2006 Annual Report

Groundwater Extraction System and Groundwater Monitoring Data Evaluation

Simplot Plant Area
Eastern Michaud Flats Superfund Site

7 March 2007

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TABLE OF CONTENTS

Page

LIST OF TABLES

LIST OF FIGURES

EXECUTIVE SUMMARY

This report provides an evaluation of the test groundwater extraction system operation and of groundwater data collected in 2006 in the Simplot Plant Area of the Eastern Michaud Flats Superfund Site.

The groundwater extraction system is being designed and implemented in accordance with a Remedial Design/Remedial Action Consent Decree (EPA, 2002). This is occurring in a phased approach that includes the operation of a test groundwater extraction system to provide data to support design of the final system. The test extraction system began routine operation in June through October 2004. Ongoing groundwater monitoring, performed in quarterly events in March, May/June, August and November 2006, provides data to assess effects of the test extraction system on downgradient groundwater conditions. Field work to fill remaining data gaps necessary to support final design of the groundwater extraction system is ongoing.

The test extraction system was operated throughout the year. It was shut down for approximately two weeks in late May/early June when the facility was taken offline for routine maintenance (Don Plant "turnaround"). Excluding turnaround, wells typically operated for 97 percent of the time or greater. It is estimated that the test extraction system, along with the facility production well SWP-4, removed approximately 35 percent of the arsenic mass flux in groundwater downgradient of the source areas. The system is also estimated to have removed an average of 1,200 pounds per day of Orthophosphate (as Total Phosphorus) in 2006.

Groundwater from the test extraction system is used as makeup water in the Phosphoric Acid Plant portion of the Don Plant. The Don Plant water balance is complex and is critical to successful facility operation. Numerous unit operations require specific water flows and have different minimum water quality requirements. Flows are continuously measured at key points within the process as part of routine operation. Flows from the test extraction system are relatively small compared to other inputs; 340 gallons per minute from the extraction system on average compared to approximately 4,000 gallons per minute from the facility production wells. Since 2002, the average flow from the extraction wells has increased from less than fifty to more than 300 gallons per minute. A corresponding decrease in fresh water consumption in the Phosphoric Acid Plant has occurred. This is expected because addition of test extraction groundwater to the reclaim cooling system has reduced the demand for fresh water input. The overall water flow to the gypsum stack has not been affected.

Assessment of groundwater data collected in 2006 identified the following key conclusions:

- Constituent concentrations in East Plant Lower Zone groundwater downgradient of the test extraction system decreased significantly in 2005 and remained at those levels in 2006. This appears to be a direct effect of the extraction system. Arsenic, Sulfate and Orthophosphate (as Total Phosphorus) concentrations all decreased in a similar manner. One technical concern related to the Portneuf River TMDL is that Orthophosphate (as Total Phosphorus) sorbed to or precipitated on aquifer solids downgradient of the extraction system will continue to desorb/dissolve after the extraction system becomes operational. These and other Site data show that changes in Arsenic and Orthophosphate (as Total Phosphorus) concentrations are concomitant. This provides evidence that phosphorus desorption/dissolution effects are not significant and that Orthophosphate (as Total Phosphorus) concentrations in groundwater will decline on a similar timeframe as Arsenic concentrations downgradient of the extraction system.

- Arsenic, Orthophosphate (as Total Phosphorus) and Sulfate concentrations in the Spring at Batiste Road have decreased since 2004, when the test extraction system came on line. Groundwater potentiometric surfaces and flow path interpretations indicate that the spring is directly downgradient of the Simplot East Plant Area, where most of the current groundwater extraction is occurring. Reduction in Orthophosphate (as Total Phosphorus) concentrations have been the most notable; the average concentration was 5.6 mg/L in 2004 and 1.1 mg/L in 2006. Arsenic concentrations averaged 0.014 mg/L in 2004 and 0.009 mg/L in 2006.

- Constituent concentrations in Batiste Spring were variable in 2006 and have been generally increasing in the past few years. For example, average Arsenic and Orthophosphate (as Total Phosphorus) concentrations were 0.009 and 2.6 mg/L in 2004 and 0.030 and 19 mg/L in 2006, respectively. The constituent concentrations at Batiste Spring are higher than any measured in groundwater wells north of Highway 30 that are downgradient of Simplot sources. FMC is also a potential current source of constituents to the spring, with estimated groundwater travel times from FMC source areas to the river ranging up to 10 years.

- A source, or sources, of Arsenic and Orthophosphate (as Total Phosphorus) to Upper Zone groundwater is present in the Phosphoric Acid Plant area. Constituent concentrations decrease rapidly in downgradient groundwater, indicating that the source mass flux is relatively small. The source does not impact the Lower Zone because migration is prevented by the American Falls Lake Bed and by significant upward groundwater flow gradients. Additional investigation has recently been performed in the Phosphoric Acid Plant area and source identification efforts are ongoing.

- Portneuf River flows and stage in May 2006 were the greatest measured since about 1996. This caused an increase in groundwater levels in both Upper Zone and Lower Zone wells. The increase appears to be greatest in wells located closest to the river and in wells completed in geologic units that have a high hydraulic conductivity. The response to river stage is mostly a pressure effect, however, water losses from the river during the high-flow period may also affect groundwater chemistry.

- Constituent concentrations in East Plant Upper Zone groundwater decrease rapidly downgradient of the target extraction area. This appears to be primarily due to mixing with river-influenced groundwater from the east.

- Constituent concentrations in Central Plant Lower Zone groundwater downgradient of production well SWP-4 are at or near background levels, indicating that SWP-4 effectively captures all gypsum stack-affected groundwater in the area.

- Concentrations of constituents in West Plant groundwater in the target extraction areas have been relatively stable. Downgradient concentrations show varying trends that probably reflect changes in mass fluxes from the gypsum stack and source areas at the closed FMC facility.

The evaluations provided in this report will be expanded and integrated with other Site data (including the findings of the ongoing “Phase 2” fieldwork and the quarterly monitoring program) to support final design of the groundwater extraction system and the associated groundwater monitoring program. The final design report is expected to be submitted in 2007.

1.0 INTRODUCTION

This report provides an evaluation of the test groundwater extraction system operation and of groundwater data collected in 2006 in the Simplot Plant Area of the Eastern Michaud Flats Superfund Site (Figure 1-1). The Eastern Michaud Flats Superfund Site is located near the City of Pocatello, Idaho and is been divided into three areas:

- The **FMC Plant Area** includes the FMC Elemental Phosphorus Facility (which ceased operations in December 2001) and contiguous land owned by FMC;
- The **Simplot Plant Area** includes the J.R. Simplot Don Plant, which produces phosphoric acid and a variety of liquid and solid fertilizers, and contiguous land owned by Simplot; and
- The **Offplant Area** surrounds the FMC and Simplot Plant Areas.

The Don Plant began production of a single superphosphate fertilizer in 1944. Phosphoric acid production began in 1954. The plant currently produces a variety of solid and liquid phosphorus- and nitrogen-based fertilizers. The principal raw material for the process is phosphate ore, which is conveyed to the facility via a slurry pipeline from the Smoky Canyon mine, near Afton, Wyoming. The primary byproduct from the Don Plant process is gypsum (calcium sulfate), which is stacked on site (the gypsum stack).

The Simplot Don Plant covers approximately 745 acres and adjoins the eastern property boundary of the FMC facility. The main portion of the plant lies approximately 500 feet southwest of the Portneuf River. Of the 745 acres, approximately 400 acres are committed to the gypsum stack. Another 185 acres are occupied by the plant and its infrastructure. The remaining acreage to the south and southeast of the plant consists of cliffs and rugged steep terrain.

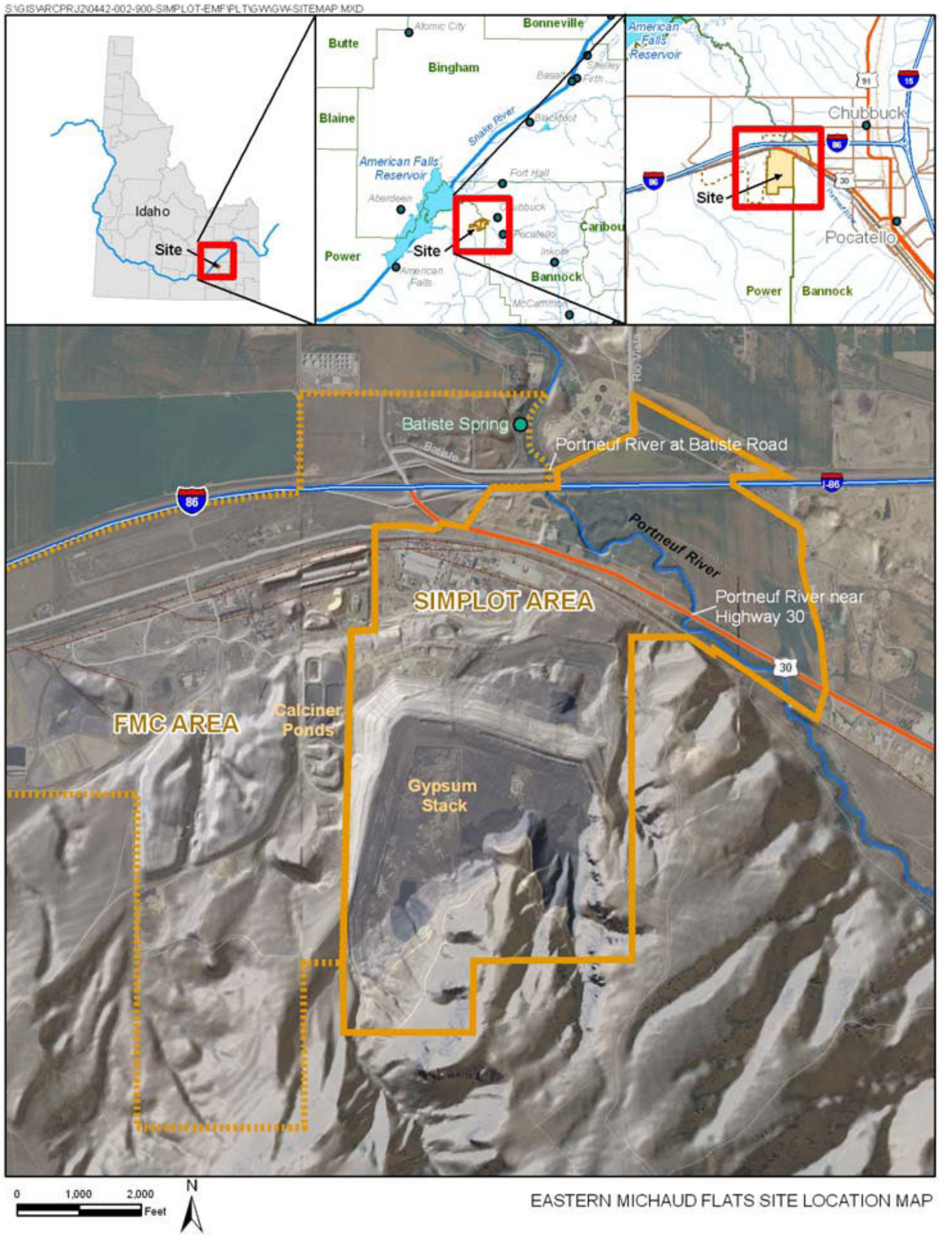


Figure 1-1: Site Location Map

The groundwater extraction system is being designed and implemented in accordance with a Remedial Design/Remedial Action Consent Decree (EPA 2002). This is occurring in a phased approach that includes the operation of a test groundwater extraction system to provide data to support design of the final system.

The test extraction system consists of a network of extraction wells near the northern and northwestern edge of the gypsum stack. The wells have been located to intercept Upper Zone and Lower Zone groundwater affected by gypsum stack seepage as it flows north from beneath the stack to the Don Plant facility area, where it mixes with groundwater inflow from the Michaud

Gravels and ultimately discharges to the Portneuf River. The test extraction well network is divided into three groups: the West Plant Area, the East Plant Area Upper Zone, and the East Plant Area Lower Zone. The West Plant Area contains extraction wells 401 and 402. The East Plant Area Upper Zone contains extraction wells 404 through 409. The East Plant Area Lower Zone contains extraction wells 410 and 411. Additional test extraction wells are scheduled to be installed as part of the ongoing "Phase 2" field work (NewFields 2006h). Figure 1-2 presents the location of the test extraction system wells and the Phase 2 wells.

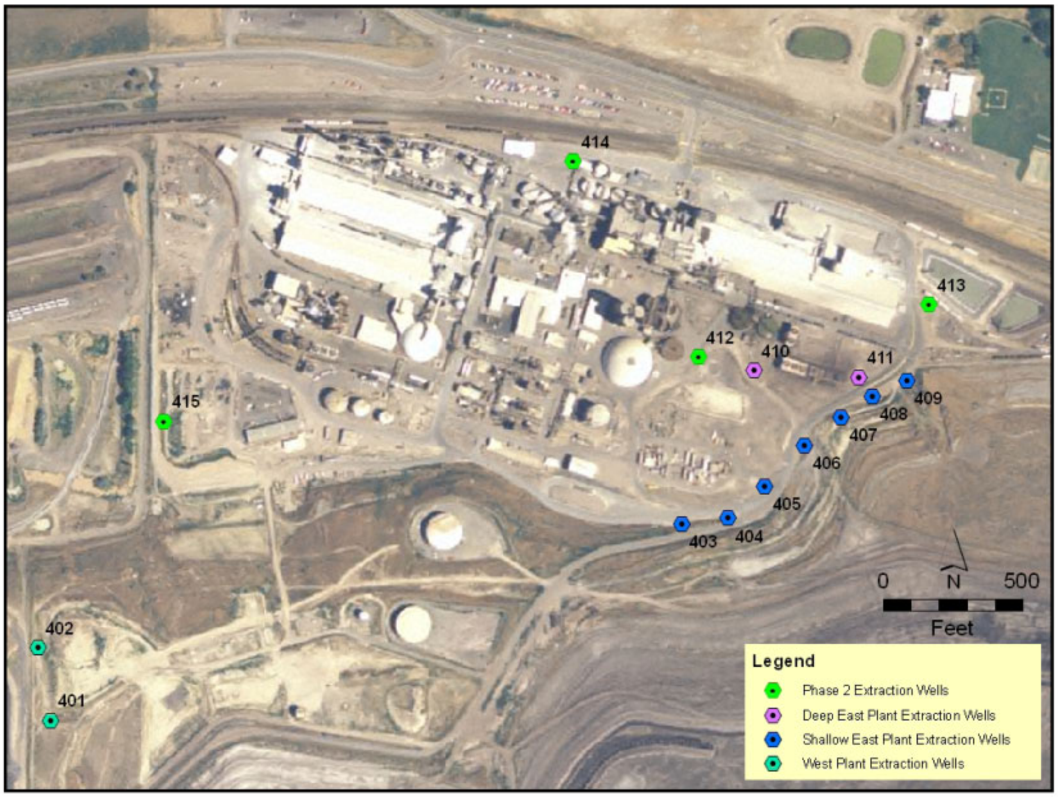


Figure 1-2: Extraction Well Locations

The test extraction system began routine operation in June 2004, when wells 401, 402, 410 and 411 were brought on line. The East Plant Upper Zone wells (404 through 409) were brought on line from August through October 2004, as operational difficulties related to lower-than-expected extraction flows were resolved. Details of the startup and initial operation and effect of the system were provided in the 2004 and 2005 annual reports (MFG 2005 and NewFields 2006a). Groundwater monitoring has been performed on a routine basis since the Remedial Investigation began in 1992. Quarterly monitoring to support remedial design/remedial action began in August 2003. In 2006, monitoring was performed in March, May/June, August and November.

