leq, L10 L90 and 1/3 octaves for daytime & night time.
It was not possible to record noise levels from the Mine in the absence of road traffic noise.
The dominant noise levels at locations 2 & 3 during daytime & night time hours was from general road traffic. Although, relatively speaking there would not be excessive traffic in the area, some of the locations were within 10 metres of the roads which would increase the Leq value.
In general the four locations around the site can be considered to be very quiet, this is highlighted in the L90 value (the value at which noise was above 90% of the time). This is a good indicator of the background levels around the site.

I have enclosed a full set of readings with this report, including the 1/3 octave readings which do not highlight any excessive tonal content emanating from the mine._

Kevin O Brien MIEI

Appendix 9
Monitoring Programme Feb 2010

Galmoy Mines Ltd.,
Monitoring Programme
February 2010

1. Introduction

The Monitoring Programme has been designed in conjunction with Golder Associates to facilitate compliance with IPPC Licence P0517-01, monitoring requirements from Authorities, and Technical Amendment B to IPPC P0517-01. The Monitoring Programme also includes the monitoring related to closure objectives. The Monitoring Programme was implemented as part of the Mine Closure Plan and forms an Addendum to the Mine Closure Plan. The Monitoring Programme and results have been designed to minimise the impacts of licensed emissions and mine closure works on the receiving waters and environment. The Monitoring Programme will be reviewed and assessed on a regular basis. Condition 11.5 of the IPPC Licence will be used to vary the frequency and monitoring parameters where appropriate based on historical data and assessment of impacts.

The Monitoring Programme is divided into a number of schedules which outline the location, methods of analysis, parameters measured and the frequency of sampling. The objectives, targets and references for the Monitoring Programme at each location are outlined. The Monitoring Programme maps illustrating the sampling locations are contained in the Appendix of this report.

2. Purpose

The Monitoring Programme is submitted as an Addendum to the Mine Closure Plan in support of the Monitoring Database submitted in April 2009 as part Of Mine Closure Committee Meeting 4 to keep track of the licensed monitoring as well as the monitoring required/intended after closure during the Active and Passive Care. This schedule is maintained as File Maker Pro database. The Monitoring Programme provides an easy to follow manual for the Monitoring Schedule.

3. Description of Monitoring Points

Table 1 outlines the schedules contained in the Monitoring Programme with the monitoring location and the monitoring codes associated with each monitoring location.

SCHEDULE	MONITORING LOCATION	MONITORING CODE
1. Process Water (i-iv)	Discharge Effluent	SW1
	Mine Water	PS1
	Treated Mine Water/ Lamella	PS3
	Reclaim Water	PS4
	Treated Process Water	PS5
	Effluent Pond Discharge	PS8
	Condition Well Water	GW1
	Appendix 1: Environmental Master Drawing	
2. Surface Water	Upstream	ASW1
	Downstream	ASW2
3. Production Wells	Production Well	WW1A / WW2B

	Appendix 1: Environmental Master Drawing	
4. Rewatering Schedule	Vent / Well / Boreholes (6 Locations) Appendix 1: Environmental Master Drawing	
5. Well Monitoring programme	18-20 Wells Appendix 3: Solute Model Monitoring Points	Model Review Committee (MRC)
6. Tailings Management Facility (TMF) (i- xi)	Piezometers (50 Piezometers) Boreholes (8 Active Wells) Sumps/Interceptor Channels (8 Active) Spillways (2) IBC Leachate TMF Compost/Tailings Piezometers TMF Herbage TMF Soil TMF Visual Inspections TMF Water Discharge Appendix 4: TMF Master Drawing	
7. Ambient Air Monitoring	Ambient Air Appendix 5: Ambient Air Monitoring Points Dust Deposition Appendix 6: Dust Deposition Monitoring Points	AA1- AA4 AA5-AA13
8. Atmosphere Monitoring	G South G North R Zone Appendix 1: Environmental Master Drawing	A2-3, A2-6 A2-8
9. Subsidence Monitoring	Outlined in Underground Failure Prevention Plan (Aug 2009)	
10. Noise/ Vibration Monitoring	Station 1 -4 Appendix 1: Environmental Master Drawing	AN1 – 4 AV1 - 4

Table 1 Schedule, Monitoring Locations and Monitoring Codes

4. Water Monitoring

4.1 Schedule: 1 Process Water

Schedule 1 outlines the monitoring programme for process water as defined under IPPC Licence P0517-01. All the monitoring locations are labeled and monitored as per IPPC Licence P0517-01, Technical Amendment B and the Reduction in Frequency Proposal (26th March 2009). They include Discharge Effluent (SW1), Effluent Pond Discharge (PS8), Mine Water (PS1), Treated Mine Water (PS3), Reclaim Water (PS4), Treated Process Water (PS5) and Condition Well Water (GW1). The monitoring locations are outlined in Appendix 1: Environmental Master map.

Schedule 1(i) Process water
Monitoring Location: Final Discharge (SW1)

The Final Discharge (SW1) sampling point is located at the north end of the site adjacent to the Goul Pumphouse. It is representative of the combined treated water flows from Effluent Pond Discharge (PS8) and the Conditioned Well Water Pond (GW1).

Parameter	Monitoring Frequency	Analysis Method/ Technique	Objectives	Targets
Flow	Continuous	Standard Methods	Minimise impacts on receiving waters and environment To obtain daily 24 hour composite sample To comply with IPPC P0517-01 Schedule 2 (ii) Produce daily report to assess compliance and quality.	Compliance with amended Schedule 2 (ii) of IPPC Discontinue monitoring on cessation of water treatment facility Frequency as per reduction proposal Decontaminate post water treatment Retain or Dismantle
Temp, Cond, pH	Continuous	Electrometric		
DO	Continuous	Online probe		
Toxicity	Annual	Toxicity Testing External Laboratory		
COD, NO_3^-, NO_2^- SO_4^{2-}	Three times a week (B)	Standard Methods		
SS, NH_3, Pb, Zn,	Daily (A)	Standard Methods		
O-Phos, As, Hg, Cd, Cu, Al, Mg, Ni, Fe, Mn, Co, Ba BOD and Mineral Oil	Monthly (C)	Atomic Absorption / ICP/ Standard Methods		

Schedule 1 (ii) Process water
Monitoring Location: Mine water (PS1) and Treated Mine Water (PS3)

The Mine Water (PS1) and Treated Mine Water (PS3) sampling points are located on the north end of the Water Treatment Plant (WTP). PS1 is representative of the water pumped from the underground areas and PS3 of the mine water sample after treatment with lime and flocculants.

Parameter	Monitoring Frequency	Analysis Method /Technique	Objectives	Targets
Flow	Continuous	Standard Methods	Minimise impacts on receiving waters and environment To comply with IPPC P0517-01 Schedule 2 (ii) Assess/Maximise Water Treatment Plant performance	Compliance with amended Schedule 2 (ii) of IPPC Frequency as per reduction proposal Discontinue monitoring on cessation of water treatment facility Decontaminate post water treatment Retain or Dismantle
pH	Continuous	pH meter		
Cond	Daily	Conductivity Meter		
SS, NH_3, Pb, Zn	Daily (A)	Standard Methods		
COD, NO_3^-, NO_2^- SO_4^{2-}	Weekly (B)	Standard Methods		
As, Hg, Cd, Cu, Al, Mg, Fe, and Cr	Monthly (C)	Atomic Absorption/ICP		

Schedule 1 (iii) Process water
Monitoring Location: Reclaim water (PS4) and Treated Process Water (PS5)

The Reclaim Water (PS4) and Treated Process Water (PS5) sampling points are located on the south end of the Water Treatment Plant (WTP). PS4 is representative of the water pumped from the Tailings Management Facility (Phase 3) and PS5 of the reclaim water sample after treatment with lime and flocculants.

Parameter	Monitoring Frequency	Analysis Method /Technique	Objectives	Targets
Flow	Continuous	Standard Methods	Minimise impacts on receiving waters and environment	Compliance with amended Schedule 2 (ii) of IPPC
pH	Continuous	pH meter	To comply with IPPC P0517-01 Schedule 2 (ii)	Frequency as per reduction proposal
DO (PS4 Grab only)	Daily	DO meter	Assess/Maximise Water Treatment Plant performance	Discontinue monitoring on cessation of water treatment facility
Conductivity	Daily	Conductivity Meter		
SS, NH_3, Pb, Zn	Daily (A)	Standard Methods		Decontaminate post water treatment
COD, NO_3^-, NO_2^- SO_4^{2-}, BOD	Weekly (B)	Standard Methods		Retain or Dismantle
As, Hg, Cd, Cu, Al, Mg, Fe, and Cr	Monthly (C)	Atomic Absorption/ICP		

Schedule 1 (iv) Process water
Monitoring Location: Effluent Pond Discharge (PS8) & (GW1)

The Effluent Pond Discharge (PS8) and Conditioned Well Water (GW1) sampling points are located at the north end of the site adjacent to the ponds. Effluent Pond Discharge is representative of the combined treated water flows. The Conditioned Well Water Pond now stores only treated water also since it became increasingly more difficult to separate clean water flow underground.

Parameter	Monitoring Frequency	Analysis Method /Technique	Objectives	Targets
Flow	Continuous	Standard Methods	To comply with IPPC P0517-01 Schedule 2 (ii) & Schedule 4 (ii) Minimise impacts on receiving waters and environment To obtain daily 24 hour composite sample	Compliance with Schedule 2 (ii) of IPPC. Frequency as per reduction proposal Discontinue monitoring on cessation of water treatment facility. Remove Sludge from ponds and dispose in Phase 3 at Mine Closure. Retain ponds or rehabilitate to forest end-use Monitor as per Long term monitoring RWSS and mine rewatering (Feb 2009)
Temp, Cond, pH	Continuous	Electrometric		
DO	Continuous	Online probe		
SS, NH_3, Pb, Zn	Daily (A)	Standard Methods		
COD, NO_3^-, NO_2^- SO_4^{2-}	Three times a week (B)	Standard Methods		
O-Phos, As, Hg, Fe, Al, Mg, Ni, Mn, Co, Ba, Cd Cu BOD and Mineral Oil	Monthly (C)	Atomic Absorption / ICP / Standard Methods		
Toxicity	Annual	Toxicity Testing External Laboratory		

4.2 Schedule 2: Surface Waters

Schedule 2 outlines the monitoring schedule for surface waters as outlined in IPPC Licence P0517-01, upstream (ASW1) and downstream (ASW2) of discharge to River Goul. The proposal for the Glasha monitoring Programme is included in Schedule 2 (ii) The Stream Augmentation Monitoring Points are outlined in Appendix 2: Stream Augmentation Location Points.

Schedule 2(i) Surface Waters
Monitoring Location: Upstream (ASW1) and Downstream (ASW2) of discharge to River Goul

Parameter	Monitoring Frequency	Analysis Method/ Technique	Objectives	Targets
Visual Inspection	Weekly	Not Applicable	Comparison of upstream and downstream monitoring points to assess the impacts To comply with Schedule 4 (ii) of IPPC. Monitor impacts of discharge downstream of discharge point by chemical and biological methods. Conduct river biotics survey for one year after cessation of mining	Compliance with Schedule 4 (ii) of IPPC. Frequency as per reduction proposal. Conduct River Biotics survey one year after cessation of mining. Continue monitoring during operation and during the operation of the WTP. Discontinue monitoring on cessation of WTP. Remove sediment from the area around the outfall of final discharge Hand over monitoring equipment to SEFB
Temp, Cond, pH, DO	Continuous	Electrometric		
SS, Pb, Zn, NH_3, SO_4^{2-} NO_3^{2-}, and NO_2^-	Weekly (B)	Standard Methods		
T. Hardness, T. Alkalinity, O-Phos, Cd, Cu, Fe, As, Al, Mg, K, and Na	Monthly (C)	Absorption /ICP/ Standard Methods		
Sediment and River Biotics Study	Annual	External Consultant		

Schedule 2(ii) Surface Waters
Monitoring Location: Glasha (GAC)

Parameter	Monitoring Frequency	Analysis Method/ Technique	Objectives	Targets
Visual Inspection	Weekly Monthly (Biannually)	Not Applicable	*TMF :* Minimise impact on Glasha surface water from the release of surface water from the TMF Assessment of water quality from TMF ongoing as per monitoring programme (Appendix 8 TMF Report) Assess water quality results versus standards in place Monitor for active care period *Mine Site:* Mine site free drainage landscape	Measure the assimilative capacity of stream post rewatering Report annually to EPA Monitor and assess as part of the Mine Closure Plan and outlined in the TMF Closure Plan May 2010 Assess frequency of biotics and sediment analysis one year post discharge Connect existing French drain system to Glasha post dismantling of WTP
DO, Cond, pH and Temp	Weekly Monthly (Biannually)	Electrometric		
COD, SS, NH_3, Pb, Zn, SO_4^{2-}, As, Cd, Fe, and Mg (NO_2^- and NO_3^{2-})	Monthly (Biannually)	Standard Methods		
Sediment and River Biotics Study	Annually	External Consultant		
(ASW Parameters Surface water Discharge)				

4.3 Schedule: 3 Production Wells

Schedule 3 outlines the monitoring schedule for production well (WW1A) and reserve well (WW2B). These are monitored in compliance with Planning Conditions 13 to 21 of PL 10.091530. The objective is to provide clean potable water to residents who may have been affected by dewatering of the area due to mining activities and this will be assessed as outlined in the Long-term plan for the Replacement Water Supply Scheme and Mine Rewatering (Feb 2009). These wells will also be closely monitored during reflooding of the mine post closure and as part of the assessment of rewatering of the orebodies. (Appendix 1: Environmental Master Drawing)

Schedule 3 (i) Production Wells
Monitoring Location: Production Wells (WW1A) and Reserve Well (WW2B)

Parameter	Monitoring Frequency	Analysis Method/ Technique	Objectives	Targets
Depth	Biannually (Monthly Rewatering)	Dip meter	Provide potable water, use standby well. Compliance with Planning Conditions of PL 10.091530 Increase frequency of some parameters as mine allowed to flood on a phased basis Assess impacts of Rewatering on water quality	Handover responsibility and management to Local Authorities 2010 Reduce monitoring after assessment Report monitoring results to MCC/MRC/EMG
Cond, pH	Weekly (Daily Rewatering)	Electrometric		
Pb, Zn	Weekly (Daily Rewatering)	Standard Methods		
SS, NH_3, NO_3^{2-}, NO_2^-, SO_4^{2-}, O-Phos, BOD, COD and NTU	Weekly	Standard Methods		
Mg, Na and Ca	Monthly	ICP		
Microbiological	Monthly	Standard Methods		

4.4 Schedule 4 Rewatering Schedule

Schedule 4 outlines the monitoring schedule detailed in the K rewatering. This schedule is devised in line with the Monitoring Programme outlined in the Rewatering of the K-zone Report (Feb 2010) and Long-term plan for the Replacement Water Supply Scheme and Mine Rewatering (Feb 2009).

