



Anvil Range Pit Lakes 2006 Evaluation of In-Situ Treatment

2006/07 Task 22



Prepared for:

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on behalf of the

FARO MINE CLOSURE PLANNING OFFICE



Prepared by:



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July 2007

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2006 Evaluation of In-Situ Treatment
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Executive Summary

Investigations undertaken in 2004 concluded that biological treatment should be continued in the Grum Pit and tested in the Faro Pit. The 2005 investigations in the Grum Pit concluded that biological treatment should be continued there. However, the 2005 fertilization program in the Faro Pit interfered with the performance of the Faro Mill water treatment system, and no further biological treatment was recommended for 2006. Water quality and physical limnological monitoring were recommended to continue the Faro and Vangorda pits in 2006. This report provides presents and discusses the results from the 2006 biological treatment program in the Grum Pit and the monitoring of the Faro and Vangorda pits

The Faro Pit was not fertilized during 2006. The monitoring results indicated that phosphate species were essentially depleted from the surface water.

The Grum Pit water responded well to fertilization and excellent algal growth was achieved. Overall mass balance calculations indicate that about 12 tonnes of zinc, in excess of the ongoing loading from the pit walls, have been removed from the Grum Pit since commencement of biological treatment in 2004. The 2006 results also demonstrated that the residual level of phosphate in the water column can be controlled by ceasing fertilizer applications in mid to late summer.

Monitoring in the Vangorda Pit indicates increasing zinc concentrations at depth, suggesting that zinc is being dissolved from treatment sludges that were previously deposited in the pit. That explanation is supported by pH values of less than 6 observed at depth.

It is recommended that monitoring of both the Faro and Vangorda Pit be continued in 2007. Mass balance calculations should be carried forward to verify the current estimates of metal loadings to each pit.

Based on the zinc removal rates observed for the Grum Pit and the level of control established in 2006, it is recommended that the fertilization program be continued in 2007. It is also recommended that bench scale water treatability testing be undertaken on the Grum Pit water to determine potential impacts on a conventional treatment system, should it become necessary to treat water prior to future discharges.

* * *

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1 Introduction

Based on the findings of an assessment of biological treatment for the removal of zinc and potentially other contaminants from water contained in the pit lakes at the Anvil Range Complex, an in-situ evaluation program has been carried out at the Grum Pit since 2004. The initial pit lake fertilization and limno-coral testing programs were carried out by Lorax Environmental Services Inc. in association with Laberge Environmental Services. Since then, the fertilization and monitoring have been carried out by Laberge Environmental Services. A program of physical limnological monitoring was also initiated in 2004 and continued in 2005.

The findings from the 2004 and 2005 programs are reported elsewhere (SRK 2005 and SRK 2006, respectively). The initial results indicated that the Grum Pit water responded rapidly to fertilization with excellent phytoplankton growth occurring within two weeks of fertilization. Zinc removal by phytoplankton was demonstrated to the extent that total zinc concentrations in the near surface water were reduced to below 0.3 mg/L. The physical limnology assessments indicated that the three pit lakes exhibit quite different physical properties, and specifically that the stability of the layer structure varies from one pit to another. The results also indicated fresh water input may be occurring to the surface of the Grum Pit through summer and early fall.

The 2005 investigations concluded that biological treatment should be continued in the Grum Pit during 2006. However, based on the 2005 findings, the duration of the 2006 fertilization program was decreased to coincide with active biological growth and to minimise residual nutrients at the end of the open water season. The 2005 fertilization program in the Faro Pit was found to interfere with the performance of the Faro Mill water treatment system and, consequently, the Faro Pit was not fertilized in 2006. However, water quality monitoring continued in both the Faro Pit and Vangorda Pit during 2006.

2 Fertilization and Monitoring Program

The fertilization and monitoring of the pit lakes was undertaken by Laberge Environmental Services. A summary of the 2006 sampling and monitoring program is provided in Table 2.1. Fertilization of the Grum Pit entailed distribution by boat of about 1.5 drums (320 L) of the fertilizer mix.

Fertilization of the Grum Pit was terminated earlier than in previous years to assess is the possibility for limiting the concentrations of nutrients in the water column at the end of the season. Neither the Faro nor the Vangorda Pit was fertilized during the 2006 summer season.

Table 2.1: Summary of Fertilization and Monitoring Program for 2006

Date	Pit Lake	Fertilize	Field Parameters	Water Quality	Chlorophyll 'a'
2 May 06 (sample under ice)	Faro	-	-	-	-
	Grum	-	X	X	X
	Vangorda	-	-	-	-
17 May 06 (sample under ice)	Faro	-	X	X	X
	Grum	-	-	-	-
	Vangorda	-	X	X	X
14 Jun 06	Faro	-	-	-	-
	Grum	X	X	X	X
	Vangorda	-	-	-	-
21 Jun 06	Faro	-	X	X	X
	Grum	X	X	X	X
	Vangorda	-	X	X	X
28 Jun 06	Faro	-	-	-	-
	Grum	X	-	-	-
	Vangorda	-	-	-	-
5 Jul 06	Faro	-	-	-	-
	Grum	X	-	-	-
	Vangorda	-	-	-	-
12 Jul 05	Faro	-	-	-	-
	Grum	X	X	X	X
	Vangorda	-	-	-	-
19 Jul 06	Faro	-	-	-	-
	Grum	X	-	-	-
	Vangorda	-	-	-	-
26 Jul 06	Faro	-	-	-	-
	Grum	X	-	-	-
	Vangorda	-	-	-	-
2 Aug 06	Faro	-	-	-	-
	Grum	X	-	-	-
	Vangorda	-	-	-	-
9 Aug 06	Faro	-	X	X	X
	Grum	-	X	X	X
	Vangorda	-	X	X	X
15 Sep 06	Faro	-	X	X	X
	Grum	-	X	X	X
	Vangorda	-	X	X	X

Field parameters included measurement of pH, temperature, TDS conductivity and dissolved oxygen at various depths in the pit lakes. The depth sampling stations that were adopted included 0.1 m, 1 m, 3 m, 5 m, 10 m, 15 m and 30 m in all three pits. Additional stations at 40 m were established in the Grum and Vangorda Pit, whereas the Faro Pit was also sampled at depths of 60 m and 80 m.

Complete field parameter results, including field reports prepared by Laberge are provided in Appendix A and analytical results for the water quality samples are provided in Appendix B. The results are discussed in the following sections respectively for each of the pit lakes.

3 Results and Discussion

3.1 Faro Pit

3.1.1 Nutrients

Dissolved orthophosphate concentrations during 2006 were below detection limit, as it was in general during 2005, even during the period the pit lake was fertilized. Depth profiles of the total phosphate-P concentrations in the Faro Pit are shown for 2005 and 2006, respectively, in Figure 3.1. As shown, there has been a significant decrease in the phosphorus concentrations in the near surface water (to a depth in excess of 15 m). The August 9, 2006 result for a depth of 30 m appears to be anomalous, especially when the corresponding ortho-phosphate-P concentration was below 0.001 mg/L. Compared to 2005, there appears to be an increase in total phosphorus at depth, likely due to the remobilization of phosphate from settled organic matter. However, as indicated by the limnological assessment, a chemocline exists within the lake and the elevated phosphorus concentrations are not likely to extend to the near surface water as long as the chemocline remains stable.

As shown in Figure 3.2, ammonia-N was present in the pit lake prior to commencement of fertilization in 2005, and may have increased marginally in the surface layer (down to a depth of about 15 m) during 2006. However, the trend is not clear, due to the seasonal variability in the data.

3.1.2 Algal Growth

The chlorophyll 'a' depth profiles from the Faro Pit are illustrated in Figure 3.3. The Faro Pit was fertilized three times in 2005, and a rapid increase in chlorophyll 'a' is indicated for the July 6, 2005 depth profile. Since then, however, the chlorophyll 'a' concentration has remained at or near the detection limit with no significant algal growth indicated during 2006.

3.1.3 Zinc Concentrations

Depth profiles for total zinc concentrations are shown in Figure 3.4. As observed in the 2004 and preceding monitoring results, a chemocline exists in the Faro Pit at a depth between 15 and 30 m below surface. The monitoring results for 2005 suggested a net removal of zinc from water immediately near the surface, as was evident, for example, in the July 2005 profile. In contrast, the results for 2006 indicate no near surface decrease in zinc concentrations. The results support the conclusion that the 2005 fertilization resulted in a significant removal of zinc from the near surface layer.

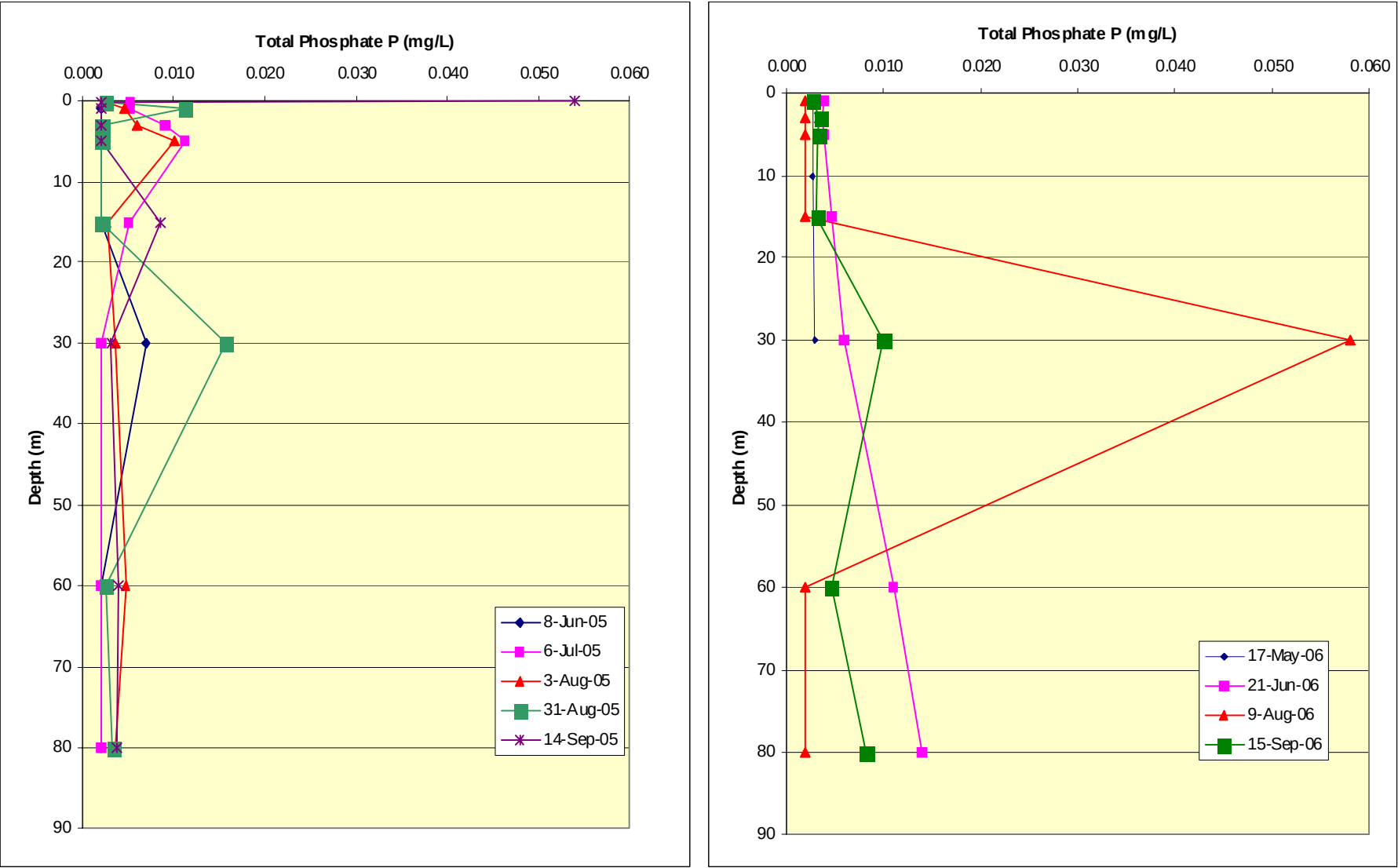


Figure 3.1: Profiles of Total Phosphate-P Concentrations Measured in the Faro Pit

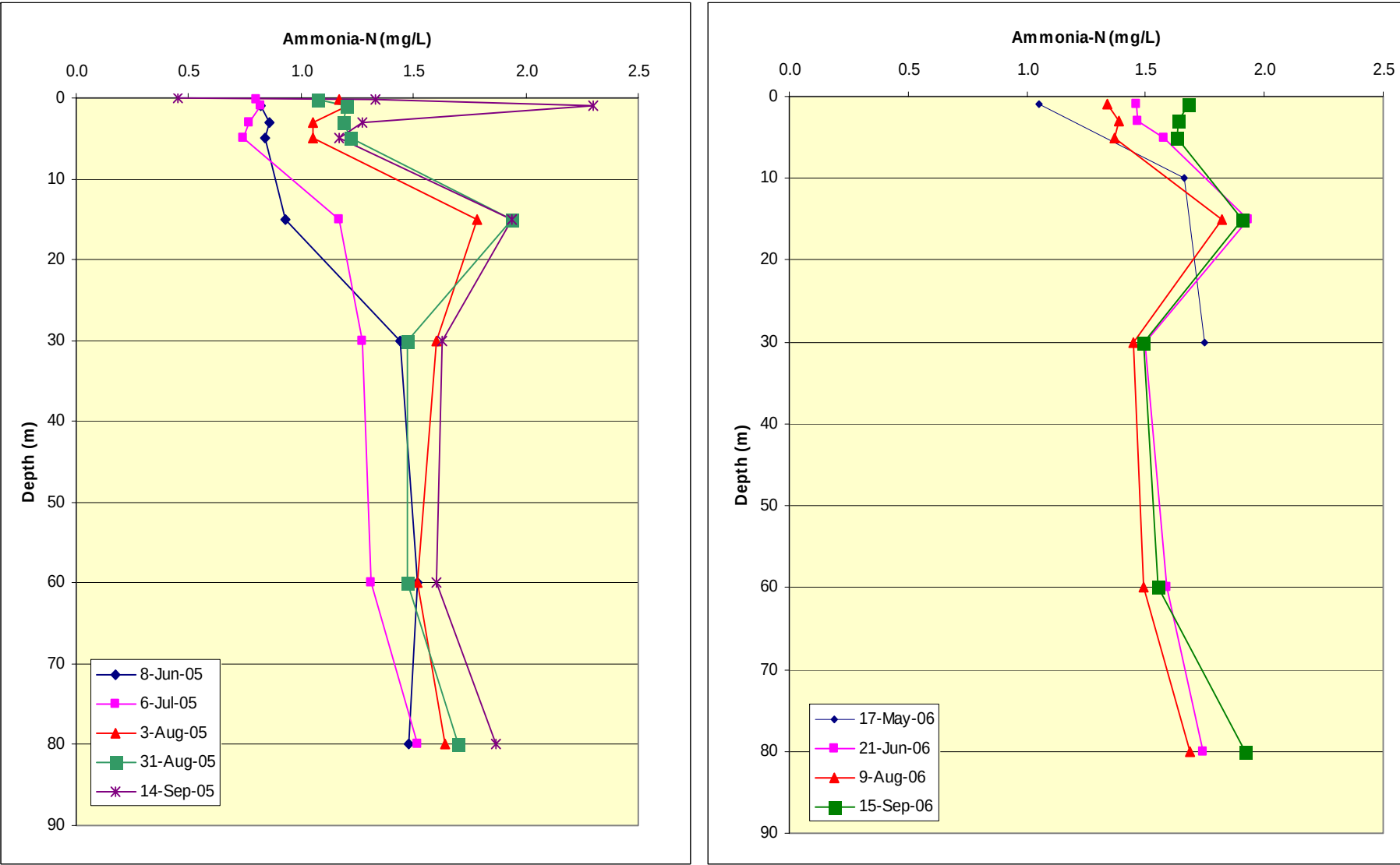


Figure 3.2: Ammonia-N Depth Profiles Measured in the Faro Pit

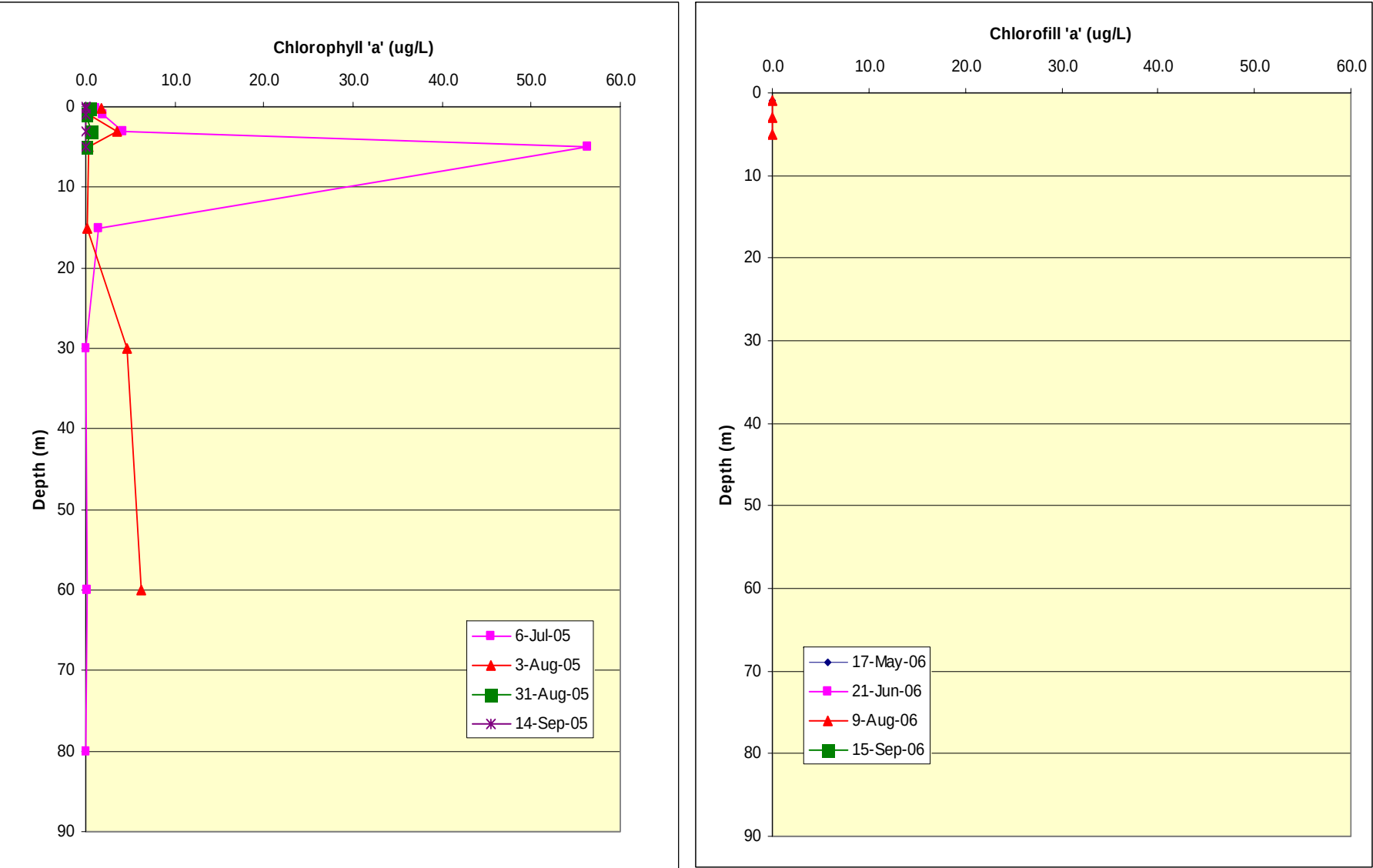


Figure 3.3: Chlorophyll 'a' Depth Profiles Measured in the Faro Pit

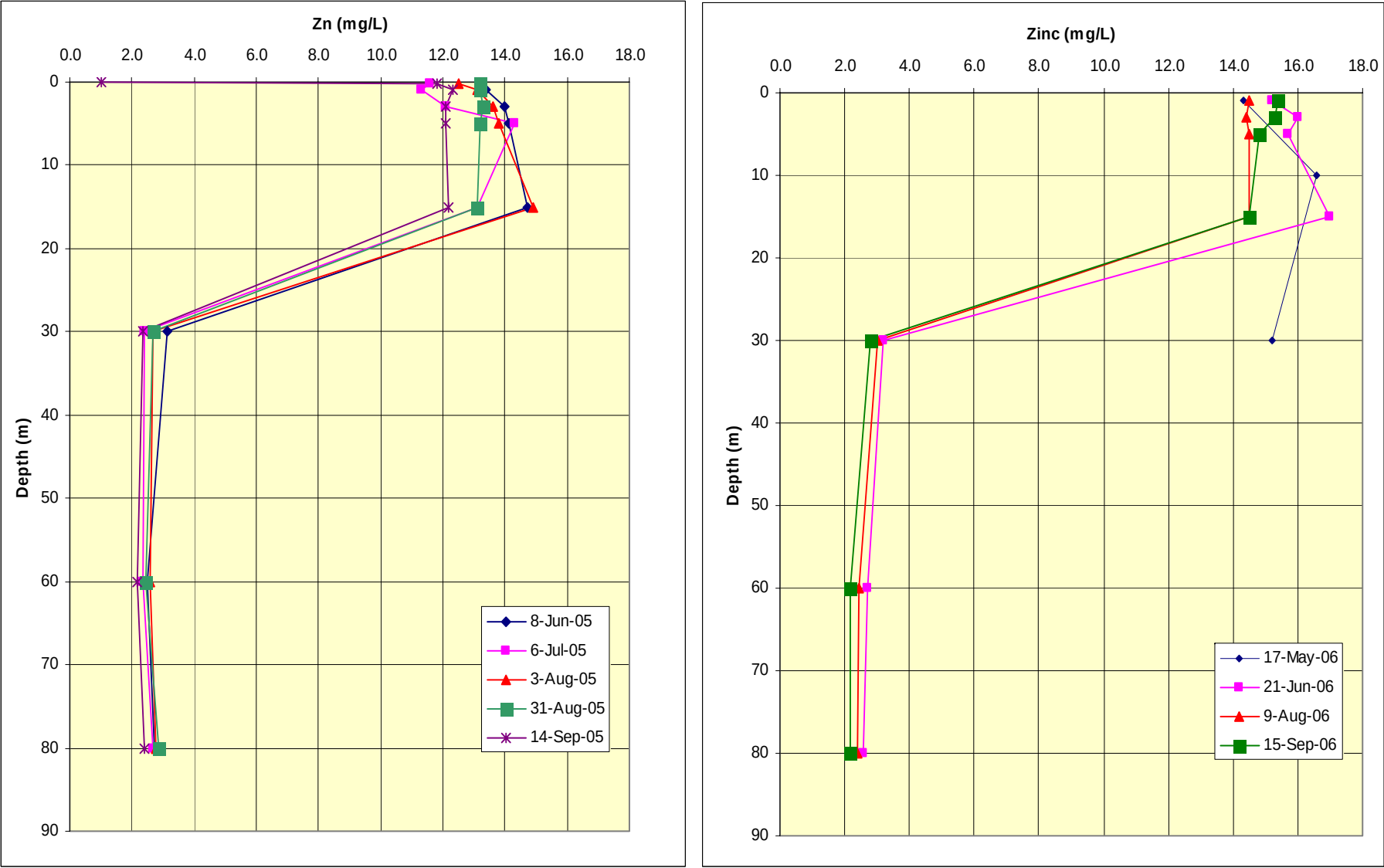


Figure 3.4: Concentration Depth Profiles Measured in the Faro Pit

At depth, zinc concentrations remained unchanged during 2006. The zinc profile is consistent with the chemocline indicated by the limnological assessment.

The average concentration in the surface layer (to a depth of 15 m) increased from about 12 mg/L in September 2005 to about 15 mg/L by September 2006. This increase suggests a net loading of about 26 tonnes of zinc to the pit lake during the year ending September 2006, compared to a net removal of between 36 (excluding estimated wall rock loadings) and 62 tonnes (including estimated wall rock loadings) for the corresponding period ending September 2005.

3.1.4 Summary

In summary, in the absence of fertilization in 2006, orthophosphate remained below detection, and total phosphorus was depleted from the surface layer to a depth of about 15 m. At depth, a marginal increase in total phosphorus was indicated. The presence of the chemocline, as indicated by the limnological assessment, would prevent this phosphorus from re-entering the surface water.

Due to the depletion of phosphorus from the surface layer, and as indicated by the very low chlorophyll “a” concentrations, no significant algal bloom was observed in 2006.

Mass balance calculations indicate that during 2005, between 45 and 60 tonnes of zinc had likely been removed from the water column as a result of the algal bloom induced by fertilization. During 2006, however, a net increase of about 26 tonnes of zinc was observed.

3.2 Grum Pit

In-situ monitoring results indicated that a thermocline developed in the Grum Pit at a depth of about 5.6 m below the water surface. A maximum surface water temperature of about 17.6°C was measured in July.

3.2.1 Nutrients

Depth concentration profiles for dissolved orthophosphate-P and total phosphate-P are shown in Figure 3.5 and Figure 3.6, respectively. As shown, during 2005 orthophosphate was consumed throughout summer, however, by fall the uptake ceased and its concentration increased due to late-season fertilization. With early termination of the fertilization during 2006, the residual orthophosphate concentrations were well below those observed at the end of 2005.

Total phosphate-P concentrations increased in the surface layer throughout the 2006 open water season as a result of fertilization, and reached peak concentrations of about 0.05 to 0.06 mg/L which were slightly higher than those observed in 2005. However, because late summer/fall fertilization was not undertaken, the concentrations had decreased by September to about 50 % of those observed at the end of 2005. (Note that the peak phosphate-P concentrations were well below the concentration of 0.22 mg/L which was set for the Colomac Mine in the NT.)

Depth profiles for ammonia-N concentrations in the Grum Pit water column are shown in Figure 3.7. As noted for orthophosphate-P, early termination of the fertilization program resulted in low ammonia-N concentrations by the end of the season. Note that by September, the ammonia-N concentration were well below the CCME guideline for the protection of freshwater aquatic life of 1.27 mg/L at a temperature of 20 oC and a pH of 7.5. Similarly, nitrate-N and nitrite-N concentrations were below their respective CCME freshwater quality guidelines of 2.9 and 0.06 mg/L, respectively.

It is apparent from these results that residual nutrient levels can effectively be controlled to acceptable levels by controlling the fertilization rate and period.

3.2.2 Algal Growth

As during previous years, rapid growth with high algal densities was achieved in the Grum Pit, as illustrated by the chlorophyll 'a' depth profiles shown in Figure 3.8. Maximum concentrations during 2006 were similar to those observed in 2005. However, the results suggest that the concentrations during early August may have been lower than that of 2005.

As during previous years, the results further indicate that, by the end of August, essentially most of the growth had been lost (settled) from the water column, with concentrations for September at or below the detection limit.

The revised fertilization program did not appear to affect biological activity within the pit lake.

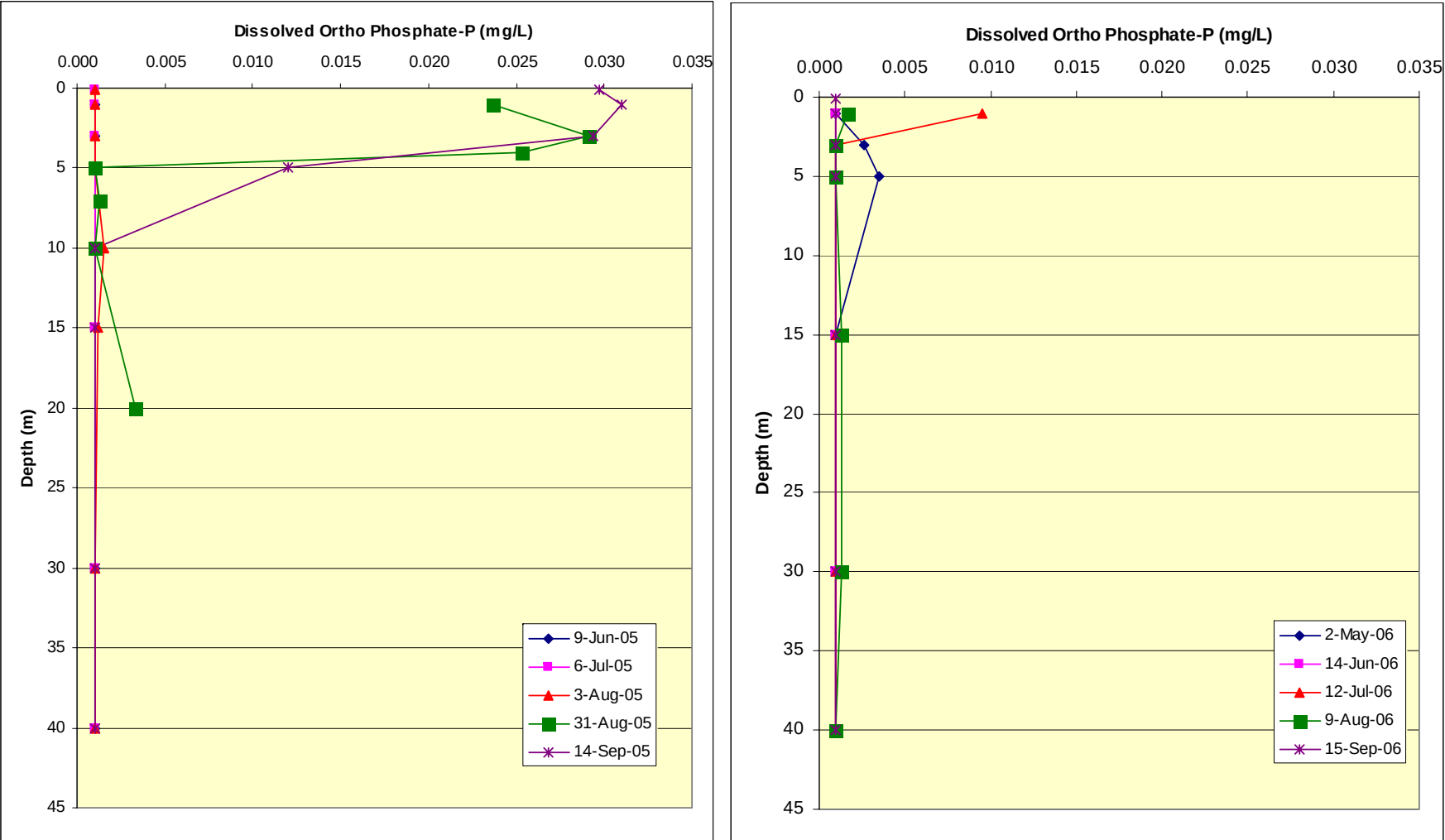


Figure 3.5: Dissolved Orthophosphate-P in the Grum Pit

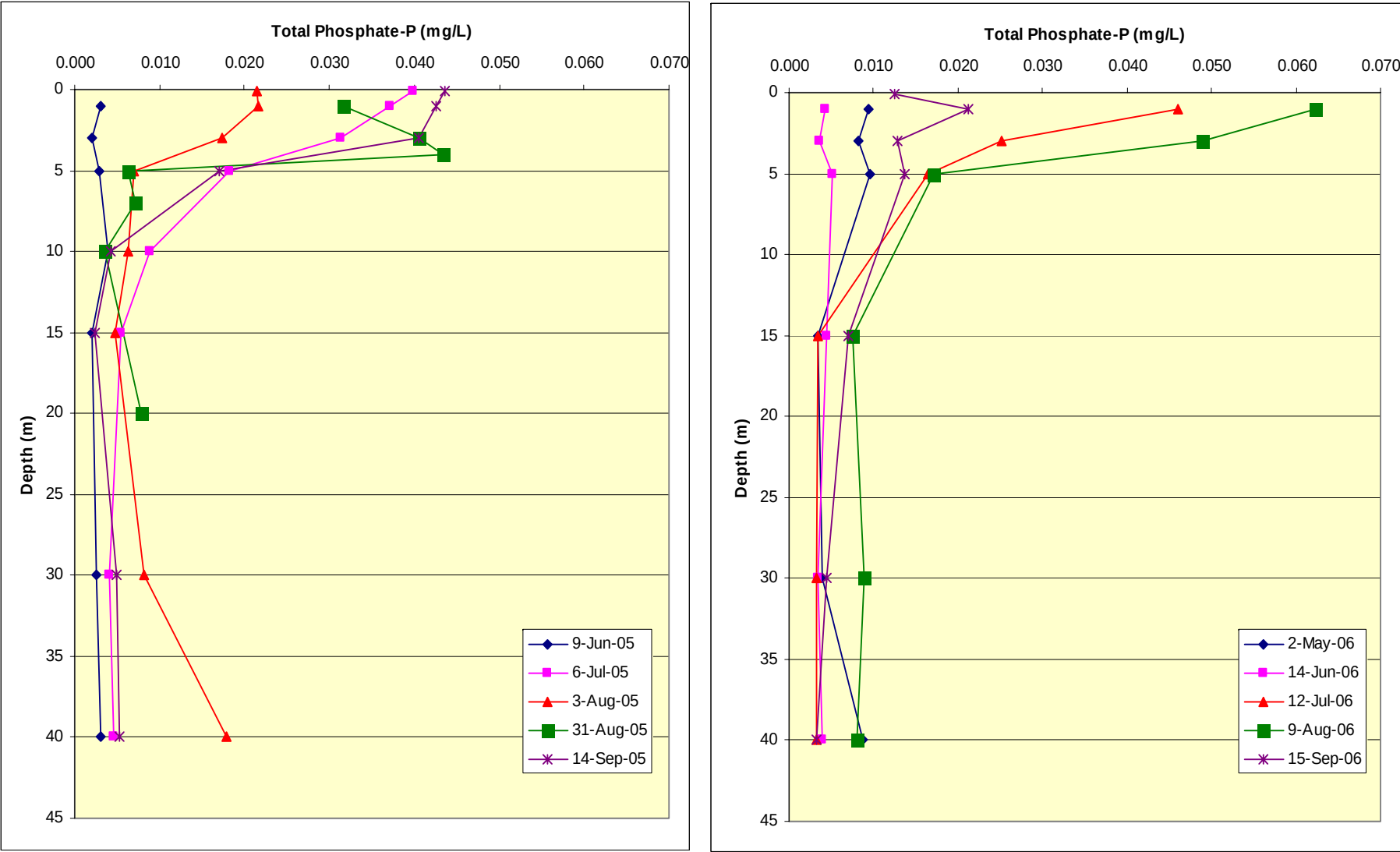


Figure 3.6: Total Phosphate-P in the Grum Pit

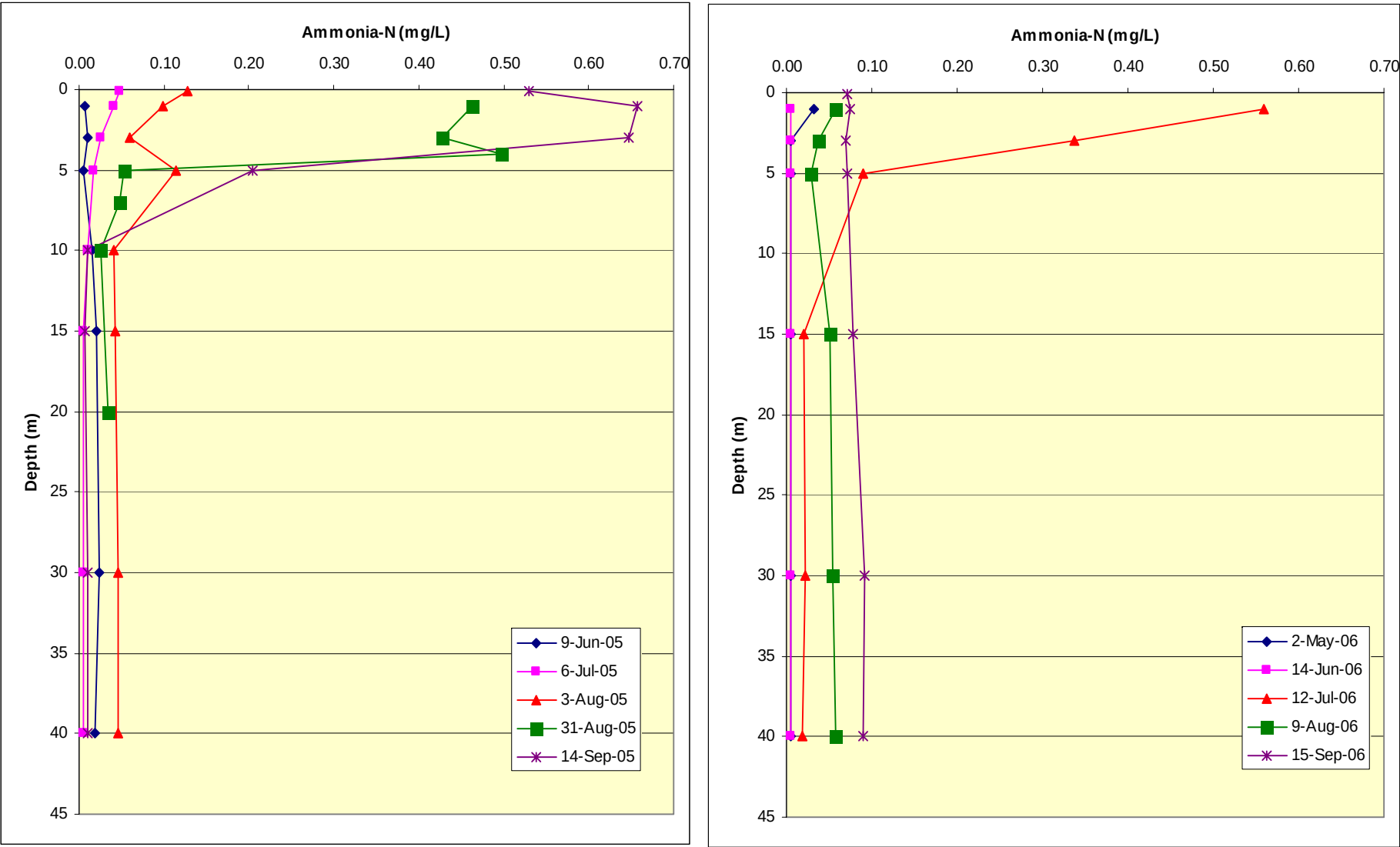


Figure 3.7: Ammonia-N Concentration Profiles in the Grum Pit

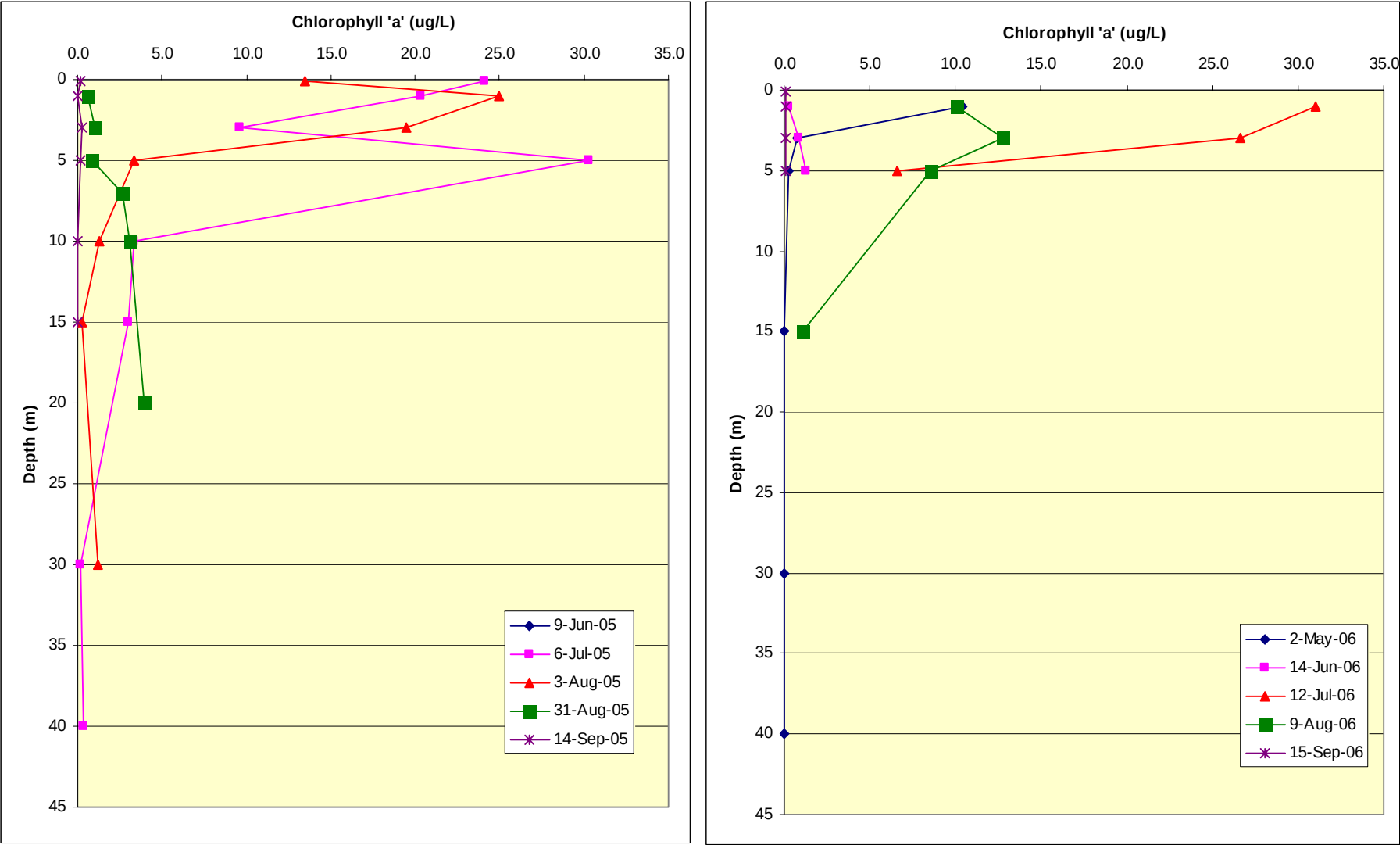


Figure 3.8: Chlorophyll 'a' Depth Profiles Measured in the Grum Pit

3.2.3 Zinc Concentrations

A comparison of depth profiles of total zinc concentrations in Grum Pit between 2005 and 2006 is provided in Figure 3.9. A similar comparison of dissolved zinc concentration profiles is provided in Figure 3.10.