Data related to the extraction test system operation and to groundwater monitoring in 2006 have been provided previously in a variety of reports:

- o Groundwater extraction flows, operation data and maintenance activities have been documented in weekly and monthly reports provided via e-mail;
- o Groundwater extraction system operational summaries have been provided in four quarterly reports (NewFields 2006b, c, d, and 2007a); and
- o Groundwater monitoring data have been provided in four quarterly reports (NewFields 2006e, f, g, and 2007b).

This document provides more detailed analyses of the extraction system operation and groundwater data, including an assessment of the effects of extraction on downgradient groundwater chemistry and other data trends. The analyses, along with the findings of the ongoing Phase 2 field work, will support final design of the extraction system, scheduled for submittal in 2007.

Information on the test groundwater extraction system operation in 2006 is provided in Section 2. An evaluation of water flows within the Don Plant process and effects of the addition of extraction water flows is described in Section 3. Section 4 provides an assessment of groundwater monitoring data.

2.0 TEST GROUNDWATER EXTRACTION SYSTEM OPERATION

This section provides a summary of the operation of the test extraction system, including overall performance and constituent mass removal, maintenance and individual well performance.

2.1 Well Operation Summary

The test extraction system was operated throughout the year. The system was shut down from May 30 to June 15 when the facility was taken offline for routine maintenance (plant “turnaround”).

A summary of the operation of the extraction wells, including percent time offline and extraction rates during the 2006 for each well is presented in Table 2-1.

Table 2-1: Extraction Well 2006 Operation Summary

Extraction Well	Time Well Offline (%)[1]	Operating Extraction Rate (gpm)[1]	
		Maximum	Average
West Plant Area			
401	2.7	63.4	45.1
402	11.7	48.3	30.6
East Plant Area – Upper Zone			
404	0.4	3.8	2.6
405	2.9 [2]	9.2	6.5 [2]
406	1.1	25.0	13.7
407	0.4	8.3	8.1
408	0.4	3.6	1.4
409	0.1	8.9	7.1
East Plant Area – Lower Zone			
410	0.7	183.5	147.3
411	0.4	115.9	92.1
		Total:	354

[1]*Excludes the shut-down time due to the Don Plant turnaround.*

[2]*Also excludes the period from March 28 to May 18 when flow meter was not operating properly.*

All extraction wells except well 402 were in operation at least 95 percent of the year (excluding the down time from the Don Plant turnaround). Down time at well 402 is mostly attributed to a blocked line and replacement of a pump. Problems were encountered with the signal from the flow meter in Well 405 over the period from the March 28 to May 18 .

A summary of the removal of key constituents by the extraction system is provided in Table 2-2.

NEWFIELDS

Table 2-2: Constituents Mass Removal Summary

Extraction Well	Average Operating Extraction Rate (gpm)[1]	2006 Mass Removal (lb/day)[2]		
		Arsenic	Orthophosphate (as Total Phosphorus)	Sulfate
West Plant Area				
401	45.1	0.239	63	1,210
402	30.6	0.141	38	839
Subtotal		0.38	101	2,049
East Plant Area – Upper Zone				
404	2.6	0.019	5	88
405	6.5	0.032	27	214
406	13.7	0.061	87	479
407	8.1	0.035	44	277
408	1.4	0.007	6	48
409	7.1	0.028	30	234
Subtotal		0.18	199	1,340
East Plant Area – Lower Zone				
410	147.3	0.675	526	4,771
411	92.1	0.386	387	2,916
Subtotal		1.06	913	7,687
TOTAL	**354**	**1.6**	**1,213**	**11,096**

[1] Excludes the shut-down time due to the Don Plant turnaround.

[2] Calculated using the flow volume discharged each quarter multiplied by that quarter's sampling results.

Mass was also removed by facility production well SWP-4. Based on the average quarterly flow rate and the measured concentrations each quarter, it is estimated that the well removed 0.60 pounds of Arsenic per day from the groundwater system on average. Combined with the test extraction system, this results in a total removal of 2.2 pounds per day. The current estimate of the mass flux of arsenic in groundwater downgradient of the gypsum stack and Phosphoric Acid Plant is 6.3 pounds per day (NewFields 2005). Therefore, it is estimated that approximately 35 percent of the Arsenic mass from Simplot sources in groundwater was removed by extraction in 2006.

2.2 Well Maintenance Summary

2.2.1 West Plant Extraction Wells

The West Plant extraction wells (Wells 401 and 402) were operated without significant problems in the first and fourth quarters of 2006. Well 401 shut off frequently for short periods of time over the period from June to August due to low level alarms. The majority of the shutdowns at well 401 were very brief and therefore it was offline only a small percentage of the time. Well 402 was shut down for about two weeks in April due to a blocked drain line and for approximately two and a half weeks in July for a pump replacement.

New water level probes (manufactured by InSitu, see Section 2.3) were installed in wells 401 and 402 in October.

2.2.2 East Plant Upper Zone Extraction Wells

Most of the East Plant Upper Zone extraction wells (Wells 404 through 409) were operated without significant problems in 2006. All wells were offline during a general power failure in March (5 hours) and during plant shutdowns for maintenance in August and October (1 day each). Wells 405 and 406 experienced the most maintenance issues.

Over the period from March 28 to May 18, the signal from the flow meter in Well 405 incorrectly indicated no flow. Due to the steady water level maintained over this period, as well as maintenance reports indicating well shutdowns during this period, it is believed that the well did continue to maintain a relatively steady pumping rate. The data indicating no flow are believed to be erroneous and caused by a loss of signal from the flow meter. This problem was corrected on May 18 and the pump motor was also replaced at this time.

Well 406 was offline for one day in January when the pump motor was replaced. In July, Well 406 was put into manual operation because of low water level caused by an spike in water extraction rate. Well 406 experienced shut off a number of times in October and November due to low level alarms, but the majority of the shutdowns were very brief and therefore it was offline only a small percentage of the time (the problem was fixed by reducing the pumping rate).

Well 408 had three brief shutdowns due to low level alarms in October (all short term). Well 409 was shut down for approximately one day in October while a pump was being replaced. It also was briefly shut down due to a water level alarm.

2.2.3 East Plant Lower Zone Extraction Wells

The East Plant Lower Zone extraction wells operated more than 99 percent of the time during 2006 (Table 2-1). The brief well shut downs were mostly due to power outages. Well 410 was down for three days in late March when the pump would not restart after a power outage and the pump motor had to be replaced. Well 411 had no significant maintenance issues.

An additional water level probe was installed in Well 410 on August 4. The performance of the new probe (manufactured by InSitu, see Section 2.3) was evaluated for about one month. At the end of the evaluation period, data collection was switched to the new probe. An InSitu probe was also installed in Well 411 in October.

2.3 Well Performance Summary

Flow and water level data are collected continuously for each extraction well. Flow rates are measured with electromagnetic flow meters (manufactured by Krohne). For most of 2006, water levels in all wells were measured with admittance-to-current transducers, otherwise known as capacitance probes (manufactured by Drexelbrook). The Drexelbrook level indicators are configured to provide only a relative reading of water level in the well and are primarily used to control pumping rate. Starting in August 2006, the Drexelbrook water level indicators in Wells 401, 402, 410, and 411 were switched to pressure transducers (manufactured by InSitu). The InSitu level indicators provide more reliable pump control and may provide more accurate water level indication. Well pumps are fitted with a variable frequency drive (VFD) which allows the speed of the pump motor to be varied to regulate flow rate. The flow and water level data have been examined and an assessment of the performance of each well has been made, as described in the following subsections.

2.3.1 West Plant Extraction Wells

2.3.1.1 Well 401

Well 401 maintained a consistent pumping rate of about 45 gpm from January to mid-May. Some difficulty was experienced controlling the pumping rate in July and August due to low-level alarm shut downs. From late August until the end of the year the flow rate was maintained from 45 to 50 gpm with the pump operating at a consistent speed and maintaining a consistent water level (see Figure 2-1). Based on this information, there was no apparent degradation in the performance of this well in 2006.

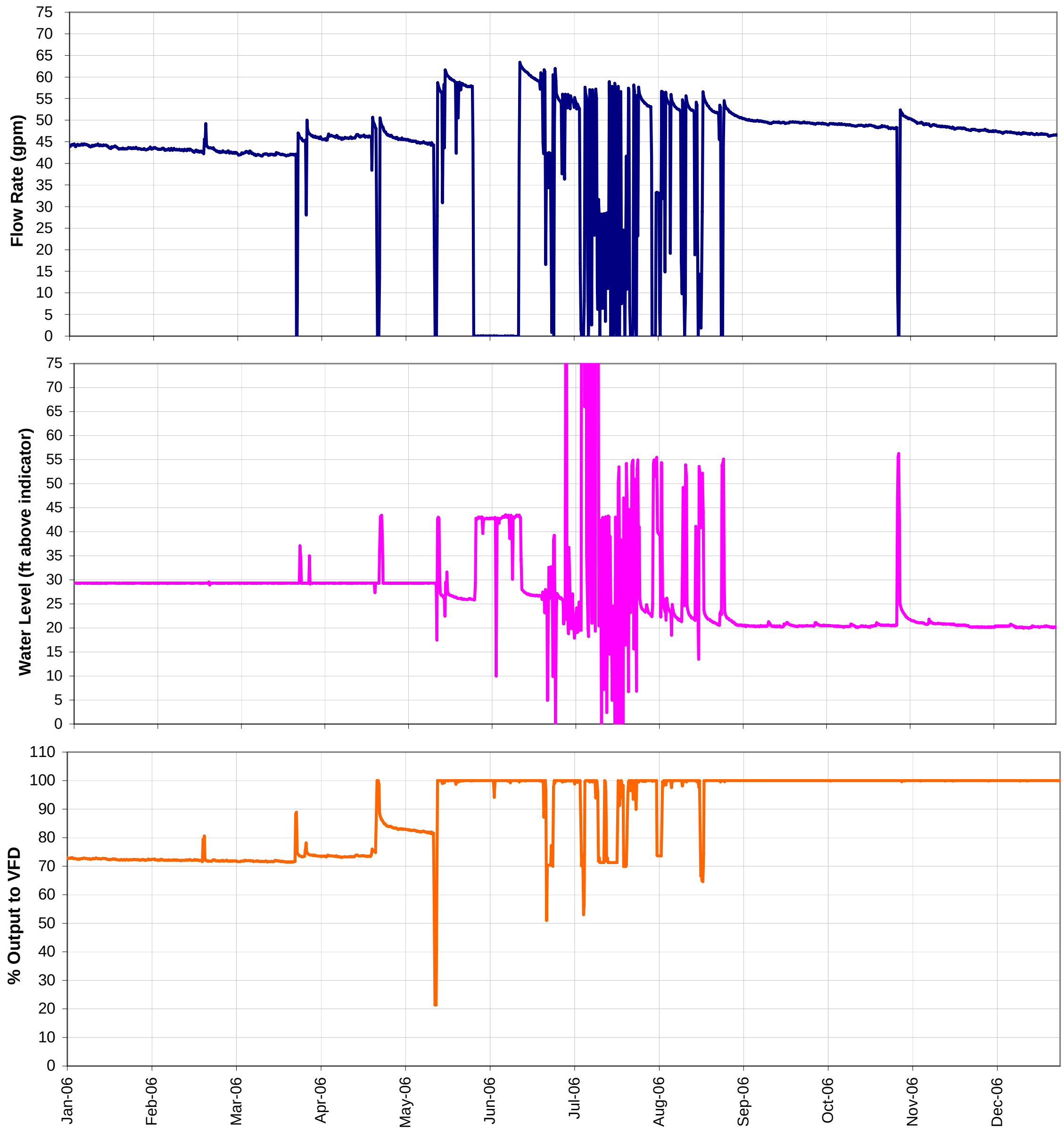


Figure 2-1: Well 401 Flow Rate, Water Level, and Relative Pump Speed

2.3.1.2 Well 402

When not shut down due to maintenance issues, Well 402 maintained a pumping rate of about 35 to 40 gpm throughout the year with the pump operating at a consistent speed and maintaining a consistent water level (see Figure 2-2). Based on this information, there is no apparent degradation in the performance of this well in 2006.

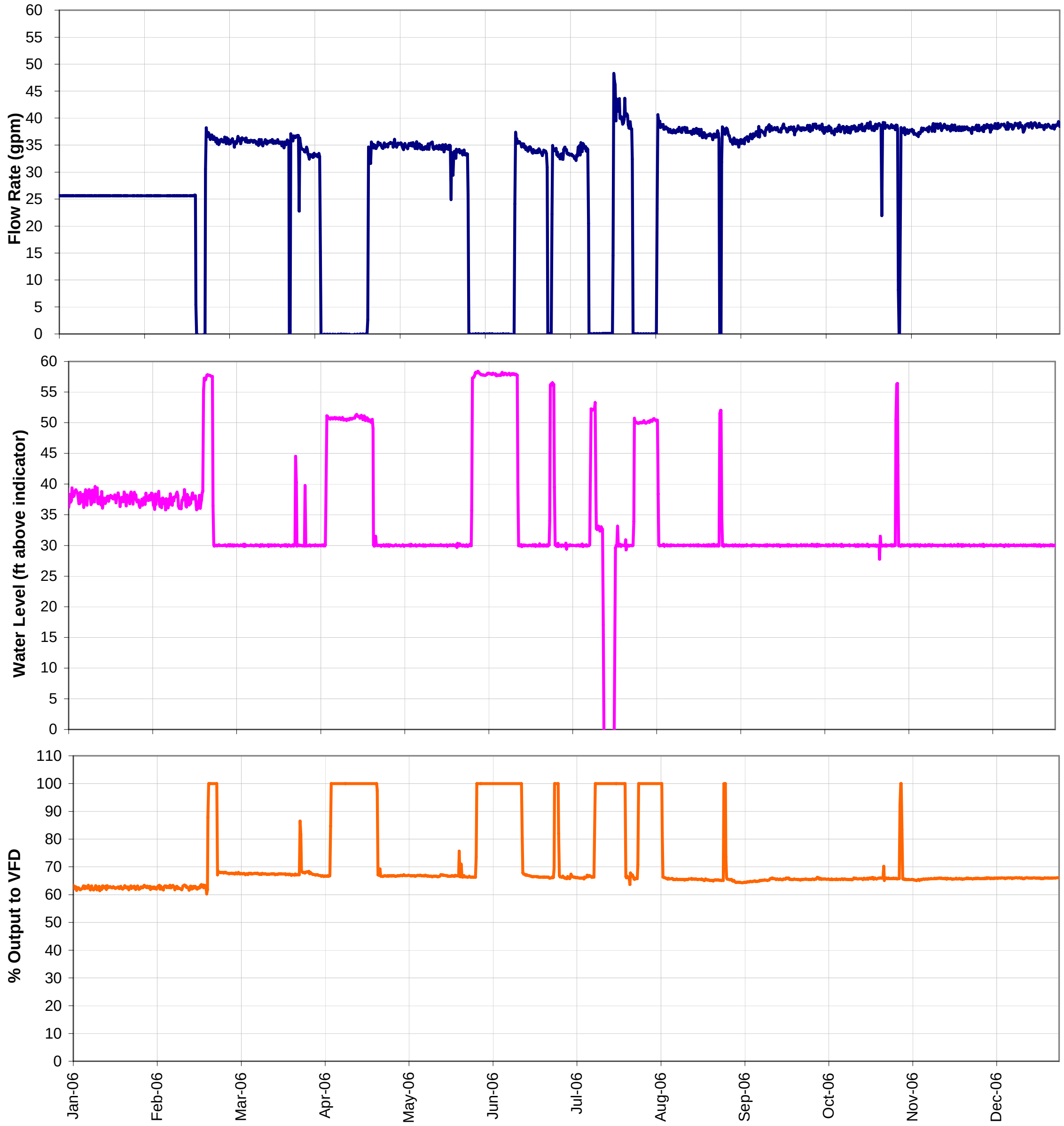


Figure 2-2: Well 402 Flow Rate, Water Level, and Relative Pump Speed

2.3.2 East Plant Upper Zone Extraction Wells

The following sub-sections provide details on the operation and performance for each well in the East Plant Area (upper zone).