A comprehensive Monitoring Programme of the fissure underground was carried out between the closure of the mine and before the resumption of RD4 mining activity.

Schedule 4 (i) Rewatering Schedule
Monitoring Location:

1) Vent Shaft and face
2) Maher's – Private Well
3) Borehole 13 – located near TMF
4) Production Wells (x2-) RWSS wells

Parameter	Monitoring Frequency	Analysis Method/ Technique	Objectives	Targets
Pb, Zn, SS, pH, NH_3, NO_2^-, NO_3^{2-} SO_4^{2-}, and Mineral Oil	Weekly	Standard Methods	Assess impacts of Rewatering on water quality	Continue monitoring until chemical stability achieved

4.5 Schedule 5 (i) Well Monitoring Programme

Schedule 5 Well Monitoring Programme outlines the monitoring programme for the solute model and the Model Review Committee (MRC). This monitoring is carried out in compliance with Planning Condition 18 of PL 10.091530. The well monitoring programme is outlined in the Rewatering of the K-zone Report (Feb 2010) and Long-term plan for the Replacement Water Supply Scheme and Mine Rewatering (Feb 2009). Appendix 3 outlines the monitoring locations of the Solute Model.

Schedule 5 (i) Well Monitoring Programme
Monitoring Location: Solute Model 18-20 Wells

Parameter	Monitoring Frequency	Analysis Method /Technique	Objectives	Targets
Water Level	Monthly	Dip meter	Assess the extent of the cone of depression in compliance with Condition 18.	Reflood mine to achieve water quality targets comparable with pre-mining
Cond, pH	Biannually	Electrometric		

SS, NH_3, NO_3^-, NO_2^-, Pb, Zn, O-Phos, SO_4^{2-}, As, Cd, Al, Ca, Mg, Na, Fe	Biannually (monthly on selected wells on rewatering)	Standard Methods	Assess the quality of water in wells and impacts on groundwater during and post-mining activities.	conditions Continue MRC until stable conditions achieved

4.6 Schedule 6: Tailings Management Facility (TMF)

Schedule 6 outlines the monitoring schedule for the TMF. It encompasses a programme devised in conjunction with Golder Associates to assess the long-term sustainability of the cap and quality of the discharge water. This also includes the monitoring programme set out in the IPPC Licence P0517-01, Technical Amendment B and the Reduction in Frequency Proposal (26th March 2009) for the facility. There are a number of monitoring locations outlined in the programme including piezometers, boreholes, sumps and internal drainage, spillways, surface water, compost piezometers and IBC trials. (Appendix 4: Tailings Management Facility Master Map)

It is Galmoy Mines intention to apply to the EPA for a licence to discharge surface water from the TMF, following passive treatment in the wetland and prior to discharge from the surface water lagoon to the Glasha Stream. The application will take cognisance of the European Communities Environment Objectives (Surface Water) Regulations 2009 (S.I. No 272 of 2009) post rehabilitation or agreed derogation there from.

Schedule 6 (i) Tailings Management Facility
Monitoring Location: Piezometers (50 on perimeter of TMF)

Parameter	Monitoring Frequency	Analysis Method/ Technique	Objectives	Targets
Visual Inspection	Monthly	Not Applicable	Monitor integrity and performance of TMF Assess frequency of monitoring post rehabilitation of Phase 1, 2 & 3	Data provided to third party annual review by UK All Reservoir Engineers
Water Level	Monthly	Dip Meter		
pH, and Cond	Monthly	Electrometric		
SO_4^{2-}	Monthly	Standard Methods		
Pb, Zn, As, Cd, Fe, Cu, Hg, Co, Mg, Mn, Ni and Cl	Quarterly	Standard Methods		

Schedule 6 (ii) Tailings Management Facility
Monitoring Location: Boreholes (8 Active Sampling Points)

Parameter	Monitoring Frequency	Analysis Method/ Technique	Objectives	Targets
Water Level	Monthly	Dip Meter	Comply with IPPC licence P0517-01	Reduction of monitoring to Quarterly and Annually in Passive Care period Continue monitoring until 2012 Assess frequency and parameters
pH, and Cond	Monthly	Electrometric		
Sulphate	Monthly	Standard Methods		
Pb, Zn, As, Cd, O-Phos, NO_2^-, NO_3^{2-}, NH_3, Fe, Cu, Hg, Co, Mg, Mn, Ni, Cl and Ca	Monthly (Quarterly)	Atomic Absorption/ICP		

Schedule 6 (iii) Tailings Management Facility
Monitoring Location: Sumps (5 Active) and Interceptor Channels (3 Active during heavy rain events).

These monitoring locations assess the safe and efficient operation of the TMF. The data collected is supplied to a third party for external review.

Parameter	Monitoring Frequency	Analysis Method/ Technique	Objectives	Targets
Water level	Monthly	Dip Meter	Assess quality of potential seepage water Continue Monitoring Programme	Provide data for external review of TMF by third party in active and passive care period Reduce frequency to Quarterly in active care and annually in passive.
pH, Cond	Monthly	Electrometric		
SS, SO_4^{2-}, Pb, and Zn	Monthly	Standard Methods		

Schedule 6 (iv) Tailings Management Facility
Monitoring Location: Spillways (Phase I to III & Phase II to III) and Decant Water

There are two spillways installed at the junctions of Phase 1 to 3 and Phase 2 to 3. The spillway facilitates the free flow of surface water from Phase 1 & 2 into the active Phase 3.

Parameter	Monitoring Frequency	Analysis Method/ Technique	Objectives	Targets
pH, Cond	Weekly	Electrometric	Assess the water quality emanating from the rehabilitated tailings management facility Prediction of water quality post closure Prediction for requirement of wetland	Continue monitoring until 2012 Review monitoring required in 2012
SO_4^{2-}, Pb, Zn, As, Cd, O-Phos, NH_3, NO_3^{2-}, S^{2-}, BOD, COD & K	Weekly	Standard Methods		

Schedule 6 (v) Tailings Management Facility
Monitoring Location: Tailings Management Facility (TMF)

In compliance with IPPC Licence P0517-01, Condition 7.6.13 an annual visual inspection is carried out by an All Reservoir Panel Engineer Inspector.

Parameter	Monitoring Frequency	Analysis Method/ Technique	Objectives	Targets
Engineers Inspection	Annually	All Reservoirs Panel Engineer Inspection	Compliance with IPPC Licence P0517-01, Condition 7.6.13	Review frequency in 2012

Schedule 6 (vi) Tailings Management Facility
Monitoring Location: Compost/Tailings Piezometers

A number of piezometers were installed in the compost placed and in the tailings to assess the impact on the interstitial water.

Parameter	Monitoring Frequency	Analysis Method/ Technique	Objectives	Targets
pH, Cond	Monthly	Electrometric	Assess water quality at interface between compost cap and tails	Continue monitoring until cap is in place
SO_4^{2-}, Pb, Zn, O-Phos, NH_3, NO_3^{2-}, S^{2-}, BOD, & COD	Monthly	Standard Methods		

Schedule 6 (vii) Tailings Management Facility
Monitoring Location: IBC Leachate Trials

A number of IBC leachate trials were set up to assess the evapotranspiration rate and surface water volume.

Parameter	Monitoring Frequency	Analysis Method/ Technique	Objectives	Targets
pH, Cond	Monthly	Electrometric	Assess quality of leachate to determine the requirement for wetland treatment pre discharge to Glasha stream determine	Continue monitoring until assessment is complete
SO_4^{2-}, Pb, Zn, O-Phos, NH_3, NO_3^{2-}, S^{2-}, BOD, & COD	Monthly	Standard Methods		

Schedule 6 (viii) Tailings Management Facility
Monitoring Location: Phase 1, 2 & 3 Herbage

Schedule 6 (viii) outlines the herbage sampling programme for the Tailings Management Facility in the Active and Passive Care.

Parameter	Monitoring Frequency	Analysis Method/ Technique	Objectives	Targets
Pb, Zn, Cd & As (Herbage)	Biannually	Composite vegetation sampling (density of 1 sample per hectare for analysis)	Assess metal uptake in herbage. to identify replacement planting needs Comply with EU Directive on undesirable substances (2002/32/EC) on animal foodstuffs Comply with IPPC P0517-01 requirement to produce annual agronomic report	Reduce to visual survey / photographic in Passive Care (2014-2018) Produce annual Agricultural Progress and Certification Report by an independent Third Party in compliance with IPPC P0517-01
Inspection of trees and shrubs (Phase 3 only)	Annually (Summer)	Not Applicable		
Pb, Zn, Cd & As (tree leaves) (Phase 3 only)	Annually	Standard Methods		
Visual survey/ Photographic record of ground cover (Phase 1, 2 & 3) and trees/shrubs on	Biannually			

Phase 3				

Schedule 6 (ix) Tailings Management Facility
Monitoring Location: Phase 1, 2 & 3 Soil

Schedule 6 (ix) outlines the soil sampling programme for the Tailings Management Facility in the Active and Passive Care.

Parameter	Monitoring Frequency	Analysis Method/ Technique	Objectives	Targets
Zn, Pb, Cd & As	Biannually	Standard methods (density of 1 sample per hectare for analysis)	Comply with IPPC P0517-01 requirement to produce annual agronomic report Continue throughout Active Care period (2009 – 2013) Use 0-10cm for surface soils and a surface to base (tailings interface) core (Phases 1 and 2 only) to confirm absence of upward migration of metals (sampling and assay of the base 30cm in two equal slices)	Same location as vegetation sampling Reduce to visual survey / photographic in Passive Care (2014-2018) Produce Annual Agricultural Progress and Certification Report by an independent Third Party in compliance with IPPC P0517-01
N, P & K	Biannually	Standard Methods		
Productivity Assessment	Annual (summer)	Quadrat Sampling		

Schedule 6 (x) Tailings Management Facility
Monitoring Location: Phase 1, 2 & 3 Water Discharge

This schedule deals with the discharge from the TMF prior to discharge to the Glasha stream. An IPPC licence will be obtained for this discharge but will be monitored for the parameters below to assess the quality of discharge.

Parameter	Monitoring Frequency	Analysis Method/ Technique	Objectives	Targets
pH, Cond & DO		Electrometric	Comply with IPPC Licence to be granted for discharge to Glasha stream Comply with European Communities Environment Objectives (Surface Water) Regulations 2009 (S.I. No 272 of 2009) post rehabilitation or	Obtain IPPC Licence for discharge to Glasha Stream when required
BOD, COD, Pb, Zn, As, Cd, NO_2^-, NO_3^{2-}, NH3 and SO_4^{2-}		Standard Methods		

			agreed derogation there from.	

4.7 Schedule 7: Ambient Air Monitoring

Schedule 7 outlines the monitoring schedule for ambient air and dust deposition as outlined in Schedule 1(iv) of IPPC Licence P0517-01 for the facility. The locations for Ambient Air monitoring are denoted in Appendix 5 and for Dust deposition in Appendix 6.

Schedule 7 (i) Ambient Air Monitoring
Monitoring Location: Ambient Air Monitoring Stations (X4)

Parameter	Monitoring Frequency	Analysis Method/ Technique	Objectives	Targets
Pb, Zn, Cd, As	Monthly	Standard Methods	Assess dust impacts on the environment	Continue monitoring programme until Phase 3 surface is covered Compliance with IPPC P0517-01
Suspended Particulates	Monthly	Standard Methods		

Schedule 7 (ii) Ambient Air Monitoring
Monitoring Location: Dust Deposition Monitoring Stations (X8) (Appendix 6)

Parameter	Monitoring Frequency	Analysis Method/ Technique	Objectives	Targets
Pb, Zn, Cd, As	Monthly	Standard Methods	Assess dust impacts on the environment	Compliance with IPPC P0517-01 Continue monitoring programme until Phase 3 surface is covered
Dust Deposited	Monthly	Standard Methods		

4.8 Schedule 8 (i) Emissions to Atmosphere Monitoring

Monitoring Location: Mine Vent Shaft (G South A2-3, G North A2-6 & R Zone A2-8)

Schedule 8 outlines the monitoring schedule for monitoring emissions to atmosphere as outlined in Schedule 1(iii) of IPPC Licence P0517-01 for the facility. The locations are denoted on the attached map (Appendix 1).