Removal of total zinc from the surface layer (above the thermocline) is clearly evident from the decrease in the zinc concentration over time. The decrease in zinc concentrations in the near surface water during 2006 was very similar to that observed in previous years. The lowest near surface total zinc concentration observed during 2006 was 0.27 mg/L compared to 0.4 mg/L during 2005. The lowest dissolved concentrations were 0.14 mg/L during 2005 and 0.06 mg/L during 2006.

Time series plots showing the changes in total zinc concentration at each depth of the monitoring program for 2005 and 2006 are shown on Figure 3.11. The figure shows the cyclical concentration changes and demonstrates the zinc removal that is occurring from the surface water. Observations from these results can be summarised as follows:

- There does not appear to any significant mixing occurring between the surface layer water and the water at depth, suggesting a stable chemocline has been established. This is illustrated in particular by the September and May results for each year. Complete mixing would have resulted in a constant concentration with depth. However, as shown, there is a clear segregation between the results at depth (15m and below) and in the near surface waters.
- The concentration at 5 m depth appears to cycle between the near surface water quality and that at depth. In fact, it exceeds the concentration at depth at times. The high total zinc concentrations may result when algal detritus, containing elevated zinc levels, settles through the zone. A similar effect has been noted for example in the Island Copper pit lake. By the end of summer when mixing occurs, the zinc concentrations at 5 m depth converge with those of the surface waters.
- The near surface waters during winter showed a marginal increase; this would be consistent with solute exclusion during the formation of the ice layer. However, in the early summer a significant net increase in the zinc concentration is observed for the 1 m water depth. The increase is contrary to the expected effect of ice melt (decrease in concentration) and not sufficient to support mixing with deeper water. These results suggest that a substantial loading of zinc to the near surface water continues. Likely sources include wall rock runoff and release of oxidation products as the water level rises.
- The decreases in zinc concentration at the 1 m and 3 m depths are significantly greater than can be accounted for by dilution by rainfall, further supporting the hypothesis of biological removal.

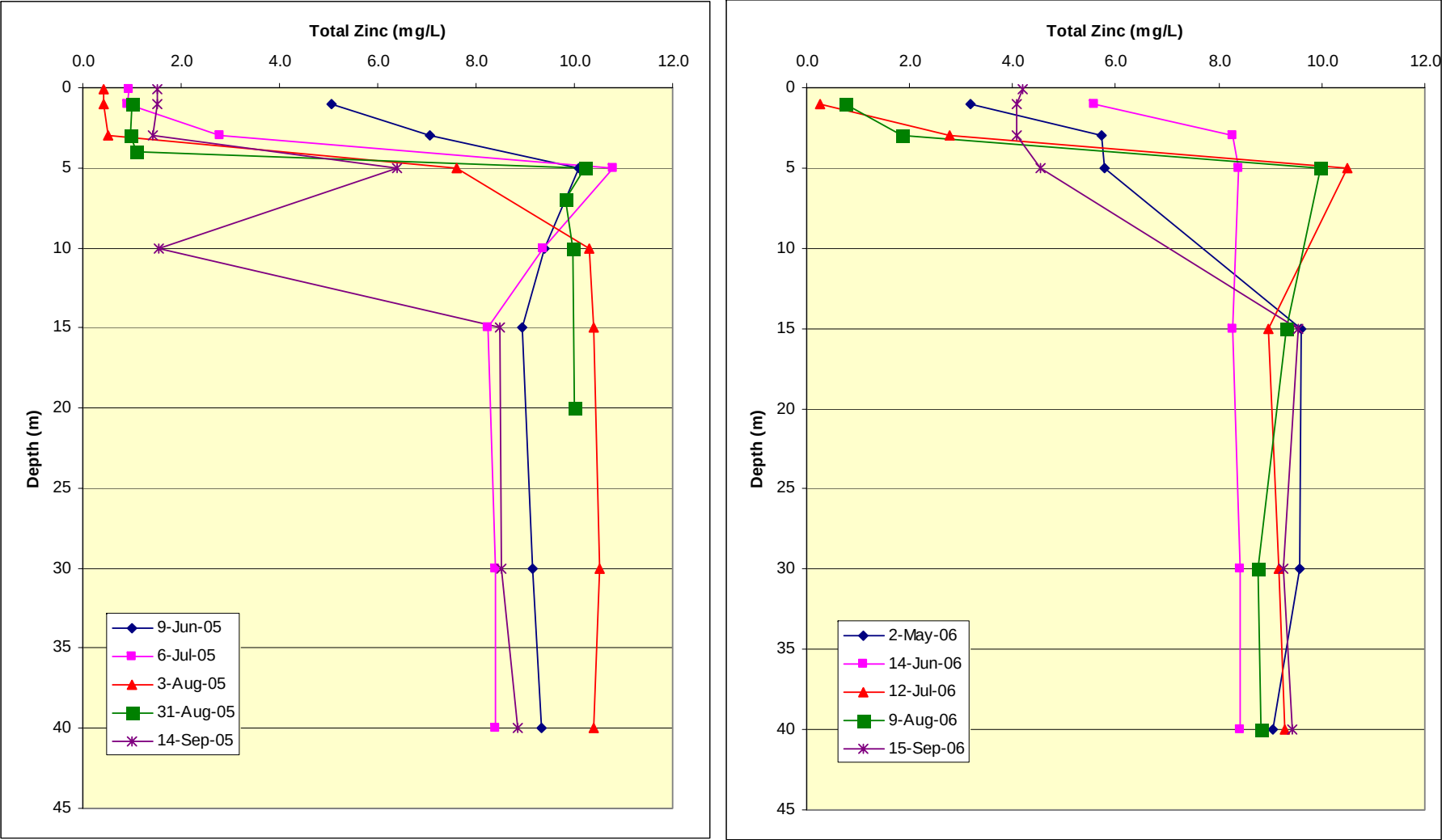


Figure 3.9: Grum Pit Total Zinc Concentration Profiles as a Function of Depth

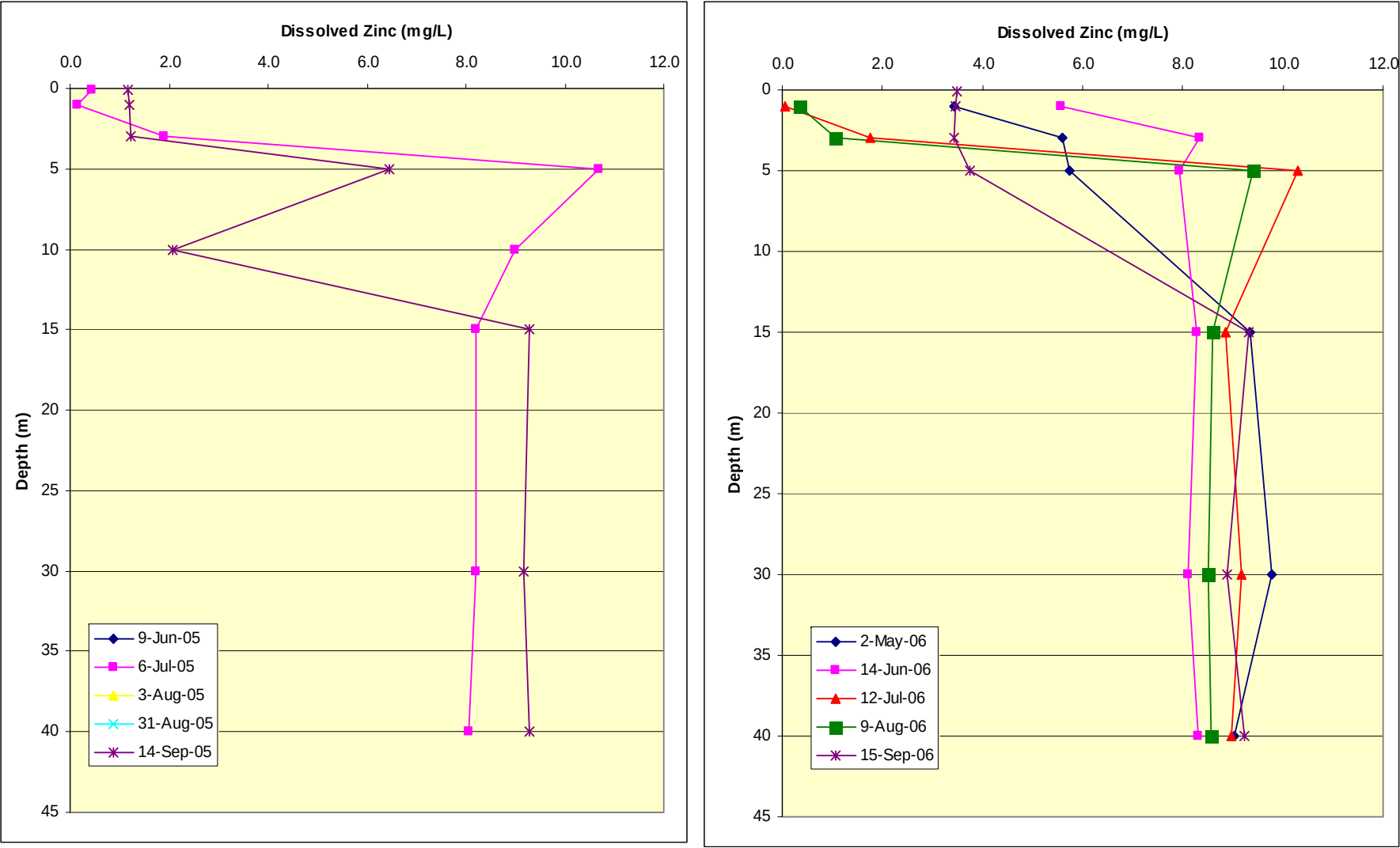


Figure 3.10: Pit Dissolved Zinc Concentration Profiles as a Function of Depth

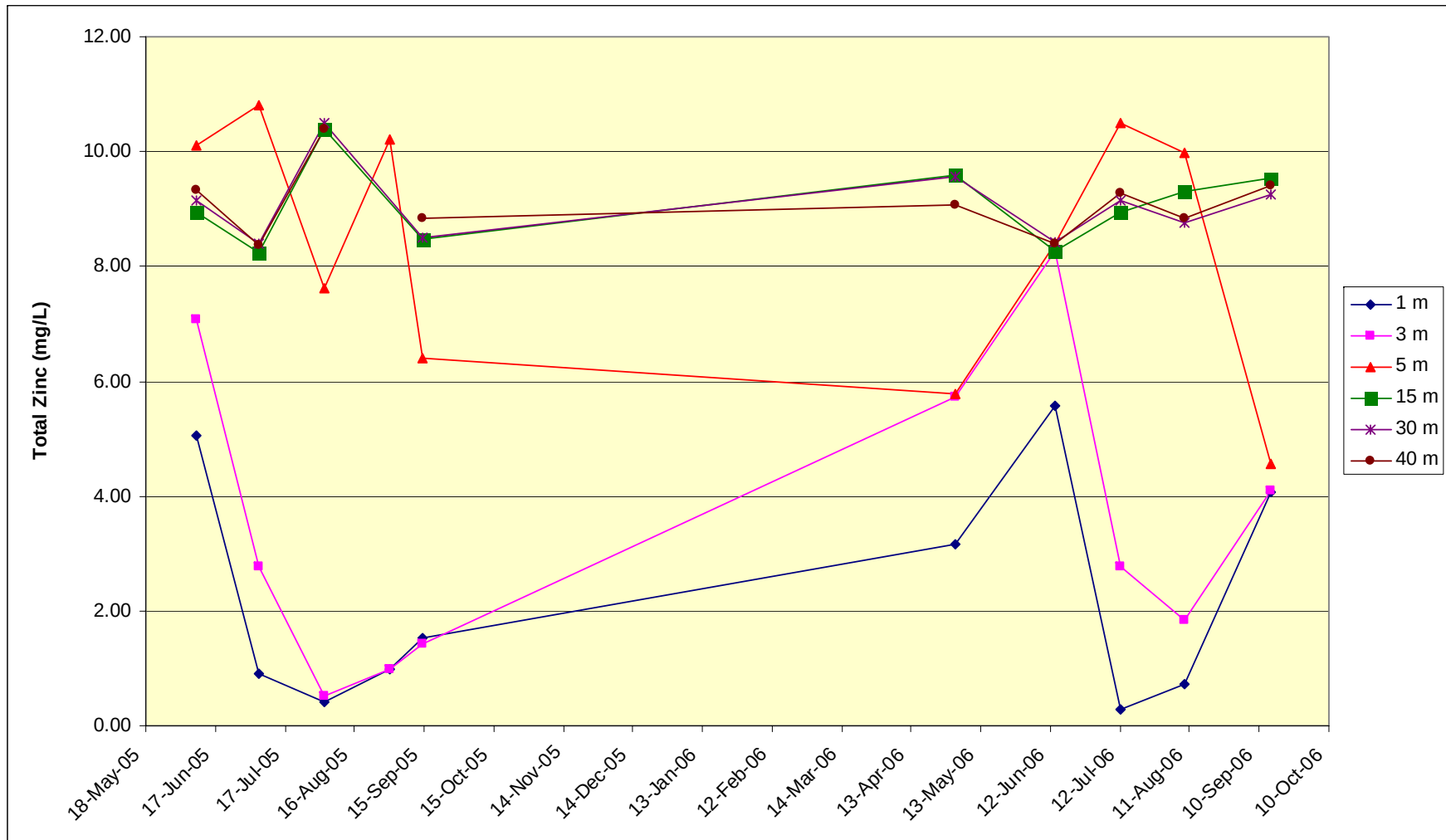


Figure 3.11: Comparison of 2005 and 2006 Zinc Concentration Profiles

Zinc metal removal was estimated by calculating the total pit lake inventory from the water concentration profiles and the volume curve at each timestep. The results from the total inventory and the change in inventory calculations of total and dissolved zinc in the lake, as a whole, are summarised in Table 3.1. The table shows the mass of total and dissolved zinc contained in the pit lake and the cumulative change with time. Cumulative net removals (negative values) or net gains (positive values) are relative to the total inventory contained in June of 2004.

Table 3.1: Estimated Inventory of Total and Dissolved Zinc in the Grum Pit

Date	Total Inventory (tonne)		*Change since June 2004 (tonne)	
	T Zn	D Zn	T Zn	D Zn
29/06/2004	45.0	45.2		
14/07/2004	49.2	47.2	4.2	1.9
28/07/2004	36.0	39.4	-9.0	-5.9
11/08/2004	42.6	41.6	-2.5	-3.7
25/08/2004	52.4	51.9	7.3	6.7
8/09/2004	64.8	63.6	19.7	18.3
9/06/2005	35.6	-	-9.4	-
6/07/2005	32.0	31.0	-13.0	-14.2
3/08/2005	36.2	-	-8.8	-
31/08/2005	26.3	-	-18.7	-
14/09/2005	27.0	29.1	-18.0	-16.2
2/05/2006	33.9	33.9	-11.1	-11.4
14/06/2006	34.1	33.4	-11.0	-11.9
12/07/2006	34.0	33.3	-11.1	-11.9
9/08/2006	33.3	31.4	-11.7	-13.9
15/09/2006	33.3	31.6	-11.8	-13.7

Note : * Negative values indicate removal and positive values indicate net gain; removals relative to inventory on 29/06/2004

As shown in the table, the net removal from the pit lake from 2004 to 2006 has been 11.8 tonnes total zinc and 13.7 tonnes dissolved zinc. The overall trend in the zinc inventory is also illustrated in Figure 3.12 which clearly shows the decrease of the zinc in the pit lake water column over time. The following observations are apparent from the results:

- Even though net removal of zinc occurred from the surface layer water of the Grum Pit, there was a net increase in the total zinc inventory toward the end of the 2004 season. Cumulatively, the total zinc content of the pit lake increased by about 19.7 tonnes during 2004, but as discussed in a previous report (SRK, 2005), at the end of 2004 most of the algae had as yet not settled from the water column.
- During the 2004/05 winter, most of the algae had settled and by June 9, 2005 a net removal of about 9.4 tonnes had occurred. Initially the removal continued, however a gain of about 4.2 tonnes in July and early August was observed.

- For the year 2005, a net removal of about 8.6 tonnes had occurred (compared to the estimated 9.4 tonne net removal through 2004 to the beginning of 2005).
- During the winter of 2005/06 (unlike the preceding winter), a net gain of about 6.9 tonnes total zinc was observed. Although the surface water quality clearly indicated a net removal of zinc from the water column, the cumulative removal for the year was only 0.7 tonnes total zinc and 2.3 tonnes dissolved zinc. Considering the initial net removals (9.4 and 8.6 tonnes per annum), and that the response to treatment in the surface layer was similar to that observed for 2005, it is apparent that in excess of 9 tonnes would have been removed from the water column. Since it is not possible at this stage to determine the magnitude of the net loading to the pit lake, the actual removal achieved by biological treatment cannot be assessed. However, at minimum, the removal rate marginally surpassed the total loading to the pit lake. Also, considering the net removals observed during 2004 and 2005, the results suggest that the loading of zinc to the Grum Pit had increased significantly during 2006.

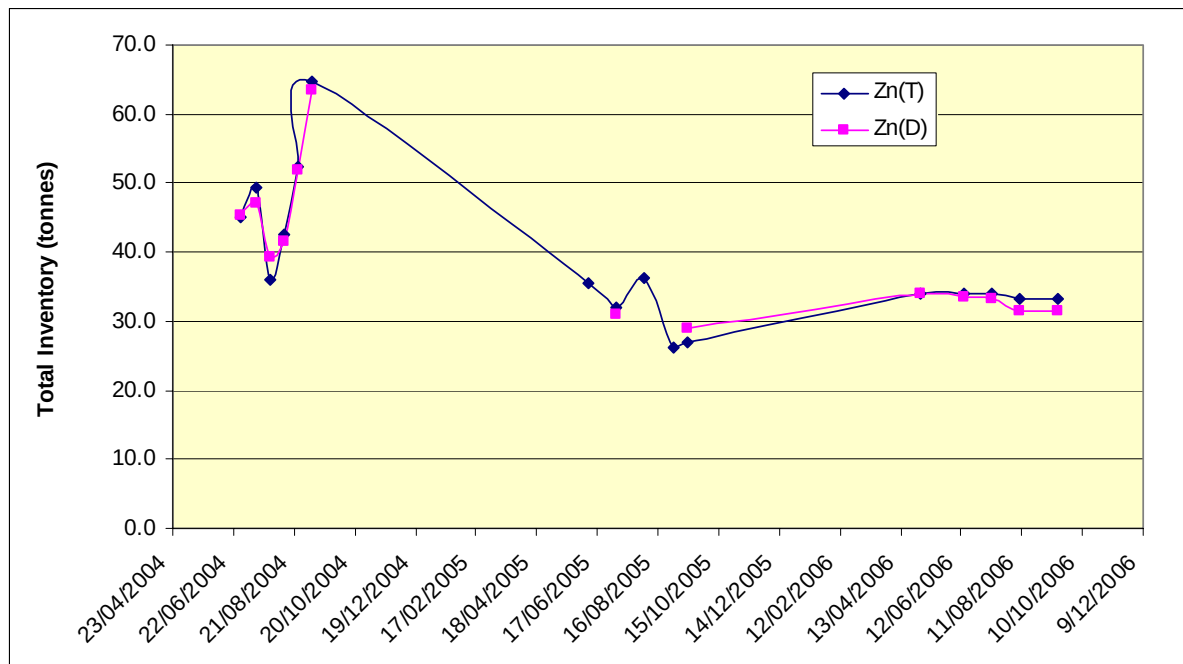


Figure 3.12: Net Change in the Zinc Inventory of the Grum Pit with Time

Currently about 33.3 tonnes of zinc still remain in the pit lake. At present, the source of the high loadings that appear to be affecting the pit lake is unknown. As noted above, the ongoing loading appears to be more substantial than previously estimated. If that pattern continues, the time to completely treat the pit lake will be longer than originally estimated.

3.2.4 Summary

The results indicate that the Grum Pit again responded well to fertilization and that excellent algal growth was achieved in 2006. Elimination of late summer fertilization has also been shown to be an effective method to control nutrient levels by the end of the season.

Overall mass balance calculations for 2004 and 2005 suggest that zinc loadings to the Grum Pit may have been underestimated in the past. The results for 2006 further suggest that the loading may have increased during 2006 (possibly due to increased runoff from the wall rocks). Nonetheless, the overall mass balance indicate that about 0.7 tonnes total zinc and about 2.3 tonnes of dissolved zinc, in excess of the annual loading, had been removed during 2006. Since biological treatment commenced in 2004, a net removal of about 11.8 tonnes of total zinc had been achieved.

Finally, by July 2006 the total zinc concentration at a depth of 1 m decreased to about 0.27 mg/L. This is well below the MMER criterion of 0.5 mg/L for zinc. The total amount of water for which this decrease was observed represents in excess of 280,000 m³ which is in excess of 1.3 times the net annual inflow to the pit. It should therefore be possible to discharge the net annual inflow at a concentration that would meet the MMER discharge limit.

3.3 Vangorda Pit

A comparison of the June and September 2006 zinc concentration depth profiles with that of September 2005 is presented in Figure 3.13. As shown, a low concentration surface layer existed in the lake by the end of 2005. This layer seems to have ‘deepened’ through 2006. However, the results also indicate that the concentrations at depth have increased consistently over the same time period from less than 140 mg/L to in excess of 160 mg/L. The reason for this substantial increase cannot be attributed to any surface sources since there is no indication that the pit lake had overturned during this period. This would suggest that the source is at depth, and since active oxidation is not likely to be occurring at these depths, it would suggest that the water treatment sludges that had previously been deposited in this pit may be dissolving and contributing to the increased concentrations. This conclusion is supported by the fact that the pH at depth has decreased to below 6, which would increase the solubility of the zinc hydroxides in the treatment sludges substantially.

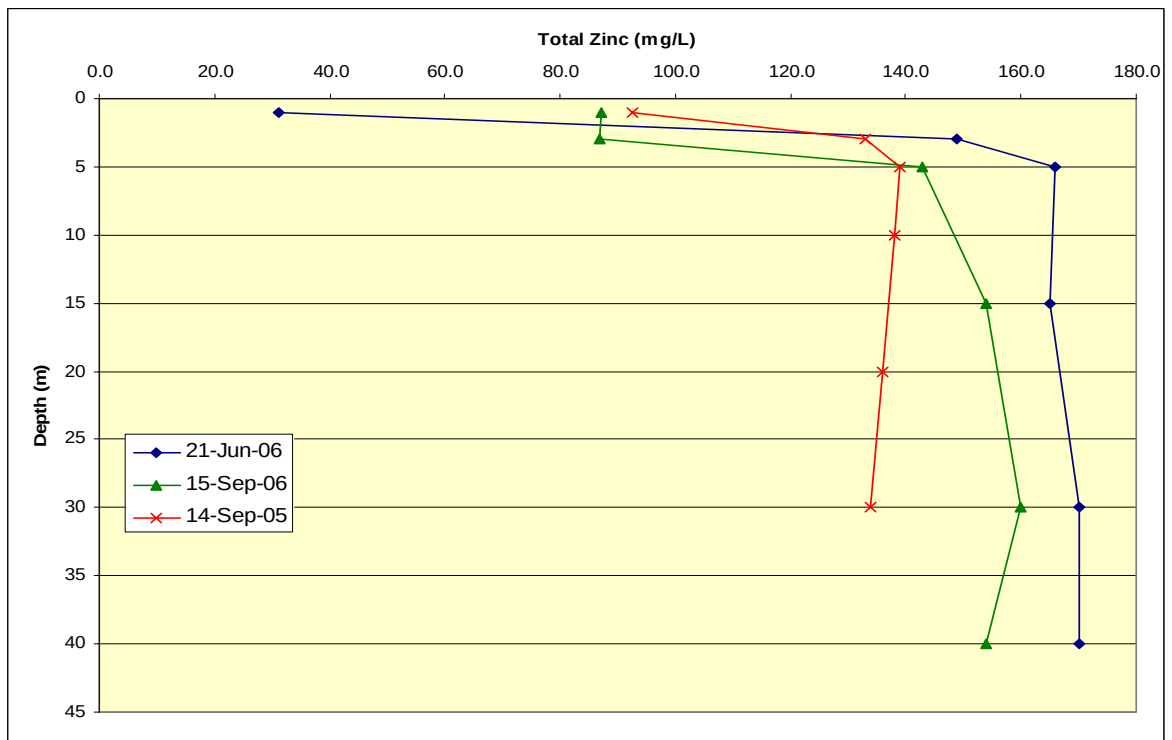


Figure 3.13: Zinc Concentration Profiles in the Vangorda Pit

4 Physical Limnology

4.1 Introduction

A climate station was established on the raft that was floated on the Grum Pit in 2006. As well, conductivity-temperature-density (CTD) profiles of the Grum Pit were monitored during the open water summer period. CTD profiles were also obtained in the Faro and Vangorda Pits. The rented equipment that was used during the 2006 season failed to calibrate appropriately, and resulted in significant differences between down casts and up casts. Therefore, no further analysis of the data was undertaken. For reference, a summary of the previous results is provided below.

4.2 Summary of 2004 and 2005 Results

The data suggest that the Faro, Vangorda and Grum Pit lakes are meromictic, but showed a range of behaviour, with varying degrees of deep water isolation.

The Faro Pit showed very little change in water temperature and conductivity below 20 m, suggesting highly isolated deep water during the study period. The deep water showed very little change from June 2004 to June 2005 with temperature steady to $\pm 0.05^{\circ}\text{C}$ and conductivity within $\pm 5 \mu\text{S/cm}$. The presence of dissolved iron indicates the absence of dissolved oxygen which is also consistent with isolated deep water. The small changes in deep water temperature and conductivity and the absence of dissolved oxygen suggest that the Faro Pit was meromictic in 2004 and 2005.

In contrast, the deep water of the Grum Pit is least isolated, possibly from mixing generated by failure of the east wall of till which is showing active creep. The decrease in deep conductivity from February 2005 to June 2005 is consistent with partial mixing of fresh water to depth. Another unusual feature in the Grum Pit is the absence of a chemocline below the surface layer. In fact, the temperature and conductivity profiles below the summer surface layer are remarkably uniform and suggestive of vertical mixing. However, despite the additional spring and summer mixing, the temperature data indicated that Grum Pit water did not turn over in the fall. The chemical profiling results from 2006 support these conclusions.

The Vangorda Pit has the highest salt content at depth, yet the deep water shows some seasonal change. These changes may be a result of ground water inflow or the relatively large influence of inflows from runoff and seepage and outflows from pumping the pit lake. The analysis of the 2005 and 2006 depth profiles for zinc, combined with pH changes, suggest that dissolution of treatment solids likely contribute to these changes.

5 Conclusions and Recommendations

5.1 Conclusions

The conclusions from the 2005 biological treatment program for the Anvil Range pit lakes can be summarised as follows.

5.1.1 Faro Pit

In the absence of fertilization in 2006, ortho-phosphate remained below analytical method detection limits, and total phosphorus was depleted from the surface layer to a depth of about 15 m. At depth, a marginal increase in total phosphorus was indicated. The presence of the chemocline, as indicated by the limnological assessment, would however prevent this phosphorus from re-entering the surface layer water.

Due to the depletion of phosphorus from the surface layer, no significant algal bloom was observed in the Faro Pit, as indicated by the very low chlorophyll “a” concentrations.

Mass balance calculations indicate that, during 2005, between 45 and 60 tonnes of zinc had likely been removed from the water column as a result of the algal bloom induced by fertilization. During 2006, however, a net increase of about 26 tonnes of zinc was observed.

5.1.2 Grum Pit

The results indicate that the Grum Pit again responded well to fertilization and that excellent algal growth was achieved in 2006. Elimination of late summer fertilization has also been shown to be an effective method to control nutrient levels at the end of the season.

Overall mass balance calculations for 2004 and 2005 suggest that zinc loadings to the Grum Pit Lake may have been underestimated in the past. The results for 2006 further suggest that the loading may have increased during 2006 (possibly due to increased runoff from the wall rocks). Nonetheless, the overall mass balance indicates about 0.7 tonnes total zinc and about 2.3 tonnes of dissolved zinc, in excess of the annual loading, had been removed during 2006. Since biological treatment commenced in 2004, a cumulative net removal of about 11.8 tonnes of total zinc had been achieved. This however does not account for the annual loadings to the pit lake; the overall removal is therefore substantially greater than the net cumulative removal.

5.1.3 Vangorda Pit

The 2005/06 results suggest that water treatment sludges that had previously been deposited in the Vangorda Pit may be dissolving and contributing to the increased zinc concentrations in the water column. This conclusion is supported by the fact that the pH at depth has decreased to below a value of 6, which would increase the solubility of zinc hydroxides present in treatment sludges.

5.2 Recommendations

5.2.1 Faro Pit

Until the cause and overall implication of potential inferences with conventional lime treatment has been established, no further fertilization of the Faro Pit should be undertaken.

As noted above, mass balance calculations suggest that overall loadings to the pit are higher than previously predicted. It is therefore recommended that profiling of the pit lake be undertaken at regular intervals during 2007 and mass balance calculations be completed to verify overall loadings and support future water quality predictions. Should the calculated loadings continue to exceed the estimated loadings, the causes for the discrepancies between the predicted and actual loadings should be determined and appropriately corrected in the water quality prediction model.

5.2.2 Grum Pit

Based on the observed performance of biological treatment in the Grum Pit, it is recommended that the fertilization program be continued in 2007. Fertilization should again be terminated by mid-August to prevent the build-up of residual nutrients in the water column.

Mixing of the water column will, in the longer term, benefit biological treatment of the pit lake. Clearly there remain unresolved issues with respect to the mechanisms that are causing partial mixing in the pit lake. It is therefore recommended that the limnology of the pit lake continue to be investigated in 2007. Specifically, Lawrence Associates recommended that under-ice profiling be carried out before ice-break-up. SRK concurs with this recommendation.

The higher than predicted loadings to the pit lake may have been a consequence of exceptionally wet conditions. It is therefore recommended that mass balance calculations again be completed for 2007 to verify overall loadings. Should the calculated loadings continue to exceed the estimated loadings, the discrepancies between the predicted and actual loadings should be corrected in the modelling.

Because fertilization caused significant interference within the Faro Mill water treatment system, and because there is a possibility that, at some time in the future, it may become necessary to treat water from the Grum Pit, it is recommended that bench scale treatability tests be undertaken on water from the Grum Pit during the 2007 summer program to assess the potential effects of this water on the Vangorda/Grum water treatment system. The bench scale testing program should be designed to, as closely as practical, approximate the Vangorda/Grum treatment plant. Specifically, lime demand, sludge generation rates, sludge densities and treated effluent water quality should be measured as part of the test program. This should also include analysis of nutrients (i.e. ammonia, nitrate and phosphorus concentrations) in the treated effluent. A control test should also be undertaken on water with fertilizer addition at the standard application rate, but with no algae present (e.g. Faro Pit Lake water), to assess the impacts of the fertilizer alone.

After results from the bench scale testing have been analysed, consideration should be given to a full-scale trial, consisting of passing Grum water through the Vangorda/Grum treatment plant at the end of the proposed 2008 treatment campaign. This timing would ensure that the trial does not impact the water treatment requirements for that season.

While the Faro experience showed a residual effect one year after the initial fertilization, it is clear that this residual effect did not significantly impact the ability to treat water. It should be noted that the fertilization rate at Grum was reduced during the 2006 program to limit the amount of residual fertilizer present in the water column at the end of the season. The results to date indicate that nutrient concentrations were depleted compared to previous seasons. It is therefore considered likely that by terminating fertilizer addition two to three years before the time that intervention is required, biological activity should be reduced sufficiently to enable water treatment. This means that, should the bench-scale testing planned for 2007 indicate that conventional treatment will be impacted by the presence of algae, then consideration should be given to terminating the bioremediation program in 2008 or 2009.

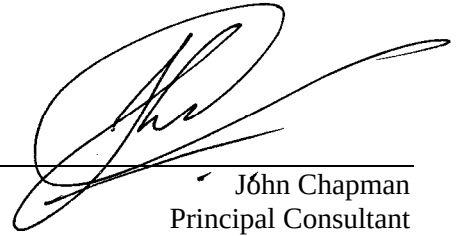
Phosphorus concentrations in the treated effluent have also been raised as a potential issue. However, the water quality monitoring results for 2006 indicate that ortho-phosphate-P concentrations are typically below the detection limit of 0.001 mg/L, and, during fertilization, the concentration is typically below 0.002 mg/L. At these concentrations, effluent phosphorus is unlikely to be a significant issue.

It is our understanding that adaptive management plan for the Grum Pit lists elevation 1210.8 m as the recommended trigger elevation. This elevation is about 20 m below the overflow elevation. If the water level is controlled at this elevation, a significant proportion of the mineralized wall rock will remain exposed which could cause additional zinc loadings to the pit lake. Overall load balance calculations to date suggest that metal loadings from the pit walls are significant. It is our recommendation that this elevation be reassessed and the benefits of reduced metal loadings be assessed against the criteria used for establishing the trigger elevation.

5.2.3 Vangorda Pit

At this time it is not foreseen that the Vangorda Pit will be utilized as an ancillary treatment system. Fertilization of this pit lake is therefore not recommended. However, it is recommended that the water column water quality profile be monitored to verify the source of the zinc at depth as the dissolution of treatment solids. Monitoring should be undertaken on a monthly basis, commencing at open water conditions, and should be continued to September 2007.

This report, “**Anvil Range Pit Lakes, 2006 Evaluation of In-Situ Treatment - 2006/07 Task 22**”,
has been prepared by SRK Consulting (Canada) Inc.



John Chapman
Principal Consultant

Cam Scott
Principal Engineer

6 References

SRK Consulting, 2004, *Anvil Range Pit Lakes, Assessment of Post Closure Conditions*. Prepared for Deloitte and Touche Inc., January 2004.

SRK Consulting, 2005, *Anvil Range Pit Lakes, Evaluation of In Situ Treatment*. Prepared for Deloitte and Touche Inc., January 2005.

SRK Consulting, 2006, *Anvil Range Pit Lakes, Evaluation of In Situ Treatment*. Prepared for Deloitte and Touche Inc., July 2006.

Appendix A

In Situ Monitoring Results

Memorandum

To: Cam Scott SRK June 25, 2006
Copies: John Chapman SRK, Roger Pieters, Faro Project Office, Deloitte
From: Ken Nordin LES

Re: Grum Pit Bio Treatment D&T 2006/7 Task 22 to June 21, 2006

This is a brief summary of the results of the project ***Grum Pit Bio Treatment D&T 2006/7 Task 22*** for the months of May and June, 2006. Digital files for the weather station, sonde casts and CTD casts will be sent under separate cover.

Summary Log

May 2 2006

Sample under ice in Grum Pit at 1,3,5,15,30 and 40m. Left boat and motor at ramp. Profile Grum Pit using Hoskins rental YSI 6600 sonde (no CTD available). Directed not to profile or sample Faro Pit or Vangorda Pit.

May 17 2006

Sample under ice in Faro Pit at 1, 10 and 30m. Profile Faro Pit with Hoskins rental YSI 6600 sonde (still no CTD available but ice in decay so used sonde). Sample and profile Vangorda pit using rental sonde at 1 and 7m, ice very rotten, accessed sample hole using improvised wooden ramp.

June 8 2006

Informed that ice went off Grum Pit this morning.

June 9 2006

Conference call on 2006 bio program. Received SRK pit lakes proposal prior to call.

June 14 2006

Prepare and launch boat, downloaded weather station and all temperature loggers. Sample Grum Pit at 1, 3, 5, 15, 30 and 40m. Cast with borrowed YSI 6600 sonde (still no CTD – has been shipped but not in Whitehorse yet). Four drums of fertilizer delivered to ramp, fertilized Grum Pit for the first time in 2006 with 1 ½ drums using pump on board boat.

June 20 2006

Prepare and launch boat at Grum Pit, do test cast with CTD 12Plus S/N 638 (rental from Applied Microsystems – same unit used last year)

June 21 2006

Fertilize Grum Pit 1 ½ drums. Shack is now on ramp, used it to prepare for sampling Faro and Vangorda. Sample Vangorda Pit at 1, 3, 5, 15, 30, and 40m. CTD cast. Move to Faro Pit, recovered buoy and towed back to position, sample Faro Pit at 1, 3, 5, 15, 30, 60, and 80m. CTD cast.

Images Faro Pit Lakes May and June, 2006:



Grum Pit under ice May 2 2006



Grum raft may 2 2006



Faro Pit May 17 2006



Faro Pit May 17 2006



Vangorda May 17 2006



Vangorda Pit May 17 2006



Grum ramp June 14 2006



Grum sampling June 14 2006



Grum Pit bird's eye June 14 2006



FCS_5 downstream May 3 2006



Grum Pit ramp June 21 2006



Grum raft June 21 2006



CTD 12 Plus S/N 638 June 21 2006



Vangorda looking east from sample site June 21 2006



Faro Pit bird's eye June 21 2006

In situ data for the May 2 and May 17 under ice sampling events and the June 14 and June 21 open water sampling events follows. Copies of field notes and chain of custody forms also follow. Digital data files will be distributed under separate cover.

If you have any questions contact the undersigned anytime.

A handwritten signature in black ink, appearing to read "Ken Nordin". The signature is fluid and cursive, with a long horizontal stroke at the end.