2.3.2.1 Well 404

Well 404 maintained a consistent pumping rate of about 2 to 4 gpm throughout the year with the pump operating at a consistent speed and maintaining a consistent water level (see Figure 2-3).

Based on this information, there was no apparent degradation in the performance of this well in 2006.

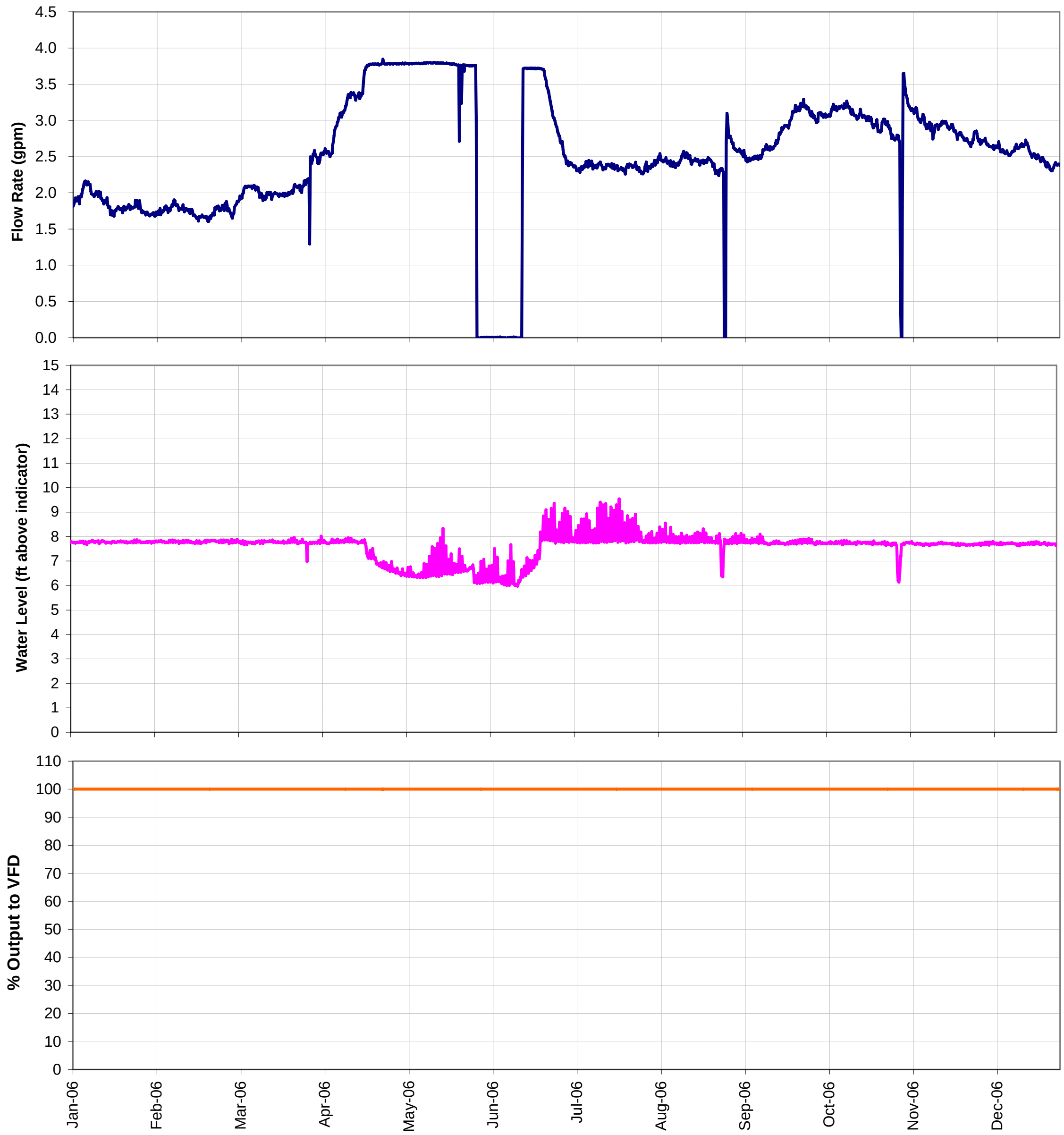


Figure 2-3: Well 404 Flow Rate, Water Level, and Relative Pump Speed

2.3.2.2 Well 405

Flow readings from Well 405 were likely in error until the flow meter signal was repaired on May 18. After this time, the flow rate was maintained at from 8 to 9 gpm until the end of the year with the pump operating at a consistent speed and maintaining a consistent water level (see Figure

2-4). Based on this information, there was no apparent degradation in the performance of this well in 2006.

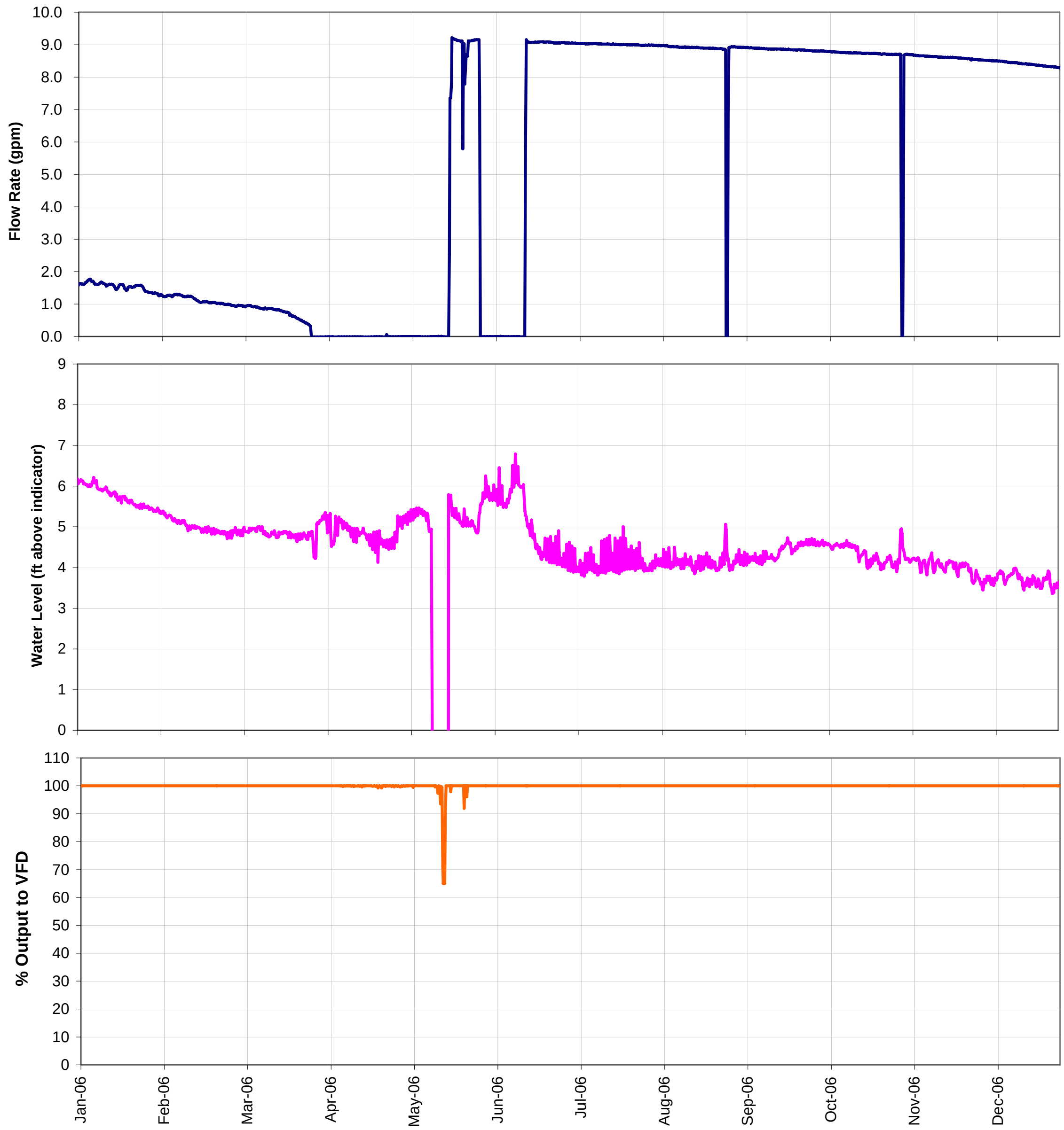


Figure 2-4: Well 405 Flow Rate, Water Level, and Relative Pump Speed

2.3.2.3 Well 406

Well 406 was operated at a flow rate of about 10 gpm until August, when the rate was increased to 14 gpm until October, and then again to about 24 gpm until the end of the year (see Figure 2-5). At the 24 gpm flow rate, the water level dropped low enough to trigger low-level shut offs a number of times. The flow rate was then adjusted to 15 gpm at the end of the year. Based on this information, there was no apparent degradation in the performance of this well in 2006.

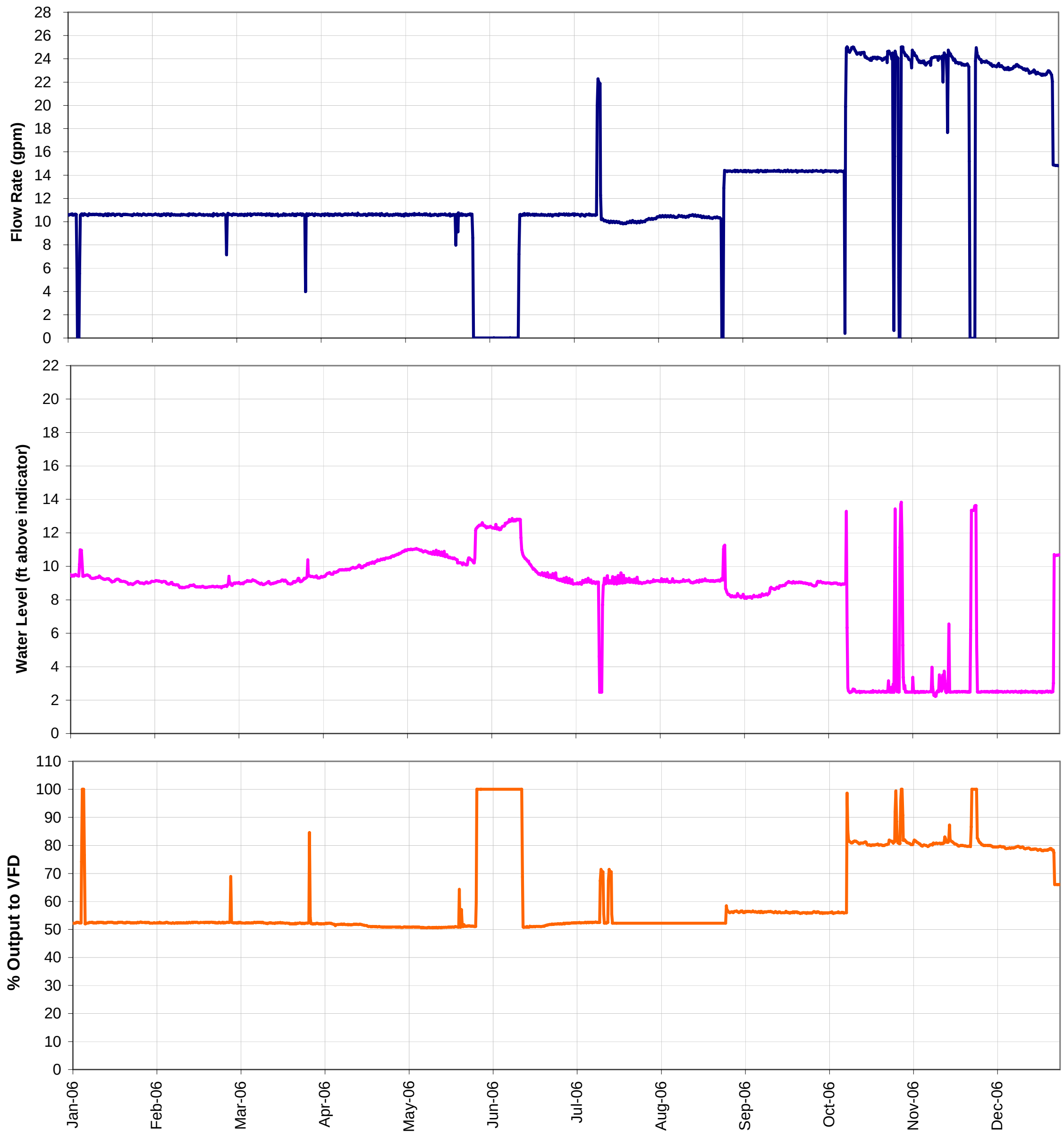


Figure 2-5: Well 406 Flow Rate, Water Level, and Relative Pump Speed

2.3.2.4 Well 407

Well 407 maintained a pumping rate of about 8 gpm throughout the year with the pump operating at a consistent speed and maintaining a consistent water level (see Figure 2-6). Based on this information, there was no apparent degradation in the performance of this well in 2006.

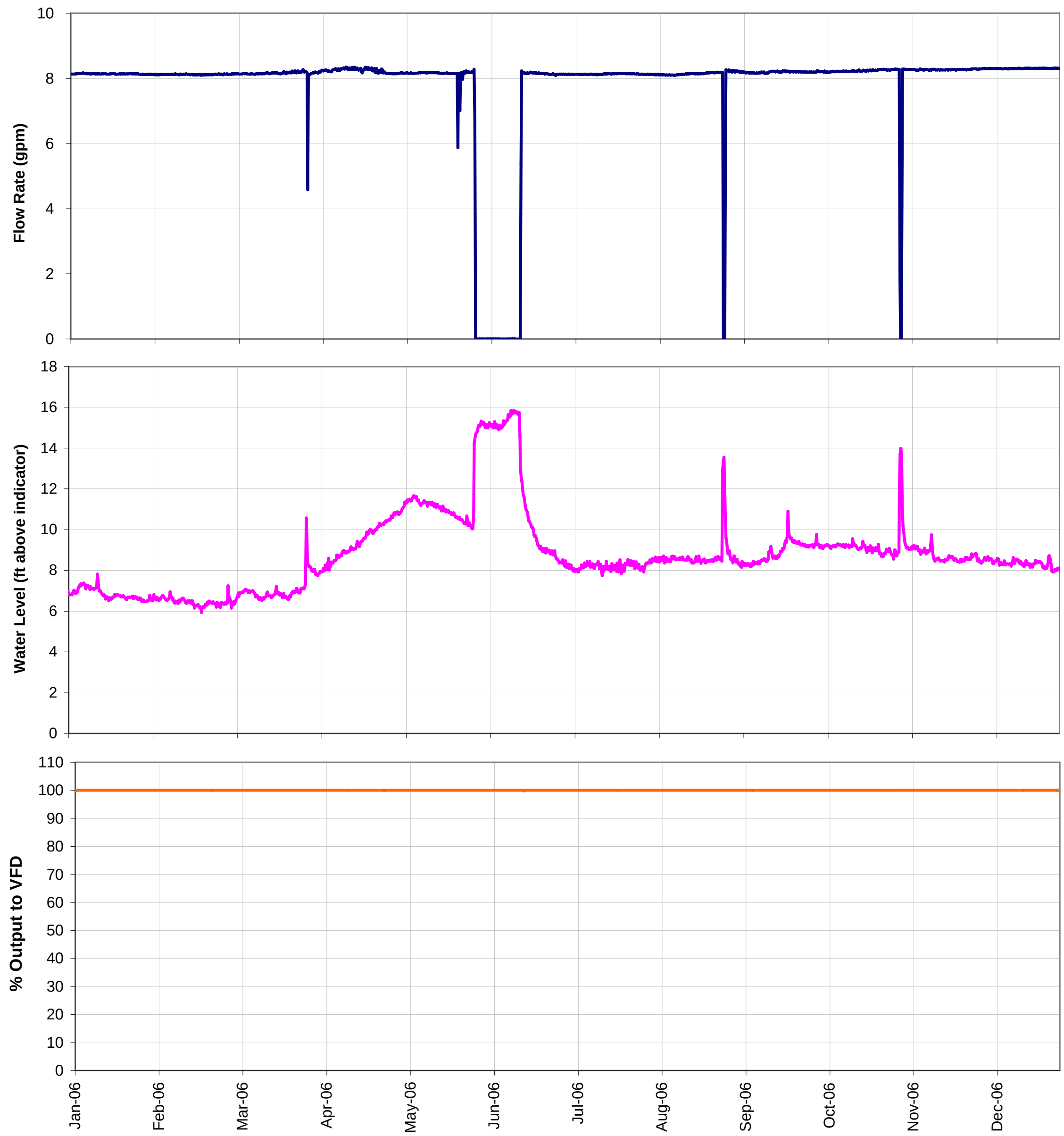


Figure 2-6: Well 407 Flow Rate, Water Level, and Relative Pump Speed

2.3.2.5 Well 408

Well 408 was operated at pumping rates typically from 1 to 2 gpm throughout the year (see Figure 2-7). There is a limited depth of water in this well and maintaining a consistent pumping rate is more difficult than at other wells. There was no apparent degradation in the performance of this well in 2006.