Parameter	Monitoring Frequency	Analysis Method/ Technique	Objectives	Targets

HS, NO_x and CO	Monthly	Flue Gas Analyser	Compliance with IPPC P0517-01 Monitor emissions during mining operations. Continue to monitor while vent shafts are operational	Cease monitoring on completion of R-zone project
Particulates	Quarterly	Isokinetic/ Gillan Pump		

4.9 Schedule 9 (i) Subsidence Monitoring
Monitoring Location: Subsidence Monitoring

Schedule 9 outlines the monitoring schedule for subsidence monitoring as outlined in Condition 13.3.2 of IPPC Licence P0517-01 for the facility, Kilkenny County Council P99-1371, Condition 2 (a) and the Underground Failure Prevention Plan (Aug 2009).

Parameter	Monitoring Frequency	Analysis Method/ Technique	Objectives	Targets
Surface Subsidence	Biannually	Automatic Precise level Readings	Carry out survey to assess subsidence due to mining (UFPP Aug 2009) Comply with Condition 13.3.2 of IPPC P0517-01 and Condition 2 (a) of Planning	Discuss duration of monitoring with Dept. Comm. Energy and Natural Resources

4. 10 Schedule 10 (i) Noise Monitoring
Monitoring Location: AN1 – AN4 Noise Monitoring Stations

Schedule 10 outlines the monitoring schedule for noise and vibration monitoring as outlined in Condition 8 of IPPC Licence P0517-01 for the facility (Appendix 1).

Parameter	Monitoring Frequency	Analysis Method/ Technique	Objectives	Targets
Noise	Continuous	Noise Monitor	Compliance with IPPC Licence P0517-01 Assess noise levels at noise sensitive locations during site demolition.	Cease monitoring when approved by the EPA Submit proposal to the EPA for cessation of continuous monitoring Discontinue monitoring after demolition
Noise Survey	Annually			

Schedule 10 (ii) Vibration Monitoring
Location: AV1 – AV4 Vibration Monitoring Stations

Parameter	Monitoring Frequency	Analysis Method/ Technique	Objectives	Targets
Vibration	Continuous	Vibration Monitor	Compliance with IPPC Licence P0517-01 Continue to monitor vibration during blasting.	Discontinue monitoring at end 2011

Appendix 1: Environmental Master Drawing

Appendix 10
TMF Audit 2010

March 2011

GALMOY MINES

Tailings Management Facility Audit 2010

Submitted to:
Galmoy Mines Ltd
Galmoy
County Kilkenny
Eire

REPORT

Report Number. 11514150007.500/A.0

Distribution:

Galmoy Mines Ltd - 13 copies (1 pdf)
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1.0 INTRODUCTION

A site inspection of the Tailings Management Facility (TMF) at Galmoy Mine was undertaken by Golder Associates UK Ltd (Golder) on behalf of Galmoy Mines Ltd (Galmoy). The site visit was carried out on 3 December 2010. The primary purpose of the site inspection was to assess the stability and integrity of the perimeter dam walls forming the Cells 1, 2 and 3 and to satisfy condition 7.6.13 of the IPPC licence. This report is based on the findings of the Golder visual inspection together with a review of the monitoring data collected during the year by Galmoy staff. Cell 1 and 2 are non operational while Cell 3 is used as an emergency water storage facility during the mining of the R Zone.

Cell 3 was completed during the summer of 2006 and tailings discharge commenced into the facility in October 2006. The mill stopped operation in the summer of 2009 although mining is continuing and Cell 3 is used as a balancing pond for mine dewatering. Cell 1 has been capped with a mixture of compost and glacial till to form the dome shape profile. The glacial material has been mixed with the upper compost layer. Compost covers approximately 70% of the tailings in Cell 2 and glacial till will be used to complete the covering of the tailings and to form the dome shape profile as per Cell 1.

To facilitate the evaluation of the TMF the dam area has been divided into sectors; the monitoring points currently evaluated within each sector are tabulated below.

Table 1-1: Dam Sectors and Monitoring Points

TMF Area	Dam Sector	Piezometers	Monitoring Wells	Drainage Samples
Cell 1	A to B	1, 2, 3, 4, 5 and 6		
	B to C	7, 8, 9, 10, 11, 12, 55 and 56		
	C to D	13, 14 15, 16, 17 and 18	BH3	
	D to A	19, 20, 21, 22, 23 and 24	BH4 and BH5	
Cell 2	A to F	25, 26 and 27	BH6 and BH7	
	F to G	28, 29, 30, 31, 32 and 33	BH8 and BH9	IDS 2
	G to H	34, 35, 36, 37, 38 and 39	BH10 and BH11	
	H to B	40, 41, 42, 57 and 58		IDS 1
Cell 3	H to I	43, 44, 45, 46, 47 and 48		
	I to C	49, 50, 51, 52, 53 and 54	BH13	

Notes:
1. Piezometers 3 and 6 were decommissioned during the construction of Cell 2 in 1999.
2. Piezometer 2 is removed/missing and not monitored.
3. Piezometers 7,8,9,10,11 and 12 were decommissioned during the construction of Cell 3 in 2006 and piezometers 55 and 56 installed.
4. Piezometer 19 was knocked over and blocked in May-June of 2001.
5. Piezometer 23 was recorded as blocked in December 1999 and is no longer monitored.
6. Piezometer 35 was recorded as blocked in October 2001 and is no longer monitored.
7. Piezometer 40 and 42 were decommissioned during the construction of Cell 3 in 2006 and piezometers 57 and 58 installed.

A plan showing the dam sectors, the location of the piezometers and monitoring well boreholes is presented in Appendix A as Drawing 1. The installation details for the piezometers and monitoring wells are presented in the 'TMF Environmental Monitoring Report', compiled by Galmoy. The results of the water level readings from the monitoring well boreholes, the piezometer readings, sulphate readings from the monitoring wells and piezometers are presented either as tables within this report or in graphical form in Appendix B and Appendix C.

Dewatering during mining activity has reduced the groundwater level beneath the Cells. Prior to mine dewatering, groundwater levels at the site typically varied between 0 m and 5 m below surface. The groundwater is currently between 47 m (BH7) and 63 m (BH13) below ground level depending on location and proximity to the mine workings. Measurements collected from BH 6, BH 7, BH 8 and BH 11 around the perimeter of Cell 2 indicated that the groundwater level has stabilised, at approximately 50 m below ground level, apart from seasonal influences.

BH 5 indicates that dewatering relating to mine activity may still be influencing groundwater levels beneath Cell 1. The groundwater level in BH 5 was approximately 63 m which is some 13 m deeper then stabilised groundwater levels in previously discussed wells.

Evidence from BH 11 and BH 13 suggested that groundwater levels beneath Cell 3 rose throughout 2010 from those recorded in 2009. The elevated groundwater can be attributed to the reduced operation of dewatering pumps for mining activity in the area following the plugging of the K access drive. Groundwater levels rose from 85 m (BH 13) and 75 m (BH 11) to approximately 65 m (BH13) and 50 m (BH11) below ground level.

BH 2 and BH 12 were removed during the construction of Cell 3 in 2006.

The sulphate data from the ongoing monitoring has been used as an indicator of potential seepage paths through the TMF. Sulphate has been chosen for its mobility. The sulphate levels in the tailings water reclaimed from Cell 3 have generally been between 931 mg/l and 3205 mg/l throughout the operation of the facility. The average for the year 2010 was 784 mg/l although values fluctuated between 1111 mg/l and 177 mg/l.

The background level for sulphate in groundwater based on the perimeter monitoring wells around Cells 1, 2 and 3 in 2010 was typically between 18 mg/l and 178 mg/l, with an average of 71.24 mg/l. It should be noted that in other sites of similar geology in Ireland, the background count for sulphate can be as high as 250 mg/l. Therefore, receptors with sulphate levels in excess of 250mg/l are likely to have resulted from contamination from the TMF.

The pH of the tailings water reclaimed from Cell 3 has generally been between 7.1 and 10.9 and the average for the year 2010 was 8.69.

The current operating water level in Cell 3 is approximately 2.7 m below the top of the access road on the dam crest.

2.0 SITE INSPECTION

The site inspection was undertaken on 3 December 2010 by Roger White of Golder. A summary of the visual inspection and comments related to specific areas are presented below for each of the dam wall sectors.

2.1 General

The TMF site is clean, tidy and the slopes well vegetated. Environmental and Mine Closure personnel undertake a daily inspection of the TMF. The security of the facility is satisfactory and the electronic gate to the site is closed at all times. The entrance to the TMF is also used to access the explosives magazine which is adjacent to the structure. The magazine is no longer in use.

A considerable amount of restoration has been undertaken over the surface of Cell 1 using a combination of growing mediums and glacial till. Approximately 100% of the surface area is covered with organic matter and glacial till and the mine is currently installing the perimeter drainage system.

The doming of Cell 1 is complete and by preventing the accumulation of water on the surface of Cell 1, the potential damage from over topping of the dam walls will be eliminated. The drainage system around Cell 1 will be connected to the decant pipes currently discharging water from Cell 1 to Cell 3.

Surplus water in Cell 2 is discharged directly into Cell 3 via two 400 mm decant pipes. Restoration of Cell 2 has commenced using a mixture of compost and glacial till and will be completed in 2011.

The proposed shape of the cap are two isolated shallow domes for Cells 1 and 2, to prevent the accumulation of water on the surface and to allow runoff from the cap to a drainage collection system at the upstream edge of the crest for discharge to the base of the downstream slopes of the cell walls. The slope of the dome is designed to be approximately 1% which may result in isolated ponding on the surface as a

result of hollows forming due to differential settlements of the underlying tailings and cap itself. This would have no impact on the structural integrity of the facility.

2.2 Dam Sector A to B

This sector of the dam wall is the common dividing wall between Cells 1 and 2. The lining in this section of the dam wall close to point B had been slightly damaged in the past and is now repaired. Tailings were placed against the damaged area to minimise the seepage.

This section of dam wall includes a chimney drain which feeds into a collector drain which then leads to an external concrete sump (IDS1) on the downstream side of the Cell 3 dam wall (Drawing 1). The original sump IDS1 was extended and located outside the footprint of Cell 3. The base of the chimney drain on the dividing wall of Cells 1 and Cells 2 and the dividing wall of Cells 2 and 3 are connected via a pipe to manholes at either end at points A and H (Figure 1) on the downstream toe of the dam walls. The pipe was to allow for camera inspection of the base of the chimney drain. The manhole at point A is several metres higher than the manhole at point H.

After the commencing of filling with water of Cell 3, water was noticed flowing into manhole H (Sump 5) which was then pumped back to Cell 3. The flow rate has continued to reduce from 6.0 l/min in 2009 to its current value of 2.4 l/min in 2010.

Piezometers 1, 2, 4 and 5 were installed in the dam crest. Piezometers 3 and 6 were decommissioned during the construction of Cell 2 and piezometer 2 is now removed. The depths of installation for each piezometer tip are tabulated below.

Table 2-1: Sector A to B Piezometer Installations

Piezometer No.	1	2	3	4	5	6
Installation depth (m)	8.77	7.46	4.33	9.93	15.96	8.96
Base installation (m AOD)	135.06	136.38	134.58	133.47	127.48	127.45

Piezometer 1 was installed into the dam foundations and piezometer 2 was installed at the base of the dam wall. Piezometer 1 shows a consistent water level of less than 0.5 m above an installation depth of 135.06 m AOD throughout 2005, 2006, 2007, 2008, 2009 and 2010. It can be assumed that this piezometer is not operating effectively as it shows no seasonal fluctuations due to rainfall.

Piezometer 4 is installed into the foundations from the crest of the dam wall and during 2010 has been between 135.0 m AOD and 135.4 m AOD. Piezometer 5 was installed into the foundations beneath the dam wall and remains dry.

The sulphate values from piezometer 4 were high in 2010 and ranging between 1159 mg/l and 1976 mg/l, with an average of around1600 mg/l. These readings are likely to be the result of previous damage to the lining in this area. Conductivity values recorded for piezometers 4 reflect the high sulphate levels.

2.3 Dam Sector B to C

This wall is now the dividing wall between Cells 1 and 3. This sector has an internal collector drain with no finger drain outlets. The collector drain is at the base of the central chimney drain. Upon visual inspection no defects in the lining of Cell 1 or 3 were observed.

Piezometers 7, 8, 10 and 11 were installed in the dam crest. Piezometers 9 and 12 were installed in the downstream side of the dam wall. The installation depths of the piezometer tips are tabulated below.

Table 2-2: Sector B to C Piezometer Installations

Piezometer No.	7	8	9	10	11	12	55	56
Installation depth (m)	15.23	11.98	7.24	Blocked	12.13	6.88	17.86	16.23
Base installation (m AOD)	128.07	131.29	127.79	Blocked	131.2	128.26	125.78	127.49

Piezometers 7 to 9, 11 and 12 have been decommissioned during the construction of Cell 3. Two new piezometers have been installed, piezometer 55 and 56. Piezometer 55 is effectively dry. Piezometer 56 indicates a water level between 130.00 m AOD and 132.87 m AOD. Sulphate levels are between 170 mg/l and 266 mg/l. Conductivity values range between 434 µS/cm and 570 µS/cm.