Ken Nordin ASCT CCEP
Laberge Environmental Services
June 25, 2006

May 2 Grum Pit in situ data

Location	Time PST 24hr	*Cond. µS/cm	pH**	*TDS mg/L	Temp °C
GP_1 Grum Pit @ 1m	11:15	828	na	369	1.4
GP_3 Grum Pit @ 3m	11:25	874	na	402	1.8
GP_5 Grum Pit @ 5m	11:40	872	na	403	2.4
GP_15 Grum Pit @ 15m	11:50	881	na	409	4.2
GP_30 Grum Pit @ 30m	12:00	895	na	412	4.1
GP_40 Grum Pit @ 40m	12:15	885	na	410	4.2

*Orion conductivity meter 115A+

**pH meter failed

Faro Pit May 17 in situ data

Location	Time PST 24hr	*Cond. µS/cm	pH**	*TDS mg/L	Temp °C
FP_1 Faro Pit @ 1m	10:15	929	5.96	416	2.2
FP_10 Faro Pit @ 10m	10:30	1061	6.33	475	2.2
FP_30 faro Pit @ 30m	11:00	1047	6.60	473	3.0

*Orion conductivity meter 115A+

**pH meter Fisher AP61

Vangorda Pit May 17 2006 in situ data

Location	Time PST 24hr	*Cond. µS/cm	pH**	*TDS mg/L	Temp °C
VP_1 Vangorda Pit @ 1m	13:30	1194	5.67	545	1.8
VP_7 Vangorda Pit @ 7m	14:20	1476	5.68	761	3.2

*Orion conductivity meter 115A+

**pH meter failed

Grum Pit June 14 2006 in situ data

Location	Time PST 24hr	*Cond. $\mu\text{S}/\text{cm}$	pH**	*TDS mg/L	Temp $^{\circ}\text{C}$
GP_1 Grum Pit @ 1m	12:00	768	7.43	371	1.9
GP_3 Grum Pit @ 3m	12:15	972	7.22	468	9.5
GP_5 Grum Pit @ 5m	12:30	1004	7.21	471	6.4
GP_15 Grum Pit @ 15m	12:45	996	7.40	468	5.9
GP_30 Grum Pit @ 30m	13:10	1007	7.35	471	5.8
GP_40 Grum Pit @ 40m	12:30	1002	7.31	467	4.5 ¹

*Orion conductivity meter 115A+

**pH meter failed

¹ started taking temperature in free running water out of sampler – works better than in sampling bottle – all previous in situ temperatures are artificially high because the water warms up in the bottle before the probe stabilizes.

Faro Pit June 21, 2006 in situ data

Location	Time PST 24hr	Cond. $\mu\text{S}/\text{cm}$	pH	TDS mg/L	Temp $^{\circ}\text{C}$
FP_1 Faro Pit @ 1m	16:00	866	6.94	413	12.8
FP_3 Faro Pit @ 3m	16:15	867	7.12	416	12.2
FP_5 Faro Pit @ 5m	16:25	903	7.13	431	10.2
FP_15 Faro Pit @ 15m	16:35	1033	7.14	478	3.8
FP_30 Faro Pit @ 30m	16:45	1110	7.06	512	4.0
FP_60 Faro Pit @ 60m	17:00	1096	6.90	509	4.0
FP_80 Faro Pit @ 80m	17:20	1118	6.80	518	4.0

Note: Dissolved Oxygen readings were taken but are not valid except for 1 m depth because water is aerated when transferring to measurement bottle. See field notes.

Vangorda Pit June 21, 2006 in situ data

Location	Time PST 24hr	Cond. µS/cm	pH	TDS mg/L	Temp °C
VP_1 Vangorda Pit @ 1m	11:50	889	5.18	428	14.1
VP_3 Vangorda Pit @ 3m	12:10	1342	5.36	638	7.1
VP_5 Vangorda Pit @ 5m	12:20	1434	5.69	674	4.1
VP_15 Vangorda Pit @ 15m	12:35	1469	5.85	689	4.0
VP_30 Vangorda Pit @ 30m	12:45	1473	5.81	690	3.8
VP_40 Vangorda Pit @ 40m	13:00	1450	5.81	687	3.8

Note: Dissolved Oxygen readings were taken but are not valid except for 1 m depth because water is aerated when transferring to measurement bottle. See field notes.

Field Note Book - Grum Pit Bio Treatment
May 2 to June 21 2006

2		MAY 2, 2006	
GRUM SAMPLE DEPTHS			
1, 3, 5, 15, 30, 40			
• set up for Grum sampling			
• drop off boat on ramp			
• re-mark rope, set up			
van Dusen			
GRUM 1-m			
pH		(ORION 115A+)	
COND	828 $\mu\text{S}/\text{cm}$	11:15 AM	
TDS	369 mg/L		
T $^{\circ}\text{C}$	1.4		
GRUM 3 m			
pH			
COND	874 $\mu\text{S}/\text{cm}$	11:25	
TDS	402 mg/L		
T $^{\circ}\text{C}$	1.8		
GRUM 5 m			
pH		11:40	
COND	872 $\mu\text{S}/\text{cm}$		
TDS	403 mg/L		
T $^{\circ}\text{C}$	2.4		
GRUM 15 m			
pH			
COND	881 $\mu\text{S}/\text{cm}$	11:50	
TDS	409 mg/L		
T $^{\circ}\text{C}$	4.2		
GRUM 30 m			
pH		12:00	
COND	895 $\mu\text{S}/\text{cm}$		
TDS	412 mg/L		
T $^{\circ}\text{C}$	4.1		
GRUM 40 m			
pH		12:15	
COND	885 $\mu\text{S}/\text{cm}$		
TDS	410 mg/L		
T $^{\circ}\text{C}$	4.2		
secchi 1.8 m			
ice 70 cm			

Field Note Book (FNB) May 2, 2006 Grum Pit
Note pH meter failed

MAY 2, 2006

PROFILE GRUM PIT

- depth 49.7 m just off raft.
- logging file Grum2.dat, ~ 25k, uploaded to PC in Ecwin software. (overwrite Grum.2 from 2005)
- logging interval 1 second, downcast only, stopped at about 47 m
- stop logging about 1:10 pm May 2, 2006, back to security, meet Ron + Craig.
- met Ron, gave us quads, motor into R-7 on skidoo trail, getting soft, check out R-7, all is well except for frozen creek in

R-7 May 2, 2006

- sensor, 6446 m, mains 11.34, Aux 12.77
- dock re-set, launch logger with 30 minute sample rate. creek is frozen stiff, no Q, no survey. (16:30)
- hellish return trip, got stuck up hills - show now very punchy - got back to Marcan and put away quads, check out of site, go to X-14 and drop off old freighter canoe for doing Q's in high water. (18:50)
- Filter + pres samples at guest house - 10 PM

FNB May 2 2006

May 17, 2006

- drilled several holes east of
barge on Faro Pit, sample

hole loc'n: 0584329 429
6915051 4867

depth 68.1 m

- YSI 6600 calibrated D.O.
at 09:00 May 17, 2006 -
(note instrument time was
08:43:00)

- Note depth is inaccurate
on 6600 $2.7m = 1.12m$ 6600
 $61.3 = 60.0m$ 6600

Secchi 4.9m 10:00 AM

- sample FARO 1m 10:15

pH 5.96
COND 929 $\mu S/cm$
TDS 416 mg/L
T°C 2.2

FNB May 17 2006 (Faro Pit)

MAY 17, 2006

FARO PIT @ 10m

pH 6.33 10:30
 COND 1061
 TDS 475
 T_{OC} 2.2

FARO PIT @ ~~30~~ 30m

pH 6.60 11:00
 COND 1047
 TDS 473
 T_{OC} 3.0

ice 61cm, top 10 rotten white
 completed sampling, pack
 up gear 11:30

set up at Vangorda Pit - open
 water all around, got some
 2x4's and built a ramp
 to access ice, use safety
 rope and got out to
 ~30m depth - not safe to
 go out much further.

MAY 17, 2006¹⁷

VANGORDA PIT @ 1m

pH 5.67 1:30 pm
 COND 1194
 TDS 545 mg/L
 T_{OC} 1.8

- samples; 1L Ag, 1L, 2x250mL
- YSI 6600 cast at about
 1:30, YSI depth 28.6m,
 depth sounder 30.5m

• File GRUM-PIT 17.05.2006

VANGORDA @ 7m

pH 5.68 2:20pm
 COND 1476
 TDS 761
 T_{OC} 3.2

- samples; 1L, 2x250mL
- Sample hole is 0594010
 690 3243
- Ice 62cm, top 8-10 is
 rotten, white, candled
 to 25cm
- Secchi 0.7m

FNB May 17 2006 (Faro and Vangorda)

GRUM PIT JUNE 14, 2006

- organize boat and gear,
out on raft 8:45,
download weather station
09:59, saved file as
Grum pit weather station -
June 14 2006 as
plug-in.

- organize and label bottles

- Download thermistors
(water temp probes)

Grum 1m - 767035-6-100756

Launch, 10 min interval

Grum 2m - 767036-6-101008 20.22°

Launch, 10 min interval

Grum 3m - 767037-6-102229 25.14

Launch, 30 min interval

Grum 5m - 767038-6-102537

Launch, 30 min interval

Grum 7m - 767039-6-102803

Launch, 30 min interval

Grum 10m - 767040-7-103309

Launch, 30 min interval

Grum 15m - 767041-6-103622

Failed to open .dte,

readout again - 6-103753,

also failed to open .dte,

try again (-6-104237.dte),

also failed to open, says

"data offload successful" but

can't open file, batteries

at ~10%, time - 88 secs.

try again, saved -6-104518 as

"Any file, still can't open.

- Doc unloaded 4 drums of
fertilizer, on ramp.

resume Hobo temps 11:30 →

try Grum 15m again,

file 113131, worked.

Grum 20m - 76042-6-113829

Launched, 30m interval

Grum 30m - 768043-6-114154

Launched, 30m interval

FNB June 14, 2006

Grum 45 m -767044-6-114448

Launched, 30 min interval
(note all loggers at ~80%
battery power)

Sampling, Grum Pit,
June 14, 2006

Grum - 1m 12:00

pH 7.43
COND 768 $\mu\text{S}/\text{cm}$
TDS 371 mg/L
T°C 16.0
secchi 1.9m

Grum - 3m 12:15

pH 7.22
COND 972 $\mu\text{S}/\text{cm}$
TDS 468 mg/L
T°C 9.5

Grum - 5m 12:30

pH 7.21
COND 1004 $\mu\text{S}/\text{cm}$
TDS 471 mg/L
T°C 6.4

(note pH is Accumet AP61,
calib. 10 AM, COND is
Orion 115A+, calib. June
13 10 AM)

Grum - 15m 12:45

pH 7.40
COND 996 $\mu\text{S}/\text{cm}$
TDS 468 mg/L
T°C 5.9

Grum - 30m 1:10

pH 7.35
COND 1007 $\mu\text{S}/\text{cm}$
TDS 471 mg/L
T°C 5.8

FNB June 14, 2006

GRUM - 40 m 1:30
 pH 7.31
 COND 1002 $\mu\text{S}/\text{cm}$
 TDS 467 mg/L
 TC 4.5 (note COND probe
 in free running H₂O from
 van Dusen - works better
 than in in situ bottle)

Note: depth at porthole on
 raft is 51.0 m

Note: all samples field filtered
 for dissolved metals, Chlorophyll
 only at 1m, 3m and 5m

raft, model 6600-D sonde,
 Ykon Contaminants equipment

Try GRUM-PIT RAFT, but DO
 not working, Δ membrane,
 calibrate, OK, Do second
 cast GRUM-2 1:30 PM

(.8 m 880 $\mu\text{S}/\text{cm}$ 9.96 mg/L)
 Sample rate is 10 seconds,
 lower 1 m increments and
 wait for stabilization, continue.

- noticed a D.O. blip on the
 downcast at about 40 m,
 and not on the upcast, so
 do a third cast GRUM-3,
 at about 1:50 PM,

recalibrate and do GRUM-4,
 notice D.O. is different
 and pit out of calibration...

FNB June 14, 2006

- went to WTP to get an MT,
download Grum Creek
CrumCK-767034-8-145100
batts 86%
- Fertilize Grum Pit Lake
3-5 PM, 320 L
using pump / barrels,
- Fixed up rope mooring
and broken pieces on raft
- Filter and prep samples
at studio, prep coc form,
check YSI 6600 data files
6-8 PM
note files saved in ecowatch:
Grum-2
Grum-4
- shipped samples Air North
Thursday June 15 3 PM
Coc # 51886

FNB June 14, 2006

JUNE 20, 2006

- check in at gate 5:30,
set up at Grum, go out
to raft to test CTD 12 plus
S/N 638

- Grum 51.05 m at porthole

- using ISS software with
new config. file, start
instrument and turn to
"monitor"

Time	pressure	T°	Cond	Sal
PST	dbar		ms/cm	
183753	.16	15.99	.641	.382

(time is 30 secs slow)

monitor + save as "project"
Std Plus 638.test

Turn off, then ON
at 18:42:00 OFF 18:51:20
(test cast on Grum Raft)

• conductivity on Orion 115-A+
is 758 $\mu\text{S}/\text{cm}$
TDS 364 mg/L
Temp 15.6 } at 1 m

• conn to ISS to check cast
• download "LOG.RW"
file, then "EXPORT" and
save as "project"
Std Plus 638-06-20-06
in Fano Projects folder
(~ 7 PM) seems to
work OK.

FNB June 20 2006 (test cast with Applied Microsystems CTD 12 Plus S/N 638)

JUNE 21, 2006

Sort + label bottles in
Grum shack 08:30 - 09:30

Faro Pit depths:

1, 3, 5, 15, 30, 60, 80

& Vangorda Pit depths:

1, 3, 5, 15, 30, 40

• Fertilized Grum Pit, 9 - 10:30
1 1/2 Drums.

• Load up boat/gear, move to
Vangorda Pit. Depth 44.6m,
(45m)

CTD ON 11:29:30

OFF 11:40:10

• anchored, payed out about 41m
of rope on CTD.

JUNE 21, 2006

Sample Vangorda Pit

VP- 1m

11:50

pH 5.18

COND 889 μ S/cm

TDS 428 mg/L

TC 14.1°

D.O. 8.26 mg/L @ 86.6%

Secchi 0.9m

Samples; 1L, 2X 250 μ l,

100ml NUTS, 1L NH₄

Field Filtered for diss. met.

VP- 3m

12:10 PM

pH 5.36

COND 638 1342 μ S/cm

TDS 638 mg/L

TC 7.1°

D.O. 8.05 mg/L @ 83.5%

Samples; 1L Ag (chl. a),

250 ml ag (NH₄) 2X 250 mL,

1X 100 ml NUTS

FNB June 21, 2006

JUNE 20, 2006
12:20

VP- 5 m

pH 5.69
COND 1434 $\mu\text{S}/\text{cm}$
TDS 674 mg/L
T $^{\circ}\text{C}$ 4.1 $^{\circ}$
D.O. 5.4 mg/L @ 54%

Samples; 250 Ag NHA, 2x250,
1x100, 1x1L

VP- 15 m

12:35

pH 5.85
COND 1469 $\mu\text{S}/\text{cm}$
TDS 689 mg/L
T $^{\circ}\text{C}$ 4.0
D.O. 5.0 mg/L @ 50%

Samples; 250 Ag NHA, 2x250,
1x1L (lost 100 mL NUTS)

JUNE 21, 2006

VP- 30 m

pH 5.81
COND 1473 $\mu\text{S}/\text{cm}$
TDS 690 mg/L
T $^{\circ}\text{C}$ 3.8 $^{\circ}$
D.O. 6.9 mg/L 61%

Samples; 1L, 250 Ag NHA,
3x250 - (one for NUTS)

VP- 40 m

1:00 PM

pH 5.81
COND 1450 $\mu\text{S}/\text{cm}$
TDS 687 mg/L
T $^{\circ}\text{C}$ 3.8
D.O.

Samples; 1L, 250 Ag NHA,
2x250, 1x100

Raining.

Go to Grumstack, complete
filter chlorophyll + preserve all
Load up and move to
Fano Pitw 2:30 PM

FNB June 21 2006 (Vangorda Pit)

FARO PIT JUNE 21, 2006

Relocate anchor in 88 m

H₂O, DO CTD cast

ON: 3:30:30

OFF: 3:51:02

(stop at 80 m)

Sample Faro Pit

FP-1

3:45

pH 6.94

4:00

COND 866 μ S/cm

TDS 413 mg/L

T_{OC} 12.8

D.O. 8.50 mg/L 89.9%

Secchi 3.9 m

Note: D.O. is accumet AP64

pH is accumet AP61

COND is Orion 115A+

(all calibrated this morning)

JUNE 21, 2006

FP-3 m

4:15

pH 7.12

COND 867 μ S/cm

TDS 416 mg/L

T_{OC} 12.2

D.O. 7.69 mg/L @ 76%

samples; 1L, 2x250, 1x100
 1x250 AgI NH₄, 1L AgI chl. a
 field filtered for diss. met

FP-5 m

4:25

pH 7.13

COND 903 μ S/cm

TDS 431 mg/L

T_{OC} 10.2

D.O. 8.20 @ 80.1%

samples; 1L, 2x250, 1x100,
 1x250 AgI NH₄, 1L AgI chl. a
 field filtered for diss. met.

FNB June 21, 2006 (Faro Pit)

JUNE 21, 2006

FP 15m

4:35

pH 7.14

COND. 1033 $\mu\text{S}/\text{cm}$ TDS 478 mg/L T $^{\circ}\text{C}$ 3.8D.O. 8.00 mg/L @ 82.8%

samples; 1L, 2x250 mL, 1x100
1,250 mL Ag1NH $_4$, field filtered
for diSS. met.

FP - 30m

4:45

pH 7.06

COND. 1110 $\mu\text{S}/\text{cm}$ TDS 512 mg/L T $^{\circ}\text{C}$ 4.0D.O. 7.15 mg/L @ 66%

samples; 1L, 2x250 mL,
1x100 mL, 1x250 Ag1NH $_4$,
Field filtered for diSS. met.

JUNE 21, 2006

FP 60m

5:PM

pH 6.90

COND. 1115 $\mu\text{S}/\text{cm}$ 1096TDS 512 mg/L 509T $^{\circ}\text{C}$ 4.0D.O. 6.0 mg/L @ 50%

(note D.O. likely wrong due
to oxygenation/aeration in
sample bottle)

FP 80m

5:20 pm

pH 6.80

COND. 1118 $\mu\text{S}/\text{cm}$ TDS 518 mg/L T $^{\circ}\text{C}$ 4.0D.O. 6.0 mg/L @ 51%

complete sampling Faro
Pit 5:30 pm
Took a look for Faro Creek
Thermister = gone!
Took boat back to Grum,
pack up and leave
site about 7:20 pm

FNB June 21, 2006 (Faro Pit)

SEND REPORT TO:

CLIENT: SRK CONSULTING ATTN: CAM SCOTT
ADDRESS: SUITE 802-1066 W. HASTINGS ST.
CITY: VANCOUVER PROV: BC POSTAL CODE: _____
TELEPHONE: 604 681 4196 FAX: _____ SAMPLER: L.E.S.
PROJECT NAME & NO.: FARO PITLAKES QUOTE NO.: _____
PO NO.: _____ ALS CONTACT: CAM DANG
REPORT FORMAT: ☐ HARDCOPY ☐ EMAIL - ADDRESS: VANCOUVER@SRK.COM
☐ FAX ☒ EXCEL ☐ PDF ☐ OTHER:

CHAIN OF CUSTODY FORM

[illegible]

TURN AROUND REQUIRED: ☒ ROUTINE ☐ RUSH - SPECIFY DATE: _____ (surcharge may apply)

SEND INVOICE TO: ☒ SAME AS REPORT INVOICE FORMAT: ☐ HARDCOPY ☐ PDF ☐ FAX
☐ DIFFERENT FROM REPORT (provide details below)

SPECIAL INSTRUCTIONS:

please send copy of results to L.E.S.
Laberge@internorth.com

RELINQUISHED BY: KEN NORDIN	DATE May 17, 2006	RECEIVED BY:	DATE
	TIME 16:30		TIME
RELINQUISHED BY:	DATE	RECEIVED BY:	DATE
	TIME		TIME

FOR LAB USE ONLY

COOLER SEAL INTACT? ☐ YES ☐ NO ☐ N/A	SAMPLE TEMPERATURE: _____ °C FROZEN? ☐ YES ☐ NO	COOLING METHOD? ☐ ICEPACKS ☐ ICE ☐ NONE
--	--	---

CLIENT COPY

SEE WHITEPAPER FOR SOURCE VERSIONS OF

CHAIN OF CUSTODY FORM

PAGE 1 OF 1

SEND REPORT TO:

CLIENT: SRK CONSULTING ATTN: CAM SCOTT

ADDRESS: SUITE 800-1066 W. HASTINGS ST.

CITY: VANCOUVER PROV.: BC POSTAL CODE: V6E 3X2

TELEPHONE: 604 681 4196 FAX: 604 687 5532 SAMPLER: L.E.S.

PROJECT NAME & NO.: GRUMPIT BIO TREATMENT QUOTE NO.

BO NO: D+T 2006/07 Task 22 ALS CONTACT: CAN DANG

REPORT FORMAT: ☒ HARDCOPY ☐ EMAIL - ADDRESS: Vancouver@srk.com

☐ FAX ☒ EXCEL ☐ PDF ☐ OTHER:

SAMPLE IDENTIFICATION		DATE / TIME COLLECTED		MATRIX	pH ₁	AL	SH	AM	NH ₃	DIS	TUT	TOD	TOD ₁	TOD ₂	TOD ₃	TOD ₄	TOD ₅	TOD ₆	TOD ₇	TOD ₈	TOD ₉	TOD ₁₀	TOD ₁₁	TOD ₁₂	TOD ₁₃	TOD ₁₄	TOD ₁₅	TOD ₁₆	TOD ₁₇	TOD ₁₈	TOD ₁₉	TOD ₂₀	TOD ₂₁	TOD ₂₂	TOD ₂₃	TOD ₂₄	TOD ₂₅	TOD ₂₆	TOD ₂₇	TOD ₂₈	TOD ₂₉	TOD ₃₀	TOD ₃₁	TOD ₃₂	TOD ₃₃	TOD ₃₄	TOD ₃₅	TOD ₃₆	TOD ₃₇	TOD ₃₈	TOD ₃₉	TOD ₄₀	TOD ₄₁	TOD ₄₂	TOD ₄₃	TOD ₄₄	TOD ₄₅	TOD ₄₆	TOD ₄₇	TOD ₄₈	TOD ₄₉	TOD ₅₀	TOD ₅₁	TOD ₅₂	TOD ₅₃	TOD ₅₄	TOD ₅₅	TOD ₅₆	TOD ₅₇	TOD ₅₈	TOD ₅₉	TOD ₆₀	TOD ₆₁	TOD ₆₂	TOD ₆₃	TOD ₆₄	TOD ₆₅	TOD ₆₆	TOD ₆₇	TOD ₆₈	TOD ₆₉	TOD ₇₀	TOD ₇₁	TOD ₇₂	TOD ₇₃	TOD ₇₄	TOD ₇₅	TOD ₇₆	TOD ₇₇	TOD ₇₈	TOD ₇₉	TOD ₈₀	TOD ₈₁	TOD ₈₂	TOD ₈₃	TOD ₈₄	TOD ₈₅	TOD ₈₆	TOD ₈₇	TOD ₈₈	TOD ₈₉	TOD ₉₀	TOD ₉₁	TOD ₉₂	TOD ₉₃	TOD ₉₄	TOD ₉₅	TOD ₉₆	TOD ₉₇	TOD ₉₈	TOD ₉₉	TOD ₁₀₀	TOD ₁₀₁	TOD ₁₀₂	TOD ₁₀₃	TOD ₁₀₄	TOD ₁₀₅	TOD ₁₀₆	TOD ₁₀₇	TOD ₁₀₈	TOD ₁₀₉	TOD ₁₁₀	TOD ₁₁₁	TOD ₁₁₂	TOD ₁₁₃	TOD ₁₁₄	TOD ₁₁₅	TOD ₁₁₆	TOD ₁₁₇	TOD ₁₁₈	TOD ₁₁₉	TOD ₁₂₀	TOD ₁₂₁	TOD ₁₂₂	TOD ₁₂₃	TOD ₁₂₄	TOD ₁₂₅	TOD ₁₂₆	TOD ₁₂₇	TOD ₁₂₈	TOD ₁₂₉	TOD ₁₃₀	TOD ₁₃₁	TOD ₁₃₂	TOD ₁₃₃	TOD ₁₃₄	TOD ₁₃₅	TOD ₁₃₆	TOD ₁₃₇	TOD ₁₃₈	TOD ₁₃₉	TOD ₁₄₀	TOD ₁₄₁	TOD ₁₄₂	TOD ₁₄₃	TOD ₁₄₄	TOD ₁₄₅	TOD ₁₄₆	TOD ₁₄₇	TOD ₁₄₈	TOD ₁₄₉	TOD ₁₅₀	TOD ₁₅₁	TOD ₁₅₂	TOD ₁₅₃	TOD ₁₅₄	TOD ₁₅₅	TOD ₁₅₆	TOD ₁₅₇	TOD ₁₅₈	TOD ₁₅₉	TOD ₁₆₀	TOD ₁₆₁	TOD ₁₆₂	TOD ₁₆₃	TOD ₁₆₄	TOD ₁₆₅	TOD ₁₆₆	TOD ₁₆₇	TOD ₁₆₈	TOD ₁₆₉	TOD ₁₇₀	TOD ₁₇₁	TOD ₁₇₂	TOD ₁₇₃	TOD ₁₇₄	TOD ₁₇₅	TOD ₁₇₆	TOD ₁₇₇	TOD ₁₇₈	TOD ₁₇₉	TOD ₁₈₀	TOD ₁₈₁	TOD ₁₈₂	TOD ₁₈₃	TOD ₁₈₄	TOD ₁₈₅	TOD ₁₈₆	TOD ₁₈₇	TOD ₁₈₈	TOD ₁₈₉	TOD ₁₉₀	TOD ₁₉₁	TOD ₁₉₂	TOD ₁₉₃	TOD ₁₉₄	TOD ₁₉₅	TOD ₁₉₆	TOD ₁₉₇	TOD ₁₉₈	TOD ₁₉₉	TOD ₂₀₀	TOD ₂₀₁	TOD ₂₀₂	TOD ₂₀₃	TOD ₂₀₄	TOD ₂₀₅	TOD ₂₀₆	TOD ₂₀₇	TOD ₂₀₈	TOD ₂₀₉	TOD ₂₁₀	TOD ₂₁₁	TOD ₂₁₂	TOD ₂₁₃	TOD ₂₁₄	TOD ₂₁₅	TOD ₂₁₆	TOD ₂₁₇	TOD ₂₁₈	TOD ₂₁₉	TOD ₂₂₀	TOD ₂₂₁	TOD ₂₂₂	TOD ₂₂₃	TOD ₂₂₄	TOD ₂₂₅	TOD ₂₂₆	TOD ₂₂₇	TOD ₂₂₈	TOD ₂₂₉	TOD ₂₃₀	TOD ₂₃₁	TOD ₂₃₂	TOD ₂₃₃	TOD ₂₃₄	TOD ₂₃₅	TOD ₂₃₆	TOD ₂₃₇	TOD ₂₃₈	TOD ₂₃₉	TOD ₂₄₀	TOD ₂₄₁	TOD ₂₄₂	TOD ₂₄₃	TOD ₂₄₄	TOD ₂₄₅	TOD ₂₄₆	TOD ₂₄₇	TOD ₂₄₈	TOD ₂₄₉	TOD ₂₅₀	TOD ₂₅₁	TOD ₂₅₂	TOD 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TURN AROUND REQUIRED: ☒ ROUTINE ☐ RUSH - SPECIFY DATE: _____ (surcharge may apply)

SEND INVOICE TO: ☒ SAME AS REPORT INVOICE FORMAT: ☐ HARDCOPY ☐ PDF ☐ FAX
☐ DIFFERENT FROM REPORT (provide details below)

SPECIAL INSTRUCTIONS: * ALS Milli-Q 5-15-06

please send copy of results to L.E.S.
Laberge@internorth.com

RELINQUISHED BY:	DATE 6.15.06	RECEIVED BY:	DATE
KEVIN NORDIN	TIME 18:00		TIME
RELINQUISHED BY:	DATE	RECEIVED BY:	DATE
	TIME		TIME

FOR LAB USE ONLY

COOLER SEAL INTACT? ☐ YES ☐ NO ☐ N/A	SAMPLE TEMPERATURE: _____ °C FROZEN? ☐ YES ☐ NO	COOLING METHOD? ☐ ICEPACKS ☐ ICE ☐ NONE
--	--	---

SEE WHITEPAPER FOR SOURCE VERSIONR_08

CLIENT COPY

Chain of Custody June 14, 2006 samples



ALS Environmental
excellence in analytical testing

Vancouver, BC 1908 Triumph Street V5L 1K5 Tel: 604-253-4188 Toll Free: 1-800-665-0243 Fax: 604-253-6700
Fort St. John, BC #2 - 8820 100th Street V1J 3W9 Tel: 250-785-8281 Fax: 250-785-8286
Calgary, AB #2 - 21 Highfield Circle SE T2G 0N6 Tel: 403-214-5431 Toll Free: 1-866-722-6231 Fax: 403-214-5430
Burlington, ON 5420 Mainway Drive, Unit 5 L7L 6A4 Tel: 905-331-3111 Toll Free: 1-888-257-3884 Fax: 905-331-4567

52455

SEND REPORT TO:

CLIENT: SRK ATTN: CAM SCOTT

ADDRESS: SUITE 800-1056 W. HASTINGS ST.

CITY: VANCOUVER PROV: BC POSTAL CODE: V6E 2X2

TELEPHONE: 604 681 4196 FAX: 604 687 5532 SAMPLER: L.E.S.

PROJECT NAME & NO: RUM PIT BIO TREATMENT QUOTE NO.:

PO NO: 2006/7 Task 22 ALS CONTACT: CAN DANG

REPORT FORMAT: ☐ HARD COPY ☐ EMAIL - ADDRESS: VANCOUVER@SRK.COM

☐ FAX ☐ EXCEL ☐ PDF ☐ OTHER:

CHAIN OF CUSTODY FORM

PAGE 1 OF 1

ANALYSIS REQUESTED:

PH CONDUCTIVITY, TSS	ALKALINITY - TOTAL	SULPHATE	AMMONIA LOW LEVEL	NITRATE/NITRITE	DISSOLVED OXYGEN	TOTAL PHOSPHATE	ICP/MS TOTAL METALS	ICP/MS DISSOLVED	(ULTRA TRACE)	CHLOROPHYLL A	NOTES (sample specific comments, due dates, etc.)
VP-1 (Vangorda pit @ 1m)	2006-06-21 11:50	H ₂ O	✓	✓	✓	✓	✓	✓	✓	✓	
VP-3m (Vangorda @ 3m)	2006-06-21 12:10	H ₂ O	✓	✓	✓	✓	✓	✓	✓	✓	
VP-5m (Vangorda @ 5m)	2006-06-21 12:20	H ₂ O	✓	✓	✓	✓	✓	✓	✓	✓	
VP-15m (Vangorda @ 15m)	2006-06-21 12:35	H ₂ O	✓	✓	✓	✓	✓	✓	✓	✓	
VP-30m (Vangorda @ 30m)	2006-06-21 12:45	H ₂ O	✓	✓	✓	✓	✓	✓	✓	✓	
VP-40m (Vangorda @ 40m)	2006-06-21 13:00	H ₂ O	✓	✓	✓	✓	✓	✓	✓	✓	
FP-1m (Faro Pit @ 1m)	2006-06-21 16:00	H ₂ O	✓	✓	✓	✓	✓	✓	✓	✓	
FP-3m (Faro Pit @ 3m)	2006-06-21 16:15	H ₂ O	✓	✓	✓	✓	✓	✓	✓	✓	
FP-5m (Faro Pit @ 5m)	2006-06-21 16:25	H ₂ O	✓	✓	✓	✓	✓	✓	✓	✓	
FP-15m (Faro Pit @ 15m)	2006-06-21 16:35	H ₂ O	✓	✓	✓	✓	✓	✓	✓	✓	
FP-30m (Faro Pit @ 30m)	2006-06-21 16:45	H ₂ O	✓	✓	✓	✓	✓	✓	✓	✓	
FP-60m (Faro Pit @ 60m)	2006-06-21 17:00	H ₂ O	✓	✓	✓	✓	✓	✓	✓	✓	
FP-80m (Faro Pit @ 80m)	2006-06-21 17:20	H ₂ O	✓	✓	✓	✓	✓	✓	✓	✓	

TURN AROUND REQUIRED: ☐ ROUTINE ☐ RUSH - SPECIFY DATE: 2006-06-22 (surcharge may apply)

SEND INVOICE TO: ☒ SAME AS REPORT INVOICE FORMAT: ☐ HARD COPY ☐ PDF ☐ FAX
☐ DIFFERENT FROM REPORT (provide details below)

SPECIAL INSTRUCTIONS:
ALL DISSOLVED METALS AND CHLOROPHYLL A
FIELD FILTERED AND PRESERVED
PLEASE COPY REPORT TO Laberge@internorth.com

RELINQUISHED BY: KEI NORDIN DATE: 2006-06-22 TIME: 18:00
RECEIVED BY: _____ DATE: _____ TIME: _____

FOR LAB USE ONLY
COOLER SEAL INTACT? ☐ YES ☐ NO ☐ N/A SAMPLE TEMPERATURE: _____ °C COOLING METHOD? ☐ ICEPACKS ☐ ICE ☐ NONE
FROZEN? ☐ YES ☐ NO

CLIENT COPY

SEE WHITEPAPER FOR SOURCE VERSION 0.8

Memorandum

To: Cam Scott SRK August 4, 2006
Copies: John Chapman SRK, Roger Pieters, Faro Project Office, Deloitte
From: Ken Nordin LES

Re: Grum Pit Bio Treatment D&T 2006/7 Task 22 to August 2, 2006

This is a brief summary of the results of the project ***Grum Pit Bio Treatment D&T 2006/7 Task 22*** for the period June 28 to August 2, 2006. Digital files for the weather station, sonde casts and CTD casts will be sent under separate cover. The Grum pit lake seemed to reach its maximum standing crop of algae about mid July this year. The rental CTD was checked against a calibration solution on July 12 and was found to have deteriorated badly compared with earlier casts and with other instruments. Lab data was not available at the time of writing to compare the CTD results with lab data. The fertilizer was inventoried and checked. There are 44 drums left in the cold storage shed at the Faro site. These drums have about 10 to 13 cm of crystalline sludge at the bottom. There are 2 full drums left on the Grum Ramp which seemed to have a bit more sludge – 20 to 25 cm.

Summary Log

June 28 2006

Fertilized Grum Pit with 1 ½ drums using pump on board boat. Notice that there is about 15 to 20 cm of crystalline sludge in bottom of drums, dumped this onto ramp in shallow water and rinsed drums.

July 5 2006

Fertilized Grum Pit with 1 ½ drums using pump on board boat. Rinsed sludge out of drums on raft, pumped onto surface.

July 12 2006

Picked up Horiba multiprobe from Anvil Lab, calibrated in Grum shack. Also checked CTD - STD638 Plus using 2,010 µS/cm standard solution. Discovered that the Horiba, and LES Orion 115 conductivity meter could be calibrated and displayed calibration value correctly while CTD was only reporting about ¼ of the calibration solution value...Sampled Grum Pit at 1, 3, 5, 15, 30 and 40 m. Downloaded weather station and temperature loggers. Fertilize Grum Pit 1 ½ drums. Rinse drums at raft – about 15 cm sludge in bottoms of these drums.

July 19 2006

Fertilize Grum Pit 1 ½ drums. Rinsed out sludge.

July 26 2006

Fertilize Grum Pit 1 ½ drums. Rinsed out sludge.

August 2 2006

Fertilize Grum Pit 1 ½ drums. Rinsed sludge out of drums from raft. (Last fertilization for 2006). Downloaded weather station.

Images Faro Pit Lakes June 28 to August 2, 2006:



Grum Pit bird's eye June 14 2006



Grum Pit bird's eye June 21, 2006



Grum Pit bird's eye June 28 2006



Grum raft June 28 2006



Emptying sludge on ramp June 28 2006



Grum bird's eye July 12 2006



Grum pit lake near ramp July 12 2006



Grum raft July 12 2006



Former "Fish" limno corral July 12 2006 is now acting as a control



Fertilizing Grum July 26 2006



Grum ramp July 26 2006



Grum raft July 26 2006



Grum bird's eye July 26 2006



Grum raft August 2 2006



Grum pit lake August 2 2006



Grum pit June 28 2006



Grum panorama July 5 2006



Grum panorama July 19 2006



Grum panorama July 26 2006



Grum Pit August 2 2006

In situ data for the July 12 sampling event follows. Copies of field notes and chain of custody forms also follow. Digital data files will be distributed under separate cover.

Two items are noteworthy from the past month's results – one is that there is a quantity of sludge at the bottom of the fertilizer drums, and the other is that the rental CTD is not performing to expectations.

Although we haven't yet received the lab data for the July 12 sampling event, it was apparent that the CTD was grossly inaccurate compared with the standard solution. Anvil Lab has a Horiba multiprobe on site that appears to work well compared with other instruments. We have since replaced our own conductivity meter with a new one. Perhaps between the two we can obtain some reliable profile data; however these instruments are not set up for data logging casts, therefore each depth interval has to be entered manually.

Your suggestions on how to deal with the pit profiling instrumentation would be welcome. If you have any comments or questions contact the undersigned anytime.



Ken Nordin ASCT CCEP
Laberge Environmental Services
August 4, 2006

July 12 Grum Pit calibration check

	Standard Solution μS/cm	Instrument reading μS/cm	comment
Calibration check July 12 2006 in Grum shack			
Anvil Lab Horiba Multiprobe	2,010	2,010	Able to set instrument
Applied Microsystems CTD 638Plus	2,010	595	Did not alter instrument, using configuration file supplied by AMT
Orion conductivity meter 115 A+	2,010	2,010	Able to set instrument
Horiba instrument had most reliable conductivity of the three tested. The Orion meter was later shown to read low in relation to standard and to Christoph Wels field conductivity meter.			