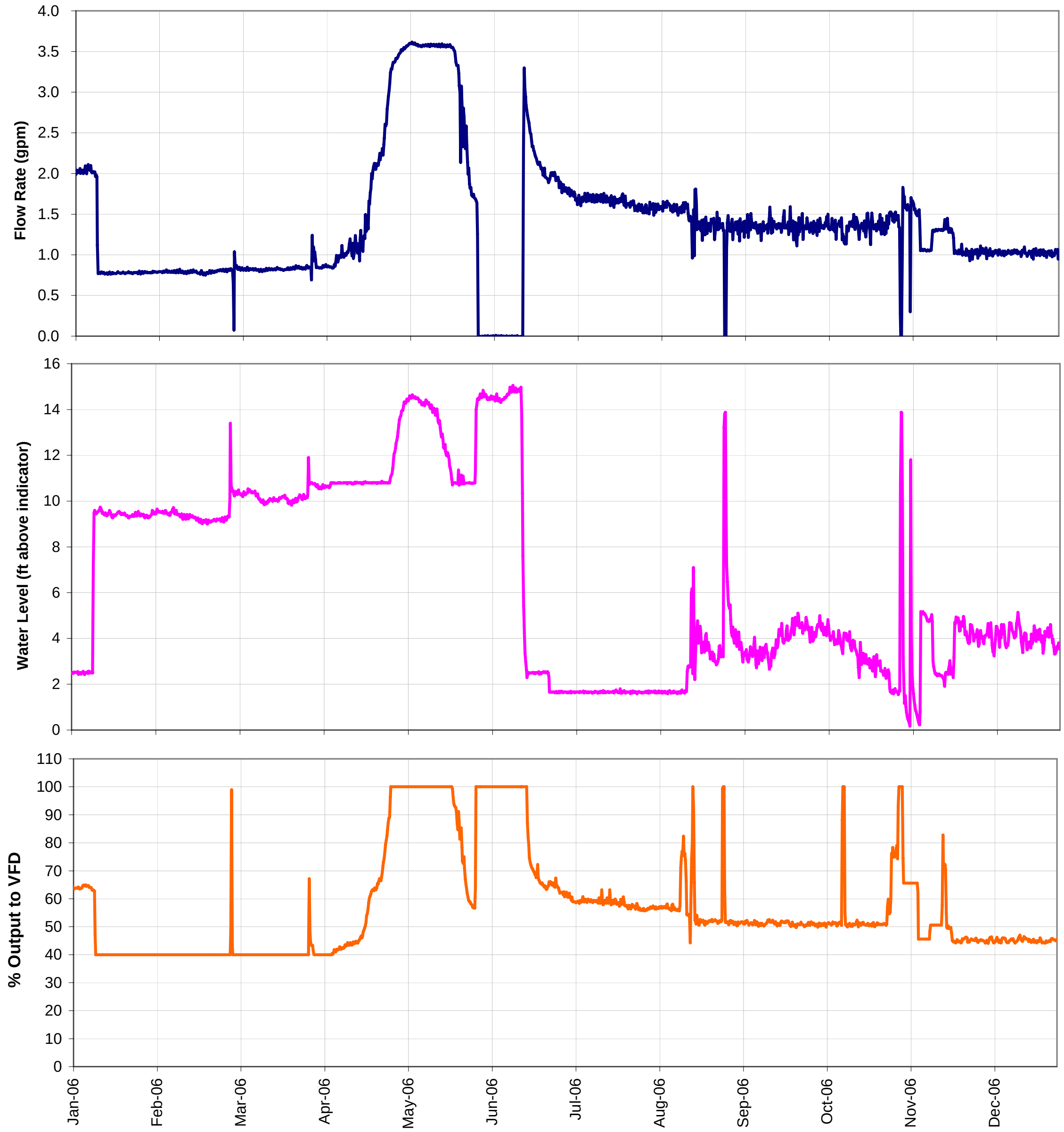


Figure 2-7: Well 408 Flow Rate, Water Level, and Relative Pump Speed

2.3.2.6 Well 409

Well 409 maintained a consistent pumping rate of about 7 to 8 gpm throughout most of the year with the pump operating at a consistent speed and maintaining a consistent water level (see Figure 2-8). Based on this information, there is no apparent degradation in the performance of this well in 2006.

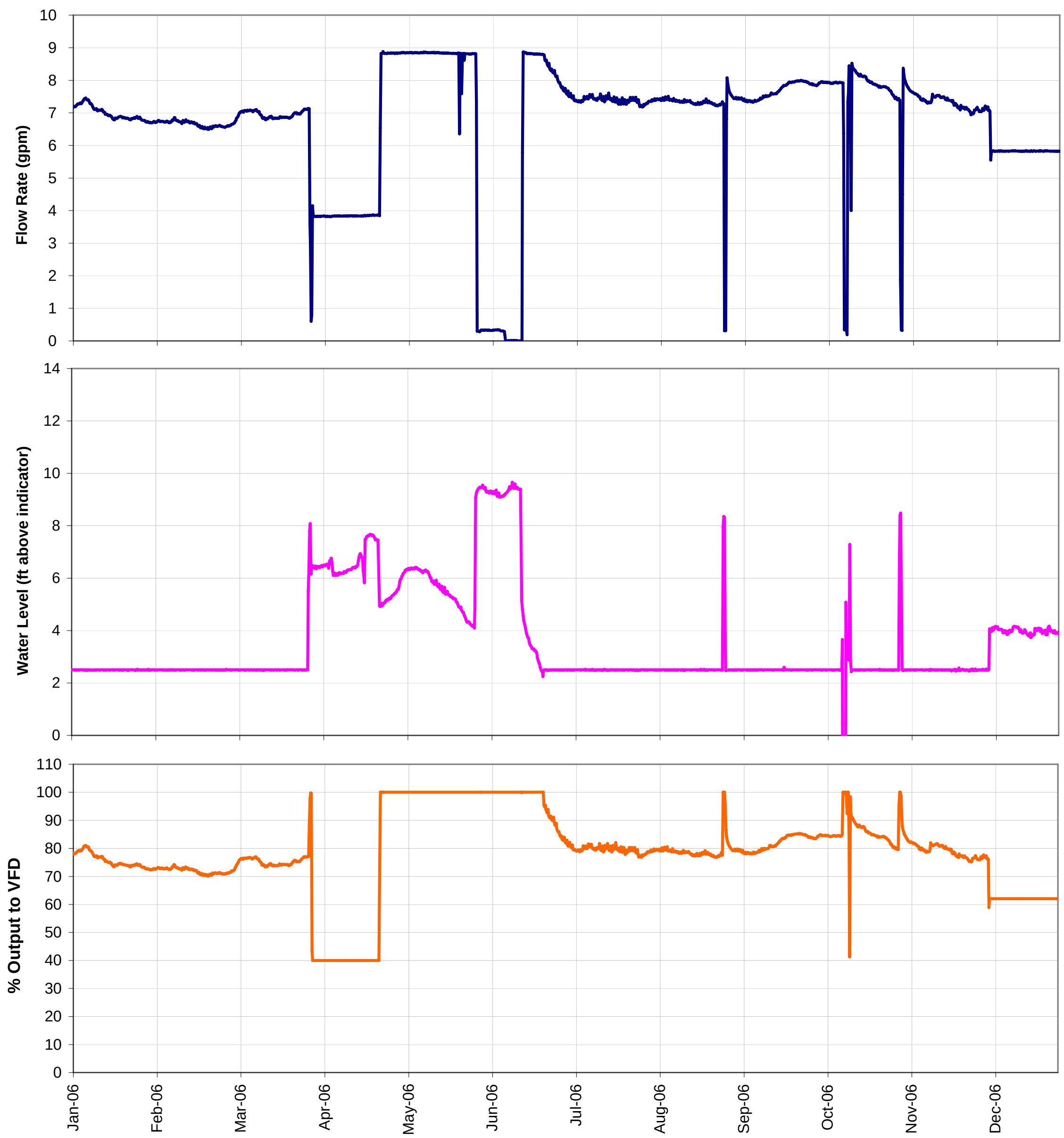


Figure 2-8: Well 409 Flow Rate, Water Level, and Relative Pump Speed

2.3.3 East Plant Lower Zone Extraction Wells

The following sub-sections give details on the operation and performance for each well in the East Plant Area (Lower Zone).

2.3.3.1 Well 410

Well 410 was operated at a flow rate of between 150 and 180 gpm through mid-July. Flow rates are typically higher (up to 180 gpm) after a shutdown period when the well has been able to recharge, then declines with time, stabilizing near 150 to 160 gpm (see Figure 2-9). Control of the pump was switched to the new InSitu water level probe in October and tied to a constant level of about 33 feet. At this setting, the flow rate had stabilized at about 130 gpm by the end of the year. There was no indication that the well significantly degraded in performance in 2006. Work is continuing on optimizing the flow rate.

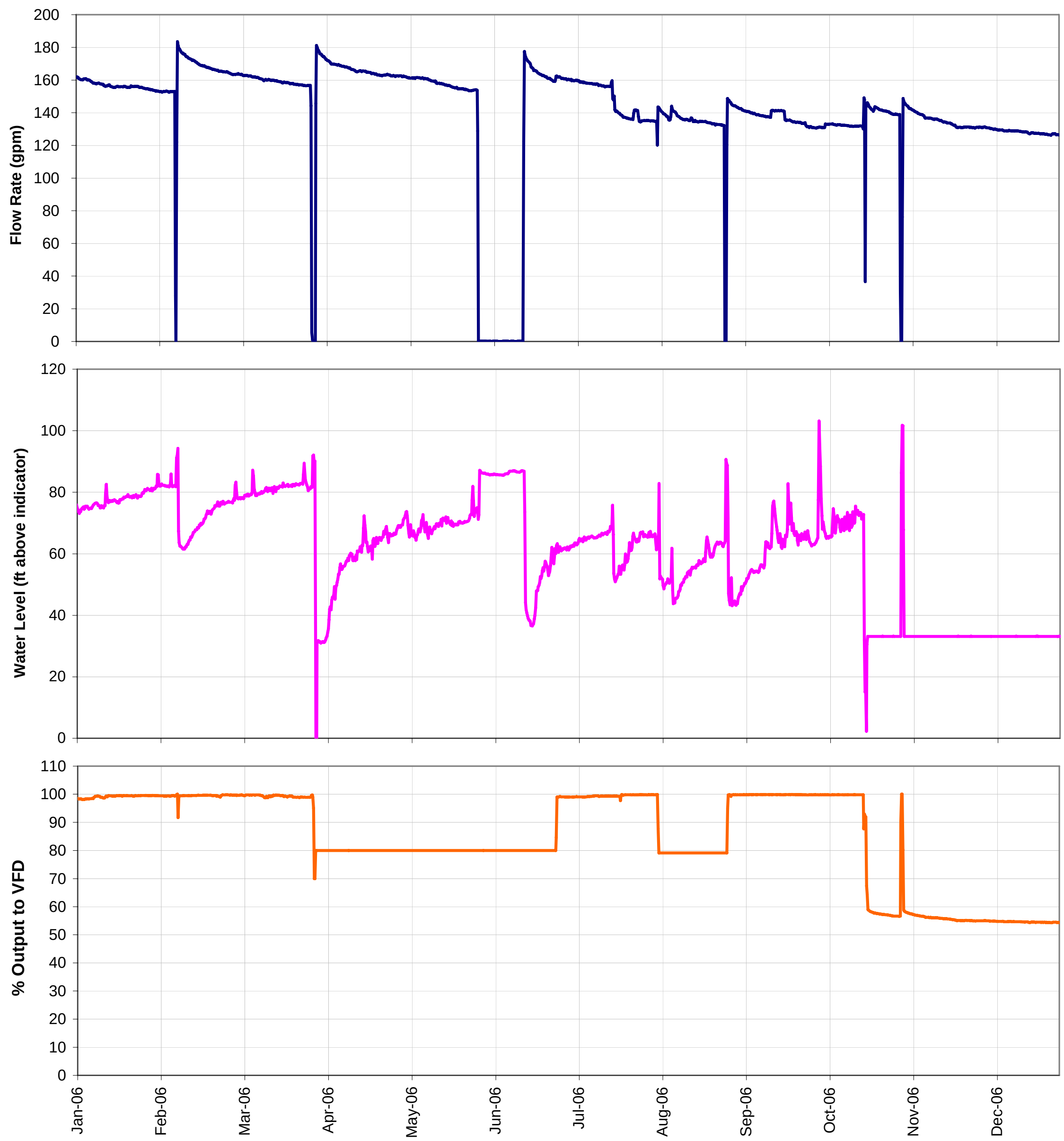


Figure 2-9: Well 410 Flow Rate, Water Level, and Relative Pump Speed

2.3.3.2 Well 411

Well 411 was operated at a flow rate of between 80 and 100 gpm throughout the year. Flow rates are typically higher (up to 110 gpm) after a shutdown period when the well has been able to recharge, then declines with time, stabilizing near 90 gpm (see Figure 2-10). Control of the pump was switched to the new InSitu water level probe in October and tied to a constant level of about 23 feet. At this setting, the flow rate had stabilized at about 85 gpm by the end of the year. There was no indication that the well significantly degraded in performance in 2006.