Monitoring well BH 2 was decommissioned during the construction of Cell 3.

2.4 Dam Sector C to D

The dam wall along this sector appears dry and well vegetated with no signs of distress or surface sloughing. This sector has a series of finger drains connected to the collector drain at the base of the chimney drain. All the finger drains were dry.

Piezometers 13, 14, 16 and 17 were installed into the dam crest. Piezometers 15 and 18 were installed in the downstream side of the dam wall. The installation depths of the tips are tabulated below.

Table 2-3: Sector C to D Piezometer Installations

Piezometer No.	13	14	15	16	17	18
Installation depth (m)	10.63	15.32	7.43	8.33	10.63	4.73
Base installation (m AOD)	132.95	128.18	128.7	132.0	132.69	132.91

All the piezometers are effectively dry.

Monitoring well, BH 3 is dry at 65 m below ground level (the base of the well) or approximate elevation of 69 m AOD. The effects of mine dewatering are clearly apparent.

No sulphate testing was carried out in the piezometers along this dam sector or in Borehole 3 as they are all effectively dry.

2.5 Dam Sector D to A

The wall along this sector of the dam appears dry and well vegetated with no signs of distress or surface sloughing. This sector has a series of finger drains connected to the collector drain at the base of the chimney drain. All the finger drains were dry. No defects were observed in the lining.

Piezometers 19, 20, 22 and 23 were installed in the dam crest. Piezometers 21 and 24 were installed in the downstream side of the dam wall. The installation depths of the tips are tabulated below.

Table 2-4: Sector D to A Piezometer Installations

Piezometer No.	19	20	21	22	23	24
Installation depth (m)	8.33	6.43	4.58	9.83	8.08	6.23
Base installation (m AOD)	135.29	137.21	135.17	133.81	135.63	133.53

Piezometers 19 and 23 are blocked. The remaining piezometers are effectively dry.

Monitoring well, BH 4, is effectively dry at 69 m below ground level apart from minor seasonal fluctuations. BH 5 indicates the water level was between 59 m and 63 m below ground level over the 2010 monitoring period. This sector of the dam is close to the mine decline and shows significant reduction in ground water level. There is no sulphate data available for Borehole 4 as it is dry. The sulphate reading monitored in Borehole 5 varied during the 2010 monitoring period between 31 mg/l and 50 mg/l.

2.6 Dam Sector A to F

The dam wall along this sector appears dry and well vegetated with no signs of distress or surface sloughing. This sector has a series of finger drains connected to the collector drain at the base of the chimney drain. All the finger drains were dry. No defects were observed in the lining.

Piezometers 25 and 26 were installed in the dam crest and Piezometer 27 was installed in the downstream side of the dam wall. The installation depths of the tips are tabulated below.

Table 2-5: Sector A to F Piezometer Installations

Piezometer No.	25	26	27
Installation depth (m)	7.92	3.14	5.10
Base installation (m AOD)	135.35	140.11	134.6

During 2010 monitoring period, Piezometer 25, installed in the dam foundations, has generally recorded water elevations fluctuating between 136.47 m and 136.62 m AOD. Piezometer 26 which was installed in the base of the dam remained effectively dry throughout 2010. Piezometer 27, installed in the dam foundations, was effectively dry throughout this period.

The sulphate values recorded in piezometer 25 were between 12 mg/l and 435 mg/l. The values recorded over the year 2010 have slightly increased compared to 2009. However the increase is not significant. This issue has no impact on the structural integrity of the dam wall.

Monitoring wells (Boreholes 6 and 7) indicate that during 2010 the water levels were similar to the 2009 readings. By the end of 2010 the water levels recorded were about 48 to 50 m below ground level.

The sulphate levels in monitoring well BH 6 have been between 92 mg/l and 100 mg/l during 2010 and are similar to the 2009 readings. The sulphate values recorded in Borehole 7 were generally between 36 mg/l and 100 mg/l in 2010.

2.7 Dam Sector F to G

The dam wall along this sector of the dam appears dry and well vegetated with no signs of distress or surface sloughing. This sector has a series of finger drains connected to the collector drain at the base of the chimney drain. All the finger drains were dry. No defects were observed in the lining. The internal drainage system of Cell 2 is connected to an external concrete sump (IDS2).

Piezometers 28, 29, 31, and 32 were installed in the dam crest and Piezometers 30 and 33 were installed in the downstream side of the dam wall. The installation depths of the tips are tabulated below.

Table 2-6: Section F to G Piezometer Installations

Piezometer No.	28	29	30	31	32	33
Installation depth (m)	11.89	6.69	5.35	14.2	9.32	6.66
Base installation (m AOD)	122.46	136.41	133.14	129.2	133.96	129.14

Readings in Piezometer 28 indicate water levels generally between 122.46 m and 123.78 m for 2010 which are similar to levels recorded in 2009. Piezometer 29 is almost dry with value averaging some 200 to 800 mm above the installation depth. During the 2010 monitoring period, Piezometer 30, which was installed into the dam foundations, recorded values of the water level of around 134.5 m AOD apart from a reading of 133.12 m AOD. Piezometer 33 installed in the dam foundation is effectively dry. Piezometer 31 was damaged in March 2006. Piezometer 32 was damaged in October 2006.

The sulphate levels recorded from Piezometer 30 during 2010 were generally low and below 50 mg/l. Conductivity measurements carried out for the same period indicated values of approximately 500 uS/cm.

Monitoring well, BH 8, indicated water levels similar to 2009 with values around 48 m to 50 m below ground level. Borehole 9 was dry. The sulphate levels in Borehole 8 were between 18 mg/l and 38 mg/l, which are similar to the values recorded in 2009.

2.8 Dam Sector G to H

This sector of the dam wall appears dry and well vegetated with no signs of distress or surface sloughing. This sector has a series of finger drains connected to the collector drain at the base of the chimney drain. All the finger drains were dry. No defects were observed in the lining.

Piezometers 34, 35, 37 and 38 were installed in the dam crest and piezometers 36 and 39 were installed in the downstream side of the dam wall. The installation depths of the tips are tabulated below.

Table 2-7: Section G to H Piezometer Installations

Piezometer No.	34	35	36	37	38	39
Installation depth (m)	12.78	8.33	6.11	13.85	8.82	6.66
Base installation (m AOD)	130.61	135.26	129.9	129.17	134.2	128.57

The water level in piezometer 34, which is installed in the dam foundation, appears to follow a seasonal fluctuation with a variation over the 2010 monitoring period of between 130.61 m AOD (effectively dry) and 131.59 m AOD. It is the same seasonal fluctuation that has been recorded in previous years. Piezometer 36, installed into the dam foundation, indicate values ranging from 129.68 m AOD (effectively dry) and 130.11 m AOD during the 2010 monitoring period. Piezometer 35 is non operational.

Piezometers 37 and 38 were both installed in the dam foundations and were effectively dry during the 2010 monitoring period. Piezometer 39, installed in the base of the dam wall, has been effectively dry during 2010, except the reading on 26 March of 129.42 m AOD.

Two readings were taken for sulphate level in piezometer 34 which ranged from 108 mg/l to 112 mg/l. The two corresponding conductivity values were 534 µS/cm and 623 µS/cm. Only two sets of readings were taken as on other occasions the piezometer was dry.

Monitoring well BH 10 is blocked while BH 11 groundwater measurements fluctuated between 46 m and 52 m below ground level. As previously mentioned, this indicates a rise in groundwater level from 2009 monitoring which could be attributed to the reduction in operating capacities of dewatering pumps following the installation of the K access plugs. The sulphate levels in BH 11 ranged from 115 mg/l to 138 mg/l.

2.9 Dam Sector H to B

This sector of the dam wall forms the dividing wall between Cell 2 and 3. No defects were observed in the lining.

Piezometers 40 and 41 were installed in the dam crest and piezometer 42 was installed in the downstream side of the dam wall. The installation depths of the tips are tabulated below.

Table 2-8: Section H to B Piezometer Installations

Piezometer No.	40	41	42	57	58
Installation depth (m)	130.6	8.74	5.07	17.85	18.19
Base installation (m AOD)	130.6	134.78	128.55	125.65	125.01

Piezometers 40, 41 and 42 decommissioned during Cell 3 construction. Two new piezometers have been installed, Piezometer 57 and 58 and both were effectively dry during the 2010 monitoring period.

BH 12 was also decommissioned during the construction of Cell 3.

2.10 Dam Sector H to I

This sector of the dam wall appears dry and well vegetated with no signs of distress or surface sloughing. This sector has a series of finger drains connected to the collector drain at the base of the chimney drain. All the finger drains were dry. No defects were observed in the lining.

Piezometers 43, 44, 46 and 47 were installed in the dam crest and piezometers 45 and 48 were installed in the downstream side of the dam wall. The installation depths of the tips are tabulated below.

Table 2-9: Sector H to I Piezometer Installations

Piezometer No.	43	44	45	46	47	48
Installation depth (m)	18.34	17.93	10.28	18.44	18.30	10.27
Base installation (m AOD)	124.67	125.08	121.80	124.56	124.70	121.74

All the piezometers were effectively dry during the 2010 monitoring period and reflect the significant dewatering of the area caused by mining.

No water samples could be obtained from the piezometers.

2.11 Dam Sector I to C

This sector of the dam wall appears dry and well vegetated with no signs of distress or surface sloughing. This sector has a series of finger drains connected to the collector drain at the base of the chimney drain. All the finger drains were dry. No defects were observed in the lining.

Piezometers 49, 50, 52 and 53 were installed in the dam crest and piezometers 51 and 54 were installed in the downstream side of the dam wall. The installation depths of the tips are tabulated below.

Table 2-10: Sector I to C Piezometer Installations

Piezometer No.	49	50	51	52	53	54
Installation depth (m)	18.38	18.43	11.41	18.26	18.19	10.24
Base installation (m AOD)	124.63	124.53	123.28	124.77	124.74	123.81

Piezometer 54 was effectively dry during the 2010 monitoring period. Piezometers 49, 50, 51, 52 and 53 are almost dry with values averaging some 100 to 200 mm above the installation depth, which reflects the significant dewatering of the area caused by mining. Piezometer 51 indicated large fluctuations in water level in the early part of 2009 and 2010 as well as later in 2010. Between the peaks in January and November 2010 the readings remain reasonably constant at 123.4m.

Monitoring well BH 13 indicates a water level between 48.5 m in November and 85.74 m in January below ground level and the sulphate levels monitored were generally between 24 mg/l and 100 mg/l. The large rise in readings can be attributed to the reduced pumping underground following the installation of the K access plugs. However, there was a substantial drop in water level at the end of the year from 48.5 m below ground level in November to 69 m below ground level in December.

3.0 CONCLUSIONS

3.1 General

Based on the visual inspection and an evaluation of the monitoring data, Cell 3, Cell 2 and Cell 1 are performing in accordance with the design. The dam walls are in excellent condition and are virtually dry for much of the year. The exception is the internal wall dividing Cell 1 from Cell 2 with Piezometer 4 recording relatively high water levels in previous years. Piezometer 4 records a maximum water level of 8.0 m below the crest level which is satisfactory. This water level is 0.5 m lower than that recorded in 2009 and could be influenced by the closure of Cell 2. The high water level does not compromise stability as the wall is internal and supported on both sides by tailings.

The finger drains operate during the wetter winter months to drain rain water percolating through the dam wall.

All damaged piezometer heads should be repaired and capped to prevent the ingress of surface water.

While the dam walls are not over grown, we would recommend that the vegetation is managed to allow for easier visual inspection. This can be achieved using sheep as carried out in the past.

3.2 Cell 3

It is understood that Cell 3 will continue as a balancing pond until the mine dewatering system is shut down in 2012. The water level is currently controlled by pumping surplus water to the water treatment plant

The water currently collected in the manhole at the outside toe of dividing wall between Cells 2 and 3 and pumped back to Cell 3 has reduced to approximately 2.4 l/min and will continue to reduce in flow rate as the water level in Cell 3 is reduced. The flow rate should be monitored more regularly once the pond water level in Cell 3 reduces prior to capping.

The spillway arrangement, sizing and preliminary design has been completed and presented in the report, Rehabilitation and Closure Plan No. 09514150006.500/A dated January 2011.

3.3 Cell 2

Cell 2 is complete and restoration has commenced. The profile of the cap will be a shallow dome formed from a composite growing medium, glacial till and sub soils. This would ensure that at closure the facility could not store water.

Where possible, surface water should be removed from any hollows and the tailings allowed to desiccate prior to placement of the cap over the entire tailings surface. Tailings, from levelling of Cell 3, have been pumped into the main central low area of Cell 2. The restoration of Cell 2 including drainage of the cap is currently being undertaken by Galmoy.

The spillway system from Cell 2 to Cell 3 should be monitored regularly during the capping operation to ensure flow is not impeded.

Heaving of the tailings due to placing the cap was noted close to the dam wall in the central section of G and H. This will have no impact on the structural integrity of the dam wall.

3.4 Cell 1

The restoration of Cell 1 involves the forming of a shallow dome formed from a composite growing medium with glacial till. This process has been completed and Galmoy are installing the perimeter drainage system.

As previously stated, any localised ponds that form on the cap will have no impact on the structural integrity of the dam wall.