July 12 Grum in situ data

Location	Time PST 24hr	¹Horiba Cond. μS/cm	²CTD 638 μS/cm	³Orion 115A+ μS/cm	pH**	¹TDS mg/L	³TDS mg/L	¹Temp °C	²Temp °C	³Temp °C
GP_1 Grum Pit @ 1m	13:15	864	612	742	8.96	550	472	17.50	17.131	17.7
Grum Pit at 2m		894	585			570		16.23		
GP_3 Grum Pit @ 3m	13:45	1240	537	1056	7.68		509	7.49	7.712	7.49
GP_5 Grum Pit @ 5m	14:00	1220	527	1153	7.19		547	5.36	5.394	5.4
Grum Pit at 6m		1210	525			800				
Grum Pit at 7m		1210	526			800				
Grum Pit at 10m		1210	521			800				
GP_15 Grum Pit @ 15m	14:30	1210	520	1207	7.68	800	565	5.33	5.77	4.3
Grum Pit at 19 m		1220	511			800		5.36		4.2
Grum Pit at 20 m		1210	512			800				
Grum pit at 22 m		1210				800		5.31		
Grum Pit at 25 m		1220				800		5.33		
GP_30 Grum Pit @ 30m	14:45	1220		1213	7.06	800	565	5.34	5.77	4.5
Grum Pit at 35 m		1210				800			4.55	
GP_40 Grum Pit @ 40m	12:15	1210		1196	7.41	800	564	5.30	4.55	4.6

Field Note Book - Grum Pit Bio Treatment
July 12 to August 2 2006

2	3																																								
Grum Shack July 12, 2006 • label bottles • mark new casting rope • calibrate pH, COND (Orion 115) • set up CTD 638 monitor CTD Reads .595 mS/cm when immersed in 2,010 μS/cm calibration solution (1 gm NaCl in 1.0 L H₂O) • calibrate Horiba multiprobe, COND, pH OK but D.O. probe doesn't work in spite of changing membrane and new KCl solution • move to grum raft and set up for sampling (12:50 PM) CTD ON 13:01:13 OFF 13:10:19	July 12, 2006 Secchi depths Grum Lake 0.5 CONTROL LIMNO (OLD FISH) 4.5 GL - 1m 1:15 PM <table border="1"> <thead> <tr> <th></th> <th>HORIBA</th> <th>ORION</th> <th>AP61</th> </tr> </thead> <tbody> <tr> <td>pH</td> <td>8.96</td> <td></td> <td>9.27</td> </tr> <tr> <td>Tc</td> <td>17.50</td> <td>17.7</td> <td>17.7</td> </tr> <tr> <td>Cond</td> <td>864</td> <td>973</td> <td>972</td> </tr> <tr> <td>TDS</td> <td>550</td> <td>472</td> <td></td> </tr> <tr> <td>depth</td> <td>1.0</td> <td></td> <td></td> </tr> <tr> <td>ORP</td> <td>37mV</td> <td></td> <td></td> </tr> <tr> <td>ION₁</td> <td>6.1 g/L</td> <td></td> <td></td> </tr> <tr> <td>ION₂</td> <td>5.9 g/L</td> <td></td> <td></td> </tr> <tr> <td>ION₃</td> <td>—</td> <td></td> <td></td> </tr> </tbody> </table> Samples 1L, 2x250, 100, 250 Ag, field filtered diss net + chl. (a)		HORIBA	ORION	AP61	pH	8.96		9.27	Tc	17.50	17.7	17.7	Cond	864	973	972	TDS	550	472		depth	1.0			ORP	37mV			ION ₁	6.1 g/L			ION ₂	5.9 g/L			ION ₃	—		
	HORIBA	ORION	AP61																																						
pH	8.96		9.27																																						
Tc	17.50	17.7	17.7																																						
Cond	864	973	972																																						
TDS	550	472																																							
depth	1.0																																								
ORP	37mV																																								
ION ₁	6.1 g/L																																								
ION ₂	5.9 g/L																																								
ION ₃	—																																								

Field Note Book (FNB) July 12, 2006 Grum Pit shack

July 12, 2006

GL - 2 m (no samples)

HORIBA:

pH 8.84
 COND 894
 T° 16.23
 TDS 570
 ORP 42 mV
 10N₁ 62 mg/L
 10N₂ 5.9 mg/L

GL - 3 m (no) 1:45 PM

pH 7.58 8.50
 COND 1,240 1056
 T° 7.49 12.1
 TDS 800 509
 ORP 90 mV
 10N₁ 62 mg/L
 10N₂ 6.0 mg/L

* Samples; 1L, 2X250, 100, 250 ag
 Field Filtered for dissmet + chl. a

GL - 5 m 14:00

HORIBA Orion AP61

pH 7.19 8.01
 COND 1220 1153
 T° 5.36 5.4
 TDS 800 547
 ORP 94
 10N₁ 64
 10N₂ 6.7

* Samples; 1L, 2X250, 100, 250 ag
 Field Filtered for dissmet + chl. a
 - HUGE Thunderheads all around

GL - 6 m 7m 10m 15m

pH 7.07 7.07 7.05 7.05
 COND 1210 1210 1210 1210
 T° 5.34 5.32 5.33 5.33
 TDS 800 800 800 800
 ORP 93 93 93 93
 10N₁ 64 64 65 65
 10N₂ 6.8 6.8 6.8 6.8

FNB July 12 2006

6

July 12, 2006

GL - 15 m

14:30

pH 7.68
COND 1207
TDS 565
T_C 4.3

• Samples; 1L, 2X250, 100, 250 µg
Field Filtered for diss. mat.
(no chlorophyll a sample)

	GL19	GL20	GL22	GL25	GL30
pH	7.06	7.05	7.06	7.06	7.06
COND	1220	1210	1210	1220	1210
T _C	5.36	5.33	5.31	5.33	5.34
TDS	800	800	800	800	800
ORP	92	93	92	92	91
ION ₁	66	66	66	66	66
ION ₂	6.8	6.8	6.8	6.8	6.8

7

July 12, 2006

GL - 30 m

14:45

pH 7.47
COND 1213
TDS 565
T_C 4.5

• Samples; 1L, 2X250, 100, 250 µg
Field Filtered for diss. mat.
no chlorophyll a

	GL35	GL40
pH	7.05	7.05
COND	1210	1210
T _C	5.30	5.28
TDS	800	800
ORP	90	85
ION ₁	68	68
ION ₂	6.7	6.7

FNB July 12 2006

July 12, 2006

G.L. 40 m

15:10

pH 7.41
 COND 1196
 TDS 564
 T°C 4.6

° Sampled; 1L, 2x250 mL, 100, 250 µg.
 Field Filtered for diss met

conclude sampling 15:20

Download HOBO weather logger

3:30 pm saved file in

plug-ins as Grum Pit-Weather

July 12-2006

status: battery 100%

Time 15:31:51

Real 15:30:48

16.5°C

Download HOBO temp. loggers:

save in Fan Projects/Boxcar

Grum 1m - 767035-7-153929

Grum 2m - 767036-7-154413

July 12, 2006

Grum 3m - 767037-7-154644

Grum 5m - 767038-7-154808

Grum 7m - 767039-7-154943

Grum 10m - 767040-7-155057

Grum 15m - 767041-7-155210

Grum 20m - 767042-7-155350

Grum 30m - 767043-7-155509

Grum 45m - 767044-7-155624

complete downloads 4 PM

FNB July 12 2006

Grum Pit

July 26 0940 h.

Lacrosse / Withers

Horiba mame mite

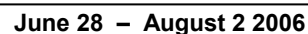
	1M	3M	5m	15m	30m
pH _{5m}	8.77	7.81	7.32	7.15	7.08
COND	.822	1.22	1.23	1.21	1.21
TEMP	16.52	9.04	5.88	5.36	5.34
SA% .04	.04	.05	.05	.05	.05
TPS%	0.56	0.8	0.8	0.8	0.8
ORP mV	24	67	81	87	86
ION 1	4.3	3.8	3.5	3.2	3.1
ION 2	1.9	1.6	1.4	1.3	1.3
ION 3	.10	.10	.11	.11	.11
(%L)					

sechi : 1.7 m

1m (repeat)

40m	1m (repeat)
7.05	.96
1.21	10.96
5.36	16.41
.05	.04
0.8	0.6
64	23
3.0	2.9
1.3	1.2
.12	.13

FNB June 14, 2006



Memorandum

To: Cam Scott SRK
Copies: John Chapman SRK, Roger Pieters, Faro Project Office, Deloitte
From: Ken Nordin LES

October 3, 2006

Re: Grum Pit Bio Treatment D&T 2006/7 Task 22 to August 2, 2006

This is a brief summary of the field data and activities under the project **Grum Pit Bio Treatment D&T 2006/7 Task 22** for the period August 9, 2006 to the end of the open water season on September 15. Digital files for the weather station, sonde casts and CTD casts will be sent under separate cover. The rental CTD was again checked against a calibration solution on August 9 (still off). A Seabird CTD was loaned from UBC for the last open water casts on September 15. Comparison with Lab data confirmed that the rental CTD was under reporting conductivity at the sample depths.

Summary Log

August 9 2006

Prepare containers in Grum shack, check CTD StdPlus 638 against calibration standard solution – still reporting low values. Sample Grum Pit at 1,3,5,15,30 and 40 m. Also cast with Horiba water quality instrument. Note last fertilization was August 2. Proceeded to Vangorda Pit and sample at 1,3,5,15,30 and 40 m. Proceed to Faro Pit, CTD cast and Horiba cast, sampled at 1,3,5,15,30,60 and 80 m.

September 15 2006

Prepare containers at Grum shack – which has been moved about ½ way up the ramp. Sample Grum Pit at 1,3,5,15,30 and 40 m. Also cast with Seabird CTD on loan from Roger Pieters – UBC. Proceeded to Vangorda Pit and sample at 1,3,5,15,30 and 40 m (no casts). Proceed to Faro Pit, CTD cast and Horiba cast, sampled at 1,3,5,15,30,60 and 80 m. Retrieved boat, motor and gear for return to Whitehorse.

Following are images from the pit lakes, in situ data, field notes and Chain of Custody forms for the two sampling events. No fertilizer was added to Grum Pit during the period. It appeared as though algae were still present in Grum Pit on September 15th. Thermoclines were also still evident.

Grum Pit looking west from water treatment plant, June 14 to September 15 2006;



Grum Pit bird's eye June 14 2006



Grum Pit bird's eye June 21, 2006



Grum Pit bird's eye June 28 2006



Grum bird's eye July 12 2006



Grum bird's eye July 26 2006



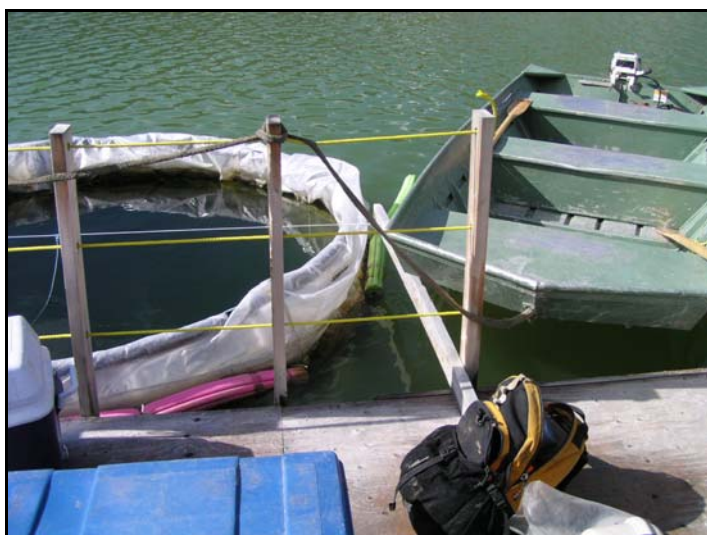
Grum Pit August 2 2006



Grum Pit August 9 2006



Grum Pit September 15 2006



Grum raft August 9 2006



Grum raft looking east August 9 2006



Vangorda August 9 2006



Vangorda waterfall August 9 2006



Faro Pit August 9 2006



Grum raft September 15 2006



Grum raft, old "EDTA" limno corral September 15 2006

In situ data for the August 9 and September 15 sampling events follows. Copies of field notes and chain of custody forms also follow. Digital data files will be distributed under separate cover.

The rental CTD (StdPlus Serial number 638) did not report conductivity values consistent with either standard solution, lab data or with other field instruments. The unit was returned to Applied Microsystems on October 3.

On September 15 two casts were made using a Seabird CTD similar to the one used in 2004, so comparisons can be made to the rental unit. The September sampling event was the last of the open water season of 2006.



Ken Nordin ASCT CCEP
Laberge Environmental Services
Whitehorse
October 3, 2006

August 9, 2006 Grum Pit calibration check

	Standard Solution μS/cm	Instrument reading μS/cm	comment
Calibration check August 9 2006 in Grum shack			
Anvil Lab Horiba Multiprobe	2,010	2,009	
Applied Microsystems CTD S/N 638	2,010	881/910	"dual" mode/original config file
WtW 330i conductivity meter	2,010 1413	2010 1413	New instrument

August 9 Grum Pit in situ data

Location	Time PST 24hr	ALS lab	¹ Horiba Cond. μS/cm	² CTD 638 μS/cm	³ WtW 330i μS/cm	pH Fisher AP61	¹ Temp °C	² Temp °C	³ Temp °C
GP_1 Grum Pit @ 1m	10:00	892	896	522	896	8.	14.75	13.944	14.1
Grum Pit at 2m			990	556			-	13.122	
GP_3 Grum Pit @ 3m	10:20	938	1180	529	965	8.90	10.49	10.028	14.0
GP_5 Grum Pit @ 5m	10:40	1070	1210	468	1087	8.33	6.98	4.957	7.6
Grum Pit at 7m			1210	465			5.53		
Grum Pit at 10m			1200	465			5.43		
GP_15 Grum Pit @ 15m	10:55	1060	1200	467	1077	7.51	5.37	4.633	4.8
Grum Pit at 20 m			1200	469			5.33		
Grum Pit at 25 m			1200	471			5.36		
GP_30 Grum Pit @ 30m	11:10	1070	1210	475	1084	7.57	5.36	4.633	4.8
Grum Pit at 35 m			1210	477			5.36		
GP_40 Grum Pit @ 40m	11:30	1070	1210		1096	7.49	5.36	4.633	4.6
Grum Pit 45 m			1210				5.35		
Grum Pit 50 m			1210				5.37		
Grum Pit 52 m			1310				5.40		

Secchi depths August 9 2006;
 Grum Lake 0.6 m
 Former "Fish" limno corral (now acts as a control) 2.9 m
 Total depth at raft is now 53.5m

Vangorda Pit August 9 2006 in situ data

Location	Time PST 24hr	ALS Lab $\mu\text{S/cm}$	¹Horiba Cond. $\mu\text{S/cm}$	²CTD 638 $\mu\text{S/cm}$	³WtW 330i $\mu\text{S/cm}$	pH Fisher AP61	¹Temp $^{\circ}\text{C}$	²Temp $^{\circ}\text{C}$	³Temp $^{\circ}\text{C}$
VP_1 Vangorda Pit @ 1m	14:15	1260	-	-	1292	5.72	-	-	14.2
VP_3 Vangorda Pit @ 3 m	14:40	1670			1740	5.35	-	-	13.1
VP_5 Vangorda Pit @ 5 m	14:35	2080			2160	5.21			6.8
VP_15 Vangorda Pit @ 15 m	14:45	2180			2270	5.27			4.4
VP_30 Vangorda Pit @ 30 m	14:55	2190			2280	5.20			4.4
VP_40 Vangorda Pit @ 40 m	15:10	2210			2290	5.31			4.4

Vangorda Secchi depth 1.2 m, total depth 46.2 m at UTM Nad 27 Canada 0593987 mE 6903316 mN

Faro Pit August 9 2006 in situ data

Location	Time PST 24hr	ALS Lab $\mu\text{S/cm}$	¹Horiba Cond. $\mu\text{S/cm}$	²CTD 638 $\mu\text{S/cm}$	³WtW 330i $\mu\text{S/cm}$	pH Fisher AP61	¹Temp $^{\circ}\text{C}$	²Temp $^{\circ}\text{C}$	³Temp $^{\circ}\text{C}$
FP_1 Faro Pit @ 1m	17:00	1160	-	-	1169	6.09	-	-	13.8
FP_3 Faro Pit @ 3m	17:20	1150			1169	6.15	-	-	13.1
FP_5 Faro Pit @ 5m	17:35	1150			1170	6.19			13.1
FP_15 Faro Pit @ 15m	17:45	1280			1321	6.00			4.6
FP_30 Faro Pit @ 30m	18:00	1400			1396	6.00			4.6
FP_60 Faro Pit @ 60m	18:15	1420			1526	6.00			4.6
FP_80 Faro Pit @ 80m	18:30	1490			1569	5.86			4.6

Faro Pit Secchi depth August 9 2006; 11.7 m. Total depth at buoy 89.2 m.

Grum Pit September 15 2006 in situ data
 (note Horiba was not deployed, but have a Seabird cast to compare with other instruments.
 Also note pH probe was down.)

Location	Time PST 24hr	²CTD 638 μS/cm	³WtW 330i μS/cm	²Temp °C	³Temp °C
Grum Surface at raft	10:10	148	925	7.719	7.7
GP_1 Grum Pit @ 1m	10:15	115	933	7.747	7.8
GP_3 Grum Pit @ 3m	10:20	96	939	7.763	7.8
GP_5 Grum Pit @ 5m	10:30	101	955	5.868	7.6
GP_15 Grum Pit @ 15m	10:47	186	1047	4.668	5.1
GP_30 Grum Pit @ 30m	10:59	294	1057	4.727	4.5
GP_40 Grum Pit @ 40m	11:15	339	1062	4.742	4.2

Grum Pit secchi depths September 15 2006;
 Grum Lake total depth at raft 54.3 m
 Grum Lake secchi 1.1 m
 Control limno corral 4.5m

Vangorda Pit in situ data September 15 2006

Location	Time PST 24hr	³WtW 330i μS/cm	³Temp °C
VP_1 Vangorda Pit @ 1m	14:15	1377	7.6
VP_3 Vangorda Pit @ 3 m	14:20	1377	7.2
VP_5 Vangorda Pit @ 5 m	14:26	2110	6.9
VP_15 Vangorda Pit @ 15 m	14:36	2210	4.3
VP_30 Vangorda Pit @ 30 m	14:50	2220	4.2
VP_40 Vangorda Pit @ 40 m	15:15	2220	4.2

Vangorda depth 48.6 m, secchi depth 0.7 m

Faro Pit in situ data September 15 2006

Location	Time PST 24hr	²CTD 638 μS/cm	³ WtW 330i μS/cm	²Temp °C	³Temp °C
FP_1 Faro Pit @ 1m	17:35	523	1169	8.806	8.7
FP_3 Faro Pit @ 3m	17:45	588	1180	8.729	8.6
FP_5 Faro Pit @ 5m	18:00	534	1183	8.786	8.7
FP_15 Faro Pit @ 15m	18:15	509	1274	4.764	4.9
FP_30 Faro Pit @ 30m	18:32	560	1446	4.384	4.5
FP_60 Faro Pit @ 60m	18:50	597	1478	4.492	4.5
FP_80 Faro Pit @ 80m	18:30	649	1574	4.737	4.5

Faro pit depth at buoy September 15 2006 86.5 m
Secchi depth 7.6 m

Field Note Book - Grum Pit Bio Treatment
August 9 to September 15 2006

4

Aug 9, 2006

- set up in Grum shack -
 change CTD to "dual"
 mode in config file,
 immerse in 2,010 $\mu\text{S/cm}$
 soln; reads .881 - .887
 mS/cm .
 change back to original
 config file; reads .910
 mS/cm
 battery volts 13.1 (good)
- check wtwt 330i
 soln 2,010
 330i 2,010
 soln 1413
 330i 1413
- at horiba
 soln (2,009)
 horiba (2,010)

5

Aug 9, 2006

- set up for sampling Grum
 raft 09:25
- depth at portal 53.5 m
- Do CTD cast with 638
 start 09:38
 OFF 09:48
- calibrate AP61 pH meter
 7.00 standard = 7.02
- Secchi depths
 Grum Lake 0.6m
 Fish Limn 2.9m
- set up for sampling Grum

GL - 1 10:00

330i / AP61

COND	905 $\mu\text{S/cm}$	896
TDS	364 mg/L	359
TC	14.1 $^{\circ}\text{C}$	

- samples; 1L, 2x250 pl,
 1x100mL, 1x250 agl
- field filter DSS nut + chl. a

Field Note Book (FNB) August 9, 2006 Grum Pit

6						7		
HORIBA 23 CAST Aug. 9						2006 GRUM RAFT		
	pH	COND	TC	Sal	TPS	ORP	ION ₁	ION ₂
1.0	8.48	896	14.75	104	570	74	2.9	.57
2.0	8.70	990			600	93	2.7	.50
3	8.00	1180	10.49		800	122	2.7	.50
5	7.70	1210	6.98		800	130	2.8	.51
7	7.58	1210	5.53		800	133	2.8	.51
10	7.48	1200	5.43		800	135	2.8	.52
15	7.35	1200	5.37		800	137	2.8	.53
20	7.27	1200	5.33		800	137	2.8	.53
25	7.23	1200	5.36		800	138	2.7	.53
30	7.18	1210	5.36		800	138	2.7	.54
35	7.15	1210	5.36		800	137	2.7	.54
40	7.12	1210	5.36		800	132	2.7	.54
45	7.09	1210	5.35		800	114	2.7	.54
50	7.06	1210	5.37		800	69	2.7	.55
52	7.05	1310	5.40		800	—	—	—

FNB Aug 9 2006 – Horiba cast in Grum Pit

Aug. 9, 2006

6L - 40 m

330i / AP61

11:30

pH 7.49

COND 1096 μ S/cm

TDS 439 mg/L

T°C 4.8

- Samples; 1L, 2x250 mL, 1x100 mL, 1x250 μ g/l
Field Filter for diss. met.

- coil up HOBAS > complete cast to 52 m 11:50

- Download Temp. Pro's (plug-ins)

Grum 1m 767035-7-115023

Grum 2m 767036-7-115533

Grum 3m 767037-7-120002

Grum 5m 767038-7-120212

Grum 7m 767039-7-120424

Grum 10m 767040-7-120630

Grum 15m 767041-7-120822

Grum 20m 767042-7-121032

Grum 30m 767043-7-121208

Grum 40m 767044-7-121333

Aug. 9, 2006¹¹

- move to Vangorda pit, set up for sampling. 1:50 PM

• UTM @ site 0593987

690 3316

46.2 m deep

Secchi depth 1.2 m

- Vangorda waterfall happening, equipment working above flume.

UP 1m

2:15 PM

330i / AP61

pH 5.72

COND 1292 μ S/cm

TDS 517 mg/L

T°C 14.2

- Samples; 1L, 2x250 mL, 1x100 mL, 1x250 μ g/l
Field Filtered for diss met and chlorophyll a

FNB Grum / Vangorda August 9 2006

Aug 9, 2006

VP- 3 m
 3301 / AP61
 pH 5.35
 COND 1740 $\mu\text{S}/\text{cm}$
 TDS 696 mg/L
 TC 13.1

2:20 PM

• samples; 1L, 2x250 pl, 1x100 mL,
 1x250 agl Field Filter diss.met,
 (no chlorophylla)

VP- 5 m
 pH 5.21
 COND 2,160 $\mu\text{S}/\text{cm}$
 TDS 861 mg/L
 TC 6.8°

2:35 PM

• samples; 1L, 2x250pl, 1x100 mL,
 1x250 agl Field Filter diss.met.

VP- 15 m
 pH 5.27
 COND 2,270 $\mu\text{S}/\text{cm}$
 TDS 908
 TC 4.4

2:45 PM

Aug. 9, 2006

VP- 30m
 pH 5.20
 COND 2280 $\mu\text{S}/\text{cm}$
 TDS 911 mg/L
 TC 4.4

2:55 PM

• samples; 1L, 2x250 mL, 1x100 mL,
 1x250 agl Field Filter diss.met.

VP- 40m
 pH 5.31
 COND 2,290 $\mu\text{S}/\text{cm}$
 TDS 917 mg/L
 TC 4.4

3:10 PM

• samples; 1L, 2x250 mL, 1x100 mL,
 1x250 mL agl Field Filter diss.met.

- mobilize to Grum Shack,
 label Faro bottles, set
 up for sampling at Faro Pit
 4:30 PM

FNB August 9 2006 - vangorda

Aug 9, 2006

CTD cast Faro Pit @ buoy

ON: 4:44 pm

OFF: 5:00 pm sech, 11.7m
total D 89.2m

Sample Faro Pit Lake

FP-1 m (330i, AP6i) 5:00pm

pH 6.09 samples;
COND 1169 $\mu\text{S/cm}$ 1L, 2X250 mL,
TDS 469 mg/L 1X100 mL, 1X250 Agl
T°C 13.8 Field Filtered for
diss. met. and
chlorophyll a
(at 1, 3 and 5 m only)

FP-3 m 5:20 pm

pH 6.15
COND 1169 $\mu\text{S/cm}$
TDS 467 mg/L
T°C 13.1

FP-5 m 5:35pm

pH 6.19
COND 1170 $\mu\text{S/cm}$
TDS 468 mg/L
T°C 13.1

Aug 9, 2006

FP-15 m 5:45

pH 6.00
COND 1321 $\mu\text{S/cm}$
TDS 527 mg/L
T°C 4.6

FP-30 m 6:00

pH 6.00
COND 1396 $\mu\text{S/cm}$
TDS -
T°C 4.6

FP-60 m 6:15

pH 6.00
COND 1526 $\mu\text{S/cm}$
TDS 606 mg/L
T°C 4.6

FP-80 m 6:30

pH 5.86
COND 1569 $\mu\text{S/cm}$
TDS 628 mg/L
T°C 4.6

FNB August 9 2006 Faro Pit

16						17		
HORIBA 23 CAST - FARO						PIT Aug. 9 2006 6:30 PM		
Depth	pH	COND	T °C	Sal	TDS	ORP	ION ₁	ION ₂
1	6.92	1270	14.38	.06	800	111	2.8	1.6
3	7.10	1270	14.36	.06	800	109	3.0	1.5
5	7.16	1270	14.12	.06	800	108	3.1	1.4
7	7.24	1400	8.61	.06	900	116	3.1	1.3
9	7.12	1420	5.82	.06?	900	121	3.2	1.3
10	7.10	1420	4.99	—	900	123	3.2	1.2
12	6.92	1420	4.89	—	900	125	3.2	1.2
15	6.84	1440	4.80	—	900	79	3.2	1.2
20	6.65	1570	4.89	.07	1000	-28	3.2	1.2
25	6.45	1600	5.02	.07	1000	-44	3.1	1.2
30	6.38	1620	5.09	.07	1000	-52	3.1	1.1
35	6.35	1630	5.13	.07	1000	-57	3.1	1.1
40	6.33	1630	5.14	.07	1000	-61	3.1	1.1
45	6.32	1630	5.15	.07	1000	-63	3.0	1.1
50	6.32	1640	5.16	.07	1000	-65	3.0	1.0
55	6.31	1640	5.17	.07	1000	-69	3.0	1.1
60	6.31	1650	5.20	.07	1100	-71	3.0	1.1
67	6.31	1670	5.24	.07	1100	-74	3.0	1.1
70	6.30	1670	5.26			-76	3.0	1.1
75	6.30	1700	5.31	.08	1100	-77	3.0	1.1
80	6.30	1730	5.37			-79	3.0	1.1
86	6.28	1770	5.44			-81	3.0	1.1

FNB August 9 2006 – Horiba cast in Faro Pit

FADO PIT LARES SEPT 15 06

- Label bottles in grum shack which is now way up the ramp.

CTD 638 ON 9:22
OFF 9:31

depth 54.3 m

Seabird CTD ON 9:37 -
soak for 2 minutes
start downcast 9:33.48
OFF 9:46:16

Secchi depths
Grum Lake 1.1
CONTROL Limno 4.5

set up van Dusen for
sampling 10:00 Am

Sept. 15, 2006

Sample Grum Lake

surface 10:10 Am

COND. 925 μ S/cm TDS 369 mg/L
T $^{\circ}$ C 7.6 Sal .2

- sample throughout:

1L, 2X 250 mL, 1X 250 μ g/L,
chlorophyll filter at
surface, 1 m, 3 m, 5 m
field filtered dissolved metals

6L - 1 m 10:15

COND 933 μ S/cm
TDS 374 mg/L
T $^{\circ}$ C 7.7
Sal .2

6L - 3 m 10:20

COND 939 μ S/cm
TDS 376 mg/L
T $^{\circ}$ C 7.8
Sal 0.2

FNB September 15 2006 Grum Pit

GL - 5 m 10:30

COND 955 $\mu\text{S}/\text{cm}$
 (T°C) 38.7 mg/L
 TDS 7.6
 Sal 0.2

GL - 15 m 10:47

COND 1047 $\mu\text{S}/\text{cm}$
 TDS 419 mg/L
 T°C 45.1°
 Sal .3

GL - 30 m 10:59

COND 1057 $\mu\text{S}/\text{cm}$
 TDS 420 mg/L
 T°C 4.5
 Sal .3

GL - 40 m 11:15

COND ~~1058~~ $\mu\text{S}/\text{cm}$ 1062
 TDS 425 mg/L
 T°C 4.2
 Sal .3

- complete sampling Grum 11:30

Sept 15, 2006

• Download Grum Pit weather station 11:20 AM

batteries 95%

wrap around full ON

memory 21% full

saved file Grum Pit

Weather Station - Sept-15-2006

Download Hubo Temp Pro's

Grum 7m - 76039-7-113116

batteries 84% 20% used

Grum 5m - 76038-7-113434

batt 84% 20% used

Grum 3m - 767037-7-113831

batt 84% 20% used

Grum 2m - 767036-7-114106

batt 84% 20% used

Grum 1m - 767035-7-114312

batt 84% 20% used

Grum 10m - 767040-8-114532

Grum 15m - 767041-6-114707

Grum 15- 115151 (re-do)

batts 84% 60% full - re-launched

FNB September 15 2006 Grum Pit

FPI Sept 15 2006

Grum 20m - 767042-7-115608

Grum 30m - 767043-7-115813

Grum 45m - 767044-7-115948

complete downloads 12:00

set up for Vangorda Pit in
 Grum shack, move to Vangorda,
 start sampling 2:10 pm

depth 48.6 m secchi 0.7 m

VP 1 m 2:15 pm

COND 1377 μ S/cm

TDS 551 mg/L

T_{OC} 7.6°

Sal 1.50

VP 3 m 2:20

COND 1377 μ S/cm

TDS 551

T_{OC} 7.2

Sal 1.5

Sept. 15, 2006

VP 5 m 2:26

COND 2.11 mS/cm

TDS 845 mg/L

T_{OC} 6.9°

Sal 0.9

VP 15 m 2:36

COND 2.21 mS/cm

TDS 883 mg/L

T_{OC} 4.3

Sal .9

VP 30 m 2:50

COND 2.22 mS/cm

TDS 888 mg/L

T_{OC} 4.2

Sal .9

VP 40 m 3:15

COND 2.22 mS/cm

TDS 890

T_{OC} 4.2

Sal .9

- complete sampling Vangorda
 3:15 pm

FNB September 15 2006 Grum / Vangorda

Sept 15, 2006

- setup for Faro Pit, move to Faro pit, briefly lost boat but then came back using gas in line...
- anchor to raft (bunny) 4:30, depth 86 m secchi 7.6 m
- do SBE Seabird CTD cast ON 5:03 PM (UBC equip) checked 5:05 = pump on, start downcast OFF 5:16 PM
- do CTD 638 STD Plus cast ON 5:19:30 (CTD 12 Plus) OFF 5:28:00 AMT rental
- start sampling Faro Pit; samples: 1L, 2x250 mL, 1x agl, 1x 100 mL Field Filtered for dissolved metals and chlorophyll a (only at 1, 3 + 5 m)

Sept. 15, 2006

(sunny, wind S 20kph +1 to +13°)

FP_ 1 m

5:35 PM

COND 1182 μ S/cm
 TDS 473 mg/L
 TC 8.7
 Sal .4

FP_ 3 m

5:45

COND 1180 μ S/cm
 TDS 472 mg/L
 TC 8.6
 Sal .4

FP_ 5 m

6:00 PM

COND 1183 μ S/cm
 TDS 473 mg/L
 TC 8.7
 Sal .4

FNB September 15 2006 Faro Pit

Sept. 15, 2006

FP-15m 6:15 PM

COND 12.74 μ S/cm
 TDS 511 mg/L
 T°C 4.9
 Sal .4

FP-30m 6:32

COND 1446 μ S/cm
 TDS 579 mg/L
 T°C 4.5
 Sal .5

FP-60m 6:50

COND 1478 μ S/cm
 TDS 592 mg/L
 T°C 4.5
 Sal .5

FP-80m 7:05 PM

COND 1574 μ S/cm
 TDS 630 mg/L
 T°C 4.5
 Sal .6

Finish Faro Pit 7:15, pack-up.

pack up samples, do
 preservation etc. at
 lab guesthouse
 on 248 Dawson Drive.

Q by AA at X-section X14

SURVEY X14: HI=100.693

BS FS ELEV

0.693

BM1 spr. on hill

2.169

BM2 spr near bank

2.920

TOP, 2m staff

.8045 staff gauge rdg

12:15 PM

pack up, move to Vanguarda V-8
 removed old 1999 PS9800 sensor -
 did Q by AA just w/s of new
 bridge. -

FNB September 15 2006 Faro Pit



ALS Environmental
excellence in analytical testing

Vancouver, BC 1988 Triumph Street V5L 1K5 Tel: 604-253-4188 Toll Free: 1-800-665-0243 Fax: 604-253-6700
Fort St. John, BC #2 - 8820 100th Street V1J 3W9 Tel: 250-785-8281 Fax: 250-785-8286
Calgary, AB #2 - 21 Highfield Circle SE T2G 5N6 Tel: 403-214-5431 Toll Free: 1-866-722-6231 Fax: 403-214-5430
Burlington, ON 5420 Mainway Drive, Unit 5 L7L 6A4 Tel: 905-331-3111 Toll Free: 1-888-257-3684 Fax: 905-331-4567

74616

SEND REPORT TO:

CLIENT: SRK ATTN: CAM SCOTT

ADDRESS: SUITE 800-1066 W. HASTINGS ST

CITY: VANCOUVER PROV.: B.C. POSTAL CODE: V6E 3X2

TELEPHONE: 604 681 4196 FAX: 604 687 5532 SAMPLER: LES

PROJECT NAME: GRUMP PIT BIO TREATMENT QUOTE NO.: _____

PO NO.: D&T 2006/7 Task 22 ALS CONTACT: CAM DANG

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CHAIN OF CUSTODY FORM

PAGE 1 OF 2

ANALYSIS REQUESTED:

	SAMPLE IDENTIFICATION	DATE / TIME COLLECTED		MATRIX	PH, COND., TSS	ALKALINITY-TOTAL	SULPHATE	AMMONIA - LOW LEVEL	NITRATE / NITRITE	DISSOLVED OXYGEN P	TOTAL PHOSPHATE	ICPMS DISSOLVED M.	ICPMS TOTAL METALS (ULTRA TRACE)	CHLOROPHYLL A	NOTES (sample specific comments, due dates, etc.)
		YYYY-MM-DD	TIME												
FOR LAB USE ONLY	GL-1 (GRUM @ 1m)	2006-08-09	10:00	H ₂ O	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	GL-3 (GRUM @ 3m)	2006-08-09	10:20	H ₂ O	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	GL-5 (GRUM @ 5m)	2006-08-09	10:40	H ₂ O	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	GL-15 (GRUM @ 15m)	2006-08-09	10:55	H ₂ O	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	GL-30 (GRUM @ 30m)	2006-08-09	11:10	H ₂ O	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	GL-40 (GRUM @ 40m)	2006-08-09	11:30	H ₂ O	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	VP-1 (Vanguard @ 1m)	2006-08-09	14:05	H ₂ O	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	VP-3 (Vanguard @ 3m)	2006-08-09	14:20	H ₂ O	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	VP-5 (Vanguard @ 5m)	2006-08-09	14:35	H ₂ O	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	VP-15m (Vanguard @ 15m)	2006-08-09	14:45	H ₂ O	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	VP-30m (Vanguard @ 30m)	2006-08-09	14:55	H ₂ O	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	VP-40 (Vanguard @ 40m)	2006-08-09	15:10	H ₂ O	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	

TURN AROUND REQUIRED: ☒ ROUTINE ☐ RUSH - SPECIFY DATE: _____ (surcharge may apply)

SEND INVOICE TO: ☒ SAME AS REPORT INVOICE FORMAT: ☐ HARD COPY ☐ PDF ☐ FAX
☐ DIFFERENT FROM REPORT (provide details below)

SPECIAL INSTRUCTIONS:

RELINQUISHED BY:	DATE: <u>Aug. 10</u>	RECEIVED BY:	DATE
<u>KEN NORDIN</u>	TIME: <u>18:00</u>		TIME
RELINQUISHED BY:	DATE	RECEIVED BY:	DATE
	TIME		TIME

FOR LAB USE ONLY		
COOLER SEAL INTACT?	SAMPLE TEMPERATURE: _____ °C	COOLING METHOD?
☐ YES ☐ NO ☐ N/A	FROZEN? ☐ YES ☐ NO	☐ ICEPACKS ☐ ICE ☐ NONE

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SEE WHITEPAPER FOR SOURCE VERSION R.0

Chain of Custody August 9 2006 1 of 2



PAGE 2 OF 2

SEND REPORT TO:

CLIENT: SRK ATTN: CAM SCOTT

ADDRESS:

CITY: _____ PROV.: _____ POSTAL CODE: _____

TELEPHONE: _____ FAX: _____ SAMPLER: LES

PROJECT NAME & NO.: PIT BID TREATMENT QUOTE NO.: _____

PO NO.: 200617 TASK 22 ALS CONTACT: CAN DING

REPORT FORMAT: ☒ HARDCOPY ☒ EMAIL - ADDRESS: yancouver@srk.com

☐ FAX ☒ EXCEL ☒ PDF ☐ OTHER:

CHAIN OF CUSTODY FORM

ANALYSIS REQUESTED:

[illegible]

NOTES (sample specific comments, due dates, etc.)

FOR LAB USE ONLY

TURN AROUND REQUIRED: ☒ ROUTINE ☐ RUSH - SPECIFY DATE: _____ (surcharge may apply)

SEND INVOICE TO: ☒ SAME AS REPORT INVOICE FORMAT: ☐ HARDCOPY ☐ PDF ☐ FAX
☐ DIFFERENT FROM REPORT (provide details below)

SPECIAL INSTRUCTIONS:

RELINQUISHED BY:	DATE
KEN NORDIN	Aug. 10
	TIME
	19:00

RECEIVED BY:	DATE:
	TIME:

RELINQUISHED BY:	DATE
	TIME

RECEIVED BY:	DATE:
	TIME:

FOR LAB USE ONLY

COOLER SEAL INTACT?
☐ YES ☐ NO ☐ N/A

SAMPLE TEMPERATURE: _____ °C
FROZEN? ☐ YES ☐ NO

COOLING METHOD?
☐ ICEPACKS ☐ ICE ☐ NONE

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C.O.C. Aug 9, 2006 2 of 2

SEND REPORT TO:

CLIENT: SRK ATTN: CAM SCOTT

ADDRESS: SUITE 800-1066 W. HASTINGS ST

CITY: VANCOUVER PROV.: BC POSTAL CODE: V6E 3X2

TELEPHONE: 604 681 4196 FAX: 604 687 5532 SAMPLER: LES

PROJECT NAME & NO.: GRUMPIT BIO TREATMENT QUOTE NO.:

PO NO.: D4T 2006/7 TASK 22 ALS CONTACT: CANDANG

REPORT FORMAT: ☒ HARDCOPY ☒ EMAIL - ADDRESS: VancouverPr@srk.com

☐ FAX ☒ EXCEL ☒ PDF ☐ OTHER:

CHAIN OF CUSTODY FORM

PAGE 1 OF 2

ANALYSIS REQUESTED:

[illegible]

NOTES (sample specific
comments, due dates, etc.)

FOR LAB USE ONLY

TURN AROUND REQUIRED: ☒ ROUTINE ☐ RUSH - SPECIFY DATE: _____ (surcharge may apply)

SEND INVOICE TO: ☒ SAME AS REPORT INVOICE FORMAT: ☐ HARDCOPY ☐ PDF ☐ FAX
☐ DIFFERENT FROM REPORT (provide details below)

SPECIAL INSTRUCTIONS:

RELINQUISHED BY:

DATE: 10/16/05

RECEIVED BY:

DATE

KEN NORDIN

TIME	19:00
------	-------

[illegible]

TIME

RELINQUISHED BY:

DATE _____

RECEIVED BY:

	DATE
--	------

2000

TIME

[illegible]

TIME

FOR LAB USE ONLY

COOLER SEAL INTACT?

☐ YES ☐ NO ☐ N/A

SAMPLE TEMPERATURE: _____ °C

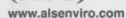
FROZEN? ☐ YES ☐ NO

COOLING METHOD?