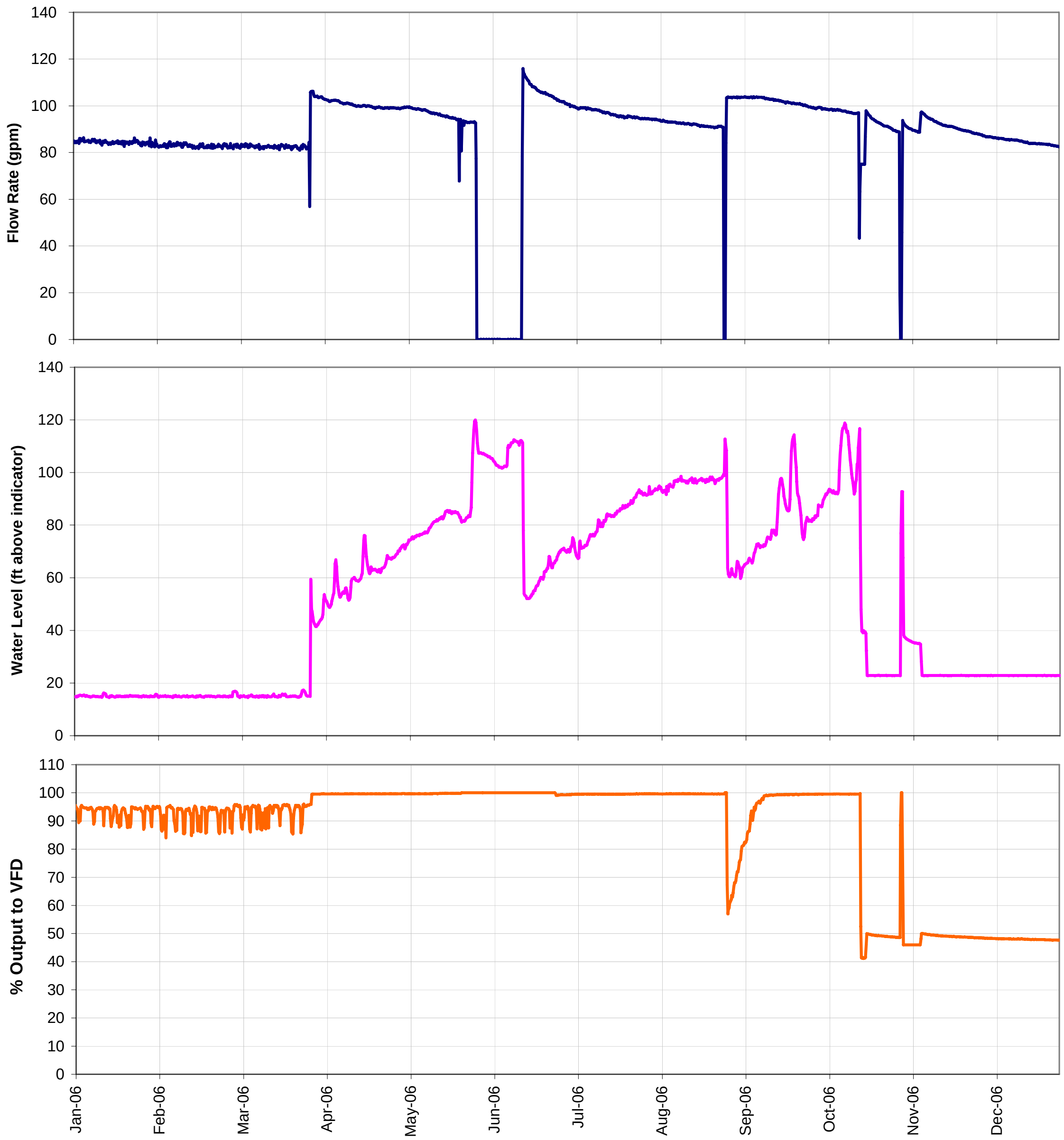


Figure 2-10: Well 411 Flow Rate, Water Level, and Relative Pump Speed

3.0 DON PLANT FACILITY WATER FLOWS

The Don Plant water balance is complex and is critical to successful facility operation. Numerous unit operations require different water flows and have different minimum water quality requirements. Flows are continuously measured at key points within the process as part of routine operation and have been reported to EPA on a monthly basis.

- Production Wells Fresh water is pumped from three production wells (SWP-4, SWP-5 and SWP-7). Flows are measured continuously at SWP-5 and SWP-7 and at various downgradient locations. Flows from SWP-4 are calculated from the total downgradient flows and the other production well flows.

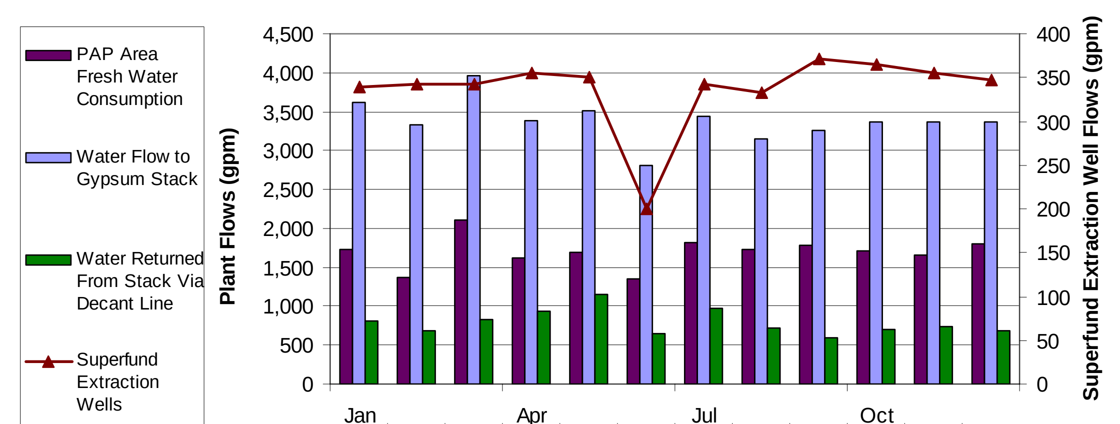
- Phosphoric Acid Plant A portion of the production well water is sent to the Phosphoric Acid Plant. Water requirements are driven by process conditions including production rate and associated cooling needs. Flows are measured at four different locations in the Phosphoric Acid Plant and the total flow is reported.

- Extraction Wells Extraction well flows are sent to the Phosphoric Acid Plant reclaim cooling towers, replacing production well water that was previously used for makeup. Flows are measured continuously for each extraction well (see Section 2.0).

- Water Flows to Gypsum Stack The principal byproduct of the Phosphoric Acid Plant process is gypsum which is slurried to the gypsum stack. The process is operated to maintain the solids content of the slurry within a given range (typically 28 to 32%). Effluent water from the Phosphoric Acid Plant unit operations (such as scrubber water blowdown and reclaim cooling system blowdown) is used as needed to maintain the required solids content The slurry density, solids content and total flow are measured continuously at the gypsum thickeners. The water flow is calculated based on the data collected and the density of gypsum.

- Gypsum Stack Decant Return Water from the gypsum slurry forms ponds on the top of the stack as the gypsum settles out. The extent of the ponded water is managed to allow dike building operations to occur. Water is pumped from the ponded area back to the reclaim cooling system. The flow rate is set by the operators on an as-needed basis.

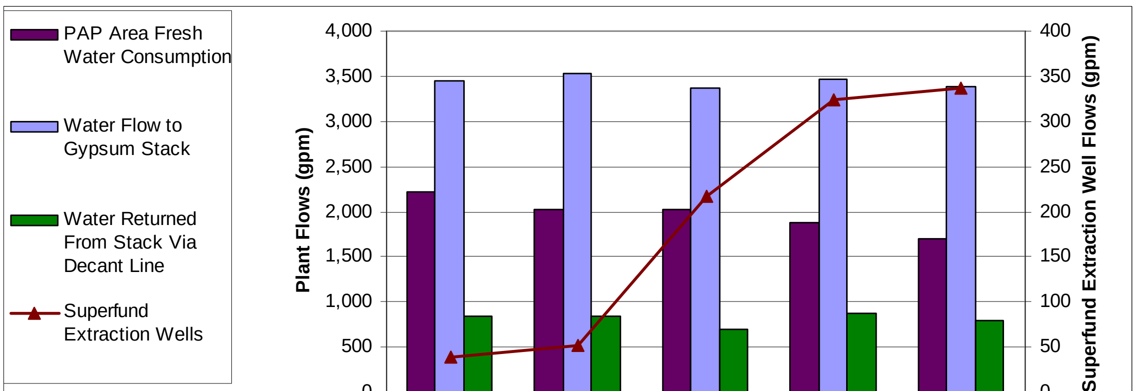
Monthly water flows related to the Phosphoric Acid Plant for 2006 are shown in Figure 3-1. Overall there are relatively minor changes in average flows from month to month and significant seasonal effects are not evident. A decrease for all flows occurred in June when facility turnaround occurred.



	Jan-06	Feb-06	Mar-06	Apr-06	May-06	Jun-06	Jul-06	Aug-06	Sep-06	Oct-06	Nov-06	Dec-06
PAP Area Fresh Water Consumption	1,721	1,373	2,100	1,618	1,685	1,348	1,826	1,735	1,785	1,707	1,657	1,802
Water Flow to Gypsum Stack	3,611	3,322	3,954	3,384	3,510	2,809	3,434	3,158	3,255	3,360	3,369	3,364
Water Returned From Stack Via Decant Line	812	689	828	935	1,144	645	978	712	590	705	741	677
Superfund Extraction Wells	340	342	342	355	351	200	342	333	371	365	355	348

Figure 3-1: Monthly Plant Flows

As shown on Figure 3-2, flows from the test extraction system are relatively small compared to other inputs. Since 2002, the average flow from the extraction wells has increased from less than fifty to approximately 340 gallons per minute. A corresponding decrease in fresh water consumption in the Phosphoric Acid Plant area has occurred. This is expected because addition of test extraction groundwater to the reclaim cooling system has reduced the demand for fresh water input. The overall water flow to the gypsum stack has not been affected.



	2002	2003	2004	2005	1,258
PAP Area Fresh Water Consumption	2,215	2,023	2,017	1,884	1,696
Water Flow to Gypsum Stack	3,447	3,530	3,373	3,461	3,378
Water Returned From Stack Via Decant Line	834	835	696	880	788
Superfund Extraction Wells	39	52	216	323	337

Figure 3-2: Yearly Plant Flows

There were changes to the relative pumping rates from the production wells in 2006. As shown in Figure 3-3, flows from SWP-4 decreased by approximately 500 gpm from the fourth quarter

2005 to the fourth quarter 2006, with a corresponding increase in flows from SWP-5. This may be causing changes in the groundwater system, as discussed in Section 4.3.

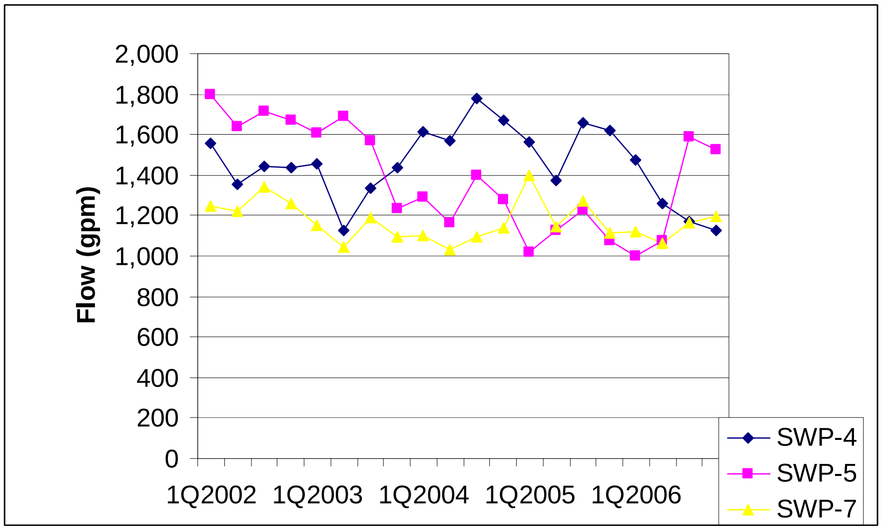


Figure 3-3: Quarterly Production Well Flows

4.0 GROUNDWATER MONITORING

This section provides a summary evaluation of the recent groundwater data with an emphasis on interpretation of conditions in key areas relative to sources, target extraction area and downgradient areas.

Routine groundwater monitoring has been performed at the Site since the Remedial Investigation began in 1992. To support the design of the groundwater extraction system a baseline groundwater monitoring event was performed in August 2003 and monitoring has been performed quarterly since that time, with essentially the same scope (sampling locations and analytes). Four sampling events were performed in 2006: in March, May/June, August and November. The monitoring analyte list is shown in Table 4-1. Sampling locations are listed on Table 4-2 and locations are shown on Figures 4-1 and 4-2.

Table 4-1: Groundwater Monitoring Analyte List - 2006.

General Chemistry	Metals	Field Parameters
Alkalinity	Arsenic, Total*	Eh
Chloride	Calcium, Total	Oxygen, Dissolved
Hardness	Magnesium, Total	pH
Nitrite+Nitrate (as N)	Potassium, Total	Specific Conductivity
Phosphorus, Total	Selenium, Total*	Temperature
Sulfate	Sodium, Total	Turbidity
TDS		

* When sample turbidity exceeds 10 NTU, the sample is filtered and dissolved Arsenic and Selenium concentrations are also measured.

Table 4-2: Groundwater Monitoring Locations - 2006.

Upper Zone						Lower Zone		
189	316	333	348	358	409	305	346	SWP-5
190	318	334	350	401	503	309	347	SWP-7
191	320	335S	351	402	505	315	410	
307	325	336	352	404	518	317	411	
308	327	338	354	405	527	326	504	
310	328	339	355	406	BRS[1]	335D	519	
312	331	340	356	407	BTS[2]	337	526	
313	332	342	357	408		344	SWP-4	

[1] The Spring at Batiste Road
[2] Batiste Spring

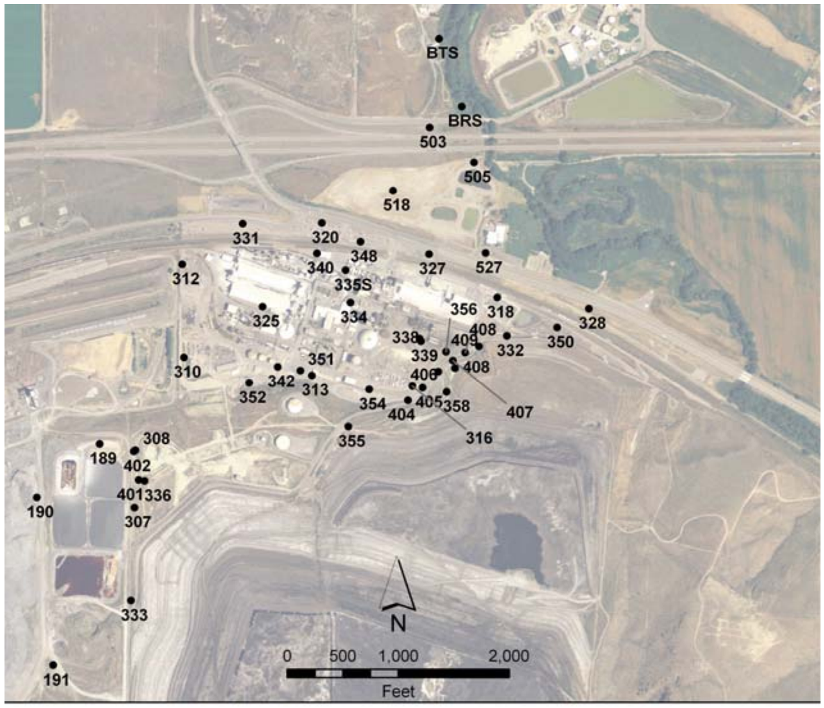


Figure 4-1: Groundwater Quality Monitoring Locations in the Upper Zone – 2006.