Report Signature Page

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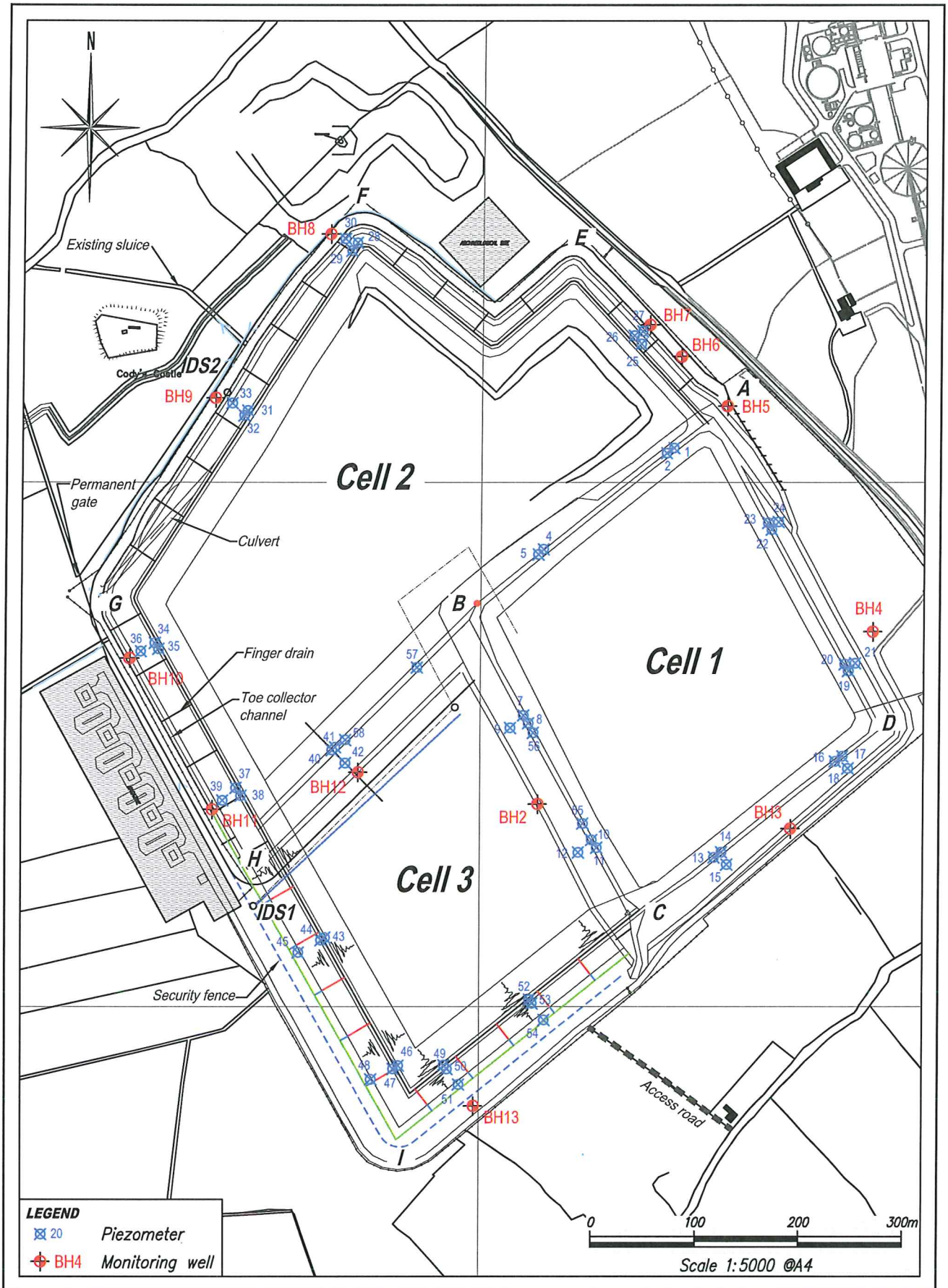
VAT No. 209 0084 92

APPENDIX A

Drawings



Date	March 2011
Project No.	11514150007
Created by	P.A.T.
File No.	518804

Golder Associates

Title

Plan Showing Locations of Piezometers and Monitoring Wells for Cells 1, 2 and 3
Arcon Mines Limited
Galmoy Tailings Dam (1, 2 and 3), Galmoy, Ireland

Figure 1

APPENDIX B

Piezometer Monitoring Data

March 2011
Report No. 11514150007.500/A.0

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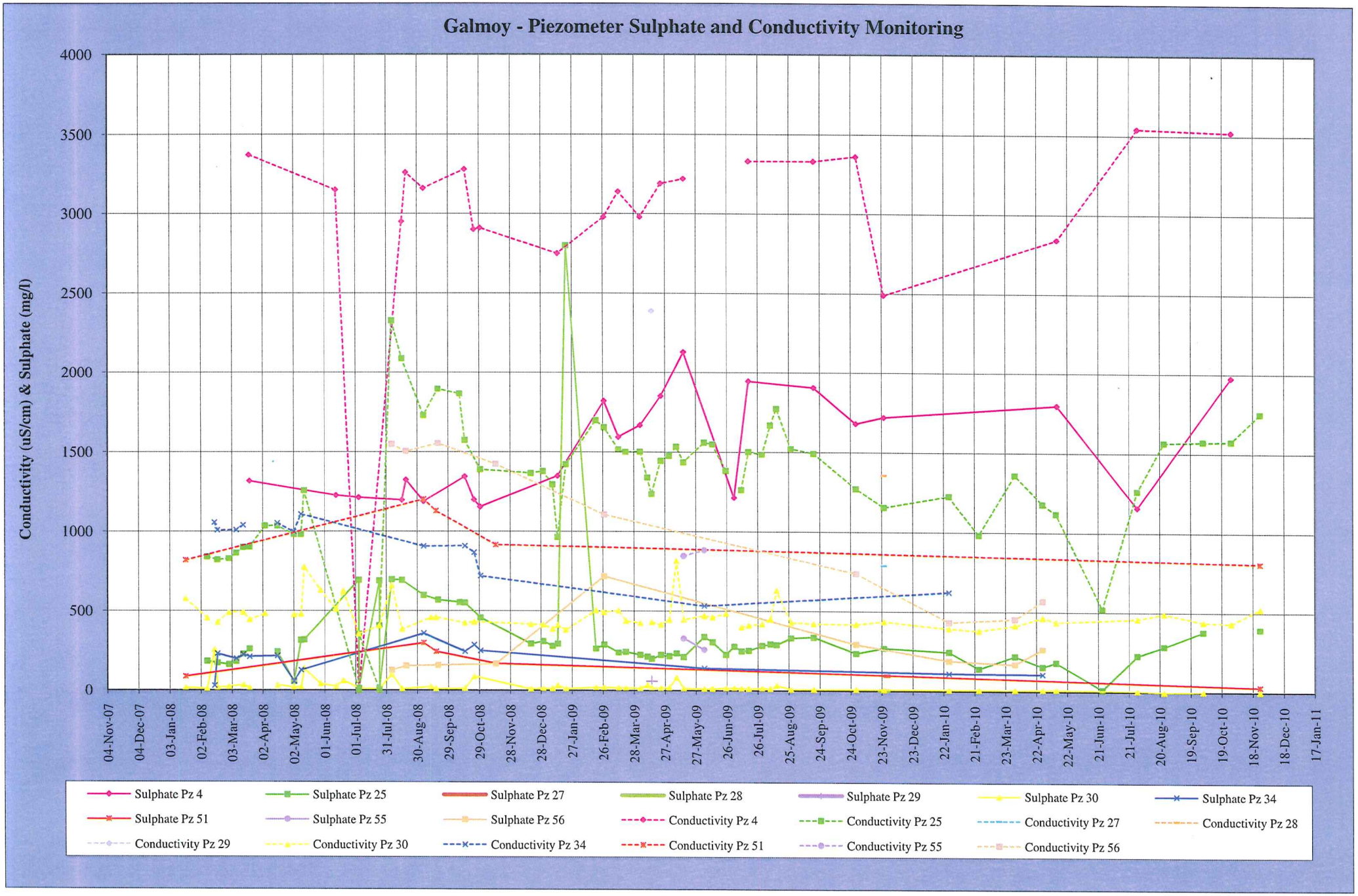
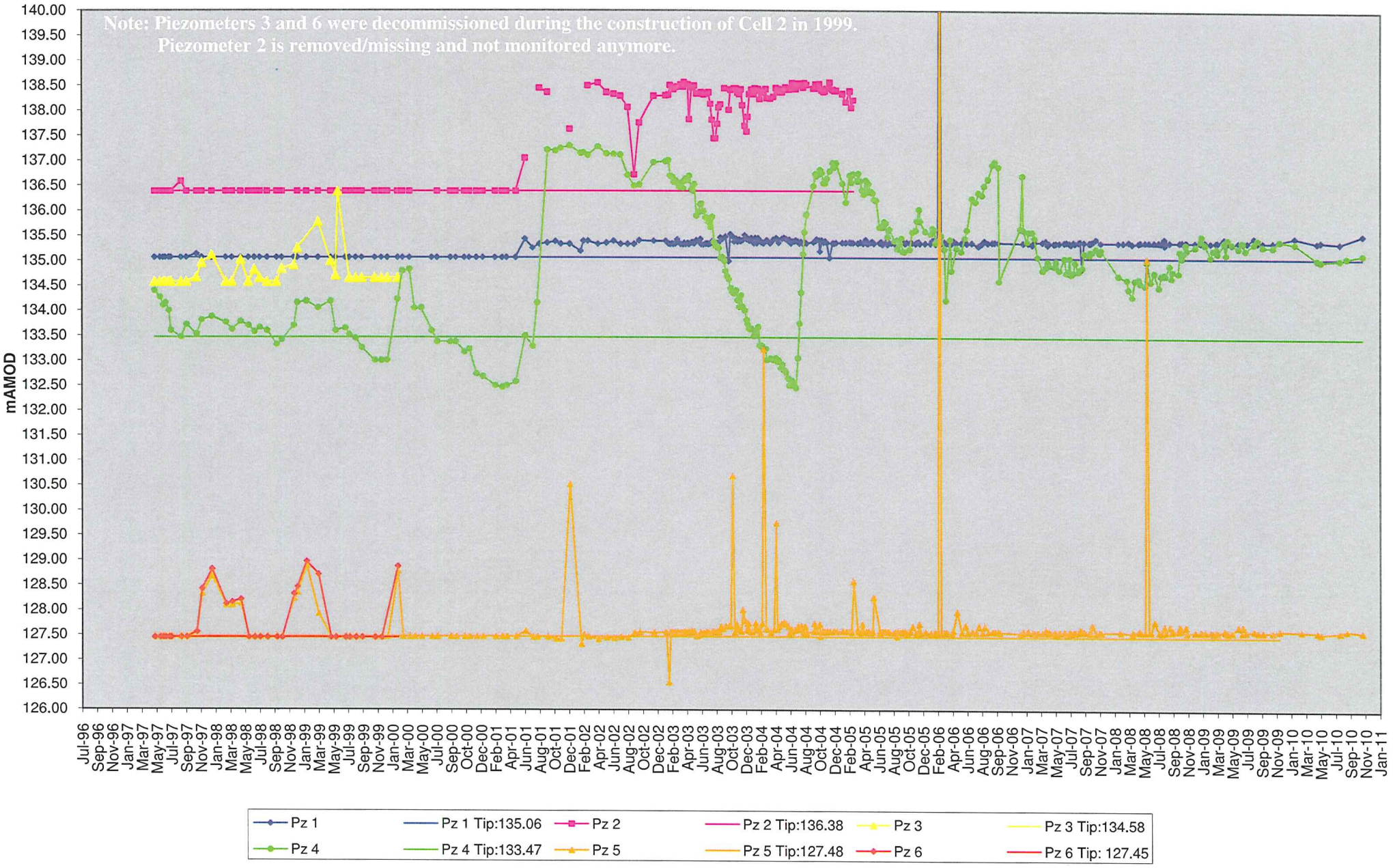
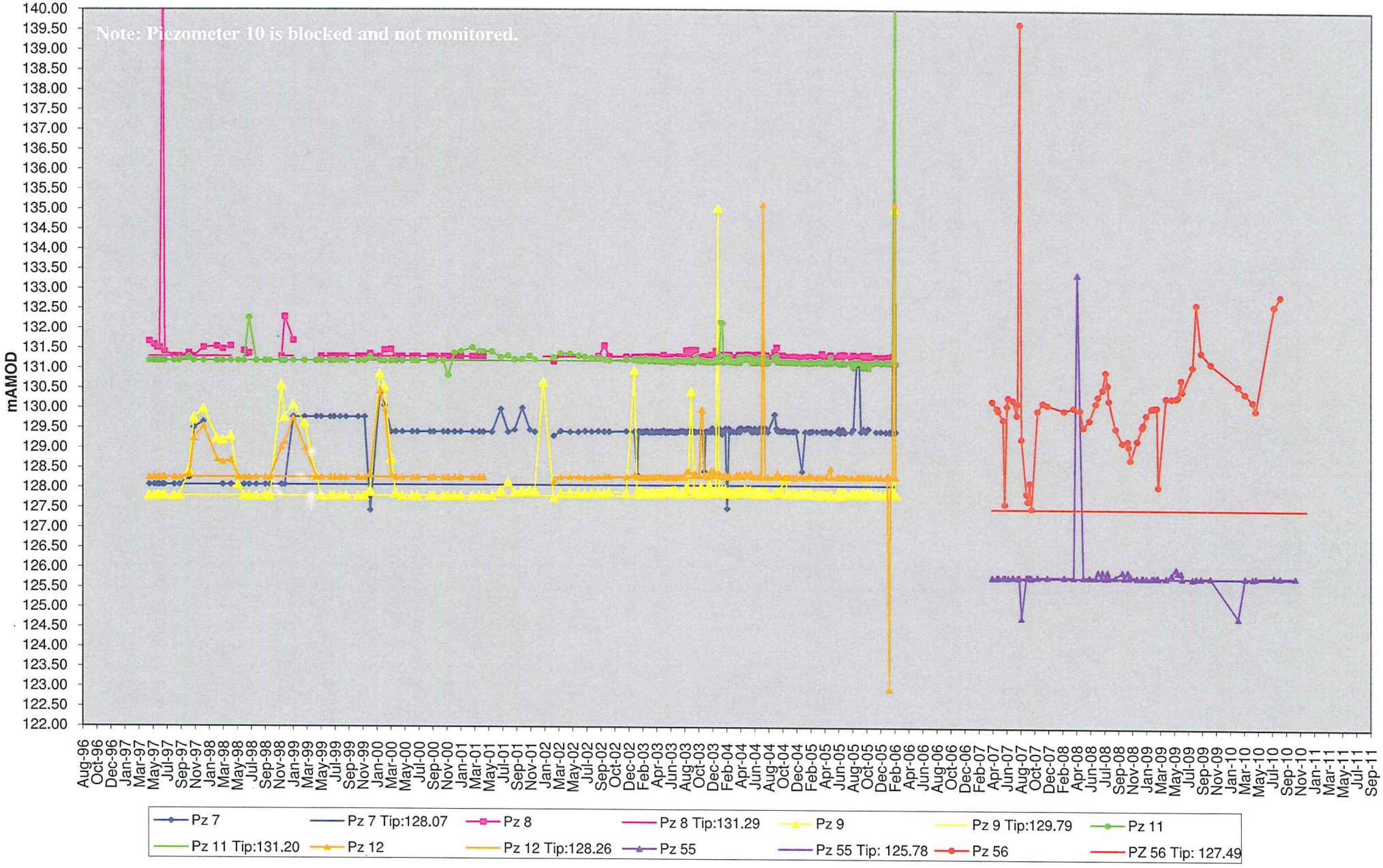