☐ ICEPACKS ☐ ICE ☐ NONE

CLIENT COPY

SEE WHITEPAPER FOR SOURCE VERSIONR 06



Vancouver, BC 1988 Triumph Street V5L 1K5 Tel: 604-254-4188 Toll Free: 1-800-665-0243 Fax: 604-253-6700
Fort St. John, BC #2 - 8820 100th Street V1J 3W9 Tel: 250-785-8281 Fax: 250-785-8286
Calgary, AB #2 - 2111 Highfield Circle SE T2G 5N6 Tel: 403-214-5431 Toll Free: 1-866-722-6231 Fax: 403-214-5430
Burlington, ON 5420 Mainway Drive Unit 5 L7L 6A4 Tel: 905-331-3111 Toll Free: 1-888-257-3684 Fax: 905-331-4567

PAGE 2 OF 2

SEND REPORT TO:

CHAIN OF CUSTODY FORM

CLIENT: SRK ATTN: CAM SCOTT

ADDRESS: _____

CITY: _____ PROV.: _____ POSTAL CODE: _____

TELEPHONE: _____ FAX: _____ SAMPLER: LES

PROJECT NAME & NO.: GRUM PIT BIO TREATMENT QUOTE NO.:

PO NO.: _____ ALS CONTACT: _____

REPORT FORMAT: ☐ HARDCOPY ☐ EMAIL - ADDRESS: _____

☐ FAX ☐ EXCEL ☐ PDF ☐ OTHER: _____

ANALYSIS REQUESTED:

FOR LAB USE ONLY

TURN AROUND REQUIRED: ☒ ROUTINE ☐ RUSH - SPECIFY DATE: _____ (surcharge may apply)

SEND INVOICE TO: ☒ SAME AS REPORT INVOICE FORMAT: ☐ HARDCOPY ☐ PDF ☐ FAX

☐ DIFFERENT FROM REPORT (provide details below)

SPECIAL INSTRUCTIONS:

RELINQUISHED BY:	DATE
KEN NORDIN	5 Sept. 16, 06
	TIME
	18:00

RELINQUISHED BY:	DATE
	TIME

RECEIVED BY:	DATE
	TIME
RECEIVED BY:	DATE
	TIME

FOR LAB USE ONLY

COOLER SEAL INTACT?	SAMPLE TEMPERATURE: _____ °C	COOLING METHOD?
☐ YES ☐ NO ☐ N/A	FROZEN? ☐ YES ☐ NO	☐ ICEPACKS ☐ ICE ☐ NONE

SEE WHITEPAPER FOR SOURCE VERSIONS 08

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C.O.C. Sept 15, 2006 2 of 2

Appendix B
Pit Lake Water Quality Monitoring Results



CERTIFICATE OF ANALYSIS

Date: May 24, 2006

ALS File No. X5404

Report On: Grum Pit Lake Water Analysis

Report To: **SRK Consulting (Canada) Inc.**
Suite 800
1066 West Hastings St.
Vancouver, BC
V6E 3X2

Attention: **Mr. Cam Scott**

Received: May 5, 2006

ALS ENVIRONMENTAL

per:

Andre Langlais, M.Sc. - Senior Account Manager
Can Dang, B.Sc. - Senior Account Manager

File No. X5404

REMARKS



For some of the submitted water samples, the measured concentration of specific dissolved parameters is greater than the corresponding total parameters concentration. The explanation for these findings is one or a combination of the following:

- laboratory method variability;
- field sampling method variability;
- bias introduced during general handling, storage, transportation and/or analysis of the sample;
- field sample grab bias - where separate grab samples are processed to produce total and dissolved samples;
- field sample split bias - where total and dissolved parameters samples are produced from the same grab sample.

For further clarification on any of the above information, please contact your ALS representative.

File No. X5404

RESULTS OF ANALYSIS - Water



Sample ID	GRUM 1m	GRUM 3m	GRUM 5m	GRUM 15m	GRUM 30m
Sample Date	06-05-02	06-05-02	06-05-02	06-05-02	06-05-02
Sample Time	11:15	11:25	11:40	11:50	12:00
ALS ID	1	2	3	4	5

Physical Tests

Conductivity	(uS/cm)	765	994	1000	1040	1050
pH		7.90	7.77	7.81	7.65	7.65
Total Suspended Solids		<3.0	<3.0	<3.0	<3.0	<3.0

Dissolved Anions

Alkalinity-Total		CaCO3	191	167	167	172	187
Sulphate	SO4		256	425	428	451	453

Nutrients

Ammonia Nitrogen	N	0.0320	<0.0050	<0.0050	<0.0050	<0.0050
Nitrate Nitrogen	N	1.07	1.97	1.99	1.43	1.41
Nitrite Nitrogen	N	0.0014	0.0026	<0.0010	<0.0010	<0.0010
Dissolved ortho-Phosphate	P	<0.0010	0.0026	0.0035	<0.0010	<0.0010
Total Phosphate	P	0.0094	0.0083	0.0095	0.0035	0.0040

Remarks regarding the analyses appear at the beginning of this report.
 Results are expressed as milligrams per litre except where noted.
 < = Less than the detection limit indicated.
 Chlorophyll a results expressed as micrograms per litre (ug/L).

RESULTS OF ANALYSIS - Water

Sample ID		GRUM 1m	GRUM 3m	GRUM 5m	GRUM 15m	GRUM 30m
Sample Date		06-05-02	06-05-02	06-05-02	06-05-02	06-05-02
Sample Time		11:15	11:25	11:40	11:50	12:00
ALS ID		1	2	3	4	5
Total Metals						
Aluminum	T-Al	<0.20	<0.20	<0.20	<0.20	<0.20
Antimony	T-Sb	<0.20	<0.20	<0.20	<0.20	<0.20
Arsenic	T-As	<0.20	<0.20	<0.20	<0.20	<0.20
Barium	T-Ba	0.082	0.050	0.049	0.045	0.046
Beryllium	T-Be	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Bismuth	T-Bi	<0.20	<0.20	<0.20	<0.20	<0.20
Boron	T-B	<0.10	<0.10	<0.10	<0.10	<0.10
Cadmium	T-Cd	<0.010	<0.010	<0.010	<0.010	<0.010
Calcium	T-Ca	96.2	113	111	117	119
Chromium	T-Cr	<0.010	<0.010	<0.010	<0.010	<0.010
Cobalt	T-Co	0.012	0.019	0.022	<0.010	<0.010
Copper	T-Cu	<0.010	<0.010	0.012	<0.010	<0.010
Iron	T-Fe	<0.030	0.045	0.058	0.050	0.091
Lead	T-Pb	<0.050	<0.050	<0.050	<0.050	<0.050
Lithium	T-Li	0.017	0.021	0.024	0.024	0.022
Magnesium	T-Mg	48.7	69.3	69.0	67.7	68.4
Manganese	T-Mn	0.240	0.389	0.389	0.0336	0.0344
Molybdenum	T-Mo	<0.030	<0.030	<0.030	<0.030	<0.030
Nickel	T-Ni	0.095	0.170	0.169	0.212	0.207
Phosphorus	T-P	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium	T-K	2.6	3.1	3.0	3.0	3.2
Selenium	T-Se	<0.20	<0.20	<0.20	<0.20	<0.20
Silicon	T-Si	4.34	3.24	3.16	2.97	3.00
Silver	T-Ag	<0.010	<0.010	<0.010	<0.010	<0.010
Sodium	T-Na	10.6	10.9	10.6	10.0	10.9
Strontium	T-Sr	0.592	0.682	0.671	0.710	0.763
Thallium	T-Tl	<0.20	<0.20	<0.20	<0.20	<0.20
Tin	T-Sn	<0.030	<0.030	<0.030	<0.030	<0.030
Titanium	T-Ti	<0.010	<0.010	<0.010	<0.010	<0.010
Vanadium	T-V	<0.030	<0.030	0.038	0.035	0.032
Zinc	T-Zn	3.17	5.73	5.79	9.60	9.56

Remarks regarding the analyses appear at the beginning of this report.
 Results are expressed as milligrams per litre except where noted.
 < = Less than the detection limit indicated.
 Chlorophyll a results expressed as micrograms per litre (ug/L).

RESULTS OF ANALYSIS - Water

Sample ID		GRUM 1m	GRUM 3m	GRUM 5m	GRUM 15m	GRUM 30m
Sample Date		06-05-02	06-05-02	06-05-02	06-05-02	06-05-02
Sample Time		11:15	11:25	11:40	11:50	12:00
ALS ID		1	2	3	4	5
<u>Dissolved Metals</u>						
Aluminum	D-Al	<0.20	<0.20	<0.20	<0.20	<0.20
Antimony	D-Sb	<0.20	<0.20	<0.20	<0.20	<0.20
Arsenic	D-As	<0.20	<0.20	<0.20	<0.20	<0.20
Barium	D-Ba	0.077	0.051	0.048	0.045	0.043
Beryllium	D-Be	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Bismuth	D-Bi	<0.20	<0.20	<0.20	<0.20	<0.20
Boron	D-B	<0.10	<0.10	<0.10	<0.10	<0.10
Cadmium	D-Cd	<0.010	<0.010	<0.010	<0.010	<0.010
Calcium	D-Ca	97.5	110	110	116	121
Chromium	D-Cr	<0.010	<0.010	<0.010	<0.010	<0.010
Cobalt	D-Co	0.012	0.018	0.019	<0.010	<0.010
Copper	D-Cu	<0.010	<0.010	<0.010	<0.010	<0.010
Iron	D-Fe	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	D-Pb	<0.050	<0.050	<0.050	<0.050	<0.050
Lithium	D-Li	0.017	0.024	0.022	0.023	0.021
Magnesium	D-Mg	49.5	68.3	68.1	66.9	70.2
Manganese	D-Mn	0.252	0.381	0.385	<0.0050	<0.0050
Molybdenum	D-Mo	<0.030	<0.030	<0.030	<0.030	<0.030
Nickel	D-Ni	0.107	0.162	0.167	0.206	0.218
Phosphorus	D-P	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium	D-K	2.6	3.0	3.0	3.1	3.1
Selenium	D-Se	<0.20	<0.20	<0.20	<0.20	<0.20
Silicon	D-Si	4.20	3.13	3.08	2.88	3.03
Silver	D-Ag	<0.010	<0.010	<0.010	<0.010	<0.010
Sodium	D-Na	10.5	10.9	10.3	10.5	10.1
Strontium	D-Sr	0.592	0.680	0.659	0.736	0.738
Thallium	D-Tl	<0.20	<0.20	<0.20	<0.20	<0.20
Tin	D-Sn	<0.030	<0.030	<0.030	<0.030	<0.030
Titanium	D-Ti	<0.010	<0.010	<0.010	<0.010	<0.010
Vanadium	D-V	<0.030	0.033	<0.030	0.037	0.034
Zinc	D-Zn	3.42	5.61	5.74	9.36	9.77
<u>Organic Parameters</u>						
Chlorophyll a		10.4	0.747	0.235	0.037	0.024

Remarks regarding the analyses appear at the beginning of this report.
 Results are expressed as milligrams per litre except where noted.
 < = Less than the detection limit indicated.
 Chlorophyll a results expressed as micrograms per litre (ug/L).

File No. X5404

RESULTS OF ANALYSIS - Water



Sample ID	GRUM 40m	BLANK
Sample Date	06-05-02	06-05-02
Sample Time	12:15	13:00
ALS ID	6	7

Physical Tests

Conductivity	(uS/cm)	1050	<2.0
pH		7.70	5.58
Total Suspended Solids		4.4	<3.0

Dissolved Anions

Alkalinity-Total		CaCO3	172	2.0
Sulphate	SO4		454	<0.50

Nutrients

Ammonia Nitrogen	N	<0.0050	<0.0050
Nitrate Nitrogen	N	1.45	<0.0050
Nitrite Nitrogen	N	<0.0010	<0.0010
Dissolved ortho-Phosphate	P	<0.0010	<0.0010
Total Phosphate	P	0.0088	<0.0020

Remarks regarding the analyses appear at the beginning of this report.
Results are expressed as milligrams per litre except where noted.
< = Less than the detection limit indicated.
Chlorophyll a results expressed as micrograms per litre (ug/L).

File No. X5404

RESULTS OF ANALYSIS - Water



Sample ID	GRUM 40m	BLANK
Sample Date	06-05-02	06-05-02
Sample Time	12:15	13:00
ALS ID	6	7

Total Metals

Aluminum	T-Al	<0.20	<0.20
Antimony	T-Sb	<0.20	<0.20
Arsenic	T-As	<0.20	<0.20
Barium	T-Ba	0.045	<0.010
Beryllium	T-Be	<0.0050	<0.0050
Bismuth	T-Bi	<0.20	<0.20
Boron	T-B	<0.10	<0.10
Cadmium	T-Cd	<0.010	<0.010
Calcium	T-Ca	115	<0.050
Chromium	T-Cr	<0.010	<0.010
Cobalt	T-Co	<0.010	<0.010
Copper	T-Cu	<0.010	<0.010
Iron	T-Fe	0.200	<0.030
Lead	T-Pb	<0.050	<0.050
Lithium	T-Li	0.025	<0.010
Magnesium	T-Mg	67.5	<0.10
Manganese	T-Mn	0.0996	<0.0050
Molybdenum	T-Mo	<0.030	<0.030
Nickel	T-Ni	0.202	<0.050
Phosphorus	T-P	<0.30	<0.30
Potassium	T-K	3.0	<2.0
Selenium	T-Se	<0.20	<0.20
Silicon	T-Si	3.02	<0.050
Silver	T-Ag	<0.010	<0.010
Sodium	T-Na	10.2	<2.0
Strontium	T-Sr	0.729	<0.0050
Thallium	T-Tl	<0.20	<0.20
Tin	T-Sn	<0.030	<0.030
Titanium	T-Ti	<0.010	<0.010
Vanadium	T-V	0.032	<0.030
Zinc	T-Zn	9.06	<0.0050

Remarks regarding the analyses appear at the beginning of this report.
 Results are expressed as milligrams per litre except where noted.
 < = Less than the detection limit indicated.
 Chlorophyll a results expressed as micrograms per litre (ug/L).

File No. X5404

RESULTS OF ANALYSIS - Water



Sample ID	GRUM 40m	BLANK
Sample Date	06-05-02	06-05-02
Sample Time	12:15	13:00
ALS ID	6	7

Dissolved Metals

Aluminum	D-Al	<0.20	<0.20
Antimony	D-Sb	<0.20	<0.20
Arsenic	D-As	<0.20	<0.20
Barium	D-Ba	0.044	<0.010
Beryllium	D-Be	<0.0050	<0.0050
Bismuth	D-Bi	<0.20	<0.20
Boron	D-B	<0.10	<0.10
Cadmium	D-Cd	<0.010	<0.010
Calcium	D-Ca	115	<0.050
Chromium	D-Cr	<0.010	<0.010
Cobalt	D-Co	<0.010	<0.010
Copper	D-Cu	<0.010	<0.010
Iron	D-Fe	<0.030	<0.030
Lead	D-Pb	<0.050	<0.050
Lithium	D-Li	0.021	<0.010
Magnesium	D-Mg	66.7	<0.10
Manganese	D-Mn	0.0433	<0.0050
Molybdenum	D-Mo	<0.030	<0.030
Nickel	D-Ni	0.202	<0.050
Phosphorus	D-P	<0.30	<0.30
Potassium	D-K	3.1	<2.0
Selenium	D-Se	<0.20	<0.20
Silicon	D-Si	2.90	<0.050
Silver	D-Ag	<0.010	<0.010
Sodium	D-Na	10.2	<2.0
Strontium	D-Sr	0.738	<0.0050
Thallium	D-Tl	<0.20	<0.20
Tin	D-Sn	<0.030	<0.030
Titanium	D-Ti	<0.010	<0.010
Vanadium	D-V	<0.030	<0.030
Zinc	D-Zn	9.02	<0.0050

Organic Parameters

Chlorophyll a	<0.010	-
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Remarks regarding the analyses appear at the beginning of this report.
 Results are expressed as milligrams per litre except where noted.
 < = Less than the detection limit indicated.
 Chlorophyll a results expressed as micrograms per litre (ug/L).

File No. X5404

Appendix 1 - QUALITY CONTROL - Replicates



Water

GRUM 30m

GRUM 30m

06-05-02
12:00

QC #
500044

Physical Tests

Conductivity	(uS/cm)	1050	1060
pH		7.65	7.68
Total Suspended Solids		<3.0	<3.0

Dissolved Anions

Alkalinity-Total		CaCO3	187	180
Sulphate	SO4		453	451

Nutrients

Ammonia Nitrogen	N	<0.0050	<0.0050
Nitrate Nitrogen	N	1.41	1.41
Nitrite Nitrogen	N	<0.0010	<0.0010
Dissolved ortho-Phosphate	P	<0.0010	<0.0010
Total Phosphate	P	0.0040	0.0039

Remarks regarding the analyses appear at the beginning of this report.
Results are expressed as milligrams per litre except where noted.
< = Less than the detection limit indicated.
Chlorophyll a results expressed as micrograms per litre (ug/L).

File No. X5404

Appendix 1 - QUALITY CONTROL - Replicates



Water GRUM 30m GRUM 30m

06-05-02
12:00

QC #
500044

Total Metals

Aluminum	T-Al	<0.20	<0.20
Antimony	T-Sb	<0.20	<0.20
Arsenic	T-As	<0.20	<0.20
Barium	T-Ba	0.046	0.045
Beryllium	T-Be	<0.0050	<0.0050
Bismuth	T-Bi	<0.20	<0.20
Boron	T-B	<0.10	<0.10
Cadmium	T-Cd	<0.010	<0.010
Calcium	T-Ca	119	122
Chromium	T-Cr	<0.010	<0.010
Cobalt	T-Co	<0.010	<0.010
Copper	T-Cu	<0.010	<0.010
Iron	T-Fe	0.091	0.093
Lead	T-Pb	<0.050	<0.050
Lithium	T-Li	0.022	0.023
Magnesium	T-Mg	68.4	70.8
Manganese	T-Mn	0.0344	0.0353
Molybdenum	T-Mo	<0.030	<0.030
Nickel	T-Ni	0.207	0.214
Phosphorus	T-P	<0.30	<0.30
Potassium	T-K	3.2	3.2
Selenium	T-Se	<0.20	<0.20
Silicon	T-Si	3.00	3.09
Silver	T-Ag	<0.010	<0.010
Sodium	T-Na	10.9	10.8
Strontium	T-Sr	0.763	0.758
Thallium	T-Tl	<0.20	<0.20
Tin	T-Sn	<0.030	<0.030
Titanium	T-Ti	<0.010	<0.010
Vanadium	T-V	0.032	<0.030
Zinc	T-Zn	9.56	9.82

Remarks regarding the analyses appear at the beginning of this report.
Results are expressed as milligrams per litre except where noted.
< = Less than the detection limit indicated.
Chlorophyll a results expressed as micrograms per litre (ug/L).

Appendix 1 - QUALITY CONTROL - Replicates

Water GRUM 30m GRUM 30m

06-05-02
12:00

QC #
500044

Dissolved Metals

Aluminum	D-Al	<0.20	<0.20
Antimony	D-Sb	<0.20	<0.20
Arsenic	D-As	<0.20	<0.20
Barium	D-Ba	0.043	0.044
Beryllium	D-Be	<0.0050	<0.0050
Bismuth	D-Bi	<0.20	<0.20
Boron	D-B	<0.10	<0.10
Cadmium	D-Cd	<0.010	<0.010
Calcium	D-Ca	121	114
Chromium	D-Cr	<0.010	<0.010
Cobalt	D-Co	<0.010	<0.010
Copper	D-Cu	<0.010	<0.010
Iron	D-Fe	<0.030	<0.030
Lead	D-Pb	<0.050	<0.050
Lithium	D-Li	0.021	0.021
Magnesium	D-Mg	70.2	66.3
Manganese	D-Mn	<0.0050	<0.0050
Molybdenum	D-Mo	<0.030	<0.030
Nickel	D-Ni	0.218	0.201
Phosphorus	D-P	<0.30	<0.30
Potassium	D-K	3.1	3.1
Selenium	D-Se	<0.20	<0.20
Silicon	D-Si	3.03	2.85
Silver	D-Ag	<0.010	<0.010
Sodium	D-Na	10.1	10.4
Strontium	D-Sr	0.738	0.726
Thallium	D-Tl	<0.20	<0.20
Tin	D-Sn	<0.030	<0.030
Titanium	D-Ti	<0.010	<0.010
Vanadium	D-V	0.034	<0.030
Zinc	D-Zn	9.77	9.16

Remarks regarding the analyses appear at the beginning of this report.
Results are expressed as milligrams per litre except where noted.
< = Less than the detection limit indicated.
Chlorophyll a results expressed as micrograms per litre (ug/L).

Appendix 2 - METHODOLOGY



Outlines of the methodologies utilized for the analysis of the samples submitted are as follows

Conductivity in Water

This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.

Recommended Holding Time:

Sample: 28 days

Reference: APHA

Laboratory Location: ALS Environmental, Vancouver

pH in Water

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode.

Recommended Holding Time:

Sample: 2 hours

Reference: APHA

Laboratory Location: ALS Environmental, Vancouver

Solids in Water

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total dissolved solids (TDS) and total suspended solids (TSS) are determined by filtering a sample through a glass fibre filter, TDS is determined by evaporating the filtrate to dryness at 180 degrees celsius, TSS is determined by drying the filter at 104 degrees celsius. Total solids are determined by evaporating a sample to dryness at 104 degrees celsius. Fixed and volatile solids are determined by igniting a dried sample residue at 550 degrees celsius.

Recommended Holding Time:

Sample: 7 days

Reference: APHA

Laboratory Location: ALS Environmental, Vancouver

Alkalinity in Water by Colourimetry

This analysis is carried out using procedures adapted from EPA Method 310.2 "Alkalinity". Total Alkalinity is determined using the methyl orange colourimetric method.

Recommended Holding Time:

File No. X5404

Appendix 2 - METHODOLOGY - Continued



Sample: 14 days
Reference: APHA

Laboratory Location: ALS Environmental, Vancouver

Dissolved Anions in Water by Ion Chromatography

This analysis is carried out using procedures adapted from APHA Method 4110 "Determination of Anions by Ion Chromatography" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography". Anions are determined by filtering the sample through a 0.45 micron membrane filter and injecting the filtrate onto a Dionex IonPac AG17 anion exchange column with a hydroxide eluent stream. Anions routinely determined by this method include: bromide, chloride, fluoride, nitrate, nitrite and sulphate.

Recommended Holding Time:
Sample: 28 days (bromide, chloride, fluoride, sulphate)
Sample: 2 days (nitrate, nitrite)
Reference: APHA and EPA

Laboratory Location: ALS Environmental, Vancouver

Ammonia in Water by Colourimetry

This analysis is carried out, on unpreserved samples, using procedures adapted from APHA Method 4500-NH₃ "Nitrogen (Ammonia)". Ammonia is determined using the phenate colourimetric method.

Recommended Holding Time:
Sample: 1 day
Reference: APHA

Laboratory Location: ALS Environmental, Vancouver

Phosphate in Water

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". All forms of phosphate are determined by the ascorbic acid colourimetric method. Dissolved ortho-phosphate (dissolved reactive phosphorous) is determined by direct measurement. Total phosphate (total phosphorous) is determined after persulphate digestion of a sample. Total dissolved phosphate (total dissolved phosphorous) is determined by filtering a sample through a 0.45 micron membrane filter followed by persulfate digestion of the filtrate.

Recommended Holding Time:
Sample: 2 days
Reference: EPA

File No. X5404

Appendix 2 - METHODOLOGY - Continued



Laboratory Location: ALS Environmental, Vancouver

Metals in Water

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" 20th Edition 1998 published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using either hotplate or microwave oven, or filtration (EPA Method 3005A). Instrumental analysis is by atomic absorption/emission spectrophotometry (EPA Method 7000 series), inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B), and/or inductively coupled plasma - mass spectrometry (EPA Method 6020).

Recommended Holding Time:

Sample: 6 months

Reference: EPA

Laboratory Location: ALS Environmental, Vancouver

Chlorophyll and Pheopigments by Fluorometry

This analysis is carried out using procedures adapted from APHA Method 10200 H. "Chlorophyll" and USEPA Method 445. The sample is filtered using either a glass fiber filter or a 0.45 micron Membrane filter. The pigments are extracted from the filter with 90% aqueous acetone. For chlorophyll a analysis the extract is read using a fluorometer. For pheopigments the extract is first acidified then read. This method not subject to interferences from chlorophyll b.

Recommended Holding Time:

Sample: 1-2 days before filtering

Filter: 28 days

Reference: APHA

Laboratory Location: ALS Environmental, Vancouver

Results contained within this certificate relate only to the samples as submitted.

This Certificate Of Analysis shall only be reproduced in full, except with the written approval of ALS Environmental.

End of Report



CERTIFICATE OF ANALYSIS

Date: June 13, 2006

ALS File No. X6100

Report On: Faro Pit Lakes Water Analysis

Report To: **SRK Consulting (Canada) Inc.**
Suite 800
1066 West Hastings St.
Vancouver, BC
V6E 3X2

Attention: **Mr. Cam Scott**

Received: May 23, 2006

ALS ENVIRONMENTAL

per:

Andre Langlais, M.Sc. - Senior Account Manager
Can Dang, B.Sc. - Senior Account Manager

File No. X6100

REMARKS



Some of the metals detection limits were increased due to high levels of metals in some of the samples.

For some of the submitted water samples, the measured concentration of specific dissolved parameters is greater than the corresponding total parameters concentration. The explanation for these findings is one or a combination of the following:

- laboratory method variability;
- field sampling method variability;
- bias introduced during general handling, storage, transportation and/or analysis of the sample;
- field sample grab bias - where separate grab samples are processed to produce total and dissolved samples;
- field sample split bias - where total and dissolved parameters samples are produced from the same grab sample.

For further clarification on any of the above information, please contact your ALS representative.

File No. X6100

RESULTS OF ANALYSIS - Water



Sample ID	FARO PIT 1m	FARO PIT 10m	FARO PIT 30m	VANGORDA PIT 1m	VANGORDA PIT 7m
Sample Date	06-05-17	06-05-17	06-05-17	06-05-17	06-05-17
Sample Time	10:00	10:30	11:00	13:30	14:20
ALS ID	1	2	3	4	5

Physical Tests

Conductivity (uS/cm)	956	1250	1250	1780	2110
pH	7.16	7.45	7.53	5.80	5.89
Total Suspended Solids	<3.0	<3.0	<3.0	17.3	32.0

Dissolved Anions

Alkalinity-Total	CaCO3	84.3	105	111	4.0	<2.0
Sulphate	SO4	452	614	614	1130	1390

Nutrients

Ammonia Nitrogen	N	1.05	1.66	1.75	0.360	0.580
Nitrite/Nitrate Nitrogen	N	0.271	0.314	0.317	0.060	<0.025
Dissolved ortho-Phosphate	P	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Phosphate	P	0.0027	0.0026	0.0030	0.0094	0.0110

Remarks regarding the analyses appear at the beginning of this report.
Results are expressed as milligrams per litre except where noted.
< = Less than the detection limit indicated.

File No. X6100

RESULTS OF ANALYSIS - Water

Sample ID	FARO PIT 1m	FARO PIT 10m	FARO PIT 30m	VANGORDA PIT 1m	VANGORDA PIT 7m
Sample Date	06-05-17	06-05-17	06-05-17	06-05-17	06-05-17
Sample Time	10:00	10:30	11:00	13:30	14:20
ALS ID	1	2	3	4	5

Total Metals

Aluminum	T-Al	0.0529	0.0325	0.0646	1.97	0.127
Antimony	T-Sb	0.00066	0.00130	0.00128	<0.0020	<0.0020
Arsenic	T-As	<0.00020	0.00025	0.00024	0.0297	0.0022
Barium	T-Ba	0.0169	0.0167	0.0162	0.0385	0.0259
Beryllium	T-Be	<0.0010	<0.0010	<0.0010	<0.010	<0.010
Bismuth	T-Bi	<0.0010	<0.0010	<0.0010	<0.010	<0.010
Boron	T-B	<0.020	<0.020	<0.020	<0.20	<0.20
Cadmium	T-Cd	0.00798	0.00215	0.00259	0.162	0.120
Calcium	T-Ca	103	156	155	202	269
Chromium	T-Cr	<0.0010	<0.0010	<0.0010	<0.010	<0.010
Cobalt	T-Co	0.0336	0.0472	0.0459	0.621	0.797
Copper	T-Cu	0.0284	0.00720	0.0129	2.23	0.0907
Iron	T-Fe	0.346	0.172	0.201	30.5	34.5
Lead	T-Pb	0.00302	0.00133	0.00185	0.0975	0.0123
Lithium	T-Li	0.036	0.057	0.052	<0.10	<0.10
Magnesium	T-Mg	48.7	68.6	68.1	86.2	110
Manganese	T-Mn	1.80	2.80	2.65	34.8	47.8
Molybdenum	T-Mo	0.00136	0.00245	0.00211	<0.0010	<0.0010
Nickel	T-Ni	0.0787	0.111	0.107	0.549	0.725
Phosphorus	T-P	<0.30	<0.30	<0.30	<0.60	<0.30
Potassium	T-K	5.6	9.3	9.4	<4.0	3.5
Selenium	T-Se	<0.0020	<0.0020	<0.0020	<0.020	<0.020
Silicon	T-Si	3.35	3.43	3.40	3.36	3.61
Silver	T-Ag	<0.000020	<0.000020	<0.000020	<0.00020	<0.00020
Sodium	T-Na	13.7	22.9	23.1	6.5	6.1
Strontium	T-Sr	0.385	0.589	0.529	1.32	1.48
Thallium	T-Tl	0.00042	0.00065	0.00060	0.0022	0.0023
Tin	T-Sn	<0.00020	<0.00020	<0.00020	<0.0020	<0.0020
Titanium	T-Ti	<0.010	<0.010	<0.010	<0.020	<0.010
Uranium	T-U	0.00151	0.00245	0.00244	0.00430	0.00054
Vanadium	T-V	<0.0020	<0.0020	<0.0020	<0.020	<0.020
Zinc	T-Zn	14.3	16.6	15.2	134	162

Remarks regarding the analyses appear at the beginning of this report.
 Results are expressed as milligrams per litre except where noted.
 < = Less than the detection limit indicated.

File No. X6100

RESULTS OF ANALYSIS - Water

Sample ID	FARO PIT 1m	FARO PIT 10m	FARO PIT 30m	VANGORDA PIT 1m	VANGORDA PIT 7m
Sample Date	06-05-17	06-05-17	06-05-17	06-05-17	06-05-17
Sample Time	10:00	10:30	11:00	13:30	14:20
ALS ID	1	2	3	4	5

Dissolved Metals

Aluminum	D-Al	0.0065	0.0089	0.0124	0.899	0.060
Antimony	D-Sb	0.00064	0.00125	0.00120	<0.0020	<0.0020
Arsenic	D-As	<0.00020	<0.00020	<0.00020	<0.0020	<0.0020
Barium	D-Ba	0.0164	0.0167	0.0160	0.0375	0.0245
Beryllium	D-Be	<0.0010	<0.0010	<0.0010	<0.010	<0.010
Bismuth	D-Bi	<0.0010	<0.0010	<0.0010	<0.010	<0.010
Boron	D-B	<0.020	<0.020	<0.020	<0.20	<0.20
Cadmium	D-Cd	0.00771	0.00204	0.00258	0.156	0.116
Calcium	D-Ca	104	155	156	211	270
Chromium	D-Cr	<0.0010	<0.0010	<0.0010	<0.010	<0.010
Cobalt	D-Co	0.0339	0.0477	0.0457	0.647	0.785
Copper	D-Cu	0.0198	0.00199	0.00425	1.37	0.0814
Iron	D-Fe	<0.030	<0.030	<0.030	23.8	31.1
Lead	D-Pb	<0.00010	0.00014	0.00021	0.0341	<0.0010
Lithium	D-Li	0.037	0.057	0.051	<0.10	<0.10
Magnesium	D-Mg	49.1	68.2	68.4	87.9	109
Manganese	D-Mn	1.80	2.83	2.66	36.8	47.0
Molybdenum	D-Mo	0.00131	0.00247	0.00219	<0.0010	<0.0010
Nickel	D-Ni	0.0790	0.113	0.105	0.587	0.729
Phosphorus	D-P	<0.30	<0.30	<0.30	<0.60	<0.30
Potassium	D-K	5.6	9.4	9.3	<4.0	3.5
Selenium	D-Se	<0.0020	<0.0020	<0.0020	<0.020	<0.020
Silicon	D-Si	3.30	3.35	3.38	3.23	3.56
Silver	D-Ag	<0.000020	<0.000020	<0.000020	<0.00020	<0.00020
Sodium	D-Na	14.0	22.8	22.8	5.4	6.1
Strontium	D-Sr	0.390	0.595	0.530	1.39	1.45
Thallium	D-Tl	0.00041	0.00063	0.00061	0.0023	0.0024
Tin	D-Sn	<0.00020	<0.00020	<0.00020	<0.0020	<0.0020
Titanium	D-Ti	<0.010	<0.010	<0.010	<0.020	<0.010
Uranium	D-U	0.00139	0.00243	0.00236	0.00253	0.00036
Vanadium	D-V	<0.0020	<0.0020	<0.0020	<0.020	<0.020
Zinc	D-Zn	14.4	16.8	15.2	138	161

Organic Parameters

Chlorophyll a	0.0303	-	-	0.0210	-
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Remarks regarding the analyses appear at the beginning of this report.
 Results are expressed as milligrams per litre except where noted.
 < = Less than the detection limit indicated.

File No. X6100

Appendix 1 - QUALITY CONTROL - Replicates



Water	FARO	FARO
	PIT	PIT
	1m	1m
	06-05-17	QC #
	10:00	502447

Physical Tests

Conductivity	(uS/cm)	956	958
pH		7.16	7.28
Total Suspended Solids		<3.0	<3.0

Dissolved Anions

Alkalinity-Total		CaCO3	84.3	88.5
Sulphate	SO4		452	452

Nutrients

Ammonia Nitrogen	N	1.05	1.04
Nitrite/Nitrate Nitrogen	N	0.271	0.269
Dissolved ortho-Phosphate	P	<0.0010	<0.0010
Total Phosphate	P	0.0027	0.0029

Remarks regarding the analyses appear at the beginning of this report.
Results are expressed as milligrams per litre except where noted.
< = Less than the detection limit indicated.

Appendix 1 - QUALITY CONTROL - Replicates

Water		FARO PIT 1m 06-05-17 10:00	FARO PIT 1m QC # 502447
Total Metals			
Aluminum	T-Al	0.0529	0.0517
Antimony	T-Sb	0.00066	0.00067
Arsenic	T-As	<0.00020	<0.00020
Barium	T-Ba	0.0169	0.0169
Beryllium	T-Be	<0.0010	<0.0010
Bismuth	T-Bi	<0.0010	<0.0010
Boron	T-B	<0.020	<0.020
Cadmium	T-Cd	0.00798	0.00818
Calcium	T-Ca	103	104
Chromium	T-Cr	<0.0010	<0.0010
Cobalt	T-Co	0.0336	0.0338
Copper	T-Cu	0.0284	0.0289
Iron	T-Fe	0.346	0.345
Lead	T-Pb	0.00302	0.00297
Lithium	T-Li	0.036	0.038
Magnesium	T-Mg	48.7	49.3
Manganese	T-Mn	1.80	1.82
Molybdenum	T-Mo	0.00136	0.00132
Nickel	T-Ni	0.0787	0.0799
Phosphorus	T-P	<0.30	<0.30
Potassium	T-K	5.6	5.6
Selenium	T-Se	<0.0020	<0.0020
Silicon	T-Si	3.35	3.38
Silver	T-Ag	<0.000020	<0.000020
Sodium	T-Na	13.7	13.9
Strontium	T-Sr	0.385	0.391
Thallium	T-Tl	0.00042	0.00042
Tin	T-Sn	<0.00020	<0.00020
Titanium	T-Ti	<0.010	<0.010
Uranium	T-U	0.00151	0.00150
Vanadium	T-V	<0.0020	<0.0020
Zinc	T-Zn	14.3	14.8

Remarks regarding the analyses appear at the beginning of this report.
 Results are expressed as milligrams per litre except where noted.
 < = Less than the detection limit indicated.

File No. X6100

Appendix 1 - QUALITY CONTROL - Replicates



Water	FARO PIT 1m 06-05-17 10:00	FARO PIT 1m QC # 502447
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Dissolved Metals

Aluminum	D-Al	0.0065	0.0056
Antimony	D-Sb	0.00064	0.00066
Arsenic	D-As	<0.00020	<0.00020
Barium	D-Ba	0.0164	0.0165
Beryllium	D-Be	<0.0010	<0.0010
Bismuth	D-Bi	<0.0010	<0.0010
Boron	D-B	<0.020	<0.020
Cadmium	D-Cd	0.00771	0.00768
Calcium	D-Ca	104	107
Chromium	D-Cr	<0.0010	<0.0010
Cobalt	D-Co	0.0339	0.0342
Copper	D-Cu	0.0198	0.0200
Iron	D-Fe	<0.030	<0.030
Lead	D-Pb	<0.00010	<0.00010
Lithium	D-Li	0.037	0.040
Magnesium	D-Mg	49.1	49.4
Manganese	D-Mn	1.80	1.82
Molybdenum	D-Mo	0.00131	0.00133
Nickel	D-Ni	0.0790	0.0799
Phosphorus	D-P	<0.30	<0.30
Potassium	D-K	5.6	5.7
Selenium	D-Se	<0.0020	<0.0020
Silicon	D-Si	3.30	3.37
Silver	D-Ag	<0.000020	<0.000020
Sodium	D-Na	14.0	14.3
Strontium	D-Sr	0.390	0.392
Thallium	D-Tl	0.00041	0.00042
Tin	D-Sn	<0.00020	<0.00020
Titanium	D-Ti	<0.010	<0.010
Uranium	D-U	0.00139	0.00138
Vanadium	D-V	<0.0020	<0.0020
Zinc	D-Zn	14.4	14.8

Remarks regarding the analyses appear at the beginning of this report.
Results are expressed as milligrams per litre except where noted.
< = Less than the detection limit indicated.

Appendix 2 - METHODOLOGY



Outlines of the methodologies utilized for the analysis of the samples submitted are as follows

Conductivity in Water

This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.

Recommended Holding Time:

Sample: 28 days

Reference: APHA

Laboratory Location: ALS Environmental, Vancouver

pH in Water

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode.

Recommended Holding Time:

Sample: 2 hours

Reference: APHA

Laboratory Location: ALS Environmental, Vancouver

Solids in Water

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total dissolved solids (TDS) and total suspended solids (TSS) are determined by filtering a sample through a glass fibre filter, TDS is determined by evaporating the filtrate to dryness at 180 degrees celsius, TSS is determined by drying the filter at 104 degrees celsius. Total solids are determined by evaporating a sample to dryness at 104 degrees celsius. Fixed and volatile solids are determined by igniting a dried sample residue at 550 degrees celsius.

Recommended Holding Time:

Sample: 7 days

Reference: APHA

Laboratory Location: ALS Environmental, Vancouver

Alkalinity in Water by Colourimetry

This analysis is carried out using procedures adapted from EPA Method 310.2 "Alkalinity". Total Alkalinity is determined using the methyl orange colourimetric method.

Recommended Holding Time:

File No. X6100

Appendix 2 - METHODOLOGY - Continued



Sample: 14 days
Reference: APHA

Laboratory Location: ALS Environmental, Vancouver

Dissolved Anions in Water by Ion Chromatography

This analysis is carried out using procedures adapted from APHA Method 4110 "Determination of Anions by Ion Chromatography" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography". Anions are determined by filtering the sample through a 0.45 micron membrane filter and injecting the filtrate onto a Dionex IonPac AG17 anion exchange column with a hydroxide eluent stream. Anions routinely determined by this method include: bromide, chloride, fluoride, nitrate, nitrite and sulphate.

Recommended Holding Time:
Sample: 28 days (bromide, chloride, fluoride, sulphate)
Sample: 2 days (nitrate, nitrite)
Reference: APHA and EPA

Laboratory Location: ALS Environmental, Vancouver

Ammonia in Water by Colourimetry

This analysis is carried out, on unpreserved samples, using procedures adapted from APHA Method 4500-NH₃ "Nitrogen (Ammonia)". Ammonia is determined using the phenate colourimetric method.