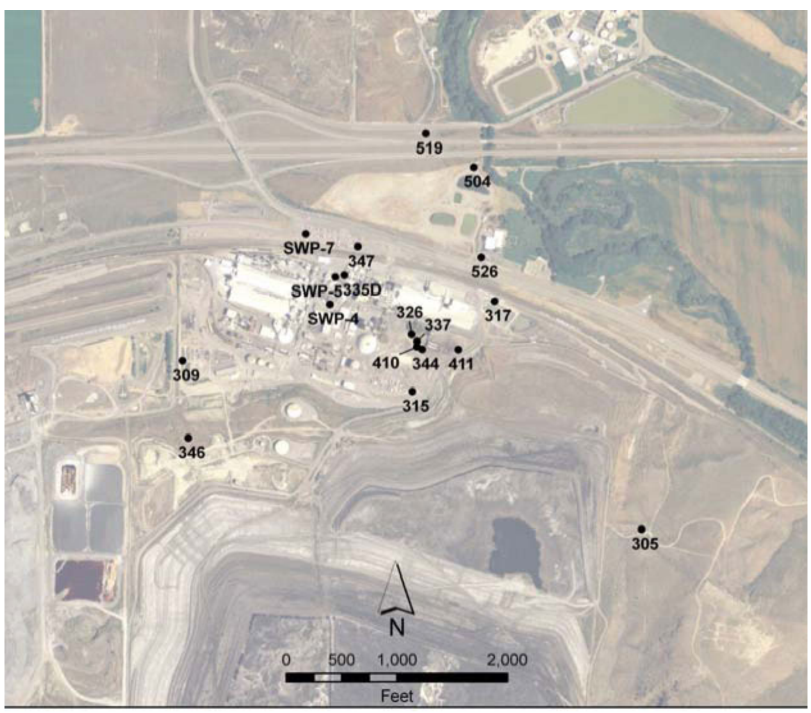


Figure 4-2: Groundwater Quality Monitoring Locations in the Lower Zone – 2006.

Data from these monitoring events have already been reported (NewFields 2006e, f, g and 2007b).

NEWFIELDS

As described above, the test groundwater extraction system began routine operation in June 2004 (the West Plant Area and East Plant Area Lower Zone extraction wells began operation in late June 2004; the East Plant Upper Zone Wells were brought on line from August to October 2004, as operational difficulties related to lower-than-expected flows were resolved [MFG, 2005]).

For the purposes of evaluation of groundwater data and design of the extraction system, the Site has been divided into distinct areas (see Figures 4-3 and 4-4):

- East Plant Area (Upper Zone and Lower Zone)
- Central Plant Area (Upper Zone and Lower Zone)
- West Plant Area
- North of I-86/Porteuf River Springs (Upper and Lower Zone)

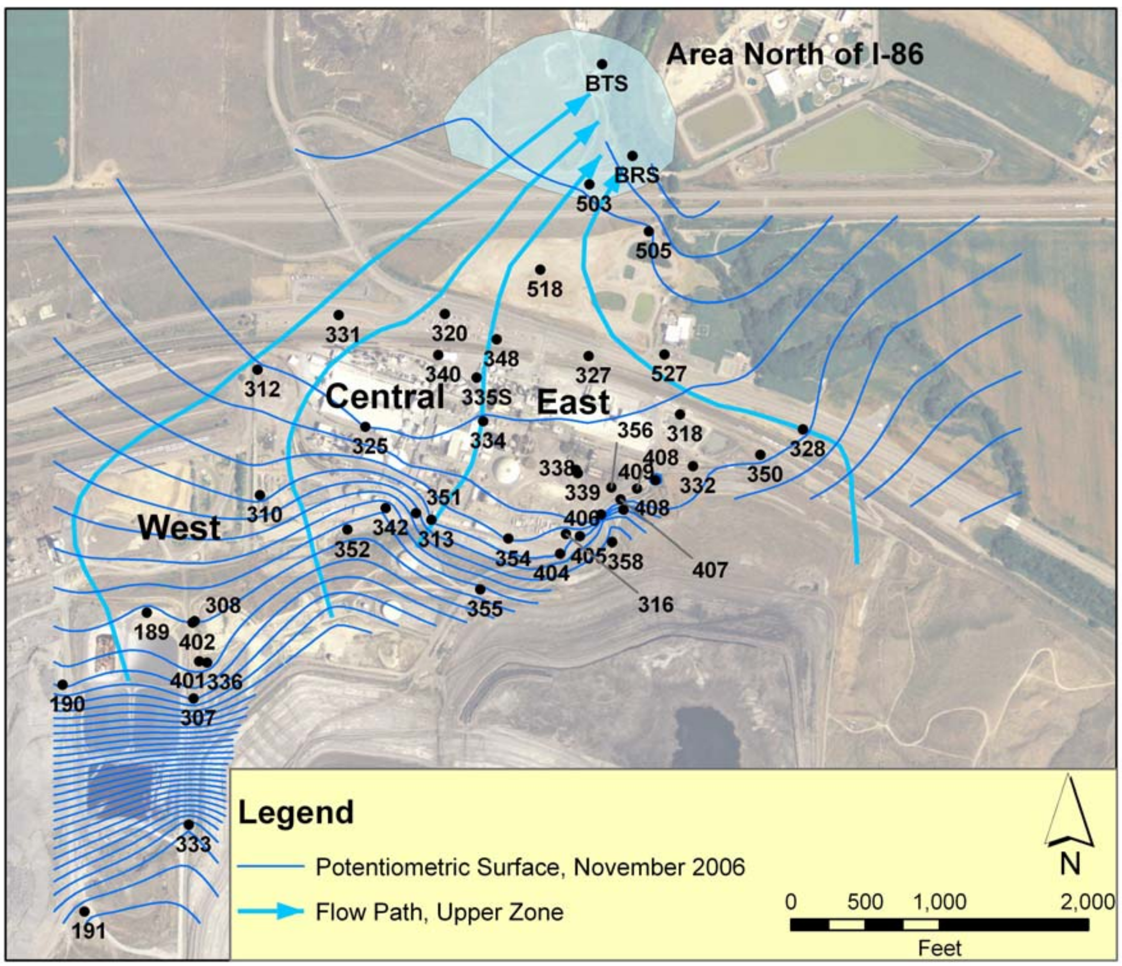


Figure 4-3: Groundwater Areas (Upper Zone).

NEWFIELDS

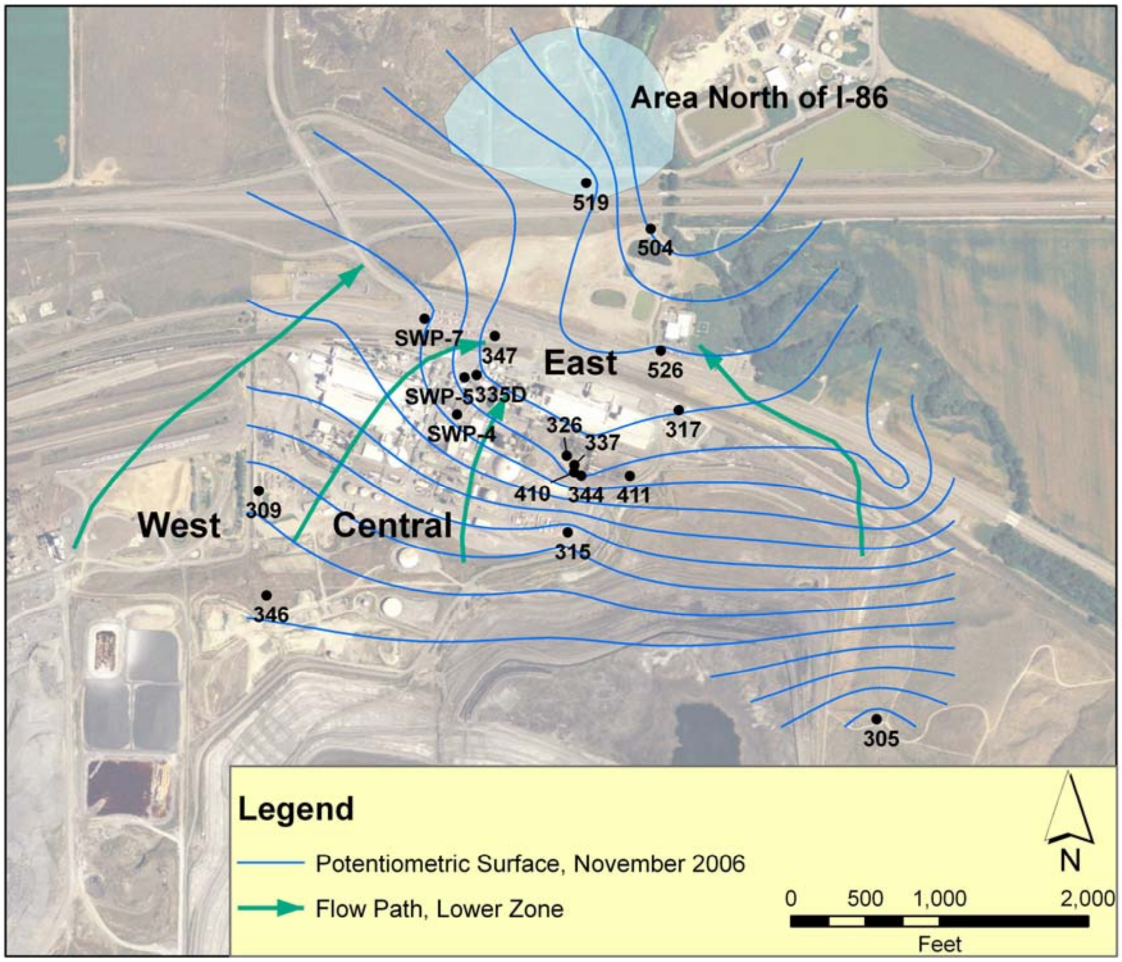


Figure 4-4: Groundwater Areas (Lower Zone).

Constituent concentrations measured in groundwater in the November 2006 monitoring event are shown in Figures 4-5 and 4-6. Groundwater monitoring data are evaluated for each of these areas in the following subsections.

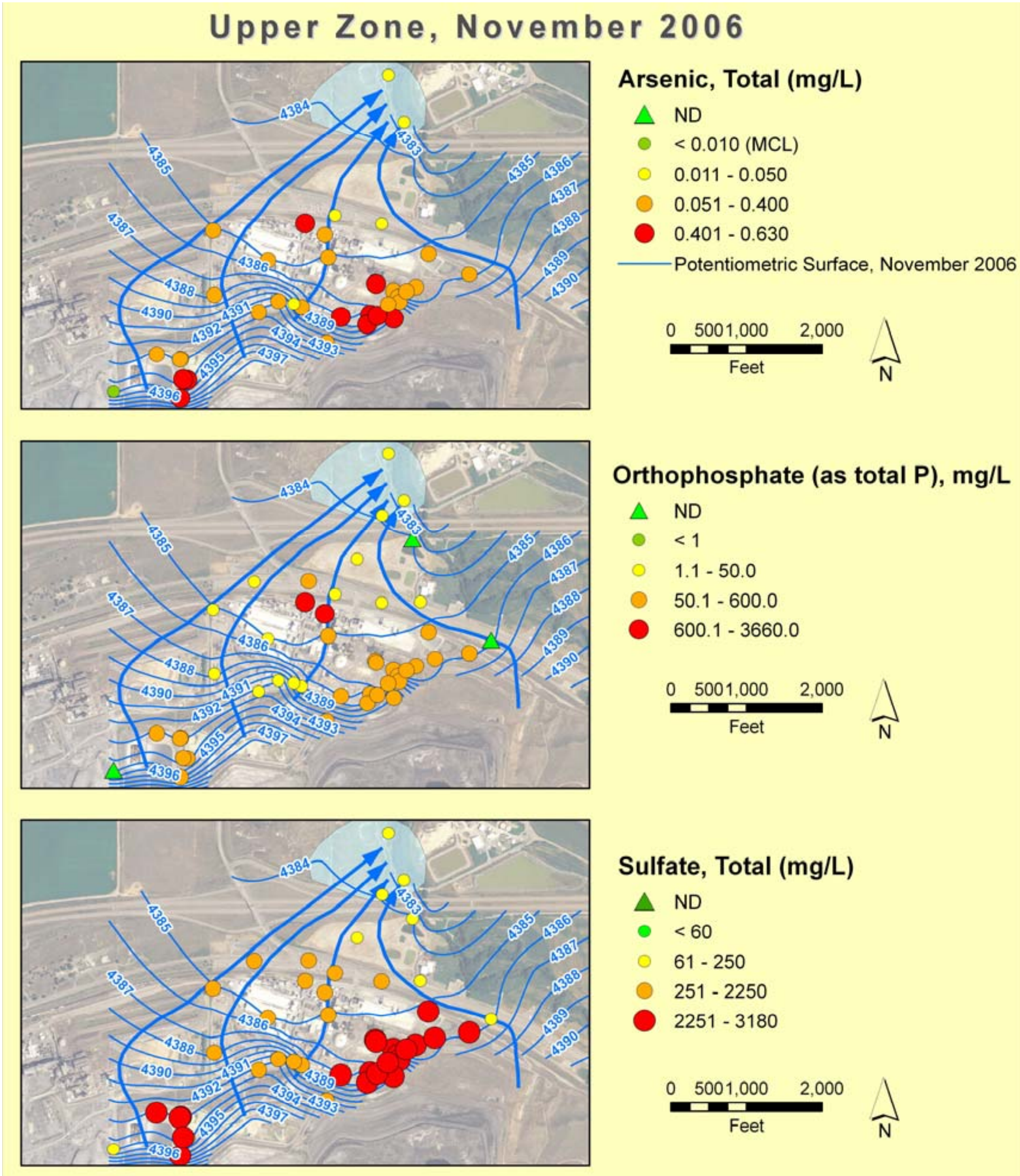


Figure 4-5: Upper Zone Constituent Concentrations, November 2006

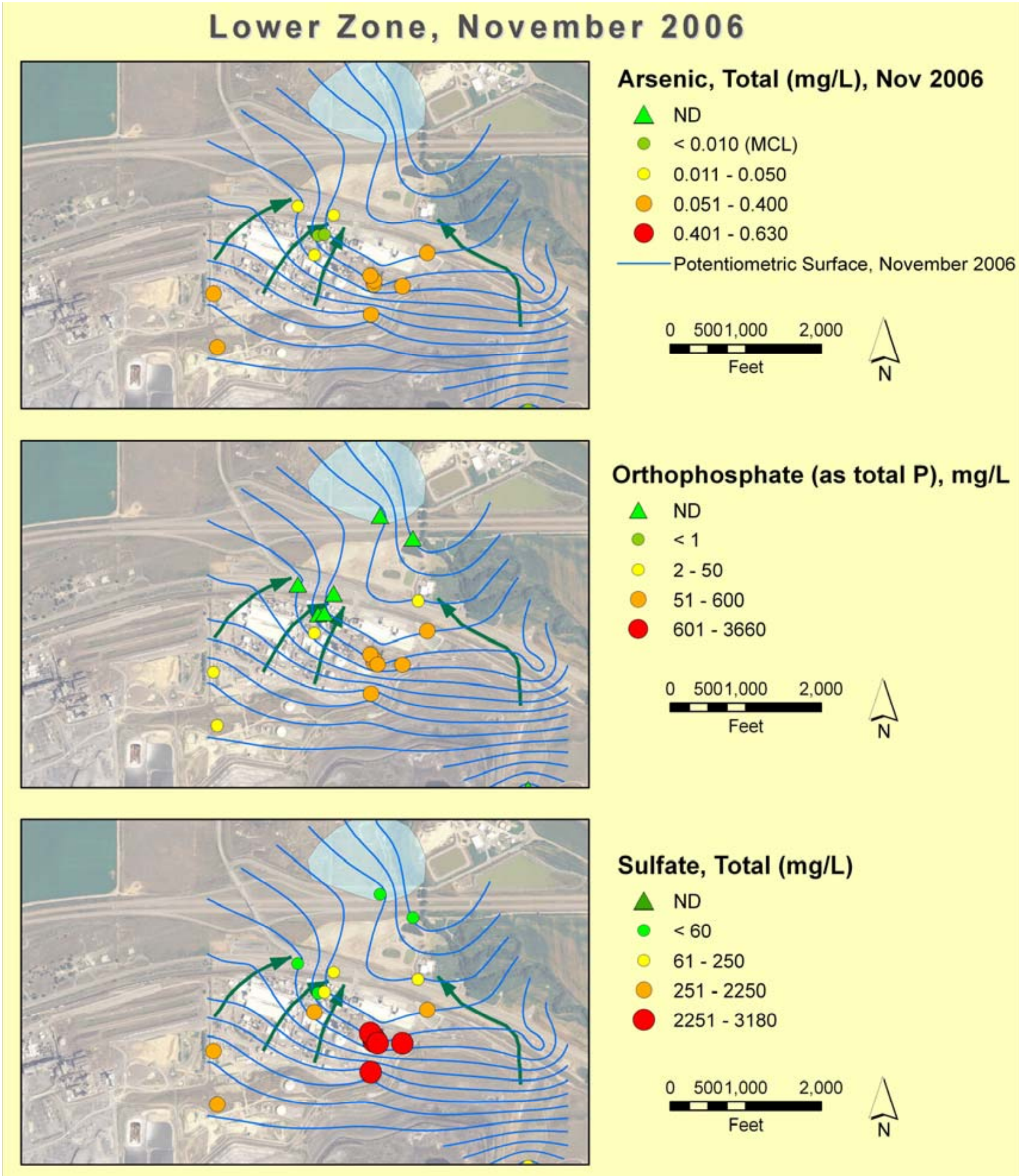


Figure 4-6: Lower Zone Constituent Concentrations, November 2006

4.1 Groundwater Levels

Groundwater levels increased in nearly all wells across the site in May 2006 at a magnitude not observed in recent years. As shown in Figure 4-7, groundwater levels increased from 2 to 3 feet in many wells in the measurement made on May 1 versus the measurement made of February 27. The levels decreased back to near February levels by August. A temporary shift occurred in the potentiometric surface at this time and some groundwater flow directions changed temporarily. The mechanism for the change was investigated in order to better understand the influence that the event may have on groundwater chemistry.