Galmoy - Piezometer Sulphate and Conductivity Monitoring
Conductivity (uS/cm) & Sulphate (mg/l)
4000
3500
3000
2500
2000
1500
1000
500
0
04-Nov-07
04-Dec-07
03-Jan-08
02-Feb-08
03-Mar-08
02-Apr-08
02-May-08
01-Jun-08
01-Jul-08
31-Jul-08
30-Aug-08
29-Sep-08
29-Oct-08
28-Nov-08
28-Dec-08
27-Jan-09
26-Feb-09
28-Mar-09
27-Apr-09
27-May-09
26-Jun-09
26-Jul-09
25-Aug-09
24-Sep-09
24-Oct-09
23-Nov-09
23-Dec-09
22-Jan-10
21-Feb-10
23-Mar-10
22-Apr-10
22-May-10
21-Jun-10
21-Jul-10
20-Aug-10
19-Sep-10
19-Oct-10
18-Nov-10
18-Dec-10
17-Jan-11
Sulphate Pz 4
Sulphate Pz 25
Sulphate Pz 27
Sulphate Pz 28
Sulphate Pz 29
Sulphate Pz 30
Sulphate Pz 34
Sulphate Pz 51
Sulphate Pz 55
Sulphate Pz 56
Conductivity Pz 4
Conductivity Pz 25
Conductivity Pz 27
Conductivity Pz 28
Conductivity Pz 29
Conductivity Pz 30
Conductivity Pz 34
Conductivity Pz 51
Conductivity Pz 55
Conductivity Pz 56

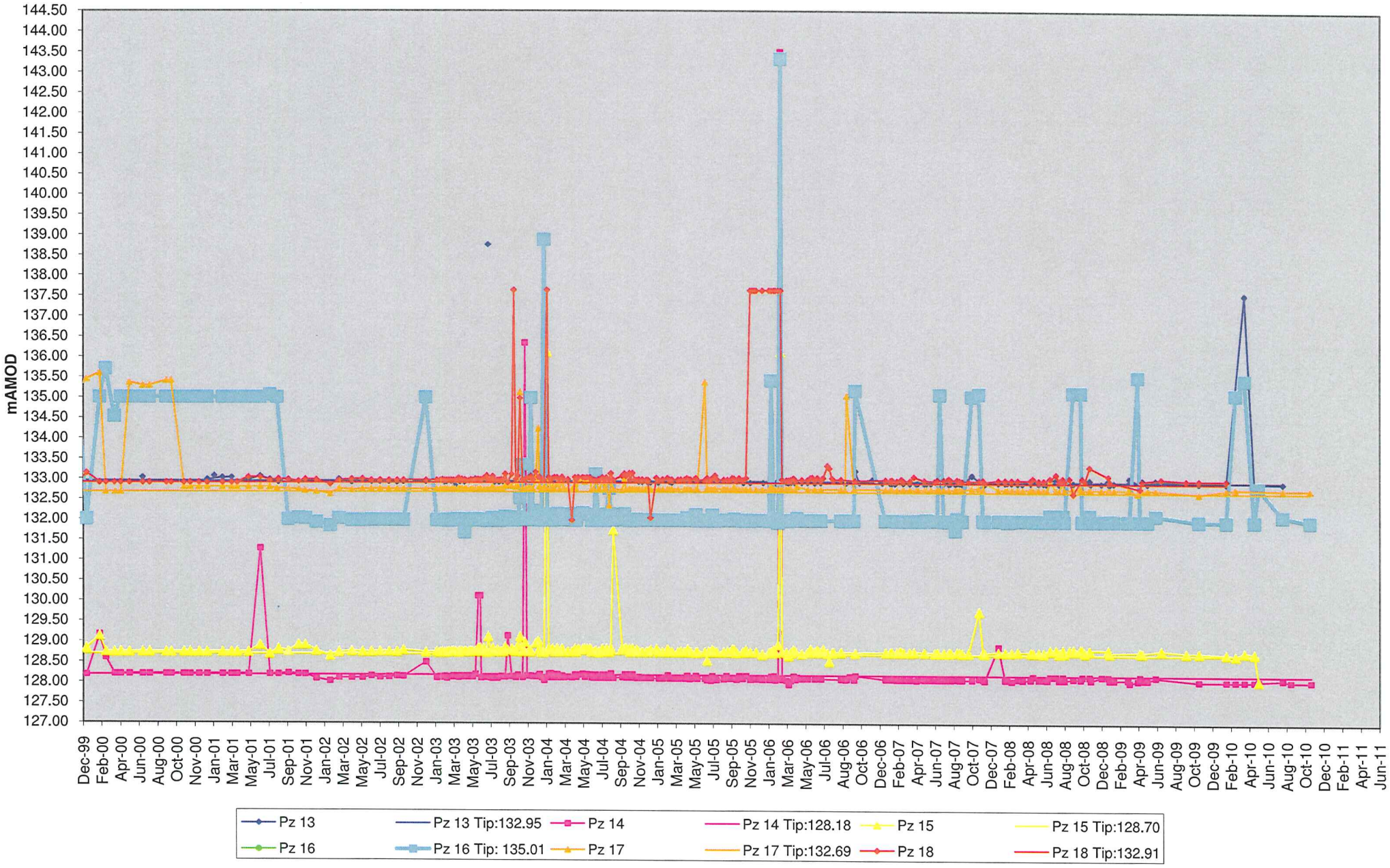
Dam Sector A - B: Piezometers 1, 2, 3, 4, 5, 6



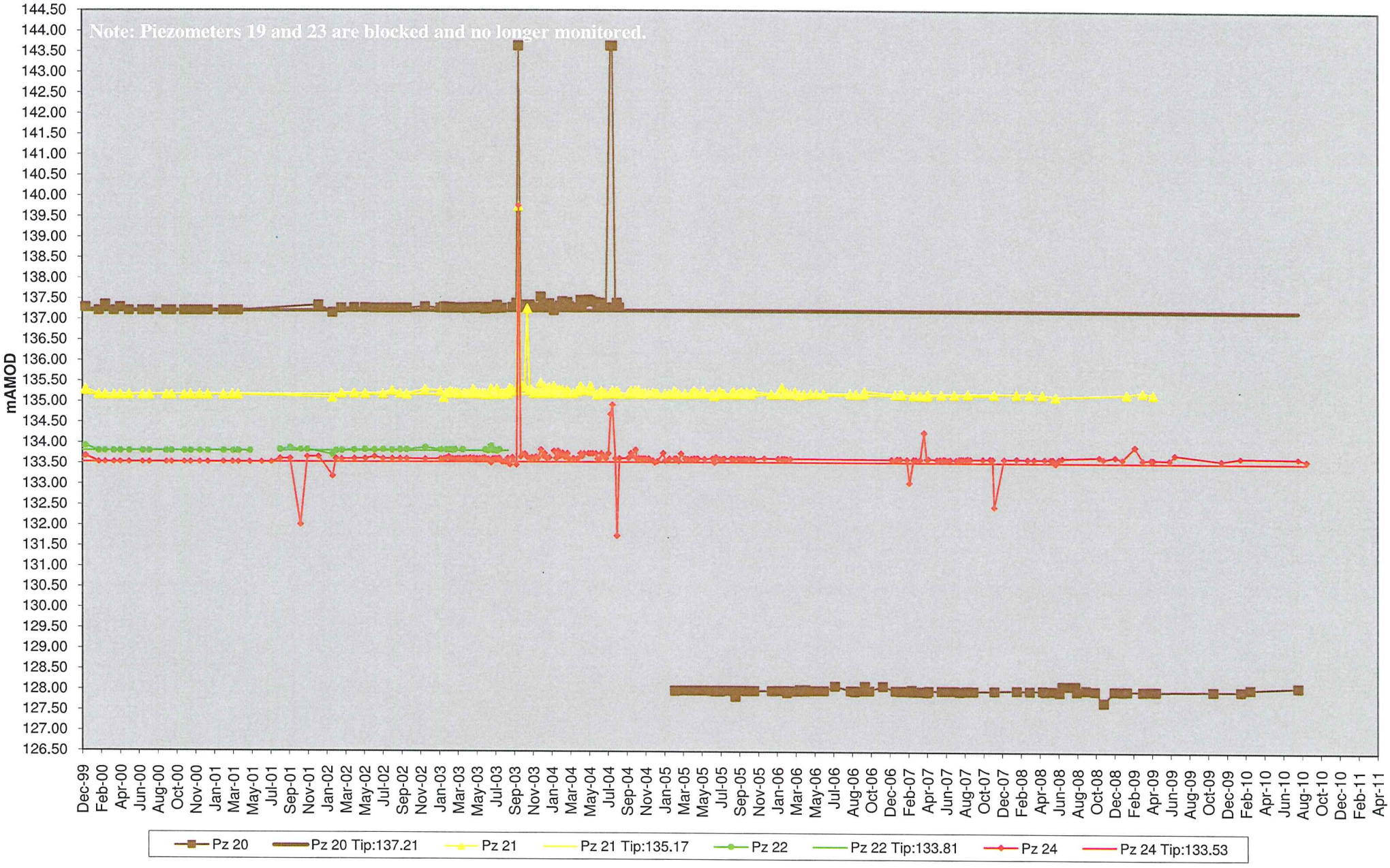
Dam Sector B - C: Piezometers 7, 8, 9, 10, 11, 12, 55 and 56



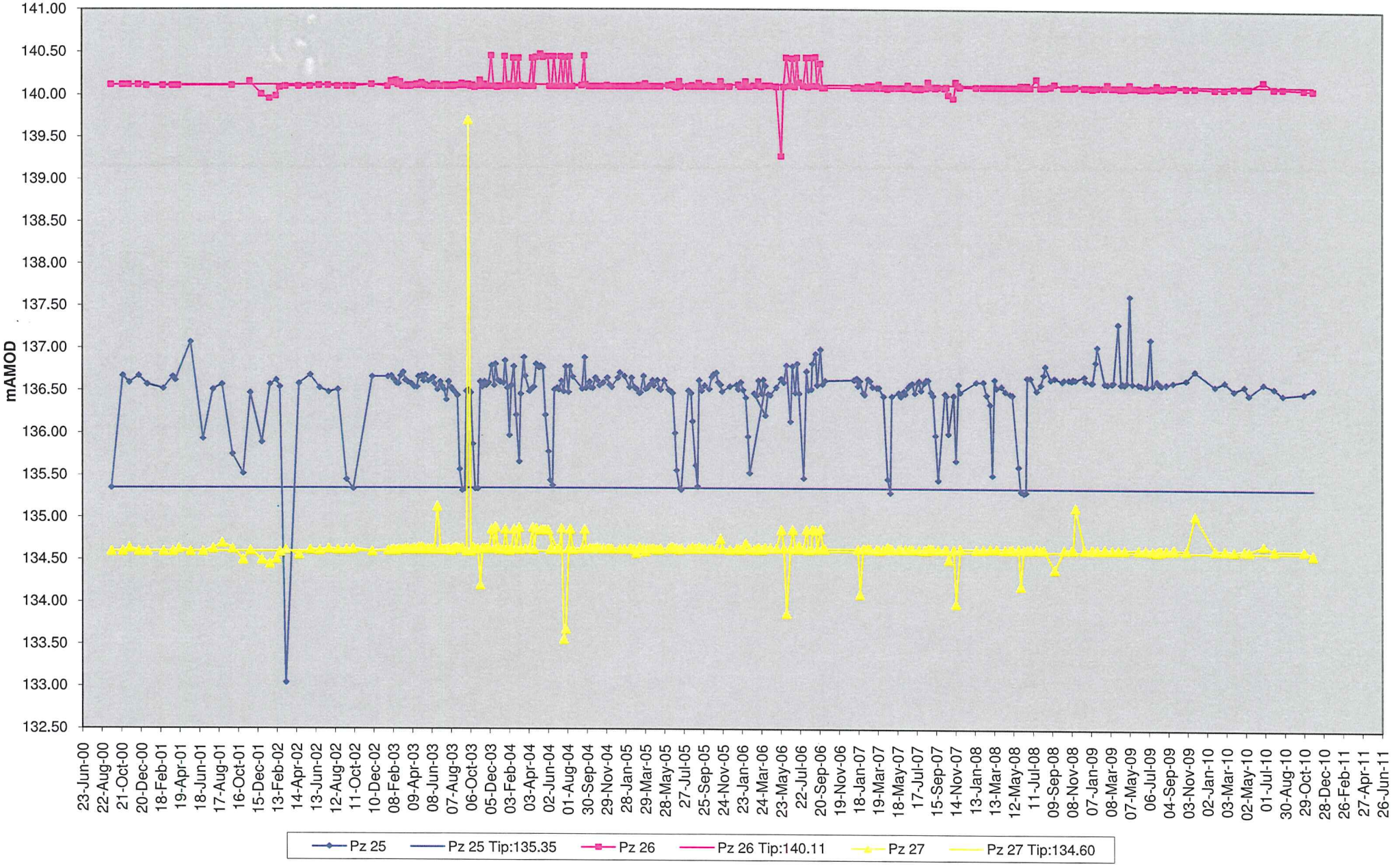
Dam Sector C - D: Piezometers 13, 14, 15, 16, 17, 18