Recommended Holding Time:
Sample: 1 day
Reference: APHA

Laboratory Location: ALS Environmental, Vancouver

Phosphate in Water

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". All forms of phosphate are determined by the ascorbic acid colourimetric method. Dissolved ortho-phosphate (dissolved reactive phosphorous) is determined by direct measurement. Total phosphate (total phosphorous) is determined after persulphate digestion of a sample. Total dissolved phosphate (total dissolved phosphorous) is determined by filtering a sample through a 0.45 micron membrane filter followed by persulfate digestion of the filtrate.

Recommended Holding Time:
Sample: 2 days
Reference: EPA

File No. X6100

Appendix 2 - METHODOLOGY - Continued



Laboratory Location: ALS Environmental, Vancouver

Metals in Water

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" 20th Edition 1998 published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using either hotplate or microwave oven, or filtration (EPA Method 3005A). Instrumental analysis is by atomic absorption/emission spectrophotometry (EPA Method 7000 series), inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B), and/or inductively coupled plasma - mass spectrometry (EPA Method 6020).

Recommended Holding Time:

Sample: 6 months

Reference: EPA

Laboratory Location: ALS Environmental, Vancouver

Chlorophyll and Pheopigments by Fluorometry

This analysis is carried out using procedures adapted from APHA Method 10200 H. "Chlorophyll" and USEPA Method 445. The sample is filtered using either a glass fiber filter or a 0.45 micron Membrane filter. The pigments are extracted from the filter with 90% aqueous acetone. For chlorophyll a analysis the extract is read using a fluorometer. For pheopigments the extract is first acidified then read. This method not subject to interferences from chlorophyll b.

Recommended Holding Time:

Sample: 1-2 days before filtering

Filter: 28 days

Reference: APHA

Laboratory Location: ALS Environmental, Vancouver

Results contained within this certificate relate only to the samples as submitted.

This Certificate Of Analysis shall only be reproduced in full, except with the written approval of ALS Environmental.

End of Report



CERTIFICATE OF ANALYSIS

Date: July 5, 2006

ALS File No. X7331

Report On: GRUM PIT BIO TREATMENT
Water Analysis

Report To: **SRK Consulting (Canada) Inc.**
Suite 800
1066 West Hastings St.
Vancouver, BC
V6E 3X2

Attention: **Mr. Cam Scott**

Received: June 16, 2006

ALS ENVIRONMENTAL

per:

Andre Langlais, M.Sc. - Senior Account Manager
Can Dang, B.Sc. - Senior Account Manager

File No. X7331

REMARKS



Some of the metals detection limits were increased due to high levels of metals in these samples.

The results for Dissolved Barium and Zinc in sample Blank were confirmed by re-analysis.

For some of the submitted water samples, the measured concentration of specific dissolved parameters is greater than the corresponding total parameters concentration. The explanation for these findings is one or a combination of the following:

- laboratory method variability;
- field sampling method variability;
- bias introduced during general handling, storage, transportation and/or analysis of the sample;
- field sample grab bias - where separate grab samples are processed to produce total and dissolved samples;
- field sample split bias - where total and dissolved parameters samples are produced from the same grab sample.

For further clarification on any of the above information, please contact your ALS representative.

File No. X7331

RESULTS OF ANALYSIS - Water



Sample ID	GL-1 GRUM@1m	GL-3 GRUM@3m	GL-5 GRUM@5m	GL-15 GRUM@15m	GL-30 GRUM@30m
Sample Date	06-06-14	06-06-14	06-06-14	06-06-14	06-06-14
Sample Time	12:00	12:15	12:30	12:45	13:10
ALS ID	1	2	3	4	5

Physical Tests

Conductivity	(uS/cm)	783	1020	1020	1020	1020
pH		7.98	7.90	7.90	7.88	7.89
Total Suspended Solids		3.7	3.0	<3.0	3.7	<3.0

Dissolved Anions

Alkalinity-Total		CaCO3	117	174	160	181	161
Sulphate	SO4		317	431	433	435	434

Nutrients

Ammonia Nitrogen	N	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Nitrite/Nitrate Nitrogen	N	0.980	1.35	1.37	1.46	1.45
Dissolved ortho-Phosphate	P	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Phosphate	P	0.0042	0.0036	0.0052	0.0044	0.0035

Remarks regarding the analyses appear at the beginning of this report.
Results are expressed as milligrams per litre except where noted.
< = Less than the detection limit indicated.

File No. X7331

RESULTS OF ANALYSIS - Water

Sample ID	GL-1 GRUM@1m	GL-3 GRUM@3m	GL-5 GRUM@5m	GL-15 GRUM@15m	GL-30 GRUM@30m
Sample Date	06-06-14	06-06-14	06-06-14	06-06-14	06-06-14
Sample Time	12:00	12:15	12:30	12:45	13:10
ALS ID	1	2	3	4	5

Total Metals

Aluminum	T-Al	0.0388	0.0388	0.0289	0.0719	0.0442
Antimony	T-Sb	0.00430	0.00609	0.00604	0.00644	0.00651
Arsenic	T-As	0.00060	0.00083	0.00085	0.00095	0.00104
Barium	T-Ba	0.0348	0.0453	0.0460	0.0492	0.0490
Beryllium	T-Be	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Bismuth	T-Bi	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Boron	T-B	<0.020	<0.020	<0.020	<0.020	<0.020
Cadmium	T-Cd	0.00316	0.00439	0.00437	0.00458	0.00470
Calcium	T-Ca	93.4	122	126	127	126
Chromium	T-Cr	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cobalt	T-Co	0.00547	0.00746	0.00744	0.00772	0.00757
Copper	T-Cu	0.00161	0.00177	0.00149	0.00150	0.00143
Iron	T-Fe	0.061	0.063	0.055	0.105	0.082
Lead	T-Pb	0.00239	0.00151	0.00099	0.00101	0.00084
Lithium	T-Li	0.018	0.025	0.026	0.024	0.024
Magnesium	T-Mg	54.2	71.0	72.8	72.9	72.4
Manganese	T-Mn	0.112	0.157	0.156	0.161	0.163
Molybdenum	T-Mo	0.00195	0.00281	0.00279	0.00299	0.00290
Nickel	T-Ni	0.132	0.193	0.193	0.193	0.194
Phosphorus	T-P	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium	T-K	2.1	2.8	2.8	2.9	2.8
Selenium	T-Se	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Silicon	T-Si	2.43	3.12	3.20	3.26	3.18
Silver	T-Ag	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
Sodium	T-Na	8.1	10.9	10.9	11.0	10.9
Strontium	T-Sr	0.562	0.808	0.808	0.868	0.877
Thallium	T-Tl	0.00073	0.00096	0.00092	0.00094	0.00094
Tin	T-Sn	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Titanium	T-Ti	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	T-U	0.00659	0.00886	0.00880	0.00916	0.00915
Vanadium	T-V	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Zinc	T-Zn	5.58	8.28	8.39	8.26	8.42

Remarks regarding the analyses appear at the beginning of this report.
 Results are expressed as milligrams per litre except where noted.
 < = Less than the detection limit indicated.

File No. X7331

RESULTS OF ANALYSIS - Water

Sample ID	GL-1 GRUM@1m	GL-3 GRUM@3m	GL-5 GRUM@5m	GL-15 GRUM@15m	GL-30 GRUM@30m
Sample Date	06-06-14	06-06-14	06-06-14	06-06-14	06-06-14
Sample Time	12:00	12:15	12:30	12:45	13:10
ALS ID	1	2	3	4	5

Dissolved Metals

Aluminum	D-Al	0.0058	0.0225	0.0028	0.0239	<0.0020
Antimony	D-Sb	0.00422	0.00609	0.00619	0.00650	0.00633
Arsenic	D-As	0.00043	0.00073	0.00072	0.00076	0.00070
Barium	D-Ba	0.0339	0.0451	0.0463	0.0483	0.0474
Beryllium	D-Be	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Bismuth	D-Bi	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Boron	D-B	<0.020	<0.020	<0.020	<0.020	<0.020
Cadmium	D-Cd	0.00304	0.00442	0.00436	0.00455	0.00461
Calcium	D-Ca	91.5	123	123	125	124
Chromium	D-Cr	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cobalt	D-Co	0.00543	0.00754	0.00704	0.00740	0.00732
Copper	D-Cu	0.00146	0.00149	0.00133	0.00137	0.00127
Iron	D-Fe	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	D-Pb	0.00142	0.00075	0.00046	0.00046	0.00022
Lithium	D-Li	0.018	0.026	0.024	0.025	0.024
Magnesium	D-Mg	53.0	71.1	71.1	72.1	71.1
Manganese	D-Mn	0.103	0.154	0.148	0.159	0.156
Molybdenum	D-Mo	0.00205	0.00284	0.00291	0.00302	0.00295
Nickel	D-Ni	0.134	0.193	0.184	0.192	0.187
Phosphorus	D-P	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium	D-K	2.1	2.8	2.8	2.8	2.8
Selenium	D-Se	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Silicon	D-Si	2.32	3.08	3.08	3.13	3.09
Silver	D-Ag	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
Sodium	D-Na	7.9	10.8	10.6	10.8	10.8
Strontium	D-Sr	0.573	0.812	0.836	0.886	0.843
Thallium	D-Tl	0.00073	0.00096	0.00093	0.00094	0.00095
Tin	D-Sn	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Titanium	D-Ti	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	D-U	0.00652	0.00883	0.00890	0.00913	0.00893
Vanadium	D-V	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Zinc	D-Zn	5.58	8.34	7.92	8.29	8.11

Remarks regarding the analyses appear at the beginning of this report.
 Results are expressed as milligrams per litre except where noted.
 < = Less than the detection limit indicated.

File No. X7331

RESULTS OF ANALYSIS - Water



Sample ID	GL-40 GRUM@40m
Sample Date	06-06-14
Sample Time	13:30
ALS ID	6

Physical Tests

Conductivity	(uS/cm)	1020
pH		7.88
Total Suspended Solids		3.7

Dissolved Anions

Alkalinity-Total		CaCO ₃	172
Sulphate	SO ₄		435

Nutrients

Ammonia Nitrogen	N	<0.0050
Nitrite/Nitrate Nitrogen	N	1.45
Dissolved ortho-Phosphate	P	<0.0010
Total Phosphate	P	0.0040

Remarks regarding the analyses appear at the beginning of this report.
Results are expressed as milligrams per litre except where noted.
< = Less than the detection limit indicated.

File No. X7331

RESULTS OF ANALYSIS - Water



Sample ID	GL-40 GRUM@40m	FIELD FILTER
Sample Date	06-06-14	06-06-14
Sample Time	13:30	21:30
ALS ID	6	7

Total Metals

Aluminum	T-Al	0.0482	<0.0010
Antimony	T-Sb	0.00651	<0.00010
Arsenic	T-As	0.00118	<0.00010
Barium	T-Ba	0.0500	<0.000050
Beryllium	T-Be	<0.0010	<0.00050
Bismuth	T-Bi	<0.0010	<0.00050
Boron	T-B	<0.020	<0.010
Cadmium	T-Cd	0.00470	<0.000050
Calcium	T-Ca	127	<0.050
Chromium	T-Cr	<0.0010	<0.00050
Cobalt	T-Co	0.00769	<0.00010
Copper	T-Cu	0.00139	<0.00010
Iron	T-Fe	0.105	<0.030
Lead	T-Pb	0.00094	<0.000050
Lithium	T-Li	0.026	<0.0050
Magnesium	T-Mg	73.0	<0.10
Manganese	T-Mn	0.167	<0.000050
Molybdenum	T-Mo	0.00298	<0.000050
Nickel	T-Ni	0.192	<0.00050
Phosphorus	T-P	<0.30	<0.30
Potassium	T-K	2.9	<2.0
Selenium	T-Se	<0.0020	<0.0010
Silicon	T-Si	3.23	<0.050
Silver	T-Ag	<0.000020	<0.000010
Sodium	T-Na	11.1	<2.0
Strontium	T-Sr	0.881	<0.00010
Thallium	T-Tl	0.00099	<0.00010
Tin	T-Sn	<0.00020	<0.00010
Titanium	T-Ti	<0.010	<0.010
Uranium	T-U	0.00921	<0.000010
Vanadium	T-V	<0.0020	<0.0010
Zinc	T-Zn	8.41	<0.0010

Remarks regarding the analyses appear at the beginning of this report.
 Results are expressed as milligrams per litre except where noted.
 < = Less than the detection limit indicated.

File No. X7331

RESULTS OF ANALYSIS - Water



Sample ID	GL-40 GRUM@40m	FIELD FILTER
Sample Date	06-06-14	06-06-14
Sample Time	13:30	21:30
ALS ID	6	7

Dissolved Metals

Aluminum	D-Al	<0.0020	<0.0010
Antimony	D-Sb	0.00649	<0.00010
Arsenic	D-As	0.00075	<0.00010
Barium	D-Ba	0.0480	0.000209
Beryllium	D-Be	<0.0010	<0.00050
Bismuth	D-Bi	<0.0010	<0.00050
Boron	D-B	<0.020	<0.010
Cadmium	D-Cd	0.00459	<0.000050
Calcium	D-Ca	129	<0.050
Chromium	D-Cr	<0.0010	<0.00050
Cobalt	D-Co	0.00747	<0.00010
Copper	D-Cu	0.00125	<0.00010
Iron	D-Fe	<0.030	<0.030
Lead	D-Pb	0.00016	<0.000050
Lithium	D-Li	0.024	<0.0050
Magnesium	D-Mg	74.4	<0.10
Manganese	D-Mn	0.159	<0.000050
Molybdenum	D-Mo	0.00305	<0.000050
Nickel	D-Ni	0.188	<0.00050
Phosphorus	D-P	<0.30	<0.30
Potassium	D-K	2.9	<2.0
Selenium	D-Se	<0.0020	<0.0010
Silicon	D-Si	3.22	<0.050
Silver	D-Ag	<0.000020	<0.000010
Sodium	D-Na	11.1	<2.0
Strontium	D-Sr	0.856	<0.00010
Thallium	D-Tl	0.00097	<0.00010
Tin	D-Sn	<0.00020	<0.00010
Titanium	D-Ti	<0.010	<0.010
Uranium	D-U	0.00910	<0.000010
Vanadium	D-V	<0.0020	<0.0010
Zinc	D-Zn	8.32	0.0014

Remarks regarding the analyses appear at the beginning of this report.
 Results are expressed as milligrams per litre except where noted.
 < = Less than the detection limit indicated.

File No. X7331

RESULTS OF ANALYSIS - Filter



Sample ID	GL-1 GRUM@1m	GL-3 GRUM@3m	GL-5 GRUM@5m
Sample Date	06-06-14	06-06-14	06-06-14
Sample Time	12:00	12:15	12:30
ALS ID	1a	2a	3a

Organic Parameters

Chlorophyll a ¹	0.263	0.804	1.28
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Remarks regarding the analyses appear at the beginning of this report.

Results are expressed as milligrams per litre except where noted.

< = Less than the detection limit indicated.

¹Chlorophyll a results expressed as mg/m3 based on a provided filtered 60 mls

File No. X7331

Appendix 1 - QUALITY CONTROL - Replicates



Water	GL-5 GRUM@5m	GL-5 GRUM@5m
	06-06-14 12:30	QC # 506469

Physical Tests

Conductivity	(uS/cm)	1020	1020
pH		7.90	7.90
Total Suspended Solids		<3.0	<3.0

Dissolved Anions

Alkalinity-Total		CaCO ₃	160	166
Sulphate	SO ₄		433	433

Nutrients

Ammonia Nitrogen	N	<0.0050	<0.0050
Nitrite/Nitrate Nitrogen	N	1.37	1.36
Dissolved ortho-Phosphate	P	<0.0010	<0.0010
Total Phosphate	P	0.0052	0.0047

Remarks regarding the analyses appear at the beginning of this report.
Results are expressed as milligrams per litre except where noted.
< = Less than the detection limit indicated.

File No. X7331

Appendix 1 - QUALITY CONTROL - Replicates



Water	GL-5 GRUM@5m	GL-5 GRUM@5m
	06-06-14 12:30	QC # 506469

Total Metals

Aluminum	T-Al	0.0289	0.0286
Antimony	T-Sb	0.00604	0.00644
Arsenic	T-As	0.00085	0.00087
Barium	T-Ba	0.0460	0.0483
Beryllium	T-Be	<0.0010	<0.0010
Bismuth	T-Bi	<0.0010	<0.0010
Boron	T-B	<0.020	<0.020
Cadmium	T-Cd	0.00437	0.00472
Calcium	T-Ca	126	123
Chromium	T-Cr	<0.0010	<0.0010
Cobalt	T-Co	0.00744	0.00736
Copper	T-Cu	0.00149	0.00153
Iron	T-Fe	0.055	0.055
Lead	T-Pb	0.00099	0.00107
Lithium	T-Li	0.026	0.025
Magnesium	T-Mg	72.8	70.9
Manganese	T-Mn	0.156	0.156
Molybdenum	T-Mo	0.00279	0.00288
Nickel	T-Ni	0.193	0.190
Phosphorus	T-P	<0.30	<0.30
Potassium	T-K	2.8	2.8
Selenium	T-Se	<0.0020	<0.0020
Silicon	T-Si	3.20	3.12
Silver	T-Ag	<0.000020	<0.000020
Sodium	T-Na	10.9	10.7
Strontium	T-Sr	0.808	0.861
Thallium	T-Tl	0.00092	0.00095
Tin	T-Sn	<0.00020	<0.00020
Titanium	T-Ti	<0.010	<0.010
Uranium	T-U	0.00880	0.00916
Vanadium	T-V	<0.0020	<0.0020
Zinc	T-Zn	8.39	8.28

Remarks regarding the analyses appear at the beginning of this report.
Results are expressed as milligrams per litre except where noted.
< = Less than the detection limit indicated.

File No. X7331

Appendix 1 - QUALITY CONTROL - Replicates



Water	GL-5 GRUM@5m	GL-5 GRUM@5m
	06-06-14 12:30	QC # 506469

Dissolved Metals

Aluminum	D-Al	0.0028	0.0056
Antimony	D-Sb	0.00619	0.00620
Arsenic	D-As	0.00072	0.00073
Barium	D-Ba	0.0463	0.0460
Beryllium	D-Be	<0.0010	<0.0010
Bismuth	D-Bi	<0.0010	<0.0010
Boron	D-B	<0.020	<0.020
Cadmium	D-Cd	0.00436	0.00444
Calcium	D-Ca	123	122
Chromium	D-Cr	<0.0010	<0.0010
Cobalt	D-Co	0.00704	0.00711
Copper	D-Cu	0.00133	0.00131
Iron	D-Fe	<0.030	<0.030
Lead	D-Pb	0.00046	0.00045
Lithium	D-Li	0.024	0.023
Magnesium	D-Mg	71.1	69.8
Manganese	D-Mn	0.148	0.149
Molybdenum	D-Mo	0.00291	0.00287
Nickel	D-Ni	0.184	0.184
Phosphorus	D-P	<0.30	<0.30
Potassium	D-K	2.8	2.8
Selenium	D-Se	<0.0020	<0.0020
Silicon	D-Si	3.08	3.03
Silver	D-Ag	<0.000020	<0.000020
Sodium	D-Na	10.6	10.5
Strontium	D-Sr	0.836	0.833
Thallium	D-Tl	0.00093	0.00094
Tin	D-Sn	<0.00020	<0.00020
Titanium	D-Ti	<0.010	<0.010
Uranium	D-U	0.00890	0.00883
Vanadium	D-V	<0.0020	<0.0020
Zinc	D-Zn	7.92	8.00

Remarks regarding the analyses appear at the beginning of this report.
Results are expressed as milligrams per litre except where noted.
< = Less than the detection limit indicated.

Appendix 2 - METHODOLOGY



Outlines of the methodologies utilized for the analysis of the samples submitted are as follows

Conductivity in Water

This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.

Recommended Holding Time:

Sample: 28 days

Reference: APHA

Laboratory Location: ALS Environmental, Vancouver

pH in Water

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode.

Recommended Holding Time:

Sample: 2 hours

Reference: APHA

Laboratory Location: ALS Environmental, Vancouver

Solids in Water

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total dissolved solids (TDS) and total suspended solids (TSS) are determined by filtering a sample through a glass fibre filter, TDS is determined by evaporating the filtrate to dryness at 180 degrees celsius, TSS is determined by drying the filter at 104 degrees celsius. Total solids are determined by evaporating a sample to dryness at 104 degrees celsius. Fixed and volatile solids are determined by igniting a dried sample residue at 550 degrees celsius.

Recommended Holding Time:

Sample: 7 days

Reference: APHA

Laboratory Location: ALS Environmental, Vancouver

Alkalinity in Water by Colourimetry

This analysis is carried out using procedures adapted from EPA Method 310.2 "Alkalinity". Total Alkalinity is determined using the methyl orange colourimetric method.

Recommended Holding Time:

File No. X7331

Appendix 2 - METHODOLOGY - Continued



Sample: 14 days
Reference: APHA

Laboratory Location: ALS Environmental, Vancouver

Dissolved Anions in Water by Ion Chromatography

This analysis is carried out using procedures adapted from APHA Method 4110 "Determination of Anions by Ion Chromatography" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography". Anions are determined by filtering the sample through a 0.45 micron membrane filter and injecting the filtrate onto a Dionex IonPac AG17 anion exchange column with a hydroxide eluent stream. Anions routinely determined by this method include: bromide, chloride, fluoride, nitrate, nitrite and sulphate.

Recommended Holding Time:
Sample: 28 days (bromide, chloride, fluoride, sulphate)
Sample: 2 days (nitrate, nitrite)
Reference: APHA and EPA

Laboratory Location: ALS Environmental, Vancouver

Ammonia in Water by Colourimetry

This analysis is carried out, on unpreserved samples, using procedures adapted from APHA Method 4500-NH₃ "Nitrogen (Ammonia)". Ammonia is determined using the phenate colourimetric method.

Recommended Holding Time:
Sample: 1 day
Reference: APHA

Laboratory Location: ALS Environmental, Vancouver

Phosphate in Water

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". All forms of phosphate are determined by the ascorbic acid colourimetric method. Dissolved ortho-phosphate (dissolved reactive phosphorous) is determined by direct measurement. Total phosphate (total phosphorous) is determined after persulphate digestion of a sample. Total dissolved phosphate (total dissolved phosphorous) is determined by filtering a sample through a 0.45 micron membrane filter followed by persulfate digestion of the filtrate.

Recommended Holding Time:
Sample: 2 days
Reference: EPA

File No. X7331

Appendix 2 - METHODOLOGY - Continued



Laboratory Location: ALS Environmental, Vancouver

Metals in Water

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" 20th Edition 1998 published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using either hotplate or microwave oven, or filtration (EPA Method 3005A). Instrumental analysis is by atomic absorption/emission spectrophotometry (EPA Method 7000 series), inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B), and/or inductively coupled plasma - mass spectrometry (EPA Method 6020).

Recommended Holding Time:

Sample: 6 months

Reference: EPA

Laboratory Location: ALS Environmental, Vancouver

Chlorophyll and Pheopigments by Fluorometry

This analysis is carried out using procedures adapted from APHA Method 10200 H. "Chlorophyll" and USEPA Method 445. The sample is filtered using either a glass fiber filter or a 0.45 micron Membrane filter. The pigments are extracted from the filter with 90% aqueous acetone. For chlorophyll a analysis the extract is read using a fluorometer. For pheopigments the extract is first acidified then read. This method not subject to interferences from chlorophyll b.

Recommended Holding Time:

Sample: 1-2 days before filtering

Filter: 28 days

Reference: APHA

Laboratory Location: ALS Environmental, Vancouver

Results contained within this certificate relate only to the samples as submitted.

This Certificate Of Analysis shall only be reproduced in full, except with the written approval of ALS Environmental.

End of Report



CERTIFICATE OF ANALYSIS

Date: July 14, 2006

ALS File No. X7752

Report On: Grum Pit Bio Treatment
Water Analysis

Report To: **SRK Consulting (Canada) Inc.**
Suite 800
1066 West Hastings St.
Vancouver, BC
V6E 3X2

Attention: **Mr. Cam Scott**

Received: June 26, 2006

ALS ENVIRONMENTAL

per:

Andre Langlais, M.Sc. - Senior Account Manager
Can Dang, B.Sc. - Senior Account Manager

File No. X7752

REMARKS



For some of the submitted water samples, the measured concentration of specific dissolved parameters is greater than the corresponding total parameters concentration. The explanation for these findings is one or a combination of the following:

- laboratory method variability;
- field sampling method variability;
- bias introduced during general handling, storage, transportation and/or analysis of the sample;
- field sample grab bias - where separate grab samples are processed to produce total and dissolved samples;
- field sample split bias - where total and dissolved parameters samples are produced from the same grab sample.

For further clarification on any of the above information, please contact your ALS representative.

File No. X7752

RESULTS OF ANALYSIS - Water



Sample ID	VP 1m Vangorda Pit@ 1m	VP 3m Vangorda @ 3m	VP 5m Vangorda @ 5m	VP 15m Vangorda @ 15m	VP 30m Vangorda @ 30m
Sample Date	06-06-21	06-06-21	06-06-21	06-06-21	06-06-21
Sample Time	11:50	12:10	12:20	12:35	12:45
ALS ID	1	2	3	4	5

Physical Tests

Conductivity (uS/cm)	1130	1910	2120	2140	2150
pH	5.02	5.17	5.55	5.48	5.57
Total Suspended Solids	4.7	14.7	30.7	35.3	37.3

Dissolved Anions

Alkalinity-Total	CaCO3	24.8	30.4	47.4	47.8	37.0
Sulphate	SO4	641	1240	1410	1410	1440

Nutrients

Ammonia Nitrogen	N	0.167	0.407	0.560	0.551	0.532
Nitrite/Nitrate Nitrogen	N	0.0714	0.038	<0.025	<0.025	<0.025
Dissolved ortho-Phosphate	P	0.0026	0.0013	0.0011	0.0012	0.0014
Total Phosphate	P	0.0051	0.0049	0.0084	0.0088	0.0138

Remarks regarding the analyses appear at the beginning of this report.
 Results are expressed as milligrams per litre except where noted.
 < = Less than the detection limit indicated.
 The Chlorophyll a expressed as mg/m3 based on 60 mls field filtered volume.

File No. X7752

RESULTS OF ANALYSIS - Water

Sample ID	VP 1m Vangorda Pit@ 1m	VP 3m Vangorda @ 3m	VP 5m Vangorda @ 5m	VP 15m Vangorda @ 15m	VP 30m Vangorda @ 30m
Sample Date	06-06-21	06-06-21	06-06-21	06-06-21	06-06-21
Sample Time	11:50	12:10	12:20	12:35	12:45
ALS ID	1	2	3	4	5

Total Metals

Aluminum	T-Al	0.161	0.503	0.162	0.133	<0.40
Antimony	T-Sb	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Arsenic	T-As	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Barium	T-Ba	0.0118	0.0272	0.0273	0.0262	0.0257
Beryllium	T-Be	<0.010	<0.010	<0.010	<0.010	<0.010
Bismuth	T-Bi	<0.010	<0.010	<0.010	<0.010	<0.010
Boron	T-B	<0.20	<0.20	<0.20	<0.20	<0.20
Cadmium	T-Cd	0.0470	0.136	0.120	0.121	0.124
Calcium	T-Ca	121	209	231	263	246
Chromium	T-Cr	<0.010	<0.010	<0.010	<0.010	<0.010
Cobalt	T-Co	0.144	0.645	0.758	0.755	0.777
Copper	T-Cu	0.235	0.612	0.143	0.146	0.146
Iron	T-Fe	6.76	23.4	28.5	35.0	34.2
Lead	T-Pb	0.0204	0.0455	0.0155	0.0178	0.0270
Lithium	T-Li	<0.10	<0.10	<0.10	<0.10	<0.10
Magnesium	T-Mg	48.0	87.3	97.8	111	104
Manganese	T-Mn	7.90	43.2	51.4	49.7	52.3
Molybdenum	T-Mo	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Nickel	T-Ni	0.131	0.590	0.681	0.685	0.696
Phosphorus	T-P	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium	T-K	<2.0	2.3	2.7	3.0	2.8
Selenium	T-Se	<0.020	<0.020	<0.020	<0.020	<0.020
Silicon	T-Si	2.43	3.11	3.14	3.56	3.36
Silver	T-Ag	<0.00020	0.00098	0.00092	0.00049	0.00084
Sodium	T-Na	2.7	4.5	4.9	5.3	5.2
Strontium	T-Sr	0.313	1.33	1.53	1.46	1.51
Thallium	T-Tl	<0.0020	0.0026	0.0024	0.0023	0.0023
Tin	T-Sn	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Titanium	T-Ti	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	T-U	0.00051	0.00170	0.00044	0.00056	0.00058
Vanadium	T-V	<0.020	<0.020	<0.020	<0.020	<0.020
Zinc	T-Zn	31.1	149	166	165	170

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 The Chlorophyll a expressed as mg/m3 based on 60 mls field filtered volume.

File No. X7752

RESULTS OF ANALYSIS - Water

Sample ID	VP 1m Vangorda Pit@ 1m	VP 3m Vangorda @ 3m	VP 5m Vangorda @ 5m	VP 15m Vangorda @ 15m	VP 30m Vangorda @ 30m
Sample Date	06-06-21	06-06-21	06-06-21	06-06-21	06-06-21
Sample Time	11:50	12:10	12:20	12:35	12:45
ALS ID	1	2	3	4	5

Dissolved Metals

Aluminum	D-Al	0.110	0.455	0.117	0.112	0.116
Antimony	D-Sb	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Arsenic	D-As	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Barium	D-Ba	0.0112	0.0260	0.0258	0.0252	0.0247
Beryllium	D-Be	<0.010	<0.010	<0.010	<0.010	<0.010
Bismuth	D-Bi	<0.010	<0.010	<0.010	<0.010	<0.010
Boron	D-B	<0.20	<0.20	<0.20	<0.20	<0.20
Cadmium	D-Cd	0.0463	0.131	0.116	0.122	0.124
Calcium	D-Ca	121	213	235	258	249
Chromium	D-Cr	<0.010	<0.010	<0.010	<0.010	<0.010
Cobalt	D-Co	0.141	0.615	0.733	0.780	0.772
Copper	D-Cu	0.221	0.609	0.136	0.145	0.140
Iron	D-Fe	5.68	22.9	27.0	34.4	32.0
Lead	D-Pb	0.0125	0.0326	0.0049	0.0092	0.0159
Lithium	D-Li	<0.10	<0.10	<0.10	<0.10	<0.10
Magnesium	D-Mg	49.1	89.3	96.0	108	103
Manganese	D-Mn	7.61	40.7	49.4	51.7	51.4
Molybdenum	D-Mo	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Nickel	D-Ni	0.128	0.556	0.655	0.699	0.685
Phosphorus	D-P	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium	D-K	<2.0	2.4	2.5	2.9	2.9
Selenium	D-Se	<0.020	<0.020	<0.020	<0.020	<0.020
Silicon	D-Si	2.42	3.19	3.08	3.45	3.27
Silver	D-Ag	<0.00020	0.00057	0.00118	0.00063	0.00098
Sodium	D-Na	2.7	4.7	4.6	5.3	5.3
Strontium	D-Sr	0.303	1.26	1.47	1.49	1.47
Thallium	D-Tl	<0.0020	0.0024	0.0023	0.0023	0.0024
Tin	D-Sn	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Titanium	D-Ti	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	D-U	0.00042	0.00164	0.00040	0.00046	0.00052
Vanadium	D-V	<0.020	<0.020	<0.020	<0.020	<0.020
Zinc	D-Zn	30.1	140	161	168	167

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 The Chlorophyll a expressed as mg/m3 based on 60 mls field filtered volume.

File No. X7752

RESULTS OF ANALYSIS - Water



Sample ID	VP 40m Vangorda @ 40m	FP 1m Faro Pit @ 1m	FP 3m Faro Pit @ 3m	FP 5m Faro Pit @ 5m	FP 15m Faro Pit @ 15m
Sample Date	06-06-21	06-06-21	06-06-21	06-06-21	06-06-21
Sample Time	13:00	16:00	16:15	16:20	16:35
ALS ID	6	7	8	9	10

Physical Tests

Conductivity	(uS/cm)	2150	1090	1100	1140	1280
pH		5.57	6.96	7.20	7.33	7.39
Total Suspended Solids		34.0	<3.0	<3.0	<3.0	<3.0

Dissolved Anions

Alkalinity-Total		CaCO3	33.0	96.5	98.0	96.7	104
Sulphate	SO4		1530	528	533	556	628

Nutrients

Ammonia Nitrogen	N	0.531	1.46	1.47	1.58	1.93
Nitrite/Nitrate Nitrogen	N	<0.025	0.329	0.328	0.334	0.314
Dissolved ortho-Phosphate	P	0.0015	<0.0010	0.0012	<0.0010	<0.0010
Total Phosphate	P	0.0069	0.0039	0.0037	0.0039	0.0046

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 The Chlorophyll a expressed as mg/m3 based on 60 mls field filtered volume.

File No. X7752

RESULTS OF ANALYSIS - Water

Sample ID	VP 40m Vangorda @ 40m	FP 1m Faro Pit @ 1m	FP 3m Faro Pit @ 3m	FP 5m Faro Pit @ 5m	FP 15m Faro Pit @ 15m
Sample Date	06-06-21	06-06-21	06-06-21	06-06-21	06-06-21
Sample Time	13:00	16:00	16:15	16:20	16:35
ALS ID	6	7	8	9	10

Total Metals

Aluminum	T-Al	0.148	0.0188	0.0211	0.0232	0.0280
Antimony	T-Sb	<0.0020	0.00096	0.00098	0.00105	0.00124
Arsenic	T-As	<0.0020	<0.00020	<0.00020	<0.00020	0.00022
Barium	T-Ba	0.0252	0.0170	0.0178	0.0175	0.0184
Beryllium	T-Be	<0.010	<0.0010	<0.0010	<0.0010	<0.0010
Bismuth	T-Bi	<0.010	<0.0010	<0.0010	<0.0010	<0.0010
Boron	T-B	<0.20	<0.020	<0.020	<0.020	<0.020
Cadmium	T-Cd	0.124	0.00525	0.00546	0.00471	0.00371
Calcium	T-Ca	299	113	145	121	148
Chromium	T-Cr	<0.010	<0.0010	<0.0010	<0.0010	<0.0010
Cobalt	T-Co	0.781	0.0424	0.0450	0.0451	0.0501
Copper	T-Cu	0.144	0.0134	0.0144	0.0141	0.00709
Iron	T-Fe	38.2	0.164	0.379	0.302	0.161
Lead	T-Pb	0.0281	0.00188	0.00192	0.00174	0.00134
Lithium	T-Li	<0.10	0.045	0.050	0.050	0.058
Magnesium	T-Mg	121	58.2	66.5	56.1	66.2
Manganese	T-Mn	52.2	2.58	2.78	2.77	3.32
Molybdenum	T-Mo	<0.0010	0.00170	0.00182	0.00183	0.00226
Nickel	T-Ni	0.704	0.0962	0.102	0.106	0.112
Phosphorus	T-P	<0.60	<0.30	<0.60	<0.30	<0.30
Potassium	T-K	<4.0	5.3	6.7	6.6	8.4
Selenium	T-Se	<0.020	<0.0020	<0.0020	<0.0020	<0.0020
Silicon	T-Si	3.59	2.70	3.11	2.82	3.14
Silver	T-Ag	0.00080	<0.000020	<0.000020	<0.000020	<0.000020
Sodium	T-Na	6.0	17.7	20.6	19.3	23.7
Strontium	T-Sr	1.52	0.503	0.543	0.541	0.631
Thallium	T-Tl	0.0024	0.00054	0.00058	0.00057	0.00066
Tin	T-Sn	<0.0020	<0.00020	<0.00020	<0.00020	<0.00020
Titanium	T-Ti	<0.020	<0.010	<0.020	<0.010	<0.010
Uranium	T-U	0.00060	0.00205	0.00221	0.00221	0.00250
Vanadium	T-V	<0.020	<0.0020	<0.0020	<0.0020	<0.0020
Zinc	T-Zn	170	15.2	16.0	15.7	17.0

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 The Chlorophyll a expressed as mg/m3 based on 60 mls field filtered volume.

File No. X7752

RESULTS OF ANALYSIS - Water

Sample ID	VP 40m Vangorda @ 40m	FP 1m Faro Pit @ 1m	FP 3m Faro Pit @ 3m	FP 5m Faro Pit @ 5m	FP 15m Faro Pit @ 15m
Sample Date	06-06-21	06-06-21	06-06-21	06-06-21	06-06-21
Sample Time	13:00	16:00	16:15	16:20	16:35
ALS ID	6	7	8	9	10

Dissolved Metals

Aluminum	D-Al	0.114	<0.0020	0.0034	0.0042	0.0084
Antimony	D-Sb	<0.0020	0.00094	0.00096	0.00099	0.00118
Arsenic	D-As	<0.0020	<0.00020	<0.00020	<0.00020	<0.00020
Barium	D-Ba	0.0242	0.0168	0.0170	0.0173	0.0175
Beryllium	D-Be	<0.010	<0.0010	<0.0010	<0.0010	<0.0010
Bismuth	D-Bi	<0.010	<0.0010	<0.0010	<0.0010	<0.0010
Boron	D-B	<0.20	<0.020	<0.020	<0.020	<0.020
Cadmium	D-Cd	0.123	0.00528	0.00535	0.00479	0.00357
Calcium	D-Ca	259	114	137	125	145
Chromium	D-Cr	<0.010	<0.0010	<0.0010	<0.0010	<0.0010
Cobalt	D-Co	0.767	0.0434	0.0440	0.0470	0.0481
Copper	D-Cu	0.138	0.00954	0.00899	0.00907	0.00217
Iron	D-Fe	32.6	<0.030	<0.060	<0.030	<0.030
Lead	D-Pb	0.0173	0.00022	0.00011	<0.00010	<0.00010
Lithium	D-Li	<0.10	0.048	0.048	0.051	0.057
Magnesium	D-Mg	104	59.8	63.3	57.6	64.8
Manganese	D-Mn	51.1	2.67	2.69	2.88	3.17
Molybdenum	D-Mo	<0.0010	0.00169	0.00169	0.00183	0.00213
Nickel	D-Ni	0.684	0.0979	0.0992	0.109	0.109
Phosphorus	D-P	<0.60	<0.30	<0.60	<0.30	<0.30
Potassium	D-K	<4.0	5.9	6.4	6.5	7.8
Selenium	D-Se	<0.020	<0.0020	<0.0020	<0.0020	<0.0020
Silicon	D-Si	3.06	2.69	2.94	2.87	3.03
Silver	D-Ag	0.00100	<0.000020	<0.000020	<0.000020	<0.000020
Sodium	D-Na	5.0	18.1	19.4	18.9	21.8
Strontium	D-Sr	1.47	0.515	0.523	0.557	0.602
Thallium	D-Tl	0.0023	0.00056	0.00054	0.00059	0.00066
Tin	D-Sn	<0.0020	<0.00020	<0.00020	<0.00020	<0.00020
Titanium	D-Ti	<0.020	<0.010	<0.020	<0.010	<0.010
Uranium	D-U	0.00054	0.00207	0.00212	0.00228	0.00236
Vanadium	D-V	<0.020	<0.0020	<0.0020	<0.0020	<0.0020
Zinc	D-Zn	167	15.3	15.4	16.0	16.5

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File No. X7752

RESULTS OF ANALYSIS - Water



Sample ID	FP 30m Faro Pit @ 30m	FP 60m Faro Pit @ 60m	FP 80m Faro Pit @ 80m
Sample Date	06-06-21	06-06-21	06-06-21
Sample Time	16:45	17:00	17:20
ALS ID	11	12	13

Physical Tests

Conductivity	(uS/cm)	1410	1430	1490
pH		7.35	7.25	7.15
Total Suspended Solids		28.0	33.3	40.0

Dissolved Anions

Alkalinity-Total		CaCO3	102	107	116
Sulphate	SO4		714	721	755

Nutrients

Ammonia Nitrogen	N	1.50	1.59	1.74
Nitrite/Nitrate Nitrogen	N	<0.0050	<0.0050	<0.0050
Dissolved ortho-Phosphate	P	0.0013	0.0011	<0.010
Total Phosphate	P	<0.0060	0.0110	0.0140

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 The Chlorophyll a expressed as mg/m3 based on 60 mls field filtered volume.