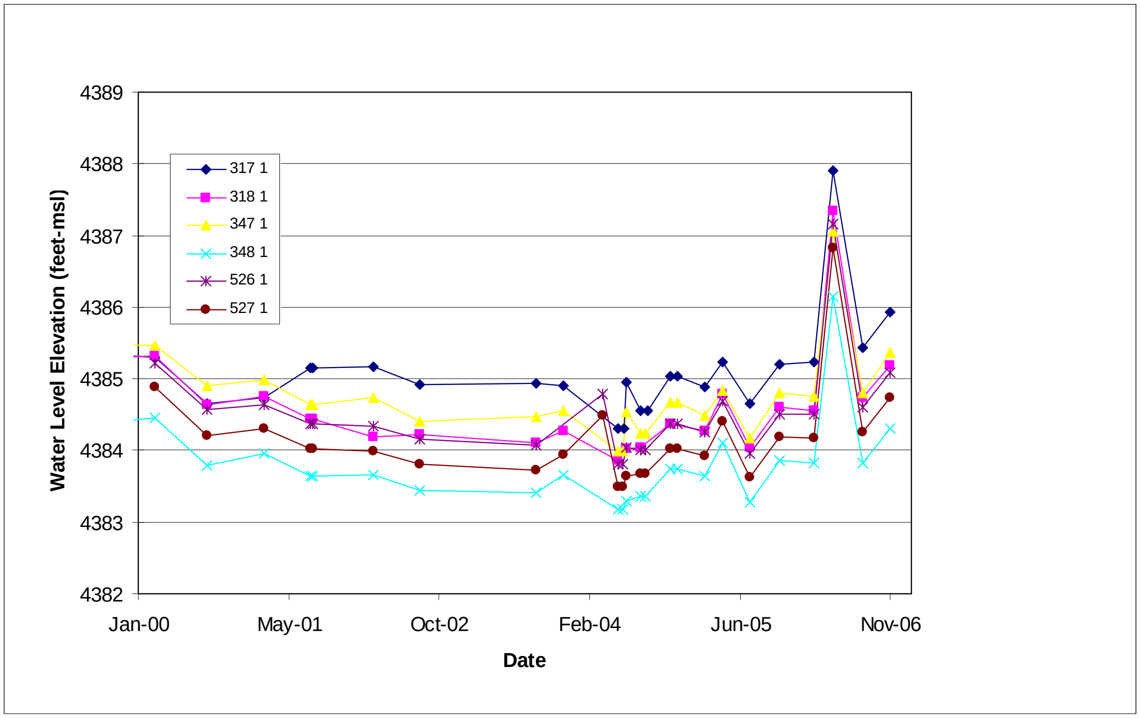


Figure 4-7: Groundwater levels in selected Upper and Lower Zone wells since 2000

Precipitation records at Pocatello Airport indicate that both 2005 and 2006 were wetter than average (15.42 in and 12.84 in respectively, versus the 11.53 average). However, local precipitation does not appear to be the primary factor influencing the groundwater level increase. Higher precipitation was observed in 2005 and, as shown in Figure 4-8, there was more precipitation in the Spring of 2005 than the Spring of 2006. In spite of the 2005 precipitation, no notable increases in groundwater levels were observed.

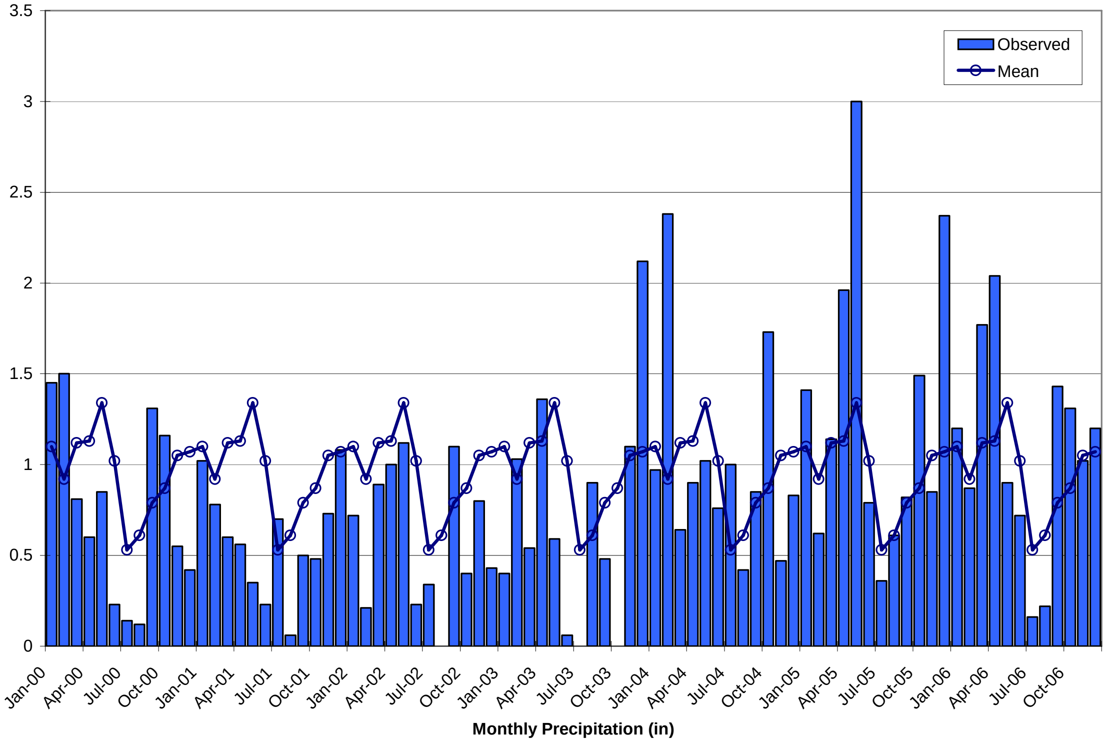


Figure 4-8: Monthly precipitation observed at the Pocatello Regional Airport. Mean for the period of record (since 1939) also shown.

Flow records for the Portneuf River indicate that flow on the river was the greatest in May 2006 than it had been since about 1996. The flow record for the USGS station in Pocatello is shown in Figure 4-9. In 2006, flow peaked at about 1400 cfs in early May, versus a peak of 700 cfs in mid-May of 2005. The corresponding river stage increased 4.67 feet at the Highway 30 bridge and 3.17 feet at Batiste Road in May 2006 compared to measurements made in February. Flow during the spring runoff period is heavily influenced by operation of the Chesterfield Reservoir (IDEQ, 1999) and the high flow may be related to water release from the reservoir.

As shown in Figures 4-10 and 4-11, groundwater levels increased in both Upper Zone and Lower Zone wells in May. The increase appears to be greatest in wells located closest to the river and in wells completed in geologic units that have a high hydraulic conductivity. The response to river stage is mostly a pressure effect, however, water losses from the river during the high-flow period may also affect groundwater chemistry.

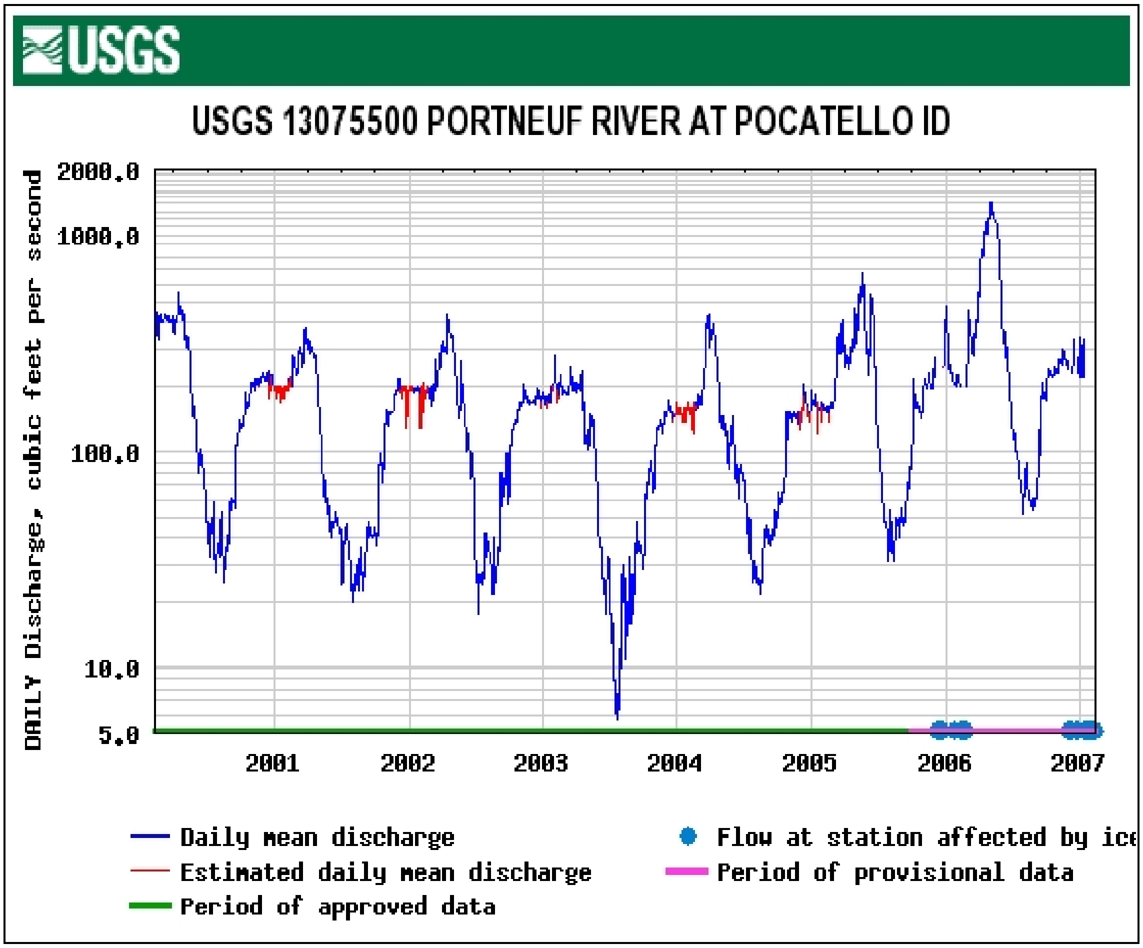


Figure 4-9: Mean daily discharge in the Portnuef River at Pocatello.

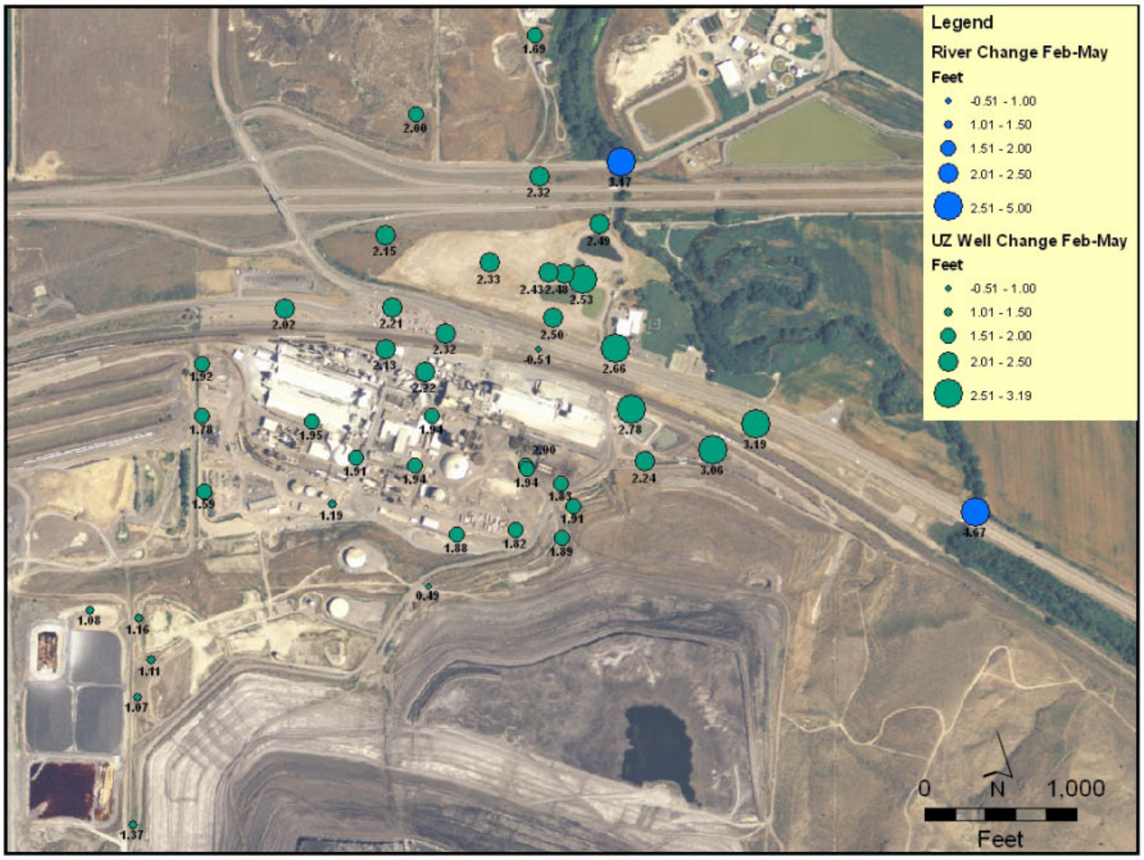


Figure 4-10: Water level changes in Upper Zone monitoring wells and the Portneuf River stations from February to May 2006