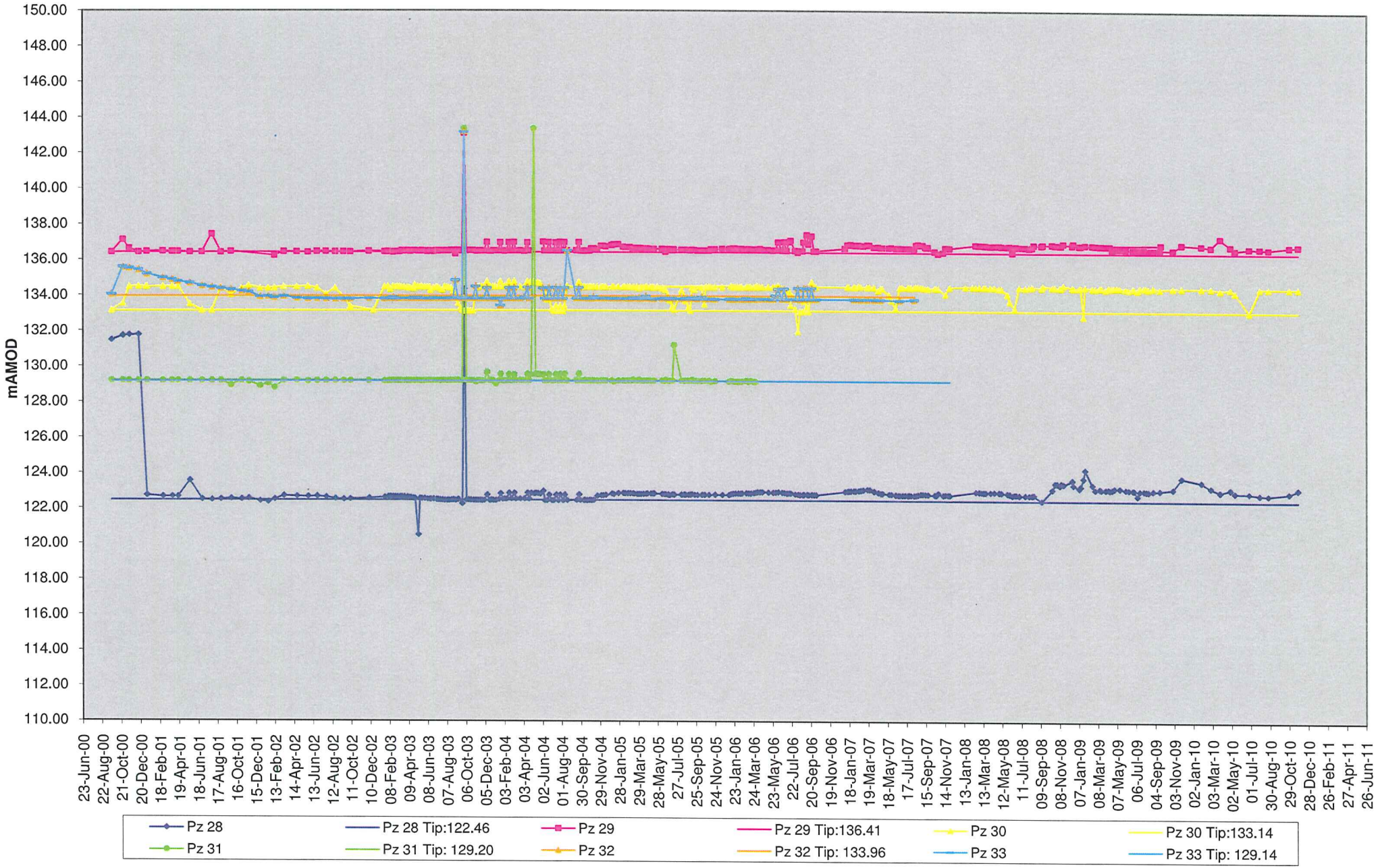
Dam Sector D - A: Piezometers 19, 20, 21, 22, 23, 24



Dam Sector A - F: Piezometers 25, 26, 27



Dam Sector F - G: Piezometers 28, 29, 30, 31, 32, 33



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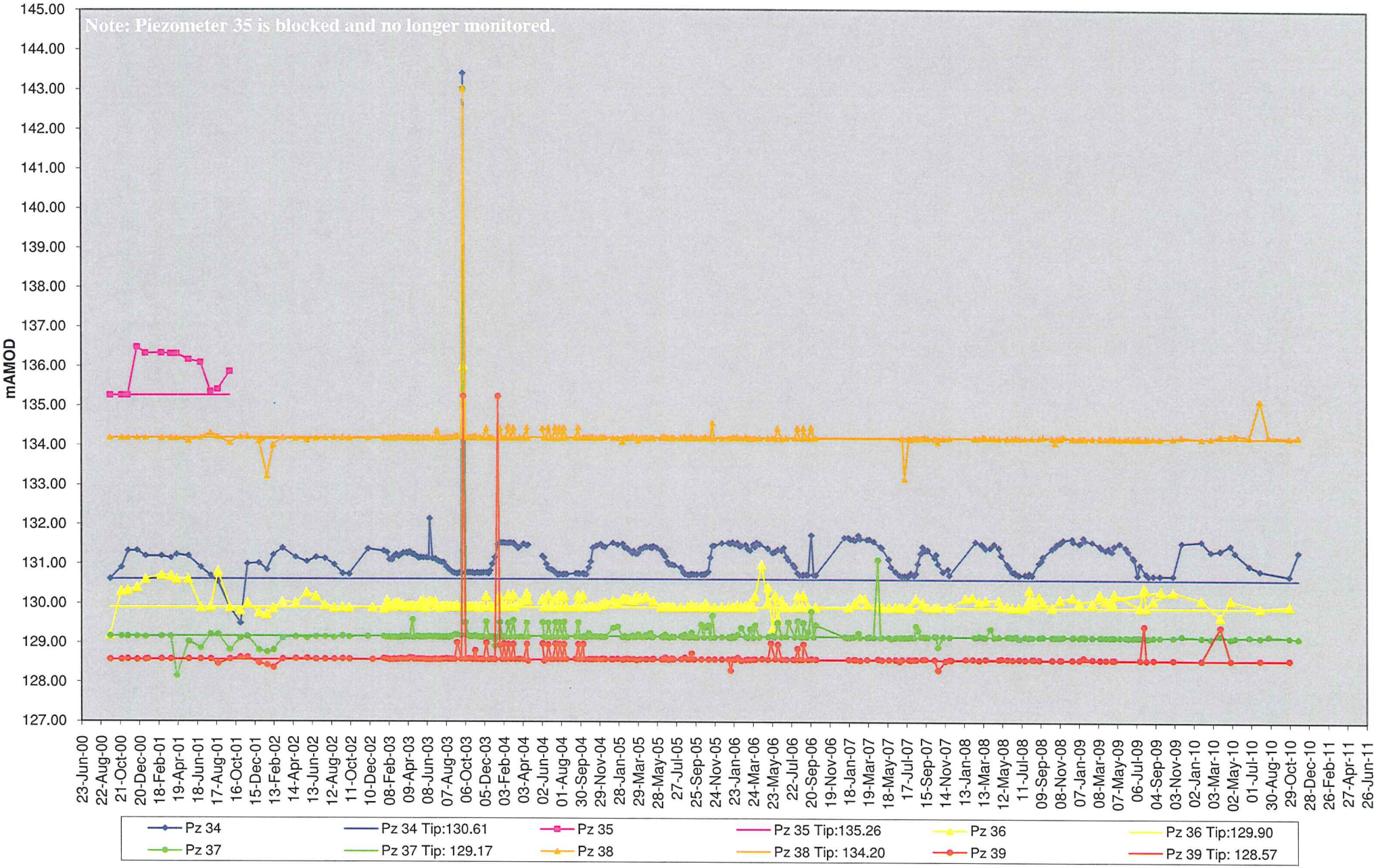
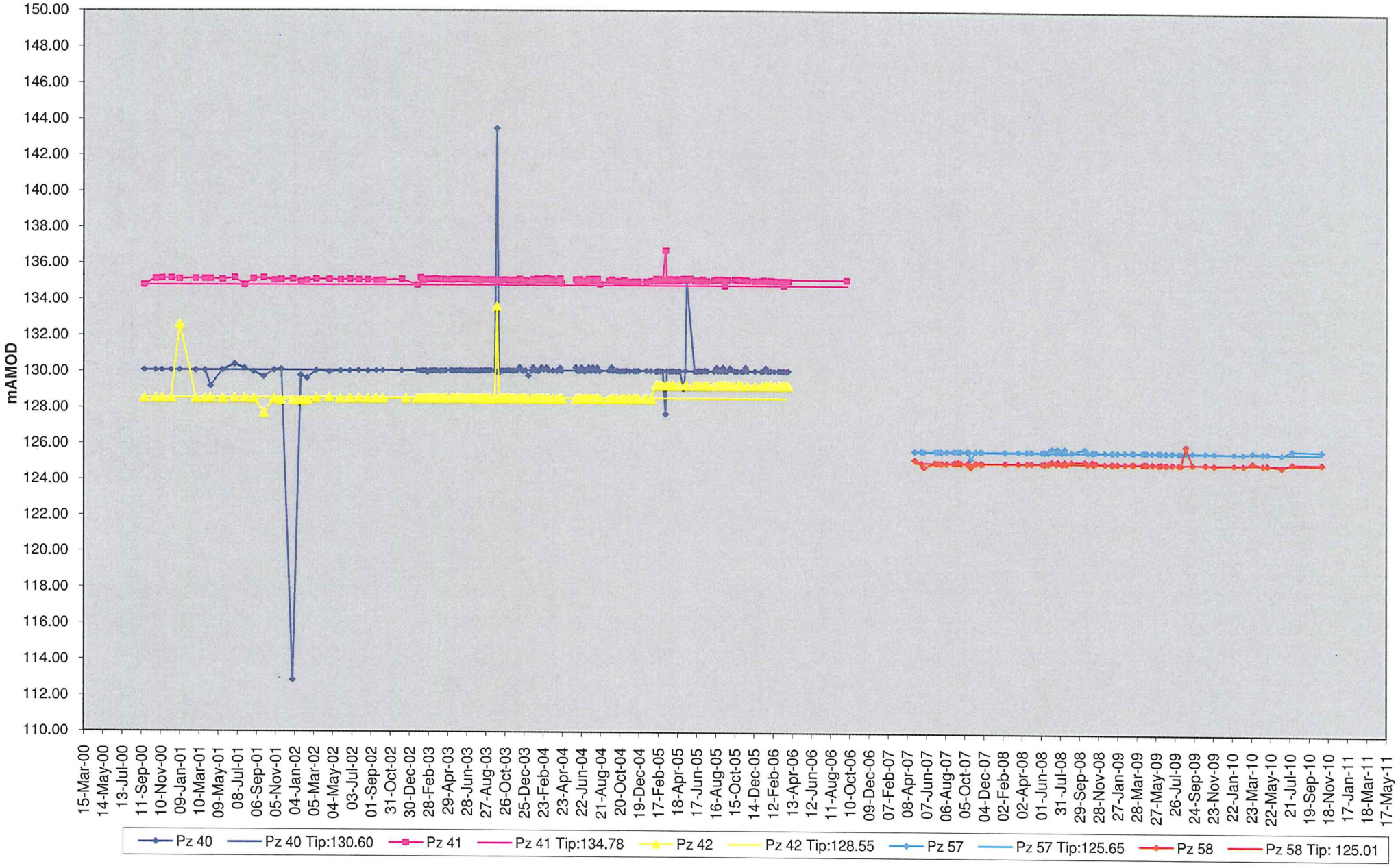
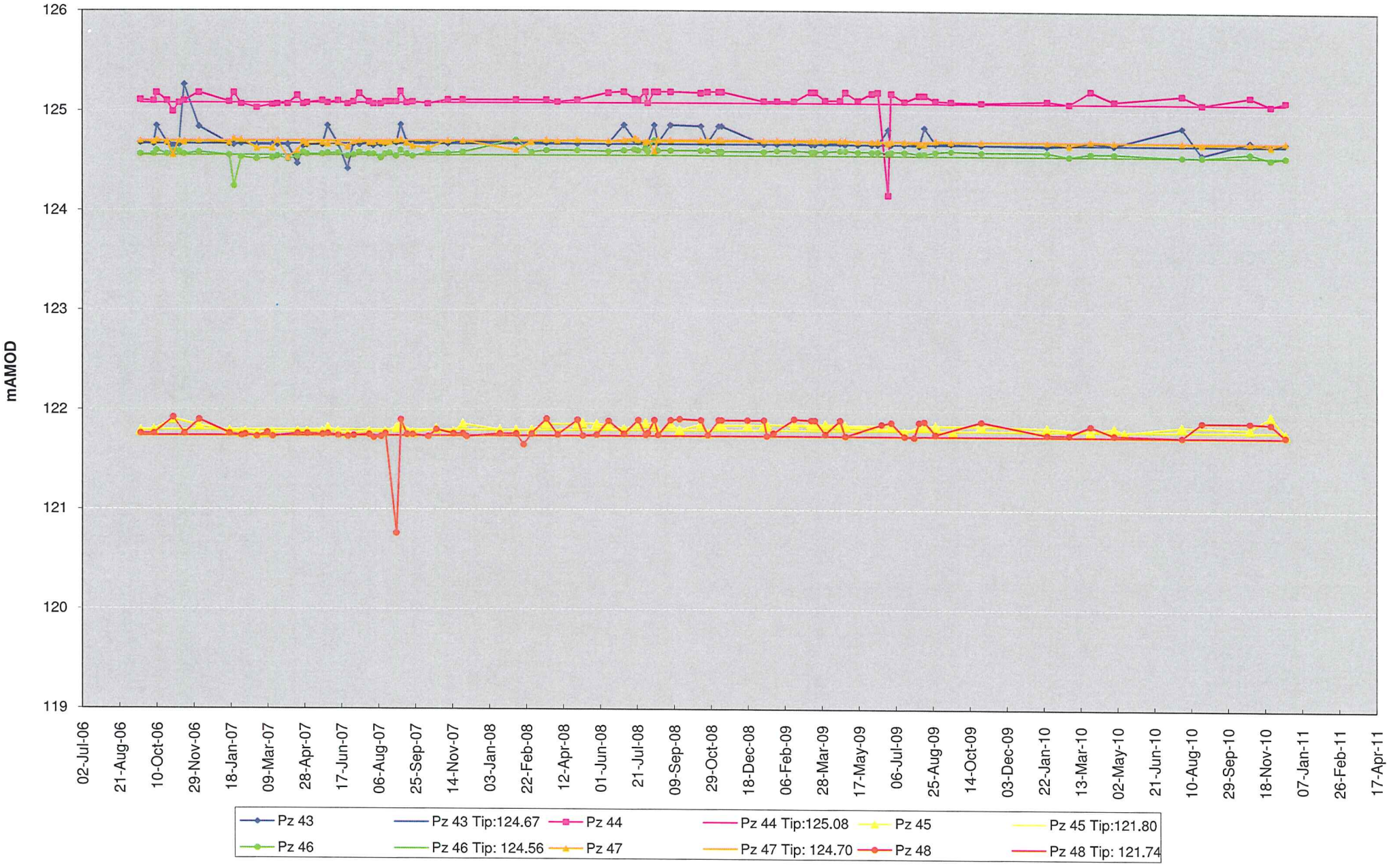
Dam Sector G - H: Piezometers 34, 35, 36, 37, 38, 39