File No. X7752

RESULTS OF ANALYSIS - Water

Sample ID	FP 30m Faro Pit @ 30m	FP 60m Faro Pit @ 60m	FP 80m Faro Pit @ 80m
Sample Date	06-06-21	06-06-21	06-06-21
Sample Time	16:45	17:00	17:20
ALS ID	11	12	13

Total Metals

Aluminum	T-Al	0.0187	0.0123	0.0120
Antimony	T-Sb	<0.00020	<0.00020	<0.00020
Arsenic	T-As	0.00104	0.00157	0.00139
Barium	T-Ba	0.0170	0.0163	0.0160
Beryllium	T-Be	<0.0010	<0.0010	<0.0010
Bismuth	T-Bi	<0.0010	<0.0010	<0.0010
Boron	T-B	<0.020	<0.020	<0.020
Cadmium	T-Cd	0.00019	<0.00010	<0.00010
Calcium	T-Ca	205	175	179
Chromium	T-Cr	<0.0010	<0.0010	<0.0010
Cobalt	T-Co	0.0348	0.0345	0.0319
Copper	T-Cu	<0.0010	<0.0010	<0.00020
Iron	T-Fe	20.4	20.3	23.4
Lead	T-Pb	0.00069	0.00065	0.00093
Lithium	T-Li	0.067	0.070	0.073
Magnesium	T-Mg	72.6	62.7	63.8
Manganese	T-Mn	4.13	4.34	4.42
Molybdenum	T-Mo	0.00332	0.00299	0.00272
Nickel	T-Ni	0.0728	0.0715	0.0743
Phosphorus	T-P	<0.60	<0.30	<0.30
Potassium	T-K	12.6	11.8	12.0
Selenium	T-Se	<0.0020	<0.0020	<0.0020
Silicon	T-Si	2.65	2.52	2.62
Silver	T-Ag	0.000035	0.000057	<0.000020
Sodium	T-Na	35.7	30.4	30.8
Strontium	T-Sr	0.638	0.671	0.745
Thallium	T-Tl	0.00025	0.00022	<0.00020
Tin	T-Sn	<0.00020	<0.00020	<0.00020
Titanium	T-Ti	<0.020	<0.010	<0.010
Uranium	T-U	0.00349	0.00409	0.00556
Vanadium	T-V	<0.0020	<0.0020	<0.0020
Zinc	T-Zn	3.17	2.69	2.56

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 < = Less than the detection limit indicated.
 The Chlorophyll a expressed as mg/m3 based on 60 mls field filtered volume.

File No. X7752

RESULTS OF ANALYSIS - Water

Sample ID	FP 30m Faro Pit @ 30m	FP 60m Faro Pit @ 60m	FP 80m Faro Pit @ 80m
Sample Date	06-06-21	06-06-21	06-06-21
Sample Time	16:45	17:00	17:20
ALS ID	11	12	13

Dissolved Metals

Aluminum	D-Al	0.0088	0.0043	0.0042
Antimony	D-Sb	<0.00020	<0.00020	<0.00020
Arsenic	D-As	0.00095	0.00062	0.00043
Barium	D-Ba	0.0169	0.0155	0.0152
Beryllium	D-Be	<0.0010	<0.0010	<0.0010
Bismuth	D-Bi	<0.0010	<0.0010	<0.0010
Boron	D-B	<0.020	<0.020	<0.020
Cadmium	D-Cd	<0.00010	<0.00010	<0.00010
Calcium	D-Ca	203	165	169
Chromium	D-Cr	<0.0010	<0.0010	<0.0010
Cobalt	D-Co	0.0358	0.0323	0.0328
Copper	D-Cu	<0.00050	<0.00050	<0.00020
Iron	D-Fe	20.1	18.8	22.2
Lead	D-Pb	<0.00010	<0.00010	<0.00010
Lithium	D-Li	0.069	0.065	0.072
Magnesium	D-Mg	71.8	59.1	60.2
Manganese	D-Mn	4.24	4.07	4.50
Molybdenum	D-Mo	0.00340	0.00283	0.00278
Nickel	D-Ni	0.0744	0.0679	0.0751
Phosphorus	D-P	<0.60	<0.30	<0.30
Potassium	D-K	12.4	11.4	11.4
Selenium	D-Se	<0.0020	<0.0020	<0.0020
Silicon	D-Si	2.62	2.35	2.46
Silver	D-Ag	0.000061	0.000057	0.000045
Sodium	D-Na	35.1	29.0	29.9
Strontium	D-Sr	0.653	0.649	0.762
Thallium	D-Tl	0.00023	0.00021	<0.00020
Tin	D-Sn	<0.00020	<0.00020	<0.00020
Titanium	D-Ti	<0.020	<0.010	<0.010
Uranium	D-U	0.00352	0.00395	0.00563
Vanadium	D-V	<0.0020	<0.0020	<0.0020
Zinc	D-Zn	3.18	2.52	2.56

Remarks regarding the analyses appear at the beginning of this report.
 Results are expressed as milligrams per litre except where noted.
 < = Less than the detection limit indicated.
 The Chlorophyll a expressed as mg/m3 based on 60 mls field filtered volume.

File No. X7752

RESULTS OF ANALYSIS - Filter



Sample ID	VP-1 Vangorda Pit @1m	VP_3m Vangorda @3m	FP-1m Faro Pit @1m	FP-3m Faro Pit @3m	FP-5m Faro Pit @ 5m
Sample Date	06-06-21	06-06-21	06-06-21	06-06-21	06-06-21
Sample Time	11:50	12:10	16:00	16:15	16:26
ALS ID	1a	2a	7a	8a	9a

Organic Parameters

Chlorophyll a	<0.010	0.012	<0.010	<0.010	<0.010
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Remarks regarding the analyses appear at the beginning of this report.
Results are expressed as milligrams per litre except where noted.
< = Less than the detection limit indicated.
The Chlorophyll a expressed as mg/m3 based on 60 mls field filtered volume.

File No. X7752

Appendix 1 - QUALITY CONTROL - Replicates



Water	VP 30m Vangorda @ 30m 06-06-21 12:45	VP 30m Vangorda @ 30m QC # 507726
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Physical Tests

Conductivity	(uS/cm)	2150	2140
pH		5.57	5.59
Total Suspended Solids		37.3	37.3

Dissolved Anions

Alkalinity-Total		CaCO3	37.0	40.0
Sulphate	SO4		1440	1470

Nutrients

Ammonia Nitrogen	N	0.532	0.520
Nitrite/Nitrate Nitrogen	N	<0.025	<0.025
Dissolved ortho-Phosphate	P	0.0014	<0.0010
Total Phosphate	P	0.0138	0.0134

Remarks regarding the analyses appear at the beginning of this report.
Results are expressed as milligrams per litre except where noted.
< = Less than the detection limit indicated.
The Chlorophyll a expressed as mg/m3 based on 60 mls field filtered volume.

File No. X7752

Appendix 1 - QUALITY CONTROL - Replicates



Water	VP 30m Vangorda @ 30m 06-06-21 12:45	VP 30m Vangorda @ 30m QC # 507726
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Total Metals

Aluminum	T-Al	<0.40	<0.40
Antimony	T-Sb	<0.0020	<0.0020
Arsenic	T-As	<0.0020	<0.0020
Barium	T-Ba	0.0257	0.0272
Beryllium	T-Be	<0.010	<0.010
Bismuth	T-Bi	<0.010	<0.010
Boron	T-B	<0.20	<0.20
Cadmium	T-Cd	0.124	0.118
Calcium	T-Ca	246	244
Chromium	T-Cr	<0.010	<0.010
Cobalt	T-Co	0.777	0.746
Copper	T-Cu	0.146	0.138
Iron	T-Fe	34.2	34.5
Lead	T-Pb	0.0270	0.0264
Lithium	T-Li	<0.10	<0.10
Magnesium	T-Mg	104	104
Manganese	T-Mn	52.3	49.7
Molybdenum	T-Mo	<0.0010	<0.0010
Nickel	T-Ni	0.696	0.676
Phosphorus	T-P	<0.30	<0.30
Potassium	T-K	2.8	2.8
Selenium	T-Se	<0.020	<0.020
Silicon	T-Si	3.36	3.36
Silver	T-Ag	0.00084	0.00076
Sodium	T-Na	5.2	5.1
Strontium	T-Sr	1.51	1.44
Thallium	T-Tl	0.0023	0.0023
Tin	T-Sn	<0.0020	<0.0020
Titanium	T-Ti	<0.010	<0.010
Uranium	T-U	0.00058	0.00058
Vanadium	T-V	<0.020	<0.020
Zinc	T-Zn	170	164

Remarks regarding the analyses appear at the beginning of this report.
 Results are expressed as milligrams per litre except where noted.
 < = Less than the detection limit indicated.
 The Chlorophyll a expressed as mg/m3 based on 60 mls field filtered volume.

File No. X7752

Appendix 1 - QUALITY CONTROL - Replicates



Water	VP 30m Vangorda @ 30m 06-06-21 12:45	VP 30m Vangorda @ 30m QC # 507726
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Dissolved Metals

Aluminum	D-Al	0.116	0.112
Antimony	D-Sb	<0.0020	<0.0020
Arsenic	D-As	<0.0020	<0.0020
Barium	D-Ba	0.0247	0.0240
Beryllium	D-Be	<0.010	<0.010
Bismuth	D-Bi	<0.010	<0.010
Boron	D-B	<0.20	<0.20
Cadmium	D-Cd	0.124	0.120
Calcium	D-Ca	249	241
Chromium	D-Cr	<0.010	<0.010
Cobalt	D-Co	0.772	0.740
Copper	D-Cu	0.140	0.138
Iron	D-Fe	32.0	30.8
Lead	D-Pb	0.0159	0.0156
Lithium	D-Li	<0.10	<0.10
Magnesium	D-Mg	103	99.2
Manganese	D-Mn	51.4	49.6
Molybdenum	D-Mo	<0.0010	<0.0010
Nickel	D-Ni	0.685	0.672
Phosphorus	D-P	<0.30	<0.30
Potassium	D-K	2.9	2.7
Selenium	D-Se	<0.020	<0.020
Silicon	D-Si	3.27	3.15
Silver	D-Ag	0.00098	0.00051
Sodium	D-Na	5.3	4.8
Strontium	D-Sr	1.47	1.45
Thallium	D-Tl	0.0024	0.0023
Tin	D-Sn	<0.0020	<0.0020
Titanium	D-Ti	<0.010	<0.010
Uranium	D-U	0.00052	0.00048
Vanadium	D-V	<0.020	<0.020
Zinc	D-Zn	167	164

Remarks regarding the analyses appear at the beginning of this report.
 Results are expressed as milligrams per litre except where noted.
 < = Less than the detection limit indicated.
 The Chlorophyll a expressed as mg/m3 based on 60 mls field filtered volume.

Appendix 2 - METHODOLOGY



Outlines of the methodologies utilized for the analysis of the samples submitted are as follows

Conductivity in Water

This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.

Recommended Holding Time:

Sample: 28 days

Reference: APHA

Laboratory Location: ALS Environmental, Vancouver

pH in Water

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode.

Recommended Holding Time:

Sample: 2 hours

Reference: APHA

Laboratory Location: ALS Environmental, Vancouver

Solids in Water

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total dissolved solids (TDS) and total suspended solids (TSS) are determined by filtering a sample through a glass fibre filter, TDS is determined by evaporating the filtrate to dryness at 180 degrees celsius, TSS is determined by drying the filter at 104 degrees celsius. Total solids are determined by evaporating a sample to dryness at 104 degrees celsius. Fixed and volatile solids are determined by igniting a dried sample residue at 550 degrees celsius.

Recommended Holding Time:

Sample: 7 days

Reference: APHA

Laboratory Location: ALS Environmental, Vancouver

Alkalinity in Water by Colourimetry

This analysis is carried out using procedures adapted from EPA Method 310.2 "Alkalinity". Total Alkalinity is determined using the methyl orange colourimetric method.

Recommended Holding Time:

File No. X7752

Appendix 2 - METHODOLOGY - Continued



Sample: 14 days
Reference: APHA

Laboratory Location: ALS Environmental, Vancouver

Dissolved Anions in Water by Ion Chromatography

This analysis is carried out using procedures adapted from APHA Method 4110 "Determination of Anions by Ion Chromatography" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography". Anions are determined by filtering the sample through a 0.45 micron membrane filter and injecting the filtrate onto a Dionex IonPac AG17 anion exchange column with a hydroxide eluent stream. Anions routinely determined by this method include: bromide, chloride, fluoride, nitrate, nitrite and sulphate.

Recommended Holding Time:
Sample: 28 days (bromide, chloride, fluoride, sulphate)
Sample: 2 days (nitrate, nitrite)
Reference: APHA and EPA

Laboratory Location: ALS Environmental, Vancouver

Ammonia in Water by Colourimetry

This analysis is carried out, on unpreserved samples, using procedures adapted from APHA Method 4500-NH3 "Nitrogen (Ammonia)". Ammonia is determined using the phenate colourimetric method.

Recommended Holding Time:
Sample: 72 hours
Reference: BC WLAP

Laboratory Location: ALS Environmental, Vancouver

Phosphate in Water

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". All forms of phosphate are determined by the ascorbic acid colourimetric method. Dissolved ortho-phosphate (dissolved reactive phosphorous) is determined by direct measurement. Total phosphate (total phosphorous) is determined after persulphate digestion of a sample. Total dissolved phosphate (total dissolved phosphorous) is determined by filtering a sample through a 0.45 micron membrane filter followed by persulfate digestion of the filtrate.

Recommended Holding Time:
Sample: 2 days
Reference: EPA

Appendix 2 - METHODOLOGY - Continued



Laboratory Location: ALS Environmental, Vancouver

Metals in Water

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" 20th Edition 1998 published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using either hotplate or microwave oven, or filtration (EPA Method 3005A). Instrumental analysis is by atomic absorption/emission spectrophotometry (EPA Method 7000 series), inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B), and/or inductively coupled plasma - mass spectrometry (EPA Method 6020).

Recommended Holding Time:

Sample: 6 months

Reference: EPA

Laboratory Location: ALS Environmental, Vancouver

Ammonia in Water by Selective Ion Electrode

This analysis is carried out, on sulphuric acid preserved samples, using procedures adapted from APHA Method 4500-NH₃ "Nitrogen (Ammonia)". Ammonia is determined using an ammonia selective electrode.

Recommended Holding Time:

Sample: 28 days

Reference: APHA

Laboratory Location: ALS Environmental, Vancouver

Chlorophyll and Pheopigments by Fluorometry

This analysis is carried out using procedures adapted from APHA Method 10200 H. "Chlorophyll" and USEPA Method 445. The sample is filtered using either a glass fiber filter or a 0.45 micron Membrane filter. The pigments are extracted from the filter with 90% aqueous acetone. For chlorophyll a analysis the extract is read using a fluorometer. For pheopigments the extract is first acidified then read. This method not subject to interferences from chlorophyll b.

Recommended Holding Time:

Sample: 1-2 days before filtering

Filter: 28 days

Reference: APHA

File No. X7752

Appendix 2 - METHODOLOGY - Continued



Laboratory Location: ALS Environmental, Vancouver

Results contained within this certificate relate only to the samples as submitted.

This Certificate Of Analysis shall only be reproduced in full, except with the written approval of ALS Environmental.

End of Report



CERTIFICATE OF ANALYSIS

Date: August 4, 2006

ALS File No. X8723

Report On: Grum Pit Bio Treatment
Water Analysis

Report To: **SRK Consulting (Canada) Inc.**
Suite 800
1066 West Hastings St.
Vancouver, BC
V6E 3X2

Attention: **Mr. Cam Scott**

Received: July 17, 2006

ALS ENVIRONMENTAL

per:

Andre Langlais, M.Sc. - Senior Account Manager
Can Dang, B.Sc. - Senior Account Manager

File No. X8723

REMARKS



Some of the metals detection limits were increased due to high levels of metals in these samples.

For some of the submitted water samples, the measured concentration of specific dissolved parameters is greater than the corresponding total parameters concentration. The explanation for these findings is one or a combination of the following:

- laboratory method variability;
- field sampling method variability;
- bias introduced during general handling, storage, transportation and/or analysis of the sample;
- field sample grab bias - where separate grab samples are processed to produce total and dissolved samples;
- field sample split bias - where total and dissolved parameters samples are produced from the same grab sample.

For further clarification on any of the above information, please contact your ALS representative.

File No. X8723

RESULTS OF ANALYSIS - Water



Sample ID	GL_1 (Grum @ 1m)	GL_3 (Grum @ 3m)	GL_5 (Grum @ 5m)	GL_15 (Grum @ 15m)	GL_30 (Grum @ 30m)
Sample Date	06-07-12	06-07-12	06-07-12	06-07-12	06-07-12
Sample Time	13:15	13:45	14:00	14:30	14:45
ALS ID	1	2	3	4	5

Physical Tests

Conductivity	(uS/cm)	820	920	1030	1030	1040
pH		8.00	8.06	7.91	7.90	7.91
Total Suspended Solids		6.4	8.4	3.8	<3.0	<3.0

Dissolved Anions

Alkalinity-Total		CaCO3	107	151	176	169	176
Sulphate	SO4		369	391	434	435	435

Nutrients

Ammonia Nitrogen	N	0.560	0.337	0.0890	0.0200	0.0213
Nitrite/Nitrate Nitrogen	N	0.179	0.855	1.33	1.44	1.44
Dissolved ortho-Phosphate	P	0.0095	<0.0010	<0.0010	<0.0010	<0.0010
Total Phosphate	P	0.0461	0.0252	0.0164	0.0034	0.0032

Remarks regarding the analyses appear at the beginning of this report.
Results are expressed as milligrams per litre except where noted.
< = Less than the detection limit indicated.

File No. X8723

RESULTS OF ANALYSIS - Water

Sample ID	GL_1 (Grum@ 1m)	GL_3 (Grum@ 3m)	GL_5 (Grum@ 5m)	GL_15 (Grum@ 15m)	GL_30 (Grum@ 30m)
Sample Date	06-07-12	06-07-12	06-07-12	06-07-12	06-07-12
Sample Time	13:15	13:45	14:00	14:30	14:45
ALS ID	1	2	3	4	5

Total Metals

Aluminum	T-Al	0.0426	0.0314	0.0179	0.0232	0.0214
Antimony	T-Sb	0.00439	0.00471	0.00605	0.00588	0.00599
Arsenic	T-As	0.00086	0.00059	0.00080	0.00107	0.00110
Barium	T-Ba	0.0277	0.0408	0.0497	0.0470	0.0472
Beryllium	T-Be	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Bismuth	T-Bi	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Boron	T-B	<0.020	<0.020	<0.020	<0.020	<0.020
Cadmium	T-Cd	0.00090	0.00300	0.00494	0.00432	0.00448
Calcium	T-Ca	88.5	110	123	121	121
Chromium	T-Cr	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cobalt	T-Co	0.00525	0.00647	0.00814	0.00771	0.00783
Copper	T-Cu	0.00109	0.00086	0.00093	0.00102	0.00126
Iron	T-Fe	0.063	0.048	0.047	0.071	0.065
Lead	T-Pb	0.00075	0.00089	0.00103	0.00114	0.00105
Lithium	T-Li	0.021	0.021	0.025	0.026	0.025
Magnesium	T-Mg	61.9	67.0	72.5	71.1	70.9
Manganese	T-Mn	0.0879	0.125	0.181	0.170	0.173
Molybdenum	T-Mo	0.00256	0.00262	0.00286	0.00284	0.00285
Nickel	T-Ni	0.123	0.151	0.205	0.194	0.197
Phosphorus	T-P	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium	T-K	2.2	2.3	2.7	2.6	2.6
Selenium	T-Se	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Silicon	T-Si	2.16	2.52	3.15	2.93	2.94
Silver	T-Ag	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
Sodium	T-Na	8.8	9.3	10.5	10.0	9.8
Strontium	T-Sr	0.590	0.749	0.882	0.847	0.858
Thallium	T-Tl	0.00084	0.00095	0.00107	0.00099	0.00100
Tin	T-Sn	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Titanium	T-Ti	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	T-U	0.00317	0.00271	0.00667	0.0105	0.0104
Vanadium	T-V	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Zinc	T-Zn	0.273	2.77	10.5	8.95	9.16

Remarks regarding the analyses appear at the beginning of this report.
 Results are expressed as milligrams per litre except where noted.
 < = Less than the detection limit indicated.

File No. X8723

RESULTS OF ANALYSIS - Water

Sample ID	GL_1 (Grum@ 1m)	GL_3 (Grum@ 3m)	GL_5 (Grum@ 5m)	GL_15 (Grum@ 15m)	GL_30 (Grum@ 30m)
Sample Date	06-07-12	06-07-12	06-07-12	06-07-12	06-07-12
Sample Time	13:15	13:45	14:00	14:30	14:45
ALS ID	1	2	3	4	5

Dissolved Metals

Aluminum	D-Al	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Antimony	D-Sb	0.00440	0.00449	0.00599	0.00581	0.00583
Arsenic	D-As	0.00054	0.00039	0.00059	0.00068	0.00073
Barium	D-Ba	0.0261	0.0376	0.0479	0.0452	0.0460
Beryllium	D-Be	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Bismuth	D-Bi	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Boron	D-B	<0.020	<0.020	<0.020	<0.020	<0.020
Cadmium	D-Cd	0.00013	0.00158	0.00445	0.00426	0.00424
Calcium	D-Ca	88.6	104	121	122	122
Chromium	D-Cr	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cobalt	D-Co	0.00471	0.00601	0.00805	0.00756	0.00776
Copper	D-Cu	0.00031	0.00034	0.00068	0.00069	0.00074
Iron	D-Fe	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	D-Pb	<0.00010	0.00035	0.00034	0.00025	0.00028
Lithium	D-Li	0.020	0.020	0.024	0.024	0.024
Magnesium	D-Mg	62.2	64.0	71.4	71.3	70.8
Manganese	D-Mn	0.0743	0.113	0.177	0.167	0.171
Molybdenum	D-Mo	0.00271	0.00260	0.00293	0.00274	0.00292
Nickel	D-Ni	0.111	0.139	0.201	0.192	0.197
Phosphorus	D-P	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium	D-K	2.2	2.2	2.6	2.7	2.7
Selenium	D-Se	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Silicon	D-Si	2.09	2.28	3.07	2.91	2.90
Silver	D-Ag	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
Sodium	D-Na	8.9	8.8	10.2	10.3	10.1
Strontium	D-Sr	0.579	0.661	0.871	0.832	0.854
Thallium	D-Tl	0.00081	0.00083	0.00103	0.00097	0.00100
Tin	D-Sn	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Titanium	D-Ti	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	D-U	0.00305	0.00273	0.00653	0.0101	0.0103
Vanadium	D-V	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Zinc	D-Zn	0.0591	1.75	10.3	8.87	9.17

Remarks regarding the analyses appear at the beginning of this report.
 Results are expressed as milligrams per litre except where noted.
 < = Less than the detection limit indicated.

File No. X8723

RESULTS OF ANALYSIS - Water



Sample ID	GL_40 (Grum @ 40m)	FIELD BLANK
Sample Date	06-07-12	06-07-12
Sample Time	15:10	16:00
ALS ID	6	7

Physical Tests

Conductivity	(uS/cm)	1030	<2.0
pH		7.89	5.62
Total Suspended Solids		3.8	<3.0

Dissolved Anions

Alkalinity-Total		CaCO3	179	<2.0
Sulphate	SO4		436	<0.50

Nutrients

Ammonia Nitrogen	N	0.0193	<0.0050
Nitrite/Nitrate Nitrogen	N	1.43	<0.0050
Dissolved ortho-Phosphate	P	<0.0010	<0.0010
Total Phosphate	P	0.0033	<0.0020

Remarks regarding the analyses appear at the beginning of this report.
Results are expressed as milligrams per litre except where noted.
< = Less than the detection limit indicated.

File No. X8723

RESULTS OF ANALYSIS - Water



Sample ID	GL_40 (Grum@ 40m)	FIELD BLANK
Sample Date	06-07-12	06-07-12
Sample Time	15:10	16:00
ALS ID	6	7

Total Metals

Aluminum	T-Al	0.0403	<0.0010
Antimony	T-Sb	0.00606	<0.00010
Arsenic	T-As	0.00163	<0.00010
Barium	T-Ba	0.0476	<0.000050
Beryllium	T-Be	<0.0010	<0.00050
Bismuth	T-Bi	<0.0010	<0.00050
Boron	T-B	<0.020	<0.010
Cadmium	T-Cd	0.00457	<0.000050
Calcium	T-Ca	115	<0.050
Chromium	T-Cr	<0.0010	<0.00050
Cobalt	T-Co	0.00823	<0.00010
Copper	T-Cu	0.00118	<0.00010
Iron	T-Fe	0.128	<0.030
Lead	T-Pb	0.00109	<0.000050
Lithium	T-Li	0.025	<0.0050
Magnesium	T-Mg	67.2	<0.10
Manganese	T-Mn	0.186	<0.000050
Molybdenum	T-Mo	0.00280	<0.000050
Nickel	T-Ni	0.202	<0.00050
Phosphorus	T-P	<0.30	<0.30
Potassium	T-K	2.5	<2.0
Selenium	T-Se	<0.0020	<0.0010
Silicon	T-Si	2.81	<0.050
Silver	T-Ag	<0.000020	<0.000010
Sodium	T-Na	9.5	<2.0
Strontium	T-Sr	0.870	<0.00010
Thallium	T-Tl	0.00105	<0.00010
Tin	T-Sn	<0.00020	<0.00010
Titanium	T-Ti	<0.010	<0.010
Uranium	T-U	0.0107	<0.000010
Vanadium	T-V	<0.0020	<0.0010
Zinc	T-Zn	9.27	<0.0010

Remarks regarding the analyses appear at the beginning of this report.
Results are expressed as milligrams per litre except where noted.
< = Less than the detection limit indicated.

File No. X8723

RESULTS OF ANALYSIS - Water



Sample ID	GL_40 (Grum@ 40m)	FIELD BLANK
Sample Date	06-07-12	06-07-12
Sample Time	15:10	16:00
ALS ID	6	7

Dissolved Metals

Aluminum	D-Al	<0.0020	<0.0010
Antimony	D-Sb	0.00584	<0.00010
Arsenic	D-As	0.00091	<0.00010
Barium	D-Ba	0.0453	0.000352
Beryllium	D-Be	<0.0010	<0.00050
Bismuth	D-Bi	<0.0010	<0.00050
Boron	D-B	<0.020	<0.010
Cadmium	D-Cd	0.00428	<0.000050
Calcium	D-Ca	116	<0.050
Chromium	D-Cr	<0.0010	<0.00050
Cobalt	D-Co	0.00809	<0.00010
Copper	D-Cu	0.00072	0.0144
Iron	D-Fe	<0.030	<0.030
Lead	D-Pb	<0.00010	<0.000050
Lithium	D-Li	0.024	<0.0050
Magnesium	D-Mg	68.1	<0.10
Manganese	D-Mn	0.181	<0.000050
Molybdenum	D-Mo	0.00284	<0.000050
Nickel	D-Ni	0.196	<0.00050
Phosphorus	D-P	<0.30	<0.30
Potassium	D-K	2.5	<2.0
Selenium	D-Se	<0.0020	<0.0010
Silicon	D-Si	2.79	<0.050
Silver	D-Ag	<0.000020	<0.000010
Sodium	D-Na	9.9	<2.0
Strontium	D-Sr	0.845	<0.00010
Thallium	D-Tl	0.00101	<0.00010
Tin	D-Sn	<0.00020	0.00058
Titanium	D-Ti	<0.010	<0.010
Uranium	D-U	0.0101	<0.000010
Vanadium	D-V	<0.0020	<0.0010
Zinc	D-Zn	8.96	0.0031

Remarks regarding the analyses appear at the beginning of this report.
Results are expressed as milligrams per litre except where noted.
< = Less than the detection limit indicated.

File No. X8723

RESULTS OF ANALYSIS - Filter



Sample ID	GL_1 FILTER	GL_3 FILTER	GL_5 FILTER
Sample Date	06-07-12	06-07-12	06-07-12
Sample Time	13:15	13:45	14:00
ALS ID	8	9	10
<u>Organic Parameters</u>			
Chlorophyll a ¹	31.0	26.6	6.60

Remarks regarding the analyses appear at the beginning of this report.

Results are expressed as milligrams per litre except where noted.

< = Less than the detection limit indicated.

¹The Chlorophyll a expressed as mg/m³ based on 60 mls field filtered volume.

File No. X8723

Appendix 1 - QUALITY CONTROL - Replicates



Water	GL_5 (Grum@ 5m) 06-07-12 14:00	GL_5 (Grum@ 5m) QC # 511807
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Physical Tests

Conductivity	(uS/cm)	1030	1030
Total Suspended Solids		3.8	3.1

Dissolved Anions

Alkalinity-Total		CaCO3	176	177
Sulphate	SO4		434	432

Nutrients

Ammonia Nitrogen	N	0.0890	0.0780
Nitrite/Nitrate Nitrogen	N	1.33	1.33
Dissolved ortho-Phosphate	P	<0.0010	<0.0010
Total Phosphate	P	0.0164	0.0076

Remarks regarding the analyses appear at the beginning of this report.
Results are expressed as milligrams per litre except where noted.
< = Less than the detection limit indicated.

File No. X8723

Appendix 1 - QUALITY CONTROL - Replicates



Water		GL_5 (Grum@ 5m) 06-07-12 14:00	GL_5 (Grum@ 5m) QC # 511807
Total Metals			
Aluminum	T-Al	0.0179	0.0185
Antimony	T-Sb	0.00605	0.00609
Arsenic	T-As	0.00080	0.00081
Barium	T-Ba	0.0497	0.0502
Beryllium	T-Be	<0.0010	<0.0010
Bismuth	T-Bi	<0.0010	<0.0010
Boron	T-B	<0.020	<0.020
Cadmium	T-Cd	0.00494	0.00484
Calcium	T-Ca	123	122
Chromium	T-Cr	<0.0010	<0.0010
Cobalt	T-Co	0.00814	0.00822
Copper	T-Cu	0.00093	0.00096
Iron	T-Fe	0.047	0.046
Lead	T-Pb	0.00103	0.00101
Lithium	T-Li	0.025	0.024
Magnesium	T-Mg	72.5	71.9
Manganese	T-Mn	0.181	0.180
Molybdenum	T-Mo	0.00286	0.00294
Nickel	T-Ni	0.205	0.204
Phosphorus	T-P	<0.30	<0.30
Potassium	T-K	2.7	2.6
Selenium	T-Se	<0.0020	<0.0020
Silicon	T-Si	3.15	3.13
Silver	T-Ag	<0.000020	<0.000020
Sodium	T-Na	10.5	10.2
Strontium	T-Sr	0.882	0.888
Thallium	T-Tl	0.00107	0.00104
Tin	T-Sn	<0.00020	<0.00020
Titanium	T-Ti	<0.010	<0.010
Uranium	T-U	0.00667	0.00649
Vanadium	T-V	<0.0020	<0.0020
Zinc	T-Zn	10.5	10.6

Remarks regarding the analyses appear at the beginning of this report.
Results are expressed as milligrams per litre except where noted.
< = Less than the detection limit indicated.

File No. X8723

Appendix 1 - QUALITY CONTROL - Replicates



Water		GL_5 (Grum@ 5m) 06-07-12 14:00	GL_5 (Grum@ 5m) QC # 511807
Dissolved Metals			
Aluminum	D-Al	<0.0020	<0.0020
Antimony	D-Sb	0.00599	0.00590
Arsenic	D-As	0.00059	0.00058
Barium	D-Ba	0.0479	0.0475
Beryllium	D-Be	<0.0010	<0.0010
Bismuth	D-Bi	<0.0010	<0.0010
Boron	D-B	<0.020	<0.020
Cadmium	D-Cd	0.00445	0.00438
Calcium	D-Ca	121	125
Chromium	D-Cr	<0.0010	<0.0010
Cobalt	D-Co	0.00805	0.00784
Copper	D-Cu	0.00068	0.00061
Iron	D-Fe	<0.030	<0.030
Lead	D-Pb	0.00034	0.00033
Lithium	D-Li	0.024	0.024
Magnesium	D-Mg	71.4	73.3
Manganese	D-Mn	0.177	0.174
Molybdenum	D-Mo	0.00293	0.00289
Nickel	D-Ni	0.201	0.199
Phosphorus	D-P	<0.30	<0.30
Potassium	D-K	2.6	2.7
Selenium	D-Se	<0.0020	<0.0020
Silicon	D-Si	3.07	3.18
Silver	D-Ag	<0.000020	<0.000020
Sodium	D-Na	10.2	10.4
Strontium	D-Sr	0.871	0.876
Thallium	D-Tl	0.00103	0.00103
Tin	D-Sn	<0.00020	<0.00020
Titanium	D-Ti	<0.010	<0.010
Uranium	D-U	0.00653	0.00636
Vanadium	D-V	<0.0020	<0.0020
Zinc	D-Zn	10.3	10.3

Remarks regarding the analyses appear at the beginning of this report.
Results are expressed as milligrams per litre except where noted.
< = Less than the detection limit indicated.

File No. X8723

Appendix 2 - METHODOLOGY



Outlines of the methodologies utilized for the analysis of the samples submitted are as follows

Conductivity in Water

This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.

Recommended Holding Time:

Sample: 28 days

Reference: APHA

Laboratory Location: ALS Environmental, Vancouver

pH in Water

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode.

Recommended Holding Time:

Sample: 2 hours

Reference: APHA

Laboratory Location: ALS Environmental, Vancouver

Solids in Water

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total dissolved solids (TDS) and total suspended solids (TSS) are determined by filtering a sample through a glass fibre filter, TDS is determined by evaporating the filtrate to dryness at 180 degrees celsius, TSS is determined by drying the filter at 104 degrees celsius. Total solids are determined by evaporating a sample to dryness at 104 degrees celsius. Fixed and volatile solids are determined by igniting a dried sample residue at 550 degrees celsius.

Recommended Holding Time:

Sample: 7 days

Reference: APHA

Laboratory Location: ALS Environmental, Vancouver

Alkalinity in Water by Colourimetry

This analysis is carried out using procedures adapted from EPA Method 310.2 "Alkalinity". Total Alkalinity is determined using the methyl orange colourimetric method.

Recommended Holding Time:

File No. X8723

Appendix 2 - METHODOLOGY - Continued



Sample: 14 days
Reference: APHA

Laboratory Location: ALS Environmental, Vancouver

Dissolved Anions in Water by Ion Chromatography

This analysis is carried out using procedures adapted from APHA Method 4110 "Determination of Anions by Ion Chromatography" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography". Anions are determined by filtering the sample through a 0.45 micron membrane filter and injecting the filtrate onto a Dionex IonPac AG17 anion exchange column with a hydroxide eluent stream. Anions routinely determined by this method include: bromide, chloride, fluoride, nitrate, nitrite and sulphate.

Recommended Holding Time:
Sample: 28 days (bromide, chloride, fluoride, sulphate)
Sample: 2 days (nitrate, nitrite)
Reference: APHA and EPA

Laboratory Location: ALS Environmental, Vancouver

Ammonia in Water by Colourimetry

This analysis is carried out, on unpreserved samples, using procedures adapted from APHA Method 4500-NH₃ "Nitrogen (Ammonia)". Ammonia is determined using the phenate colourimetric method.

Recommended Holding Time:
Sample: 72 hours
Reference: BC WLAP

Laboratory Location: ALS Environmental, Vancouver

Phosphate in Water

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". All forms of phosphate are determined by the ascorbic acid colourimetric method. Dissolved ortho-phosphate (dissolved reactive phosphorous) is determined by direct measurement. Total phosphate (total phosphorous) is determined after persulphate digestion of a sample. Total dissolved phosphate (total dissolved phosphorous) is determined by filtering a sample through a 0.45 micron membrane filter followed by persulfate digestion of the filtrate.

Recommended Holding Time:
Sample: 2 days
Reference: EPA

File No. X8723

Appendix 2 - METHODOLOGY - Continued



Laboratory Location: ALS Environmental, Vancouver

Metals in Water

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" 20th Edition 1998 published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using either hotplate or microwave oven, or filtration (EPA Method 3005A). Instrumental analysis is by atomic absorption/emission spectrophotometry (EPA Method 7000 series), inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B), and/or inductively coupled plasma - mass spectrometry (EPA Method 6020).

Recommended Holding Time:

Sample: 6 months

Reference: EPA

Laboratory Location: ALS Environmental, Vancouver

Chlorophyll and Pheopigments by Fluorometry

This analysis is carried out using procedures adapted from APHA Method 10200 H. "Chlorophyll" and USEPA Method 445. The sample is filtered using either a glass fiber filter or a 0.45 micron Membrane filter. The pigments are extracted from the filter with 90% aqueous acetone. For chlorophyll a analysis the extract is read using a fluorometer. For pheopigments the extract is first acidified then read. This method not subject to interferences from chlorophyll b.

Recommended Holding Time:

Sample: 1-2 days before filtering

Filter: 28 days

Reference: APHA

Laboratory Location: ALS Environmental, Vancouver

Results contained within this certificate relate only to the samples as submitted.

This Certificate Of Analysis shall only be reproduced in full, except with the written approval of ALS Environmental.

End of Report



CERTIFICATE OF ANALYSIS

Date: September 11, 2006

ALS File No. Z1057

Report On: D&T 2006/7 Task 22
Water Analysis

Report To: **SRK Consulting (Canada) Inc.**
Suite 800
1066 West Hastings St.
Vancouver, BC
V6E 3X2

Attention: **Mr. Cam Scott**

Received: August 11, 2006

ALS ENVIRONMENTAL

per:

Andre Langlais, M.Sc. - Senior Account Manager
Can Dang, B.Sc. - Senior Account Manager

File No. Z1057

REMARKS



Some of the metals detection limits were increased due to high levels of metals in these samples.

For some of the submitted water samples, the measured concentration of specific dissolved parameters is greater than the corresponding total parameters concentration. The explanation for these findings is one or a combination of the following:

- laboratory method variability;
- field sampling method variability;
- bias introduced during general handling, storage, transportation and/or analysis of the sample;
- field sample grab bias - where separate grab samples are processed to produce total and dissolved samples;
- field sample split bias - where total and dissolved parameters samples are produced from the same grab sample.

For further clarification on any of the above information, please contact your ALS representative.

File No. Z1057

RESULTS OF ANALYSIS - Water



Sample ID	GL_1 (GRUM@ 1m)	GL_3 (GRUM@ 3m)	GL_5 (GRUM@ 5m)	GL_15 (GRUM@ 15m)	GL_30 (GRUM@ 30m)
Sample Date	06-08-09	06-08-09	06-08-09	06-08-09	06-08-09
Sample Time	10:00	10:20	10:40	10:55	11:10
ALS ID	1	2	3	4	5

Physical Tests

Conductivity	(uS/cm)	892	938	1070	1060	1070
pH		7.91	8.05	7.51	7.54	7.61
Total Suspended Solids		3.7	6.3	<3.0	<3.0	<3.0

Dissolved Anions

Alkalinity-Total		CaCO3	128	140	176	171	174
Sulphate	SO4		375	389	433	434	434

Nutrients

Ammonia Nitrogen	N	0.057	0.037	0.028	0.050	0.055
Nitrate Nitrogen	N	0.676	0.762	1.24	1.32	1.28
Nitrite Nitrogen	N	0.0052	0.0044	0.0022	0.0026	0.0048
Nitrite/Nitrate Nitrogen	N	0.681	0.767	1.24	1.32	1.28
Dissolved ortho-Phosphate	P	0.0017	<0.0010	<0.0010	0.0013	0.0013
Total Phosphate	P	0.0623	0.0490	0.0172	0.0076	0.0089

Remarks regarding the analyses appear at the beginning of this report.
Results are expressed as milligrams per litre except where noted.
< = Less than the detection limit indicated.