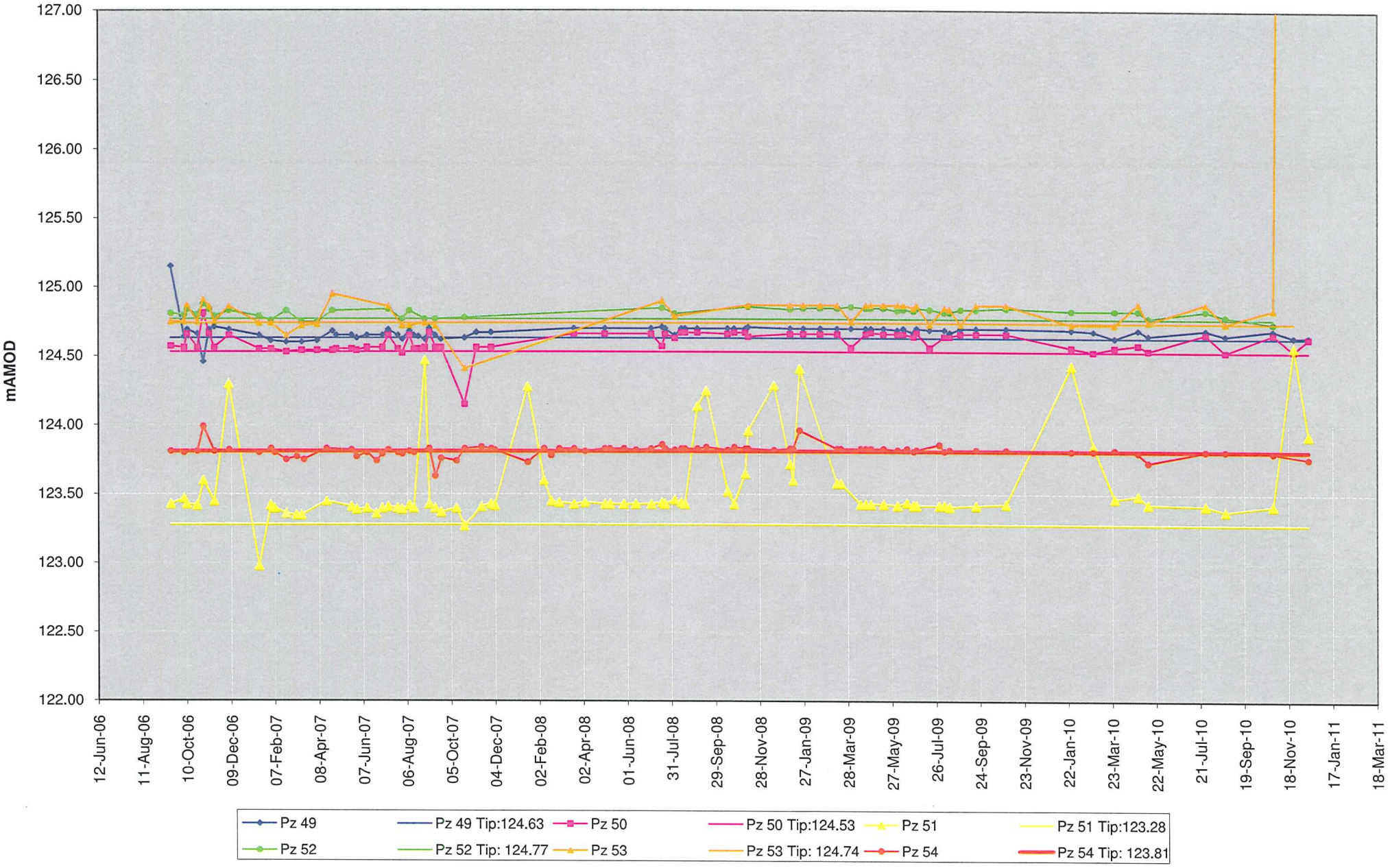
Dam Sector H - B: Piezometers 40, 41, 42, 57 and 58



Dam Sector H - I: Piezometers 43, 44, 45, 46, 47, 48

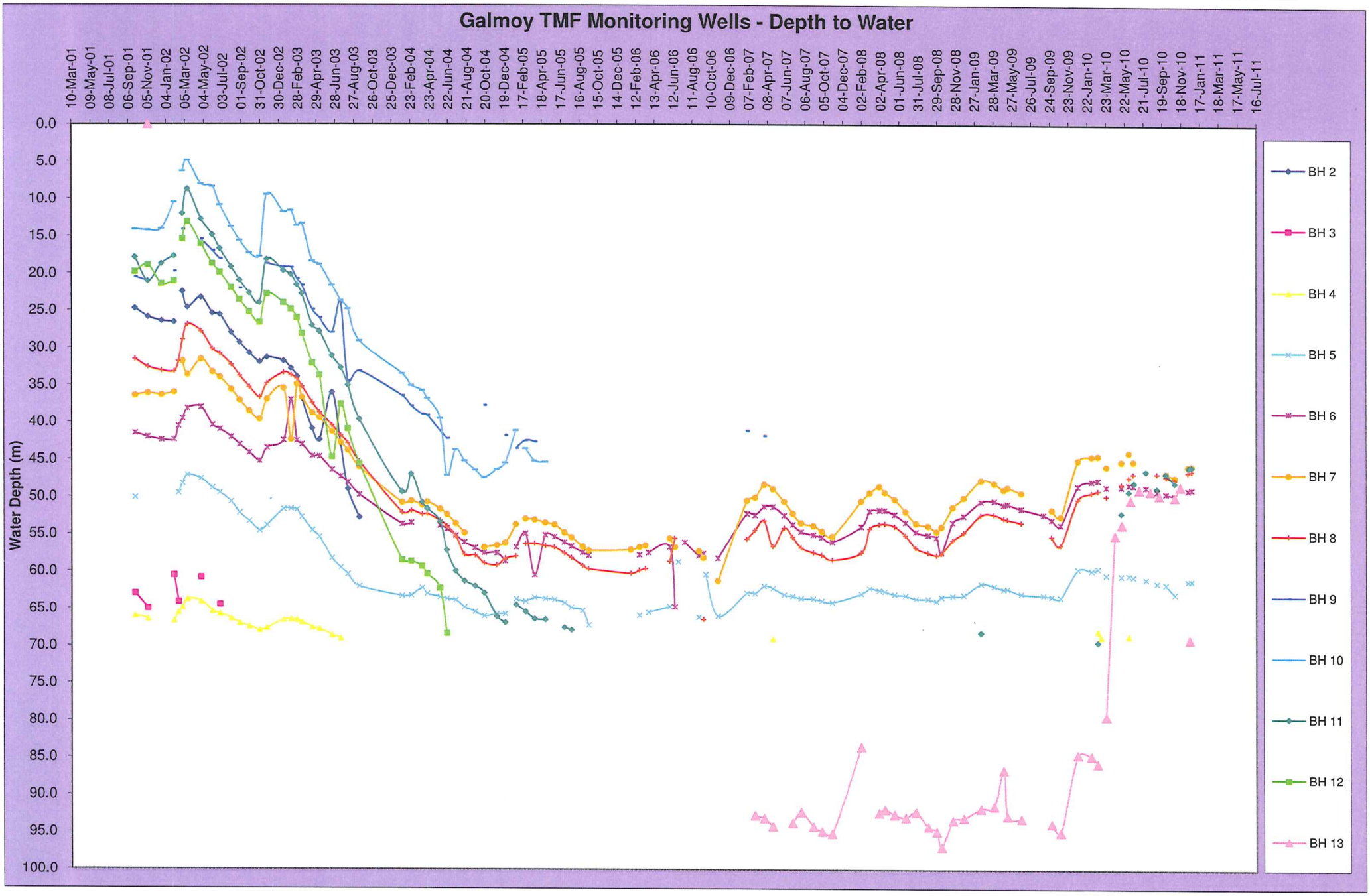


Dam Sector I - C: Piezometers 49, 50, 51, 52, 53, 54



APPENDIX C

Well Monitoring Data


Galmoy TMF Monitoring Wells - Depth to Water
Water Depth (m)
0.0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
40.0
45.0
50.0
55.0
60.0
65.0
70.0
75.0
80.0
85.0
90.0
95.0
100.0
10-Mar-01
09-May-01
08-Jul-01
06-Sep-01
05-Nov-01
04-Jan-02
05-Mar-02
04-May-02
03-Jul-02
01-Sep-02
31-Oct-02
30-Dec-02
28-Feb-03
29-Apr-03
28-Jun-03
27-Aug-03
26-Oct-03
25-Dec-03
23-Feb-04
23-Apr-04
22-Jun-04
21-Aug-04
20-Oct-04
19-Dec-04
17-Feb-05
18-Apr-05
17-Jun-05
16-Aug-05
15-Oct-05
14-Dec-05
12-Feb-06
13-Apr-06
12-Jun-06
11-Aug-06
10-Oct-06
09-Dec-06
07-Feb-07
08-Apr-07
07-Jun-07
06-Aug-07
05-Oct-07
04-Dec-07
02-Feb-08
02-Apr-08
01-Jun-08
31-Jul-08
29-Sep-08
28-Nov-08
27-Jan-09
28-Mar-09
27-May-09
26-Jul-09
24-Sep-09
23-Nov-09
22-Jan-10
23-Mar-10
22-May-10
21-Jul-10
19-Sep-10
18-Nov-10
17-Jan-11
18-Mar-11
17-May-11
16-Jul-11
BH 2
BH 3
BH 4
BH 5
BH 6
BH 7
BH 8
BH 9
BH 10
BH 11
BH 12
BH 13

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