File No. Z1057

RESULTS OF ANALYSIS - Water

Sample ID	GL_1 (GRUM@ 1m)	GL_3 (GRUM@ 3m)	GL_5 (GRUM@ 5m)	GL_15 (GRUM@ 15m)	GL_30 (GRUM@ 30m)
Sample Date	06-08-09	06-08-09	06-08-09	06-08-09	06-08-09
Sample Time	10:00	10:20	10:40	10:55	11:10
ALS ID	1	2	3	4	5

Total Metals

Aluminum	T-Al	0.0052	0.0042	<0.0020	0.0070	0.0182
Antimony	T-Sb	0.00521	0.00551	0.00683	0.00681	0.00655
Arsenic	T-As	0.00077	0.00069	0.00069	0.00099	0.00157
Barium	T-Ba	0.0366	0.0401	0.0506	0.0480	0.0471
Beryllium	T-Be	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Bismuth	T-Bi	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Boron	T-B	<0.020	<0.020	<0.020	<0.020	<0.020
Cadmium	T-Cd	0.00055	0.00098	0.00224	0.00464	0.00436
Calcium	T-Ca	102	105	126	124	127
Chromium	T-Cr	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cobalt	T-Co	0.00559	0.00625	0.00878	0.00864	0.00857
Copper	T-Cu	0.00086	0.00065	0.00056	0.00086	0.00098
Iron	T-Fe	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	T-Pb	0.00066	0.00061	0.00059	0.00042	0.00082
Lithium	T-Li	0.023	0.026	0.027	0.028	0.028
Magnesium	T-Mg	65.2	65.3	72.5	72.1	73.6
Manganese	T-Mn	0.0692	0.0950	0.199	0.182	0.224
Molybdenum	T-Mo	0.00307	0.00312	0.00301	0.00310	0.00299
Nickel	T-Ni	0.123	0.141	0.215	0.210	0.195
Phosphorus	T-P	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium	T-K	2.5	2.5	2.8	2.8	2.9
Selenium	T-Se	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Silicon	T-Si	2.48	2.52	3.05	3.02	3.11
Silver	T-Ag	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
Sodium	T-Na	9.7	10.0	10.9	11.2	11.2
Strontium	T-Sr	0.659	0.700	0.850	0.917	0.872
Thallium	T-Tl	0.00095	0.00102	0.00113	0.00109	0.00110
Tin	T-Sn	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Titanium	T-Ti	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	T-U	0.00363	0.00354	0.00808	0.0110	0.0106
Vanadium	T-V	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Zinc	T-Zn	0.738	1.85	9.97	9.30	8.75

Remarks regarding the analyses appear at the beginning of this report.
 Results are expressed as milligrams per litre except where noted.
 < = Less than the detection limit indicated.

RESULTS OF ANALYSIS - Water

Sample ID	GL_1 (GRUM@ 1m)	GL_3 (GRUM@ 3m)	GL_5 (GRUM@ 5m)	GL_15 (GRUM@ 15m)	GL_30 (GRUM@ 30m)
Sample Date	06-08-09	06-08-09	06-08-09	06-08-09	06-08-09
Sample Time	10:00	10:20	10:40	10:55	11:10
ALS ID	1	2	3	4	5

Dissolved Metals

Aluminum	D-Al	0.0025	0.0024	<0.0020	<0.0020	<0.0020
Antimony	D-Sb	0.00501	0.00520	0.00649	0.00637	0.00632
Arsenic	D-As	0.00070	0.00056	0.00051	0.00076	0.00072
Barium	D-Ba	0.0358	0.0382	0.0480	0.0452	0.0446
Beryllium	D-Be	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Bismuth	D-Bi	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Boron	D-B	<0.020	<0.020	<0.020	<0.020	<0.020
Cadmium	D-Cd	0.00028	0.00067	0.00176	0.00433	0.00431
Calcium	D-Ca	97.0	101	119	121	119
Chromium	D-Cr	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cobalt	D-Co	0.00524	0.00593	0.00835	0.00809	0.00835
Copper	D-Cu	0.00079	0.00058	0.00052	0.00075	0.00075
Iron	D-Fe	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	D-Pb	0.00037	0.00036	0.00037	0.00020	0.00011
Lithium	D-Li	0.023	0.024	0.027	0.026	0.027
Magnesium	D-Mg	61.3	62.8	68.7	69.3	68.0
Manganese	D-Mn	0.0612	0.0837	0.189	0.173	0.194
Molybdenum	D-Mo	0.00301	0.00293	0.00284	0.00299	0.00293
Nickel	D-Ni	0.116	0.131	0.203	0.197	0.193
Phosphorus	D-P	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium	D-K	2.3	2.5	2.6	2.7	2.6
Selenium	D-Se	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Silicon	D-Si	2.24	2.36	3.07	3.01	2.95
Silver	D-Ag	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
Sodium	D-Na	9.1	9.7	10.4	10.7	10.3
Strontium	D-Sr	0.638	0.668	0.797	0.863	0.857
Thallium	D-Tl	0.00095	0.00100	0.00108	0.00102	0.00106
Tin	D-Sn	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Titanium	D-Ti	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	D-U	0.00352	0.00353	0.00643	0.0104	0.0103
Vanadium	D-V	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Zinc	D-Zn	0.342	1.08	9.41	8.60	8.50

Organic Parameters

Chlorophyll a ¹	10.1	12.8	8.50	1.10	-
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Remarks regarding the analyses appear at the beginning of this report.

Results are expressed as milligrams per litre except where noted.

< = Less than the detection limit indicated.

¹Results are expressed as milligrams per cubic metre.

File No. Z1057

RESULTS OF ANALYSIS - Water



Sample ID	GL_40 (GRUM@ 40m)	VP_1 Vangorda @ 1m	VP_3 Vangorda @ 3m	VP_5 Vangorda @ 5m	VP_15M Vangorda @ 15m
Sample Date	06-08-09	06-08-09	06-08-09	06-08-09	06-08-09
Sample Time	11:30	14:05	14:20	14:35	14:45
ALS ID	6	7	8	9	10

Physical Tests

Conductivity	(uS/cm)	1070	1260	1670	2080	2180
pH		7.66	7.04	6.70	6.40	5.96
Total Suspended Solids		3.0	<3.0	10.3	22.3	33.7

Dissolved Anions

Alkalinity-Total		CaCO3	175	16.8	11.1	12.7	12.6
Sulphate	SO4		434	715	1040	1370	1450

Nutrients

Ammonia Nitrogen	N	0.058	0.174	0.271	0.505	0.502
Nitrate Nitrogen	N	1.26	0.0494	0.0322	<0.12	<0.12
Nitrite Nitrogen	N	0.0052	0.0020	0.0015	<0.025	<0.025
Nitrite/Nitrate Nitrogen	N	1.26	0.0514	0.0337	<0.12	<0.12
Dissolved ortho-Phosphate	P	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Phosphate	P	0.0080	<0.0020	<0.0020	<0.0020	<0.0020

Remarks regarding the analyses appear at the beginning of this report.
Results are expressed as milligrams per litre except where noted.
< = Less than the detection limit indicated.

File No. Z1057

RESULTS OF ANALYSIS - Water

Sample ID	GL_40 (GRUM@ 40m)	VP_1 Vangorda @ 1m	VP_3 Vangorda @ 3m	VP_5 Vangorda @ 5m	VP_15M Vangorda @ 15m
Sample Date	06-08-09	06-08-09	06-08-09	06-08-09	06-08-09
Sample Time	11:30	14:05	14:20	14:35	14:45
ALS ID	6	7	8	9	10

Total Metals

Aluminum	T-Al	0.0185	0.053	0.176	0.171	0.164
Antimony	T-Sb	0.00661	<0.0010	<0.0020	<0.0020	<0.0020
Arsenic	T-As	0.00137	<0.0010	<0.0020	<0.0020	<0.0020
Barium	T-Ba	0.0470	0.0249	0.0259	0.0226	0.0218
Beryllium	T-Be	<0.0010	<0.0050	<0.010	<0.010	<0.010
Bismuth	T-Bi	<0.0010	<0.0050	<0.010	<0.010	<0.010
Boron	T-B	<0.020	<0.10	<0.20	<0.20	<0.20
Cadmium	T-Cd	0.00437	0.106	0.120	0.111	0.120
Calcium	T-Ca	122	137	174	245	249
Chromium	T-Cr	<0.0010	<0.0050	<0.010	<0.010	<0.010
Cobalt	T-Co	0.00868	0.337	0.544	0.664	0.731
Copper	T-Cu	0.00086	0.149	0.408	0.159	0.123
Iron	T-Fe	<0.030	0.566	9.97	29.9	41.0
Lead	T-Pb	0.00056	0.0117	0.0371	0.0210	0.0373
Lithium	T-Li	0.027	<0.050	<0.10	<0.10	<0.10
Magnesium	T-Mg	70.8	58.9	76.6	103	105
Manganese	T-Mn	0.233	22.6	31.3	44.0	47.1
Molybdenum	T-Mo	0.00330	0.00264	<0.0010	0.0029	0.0023
Nickel	T-Ni	0.200	0.337	0.488	0.628	0.664
Phosphorus	T-P	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium	T-K	2.8	<2.0	2.2	3.0	2.9
Selenium	T-Se	<0.0020	<0.010	<0.020	<0.020	<0.020
Silicon	T-Si	3.01	2.74	2.90	3.38	3.34
Silver	T-Ag	<0.000020	<0.00010	0.00066	<0.00020	<0.00020
Sodium	T-Na	10.9	3.3	4.0	5.4	5.2
Strontium	T-Sr	0.872	0.877	1.06	1.40	1.45
Thallium	T-Tl	0.00111	0.0029	0.0026	0.0023	0.0023
Tin	T-Sn	<0.00020	<0.0010	<0.0020	<0.0020	<0.0020
Titanium	T-Ti	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	T-U	0.0104	0.00041	0.00168	0.00056	0.00054
Vanadium	T-V	<0.0020	<0.010	<0.020	<0.020	<0.020
Zinc	T-Zn	8.83	72.4	99.3	133	147

Remarks regarding the analyses appear at the beginning of this report.
 Results are expressed as milligrams per litre except where noted.
 < = Less than the detection limit indicated.

RESULTS OF ANALYSIS - Water

Sample ID	GL_40 (GRUM@ 40m)	VP_1 Vangorda @ 1m	VP_3 Vangorda @ 3m	VP_5 Vangorda @ 5m	VP_15M Vangorda @ 15m
Sample Date	06-08-09	06-08-09	06-08-09	06-08-09	06-08-09
Sample Time	11:30	14:05	14:20	14:35	14:45
ALS ID	6	7	8	9	10

Dissolved Metals

Aluminum	D-Al	<0.0020	<0.010	0.105	0.095	0.100
Antimony	D-Sb	0.00648	<0.0010	<0.0020	<0.0020	<0.0020
Arsenic	D-As	0.00072	<0.0010	<0.0020	<0.0020	<0.0020
Barium	D-Ba	0.0427	0.0225	0.0246	0.0224	0.0208
Beryllium	D-Be	<0.0010	<0.0050	<0.010	<0.010	<0.010
Bismuth	D-Bi	<0.0010	<0.0050	<0.010	<0.010	<0.010
Boron	D-B	<0.020	<0.10	<0.20	<0.20	<0.20
Cadmium	D-Cd	0.00421	0.106	0.119	0.109	0.117
Calcium	D-Ca	116	136	170	242	251
Chromium	D-Cr	<0.0010	<0.0050	<0.010	<0.010	<0.010
Cobalt	D-Co	0.00843	0.344	0.523	0.670	0.726
Copper	D-Cu	0.00071	0.107	0.372	0.153	0.120
Iron	D-Fe	<0.030	<0.030	7.62	28.6	42.2
Lead	D-Pb	<0.00010	0.00090	0.0130	0.0135	0.0312
Lithium	D-Li	0.027	<0.050	<0.10	<0.10	<0.10
Magnesium	D-Mg	67.4	58.7	75.6	99.4	107
Manganese	D-Mn	0.226	23.0	30.6	43.8	47.3
Molybdenum	D-Mo	0.00333	0.00206	<0.0010	0.0027	0.0022
Nickel	D-Ni	0.196	0.355	0.478	0.623	0.663
Phosphorus	D-P	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium	D-K	2.7	<2.0	2.1	2.8	3.1
Selenium	D-Se	<0.0020	<0.010	<0.020	<0.020	<0.020
Silicon	D-Si	2.92	2.67	2.83	3.21	3.37
Silver	D-Ag	<0.000020	<0.00010	0.00066	<0.00020	<0.00020
Sodium	D-Na	10.4	3.2	4.0	5.2	5.5
Strontium	D-Sr	0.873	0.886	1.03	1.42	1.42
Thallium	D-Tl	0.00110	0.0028	0.0026	0.0022	0.0022
Tin	D-Sn	<0.00020	<0.0010	<0.0020	<0.0020	<0.0020
Titanium	D-Ti	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	D-U	0.0102	0.00016	0.00121	0.00050	0.00050
Vanadium	D-V	<0.0020	<0.010	<0.020	<0.020	<0.020
Zinc	D-Zn	8.56	73.0	95.3	134	148

Organic Parameters

Chlorophyll a ¹	-	<0.010	-	-	-
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Remarks regarding the analyses appear at the beginning of this report.

Results are expressed as milligrams per litre except where noted.

< = Less than the detection limit indicated.

¹Results are expressed as milligrams per cubic metre.

File No. Z1057

RESULTS OF ANALYSIS - Water



Sample ID	VP_30M Vangorda @30m	VP_40 Vangorda @40m	FP_1 Faro Pit @1m	FP_3 Faro Pit @3m	FP_5 Faro Pit @5m
Sample Date	06-08-09	06-08-09	06-08-09	06-08-09	06-08-09
Sample Time	14:55	15:10	17:00	17:20	17:35
ALS ID	11	12	13	14	15

Physical Tests

Conductivity	(uS/cm)	2190	2210	1160	1150	1150
pH		5.81	5.67	6.84	7.26	7.37
Total Suspended Solids		32.3	33.7	<3.0	<3.0	<3.0

Dissolved Anions

Alkalinity-Total		CaCO3	11.5	13.1	74.9	102	103
Sulphate	SO4		1450	1450	549	552	552

Nutrients

Ammonia Nitrogen	N	0.522	0.519	1.34	1.39	1.37
Nitrate Nitrogen	N	<0.12	<0.12	0.335	0.338	0.340
Nitrite Nitrogen	N	<0.025	<0.025	0.0033	0.0037	0.0038
Nitrite/Nitrate Nitrogen	N	<0.12	<0.12	0.338	0.342	0.344
Dissolved ortho-Phosphate	P	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Phosphate	P	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020

Remarks regarding the analyses appear at the beginning of this report.
Results are expressed as milligrams per litre except where noted.
< = Less than the detection limit indicated.

File No. Z1057

RESULTS OF ANALYSIS - Water

Sample ID	VP_30M Vangorda @30m	VP_40 Vangorda @40m	FP_1 Faro Pit @1m	FP_3 Faro Pit @3m	FP_5 Faro Pit @5m
Sample Date	06-08-09	06-08-09	06-08-09	06-08-09	06-08-09
Sample Time	14:55	15:10	17:00	17:20	17:35
ALS ID	11	12	13	14	15

Total Metals

Aluminum	T-Al	0.165	0.176	0.0092	0.0044	0.0049
Antimony	T-Sb	<0.0020	<0.0020	0.00110	0.00101	0.00104
Arsenic	T-As	<0.0020	<0.0020	0.00023	<0.00020	<0.00020
Barium	T-Ba	0.0208	0.0213	0.0174	0.0168	0.0171
Beryllium	T-Be	<0.010	<0.010	<0.0010	<0.0010	<0.0010
Bismuth	T-Bi	<0.010	<0.010	<0.0010	<0.0010	<0.0010
Boron	T-B	<0.20	<0.20	<0.020	<0.020	<0.020
Cadmium	T-Cd	0.119	0.119	0.00556	0.00539	0.00529
Calcium	T-Ca	253	247	135	137	137
Chromium	T-Cr	<0.010	<0.010	<0.0010	<0.0010	<0.0010
Cobalt	T-Co	0.733	0.733	0.0439	0.0440	0.0445
Copper	T-Cu	0.119	0.122	0.0123	0.00611	0.00612
Iron	T-Fe	45.3	42.0	0.044	0.035	0.039
Lead	T-Pb	0.0410	0.0438	0.00099	0.00074	0.00087
Lithium	T-Li	<0.10	<0.10	0.054	0.055	0.056
Magnesium	T-Mg	108	106	62.8	63.8	64.1
Manganese	T-Mn	48.1	47.9	2.37	2.58	2.60
Molybdenum	T-Mo	0.0017	0.0021	0.00168	0.00171	0.00186
Nickel	T-Ni	0.672	0.671	0.109	0.108	0.110
Phosphorus	T-P	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium	T-K	3.1	2.9	7.2	7.3	7.2
Selenium	T-Se	<0.020	<0.020	<0.0020	<0.0020	<0.0020
Silicon	T-Si	3.40	3.30	3.08	3.12	3.14
Silver	T-Ag	<0.00020	<0.00020	<0.000020	<0.000020	<0.000020
Sodium	T-Na	5.7	5.2	20.0	20.2	20.1
Strontium	T-Sr	1.45	1.44	0.501	0.575	0.577
Thallium	T-Tl	0.0023	0.0023	0.00059	0.00057	0.00058
Tin	T-Sn	<0.0020	<0.0020	<0.00020	<0.00020	<0.00020
Titanium	T-Ti	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	T-U	0.00050	0.00053	0.00236	0.00230	0.00235
Vanadium	T-V	<0.020	<0.020	<0.0020	<0.0020	<0.0020
Zinc	T-Zn	149	142	14.5	14.4	14.5

Remarks regarding the analyses appear at the beginning of this report.
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RESULTS OF ANALYSIS - Water

Sample ID	VP_30M Vangorda @30m	VP_40 Vangorda @40m	FP_1 Faro Pit @1m	FP_3 Faro Pit @3m	FP_5 Faro Pit @5m
Sample Date	06-08-09	06-08-09	06-08-09	06-08-09	06-08-09
Sample Time	14:55	15:10	17:00	17:20	17:35
ALS ID	11	12	13	14	15

Dissolved Metals

Aluminum	D-Al	0.099	0.096	0.0024	0.0061	0.0022
Antimony	D-Sb	<0.0020	<0.0020	0.00107	0.00102	0.00102
Arsenic	D-As	<0.0020	<0.0020	0.00020	<0.00020	<0.00020
Barium	D-Ba	0.0206	0.0199	0.0169	0.0166	0.0168
Beryllium	D-Be	<0.010	<0.010	<0.0010	<0.0010	<0.0010
Bismuth	D-Bi	<0.010	<0.010	<0.0010	<0.0010	<0.0010
Boron	D-B	<0.20	<0.20	<0.020	<0.020	<0.020
Cadmium	D-Cd	0.116	0.113	0.00548	0.00531	0.00536
Calcium	D-Ca	251	247	137	132	136
Chromium	D-Cr	<0.010	<0.010	<0.0010	<0.0010	<0.0010
Cobalt	D-Co	0.724	0.707	0.0434	0.0431	0.0453
Copper	D-Cu	0.117	0.112	0.0114	0.00525	0.00540
Iron	D-Fe	42.5	41.4	<0.030	<0.030	<0.030
Lead	D-Pb	0.0361	0.0356	0.00026	0.00030	0.00032
Lithium	D-Li	<0.10	<0.10	0.053	0.055	0.055
Magnesium	D-Mg	108	103	63.3	61.6	63.0
Manganese	D-Mn	47.7	46.0	2.33	2.55	2.63
Molybdenum	D-Mo	0.0018	0.0014	0.00165	0.00176	0.00183
Nickel	D-Ni	0.663	0.650	0.107	0.109	0.110
Phosphorus	D-P	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium	D-K	3.0	2.9	7.4	7.2	7.2
Selenium	D-Se	<0.020	<0.020	<0.0020	<0.0020	<0.0020
Silicon	D-Si	3.37	3.20	3.12	3.01	3.06
Silver	D-Ag	<0.00020	<0.00020	<0.000020	<0.000020	<0.000020
Sodium	D-Na	5.3	5.0	20.3	19.9	20.1
Strontium	D-Sr	1.43	1.39	0.495	0.567	0.582
Thallium	D-Tl	0.0023	0.0021	0.00059	0.00057	0.00058
Tin	D-Sn	<0.0020	<0.0020	<0.00020	<0.00020	<0.00020
Titanium	D-Ti	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	D-U	0.00048	0.00051	0.00233	0.00226	0.00232
Vanadium	D-V	<0.020	<0.020	<0.0020	<0.0020	<0.0020
Zinc	D-Zn	139	136	14.3	14.1	14.5

Organic Parameters

Chlorophyll a ¹	-	-	<0.010	<0.010	0.035
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Remarks regarding the analyses appear at the beginning of this report.

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< = Less than the detection limit indicated.

¹Results are expressed as milligrams per cubic metre.

File No. Z1057

RESULTS OF ANALYSIS - Water



Sample ID	FP_15 Faro Pit @ 15m	FP_30 Faro Pit @ 30m	FP_60 Faro Pit @ 60m	FP_80 Faro Pit @ 80m
Sample Date	06-08-09	06-08-09	06-08-09	06-08-09
Sample Time	17:45	18:00	18:15	18:30
ALS ID	16	17	18	19

Physical Tests

Conductivity	(uS/cm)	1280	1400	1420	1490
pH		7.37	7.50	7.48	7.43
Total Suspended Solids		<3.0	25.7	25.0	31.0

Dissolved Anions

Alkalinity-Total		CaCO3	111	96.6	110	140
Sulphate	SO4		619	679	700	720

Nutrients

Ammonia Nitrogen	N	1.82	1.45	1.49	1.69
Nitrate Nitrogen	N	0.220	<0.0050	<0.0050	<0.0050
Nitrite Nitrogen	N	0.0038	<0.0010	<0.0010	<0.0010
Nitrite/Nitrate Nitrogen	N	0.223	<0.0050	<0.0050	<0.0050
Dissolved ortho-Phosphate	P	<0.0010	<0.0010	<0.0010	<0.0010
Total Phosphate	P	<0.0020	0.058	<0.0020	<0.0020

Remarks regarding the analyses appear at the beginning of this report.
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< = Less than the detection limit indicated.

File No. Z1057

RESULTS OF ANALYSIS - Water

Sample ID	FP_15 Faro Pit @ 15m	FP_30 Faro Pit @ 30m	FP_60 Faro Pit @ 60m	FP_80 Faro Pit @ 80m	FIELD BLANK
Sample Date	06-08-09	06-08-09	06-08-09	06-08-09	06-08-09
Sample Time	17:45	18:00	18:15	18:30	20:30
ALS ID	16	17	18	19	20

Total Metals

Aluminum	T-Al	0.0138	0.0186	0.0126	0.0105	<0.0010
Antimony	T-Sb	0.00112	<0.00020	<0.00020	<0.00020	<0.00010
Arsenic	T-As	<0.00020	0.00087	0.00123	0.00098	<0.00010
Barium	T-Ba	0.0174	0.0166	0.0157	0.0158	<0.000050
Beryllium	T-Be	<0.0010	<0.0010	<0.0010	<0.0010	<0.00050
Bismuth	T-Bi	<0.0010	<0.0010	<0.0010	<0.0010	<0.00050
Boron	T-B	<0.020	<0.020	<0.020	<0.020	<0.010
Cadmium	T-Cd	0.00308	0.00014	<0.00010	<0.00010	<0.000050
Calcium	T-Ca	149	192	191	207	<0.050
Chromium	T-Cr	<0.0010	<0.0010	<0.0010	<0.0010	<0.00050
Cobalt	T-Co	0.0473	0.0351	0.0332	0.0320	<0.00010
Copper	T-Cu	0.00377	0.00116	0.00081	0.00069	<0.00010
Iron	T-Fe	0.118	20.4	22.6	28.0	<0.030
Lead	T-Pb	0.00078	0.00062	0.00063	0.00072	<0.000050
Lithium	T-Li	0.065	0.073	0.074	0.079	<0.0050
Magnesium	T-Mg	64.8	68.6	67.5	72.7	<0.10
Manganese	T-Mn	3.19	4.06	4.05	4.27	<0.000050
Molybdenum	T-Mo	0.00214	0.00334	0.00290	0.00271	<0.000050
Nickel	T-Ni	0.109	0.0735	0.0687	0.0734	<0.00050
Phosphorus	T-P	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium	T-K	9.0	13.5	13.1	13.6	<2.0
Selenium	T-Se	<0.0020	<0.0020	<0.0020	<0.0020	<0.0010
Silicon	T-Si	2.84	2.65	2.62	2.92	<0.050
Silver	T-Ag	<0.000020	<0.000020	<0.000020	<0.000020	<0.000010
Sodium	T-Na	24.3	34.5	33.9	35.6	<2.0
Strontium	T-Sr	0.632	0.673	0.684	0.759	<0.00010
Thallium	T-Tl	0.00059	0.00023	0.00022	<0.00020	<0.00010
Tin	T-Sn	<0.00020	<0.00020	<0.00020	<0.00020	<0.00010
Titanium	T-Ti	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	T-U	0.00228	0.00354	0.00399	0.00535	<0.000010
Vanadium	T-V	<0.0020	<0.0020	<0.0020	<0.0020	<0.0010
Zinc	T-Zn	14.5	3.02	2.43	2.40	<0.0010

Remarks regarding the analyses appear at the beginning of this report.
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 < = Less than the detection limit indicated.

File No. Z1057

RESULTS OF ANALYSIS - Water

Sample ID	FP_15 Faro Pit @ 15m	FP_30 Faro Pit @ 30m	FP_60 Faro Pit @ 60m	FP_80 Faro Pit @ 80m	FIELD BLANK
Sample Date	06-08-09	06-08-09	06-08-09	06-08-09	06-08-09
Sample Time	17:45	18:00	18:15	18:30	20:30
ALS ID	16	17	18	19	20

Dissolved Metals

Aluminum	D-Al	0.0060	0.0063	0.0053	0.0038	<0.0010
Antimony	D-Sb	0.00105	<0.00020	<0.00020	<0.00020	<0.00010
Arsenic	D-As	<0.00020	0.00075	0.00085	0.00062	<0.00010
Barium	D-Ba	0.0164	0.0157	0.0155	0.0149	<0.000050
Beryllium	D-Be	<0.0010	<0.0010	<0.0010	<0.0010	<0.00050
Bismuth	D-Bi	<0.0010	<0.0010	<0.0010	<0.0010	<0.00050
Boron	D-B	<0.020	<0.020	<0.020	<0.020	<0.010
Cadmium	D-Cd	0.00295	<0.00010	<0.00010	<0.00010	<0.000050
Calcium	D-Ca	151	192	190	208	<0.050
Chromium	D-Cr	<0.0010	<0.0010	<0.0010	<0.0010	<0.00050
Cobalt	D-Co	0.0449	0.0337	0.0330	0.0311	<0.00010
Copper	D-Cu	0.00105	0.00060	0.00057	0.00052	<0.00010
Iron	D-Fe	<0.030	20.3	22.6	27.9	<0.030
Lead	D-Pb	0.00012	<0.00010	<0.00010	0.00012	<0.000050
Lithium	D-Li	0.061	0.069	0.074	0.077	<0.0050
Magnesium	D-Mg	65.7	68.4	67.2	72.3	<0.10
Manganese	D-Mn	3.03	3.91	4.05	4.19	<0.000050
Molybdenum	D-Mo	0.00198	0.00332	0.00288	0.00252	<0.000050
Nickel	D-Ni	0.102	0.0709	0.0675	0.0716	<0.00050
Phosphorus	D-P	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium	D-K	9.1	13.3	13.3	13.7	<2.0
Selenium	D-Se	<0.0020	<0.0020	<0.0020	<0.0020	<0.0010
Silicon	D-Si	2.88	2.64	2.60	2.89	<0.050
Silver	D-Ag	<0.000020	<0.000020	<0.000020	<0.000020	<0.000010
Sodium	D-Na	24.3	34.5	34.5	35.5	<2.0
Strontium	D-Sr	0.598	0.637	0.678	0.740	<0.00010
Thallium	D-Tl	0.00056	0.00022	0.00021	<0.00020	<0.00010
Tin	D-Sn	<0.00020	<0.00020	<0.00020	<0.00020	<0.00010
Titanium	D-Ti	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	D-U	0.00213	0.00328	0.00388	0.00524	<0.000010
Vanadium	D-V	<0.0020	<0.0020	<0.0020	<0.0020	<0.0010
Zinc	D-Zn	13.6	2.87	2.35	2.30	<0.0010

Remarks regarding the analyses appear at the beginning of this report.
 Results are expressed as milligrams per litre except where noted.
 < = Less than the detection limit indicated.

File No. Z1057

Appendix 1 - QUALITY CONTROL - Replicates



Water	VP_5 Vangorda @5m 06-08-09 14:35	VP_5 Vangorda @5m QC # 516429	FP_1 Faro Pit @1m 06-08-09 17:00	FP_1 Faro Pit @1m QC # 516430
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Physical Tests

Conductivity	(uS/cm)	2080	2080	1160	1150
pH		6.40	6.19	6.84	7.12
Total Suspended Solids		22.3	23.7	<3.0	<3.0

Dissolved Anions

Sulphate	SO4	1370	1360	549	545
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Nutrients

Ammonia Nitrogen	N	0.505	0.481	1.34	1.30
Nitrate Nitrogen	N	<0.12	<0.12	0.335	0.338
Nitrite Nitrogen	N	<0.025	<0.025	0.0033	0.0037
Nitrite/Nitrate Nitrogen	N	<0.12	<0.12	0.338	0.342
Dissolved ortho-Phosphate	P	<0.0010	<0.0010	<0.0010	<0.0010
Total Phosphate	P	<0.0020	<0.0020	<0.0020	<0.0020

Remarks regarding the analyses appear at the beginning of this report.
Results are expressed as milligrams per litre except where noted.
< = Less than the detection limit indicated.

Appendix 1 - QUALITY CONTROL - Replicates



Water		VP_5 Vangorda @5m 06-08-09 14:35	VP_5 Vangorda @5m QC # 516429	FP_1 Faro Pit @1m 06-08-09 17:00	FP_1 Faro Pit @1m QC # 516430
Total Metals					
Aluminum	T-Al	0.171	0.172	0.0092	0.0077
Antimony	T-Sb	<0.0020	<0.0020	0.00110	0.00108
Arsenic	T-As	<0.0020	<0.0020	0.00023	0.00021
Barium	T-Ba	0.0226	0.0232	0.0174	0.0173
Beryllium	T-Be	<0.010	<0.010	<0.0010	<0.0010
Bismuth	T-Bi	<0.010	<0.010	<0.0010	<0.0010
Boron	T-B	<0.20	<0.20	<0.020	<0.020
Cadmium	T-Cd	0.111	0.111	0.00556	0.00574
Calcium	T-Ca	245	243	135	136
Chromium	T-Cr	<0.010	<0.010	<0.0010	<0.0010
Cobalt	T-Co	0.664	0.688	0.0439	0.0441
Copper	T-Cu	0.159	0.161	0.0123	0.0122
Iron	T-Fe	29.9	29.6	0.044	0.042
Lead	T-Pb	0.0210	0.0213	0.00099	0.00100
Lithium	T-Li	<0.10	<0.10	0.054	0.055
Magnesium	T-Mg	103	102	62.8	63.4
Manganese	T-Mn	44.0	44.6	2.37	2.37
Molybdenum	T-Mo	0.0029	0.0029	0.00168	0.00166
Nickel	T-Ni	0.628	0.639	0.109	0.107
Phosphorus	T-P	<0.30	<0.30	<0.30	<0.30
Potassium	T-K	3.0	3.0	7.2	7.6
Selenium	T-Se	<0.020	<0.020	<0.0020	<0.0020
Silicon	T-Si	3.38	3.33	3.08	3.12
Silver	T-Ag	<0.00020	<0.00020	<0.000020	<0.000020
Sodium	T-Na	5.4	5.5	20.0	21.1
Strontium	T-Sr	1.40	1.42	0.501	0.504
Thallium	T-Tl	0.0023	0.0023	0.00059	0.00058
Tin	T-Sn	<0.0020	<0.0020	<0.00020	<0.00020
Titanium	T-Ti	<0.010	<0.010	<0.010	<0.010
Uranium	T-U	0.00056	0.00056	0.00236	0.00239
Vanadium	T-V	<0.020	<0.020	<0.0020	<0.0020
Zinc	T-Zn	133	137	14.5	14.5

Remarks regarding the analyses appear at the beginning of this report.
Results are expressed as milligrams per litre except where noted.
< = Less than the detection limit indicated.

Appendix 1 - QUALITY CONTROL - Replicates



Water		VP_5 Vangorda @5m 06-08-09 14:35	VP_5 Vangorda @5m QC # 516429	FP_1 Faro Pit @1m 06-08-09 17:00	FP_1 Faro Pit @1m QC # 516430
Dissolved Metals					
Aluminum	D-Al	0.095	0.091	0.0024	0.0029
Antimony	D-Sb	<0.0020	<0.0020	0.00107	0.00102
Arsenic	D-As	<0.0020	<0.0020	0.00020	<0.00020
Barium	D-Ba	0.0224	0.0225	0.0169	0.0167
Beryllium	D-Be	<0.010	<0.010	<0.0010	<0.0010
Bismuth	D-Bi	<0.010	<0.010	<0.0010	<0.0010
Boron	D-B	<0.20	<0.20	<0.020	<0.020
Cadmium	D-Cd	0.109	0.107	0.00548	0.00531
Calcium	D-Ca	242	237	137	140
Chromium	D-Cr	<0.010	<0.010	<0.0010	<0.0010
Cobalt	D-Co	0.670	0.657	0.0434	0.0428
Copper	D-Cu	0.153	0.152	0.0114	0.0112
Iron	D-Fe	28.6	27.8	<0.030	<0.030
Lead	D-Pb	0.0135	0.0138	0.00026	0.00027
Lithium	D-Li	<0.10	<0.10	0.053	0.052
Magnesium	D-Mg	99.4	97.3	63.3	65.0
Manganese	D-Mn	43.8	43.1	2.33	2.27
Molybdenum	D-Mo	0.0027	0.0024	0.00165	0.00160
Nickel	D-Ni	0.623	0.605	0.107	0.105
Phosphorus	D-P	<0.30	<0.30	<0.30	<0.30
Potassium	D-K	2.8	2.9	7.4	7.6
Selenium	D-Se	<0.020	<0.020	<0.0020	<0.0020
Silicon	D-Si	3.21	3.13	3.12	3.18
Silver	D-Ag	<0.00020	<0.00020	<0.000020	<0.000020
Sodium	D-Na	5.2	5.1	20.3	21.0
Strontium	D-Sr	1.42	1.39	0.495	0.488
Thallium	D-Tl	0.0022	0.0022	0.00059	0.00056
Tin	D-Sn	<0.0020	<0.0020	<0.00020	<0.00020
Titanium	D-Ti	<0.010	<0.010	<0.010	<0.010
Uranium	D-U	0.00050	0.00048	0.00233	0.00231
Vanadium	D-V	<0.020	<0.020	<0.0020	<0.0020
Zinc	D-Zn	134	133	14.3	14.1

Remarks regarding the analyses appear at the beginning of this report.
Results are expressed as milligrams per litre except where noted.
< = Less than the detection limit indicated.

Appendix 2 - METHODOLOGY



Outlines of the methodologies utilized for the analysis of the samples submitted are as follows

Conductivity in Water

This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.

Recommended Holding Time:

Sample: 28 days

Reference: APHA

Laboratory Location: ALS Environmental, Vancouver

pH in Water

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode.

Recommended Holding Time:

Sample: 2 hours

Reference: APHA

Laboratory Location: ALS Environmental, Vancouver

Solids in Water

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total dissolved solids (TDS) and total suspended solids (TSS) are determined by filtering a sample through a glass fibre filter, TDS is determined by evaporating the filtrate to dryness at 180 degrees celsius, TSS is determined by drying the filter at 104 degrees celsius. Total solids are determined by evaporating a sample to dryness at 104 degrees celsius. Fixed and volatile solids are determined by igniting a dried sample residue at 550 degrees celsius.

Recommended Holding Time:

Sample: 7 days

Reference: APHA

Laboratory Location: ALS Environmental, Vancouver

Alkalinity in Water by Colourimetry

This analysis is carried out using procedures adapted from EPA Method 310.2 "Alkalinity". Total Alkalinity is determined using the methyl orange colourimetric method.

Recommended Holding Time:

File No. Z1057

Appendix 2 - METHODOLOGY - Continued



Sample: 14 days
Reference: APHA

Laboratory Location: ALS Environmental, Vancouver

Dissolved Anions in Water by Ion Chromatography

This analysis is carried out using procedures adapted from APHA Method 4110 "Determination of Anions by Ion Chromatography" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography". Anions are determined by filtering the sample through a 0.45 micron membrane filter and injecting the filtrate onto a Dionex IonPac AG17 anion exchange column with a hydroxide eluent stream. Anions routinely determined by this method include: bromide, chloride, fluoride, nitrate, nitrite and sulphate.

Recommended Holding Time:
Sample: 28 days (bromide, chloride, fluoride, sulphate)
Sample: 2 days (nitrate, nitrite)
Reference: APHA and EPA

Laboratory Location: ALS Environmental, Vancouver

Ammonia in Water by Selective Ion Electrode

This analysis is carried out, on sulphuric acid preserved samples, using procedures adapted from APHA Method 4500-NH3 "Nitrogen (Ammonia)". Ammonia is determined using an ammonia selective electrode.

Recommended Holding Time:
Sample: 28 days
Reference: APHA

Laboratory Location: ALS Environmental, Vancouver

Phosphate in Water

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". All forms of phosphate are determined by the ascorbic acid colourimetric method. Dissolved ortho-phosphate (dissolved reactive phosphorous) is determined by direct measurement. Total phosphate (total phosphorous) is determined after persulphate digestion of a sample. Total dissolved phosphate (total dissolved phosphorous) is determined by filtering a sample through a 0.45 micron membrane filter followed by persulfate digestion of the filtrate.

Recommended Holding Time:
Sample: 2 days
Reference: EPA

File No. Z1057

Appendix 2 - METHODOLOGY - Continued



Laboratory Location: ALS Environmental, Vancouver

Metals in Water

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" 21th Edition 2005 published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using either hotplate or microwave oven, or filtration (EPA Method 3005A). Instrumental analysis is by atomic absorption/emission spectrophotometry (EPA Method 7000 series), inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B), and/or inductively coupled plasma - mass spectrometry (EPA Method 6020).

Recommended Holding Time:

Sample: 6 months

Reference: EPA

Laboratory Location: ALS Environmental, Vancouver

Chlorophyll and Pheopigments by Fluorometry

This analysis is carried out using procedures adapted from APHA Method 10200 H. "Chlorophyll" and USEPA Method 445. The sample is filtered using either a glass fiber filter or a 0.45 micron Membrane filter. The pigments are extracted from the filter with 90% aqueous acetone. For chlorophyll a analysis the extract is read using a fluorometer. For pheopigments the extract is first acidified then read. This method not subject to interferences from chlorophyll b.

Recommended Holding Time:

Sample: 1-2 days before filtering

Filter: 28 days

Reference: APHA

Laboratory Location: ALS Environmental, Vancouver

Results contained within this certificate relate only to the samples as submitted.

This Certificate Of Analysis shall only be reproduced in full, except with the written approval of ALS Environmental.

End of Report