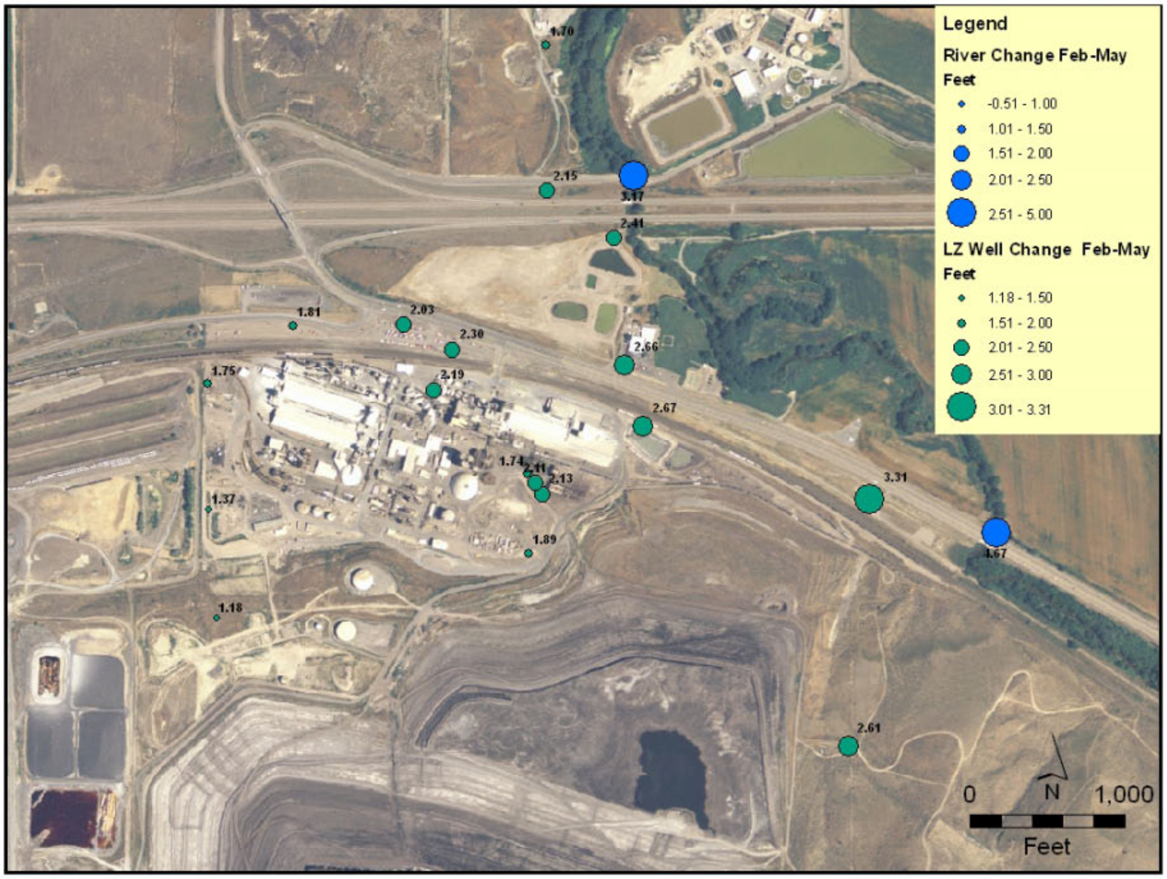


Figure 4-11: Water level changes in Lower Zone monitoring wells and the Portneuf River stations from February to May 2006

4.2 East Plant Area

4.2.1 Upper Zone

The East Plant Upper Zone area and associated groundwater extraction and monitoring wells are shown in Figure 4-12.

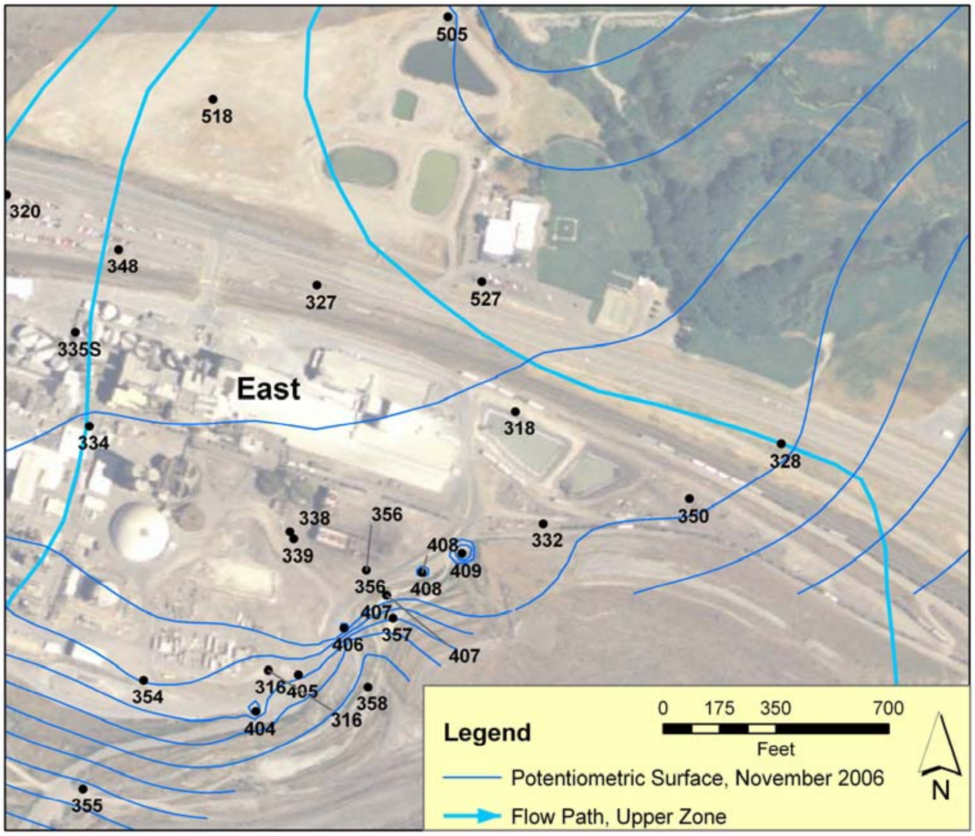


Figure 4-12: East Plant Area Upper Zone Wells.

Arsenic concentrations measured in the extraction wells (404 through 409) are shown in Figure 4-13. Concentrations at each well have remained relatively constant, with no significant change apparent since pumping began in late 2004. Spatially concentrations have ranged from approximately 0.3 mg/L to 0.65 mg/L, with concentrations generally decreasing from west to east.

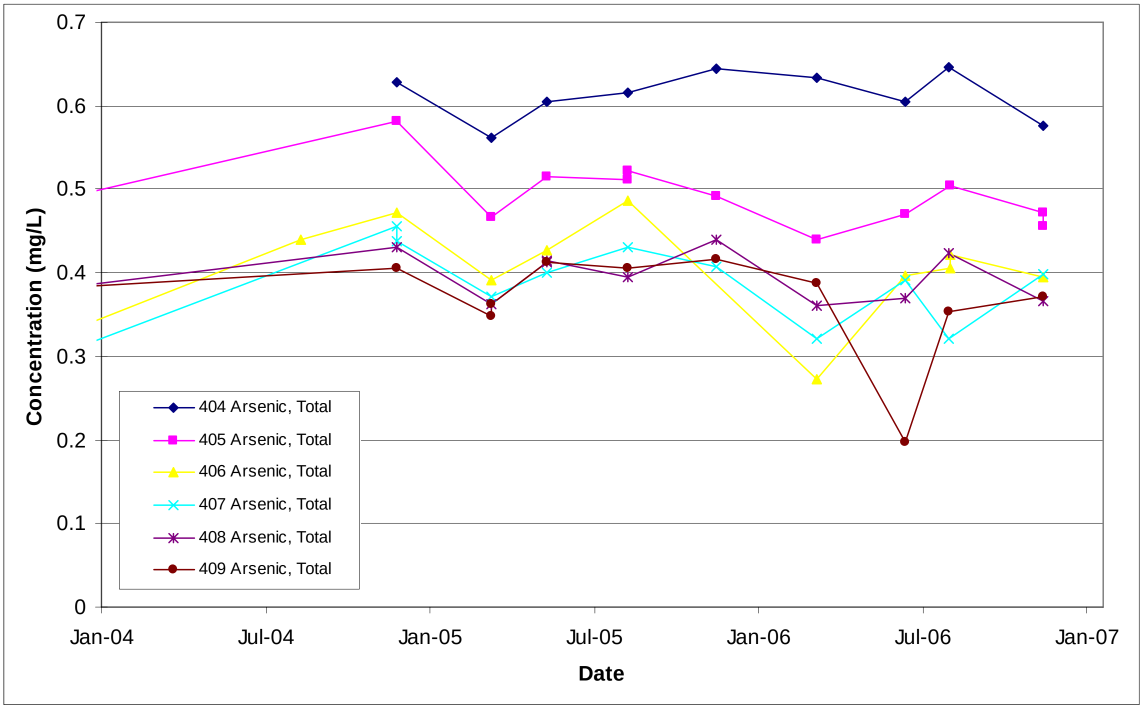


Figure 4-13: Arsenic Concentrations – East Plant Upper Zone Extraction Wells

Arsenic concentrations in monitoring wells immediately downgradient of the extraction wells have ranged between 0.2 and 0.45 mg/L (see Figure 4-14). Further downgradient Arsenic concentrations reduce to between approximately 0.01 and 0.02 mg/L (Figure 4-15). Concentrations have been relatively stable over time and no downward trend is apparent after the test extraction system became operational.

NEWFIELDS

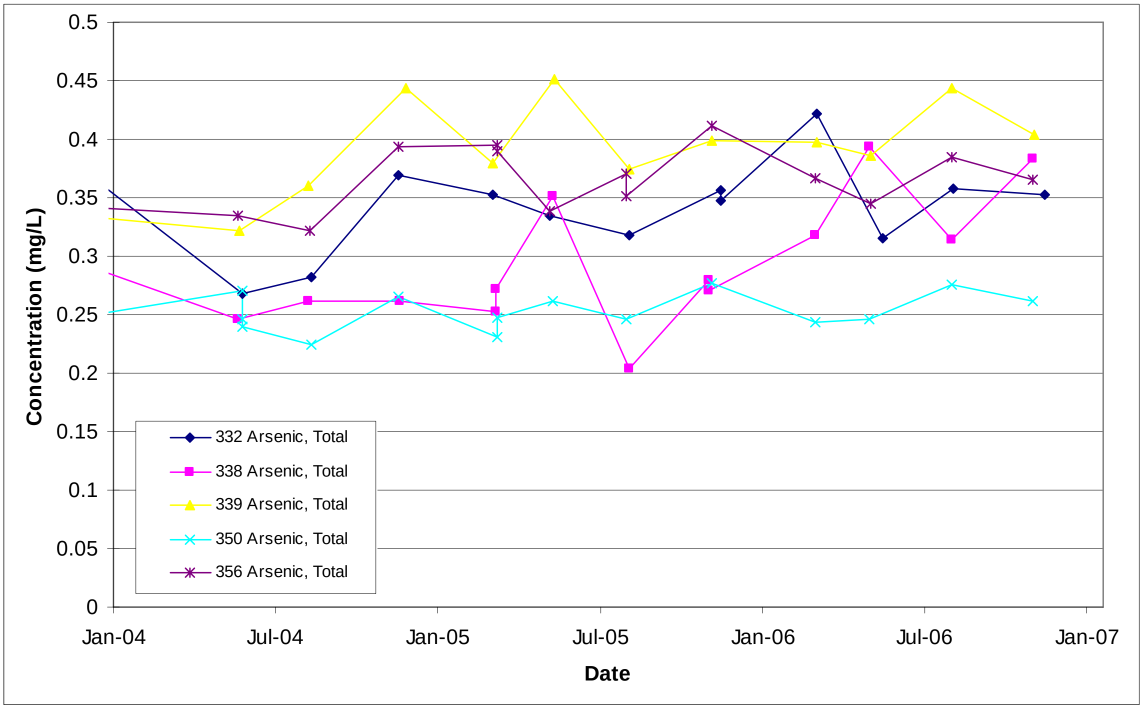


Figure 4-14: Arsenic Concentrations – Vicinity of East Plant Upper Zone Extraction Area

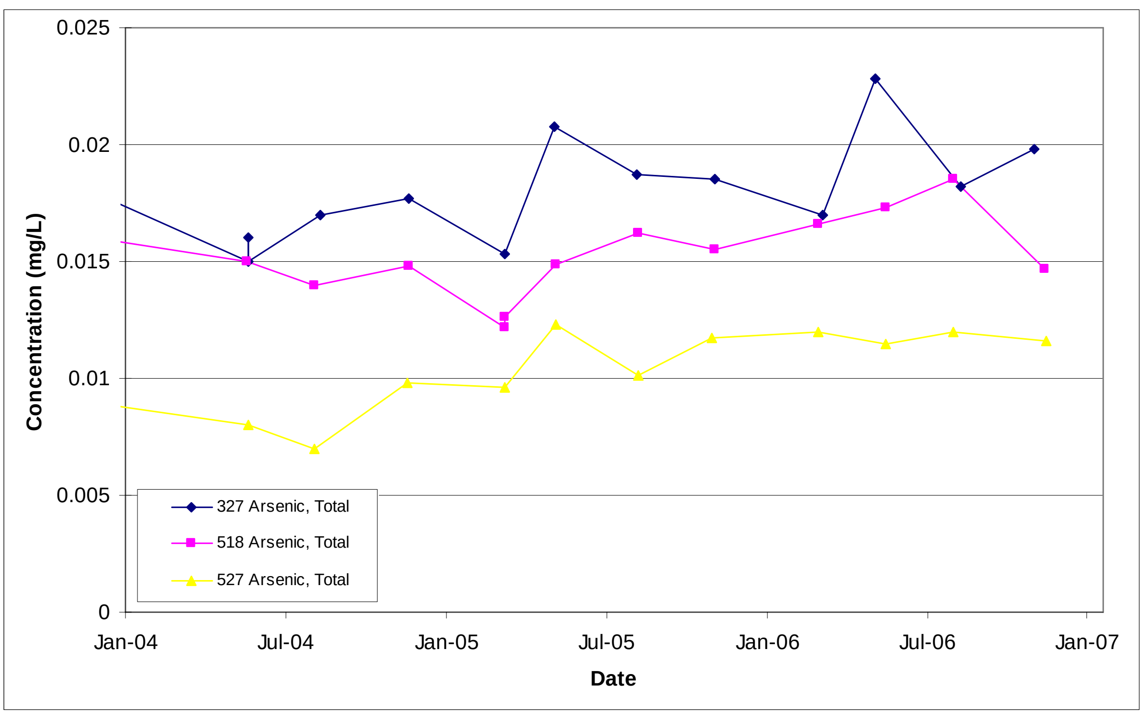


Figure 4-15: Arsenic Concentrations Downgradient of the East Plant Upper Zone Extraction Area

Concentrations of different constituents undergo similar reductions as Upper Zone groundwater migrates north from the stack area (see Figure 4-16). This reduction in concentrations is the result of mixing of stack-affected groundwater with river-influenced water from the east. Arsenic concentrations at well 328 (the furthest well to the northeast of the extraction area – see Figure 4-3) have consistently been below detection limits and groundwater at this location appears representative of unimpacted conditions. Groundwater levels throughout the East Plant area are influenced by seasonal effects (see Figure 4-7), and a similar temporal trend is shown throughout the area. This correlates with Portneuf River stage, as discussed in Section 4.1. It appears that water from the river enters the groundwater system upstream of Batiste Road, resulting in dilution of constituent concentrations in shallow groundwater in areas close to the river. The rate and location of flow from the river varies with the river stage.

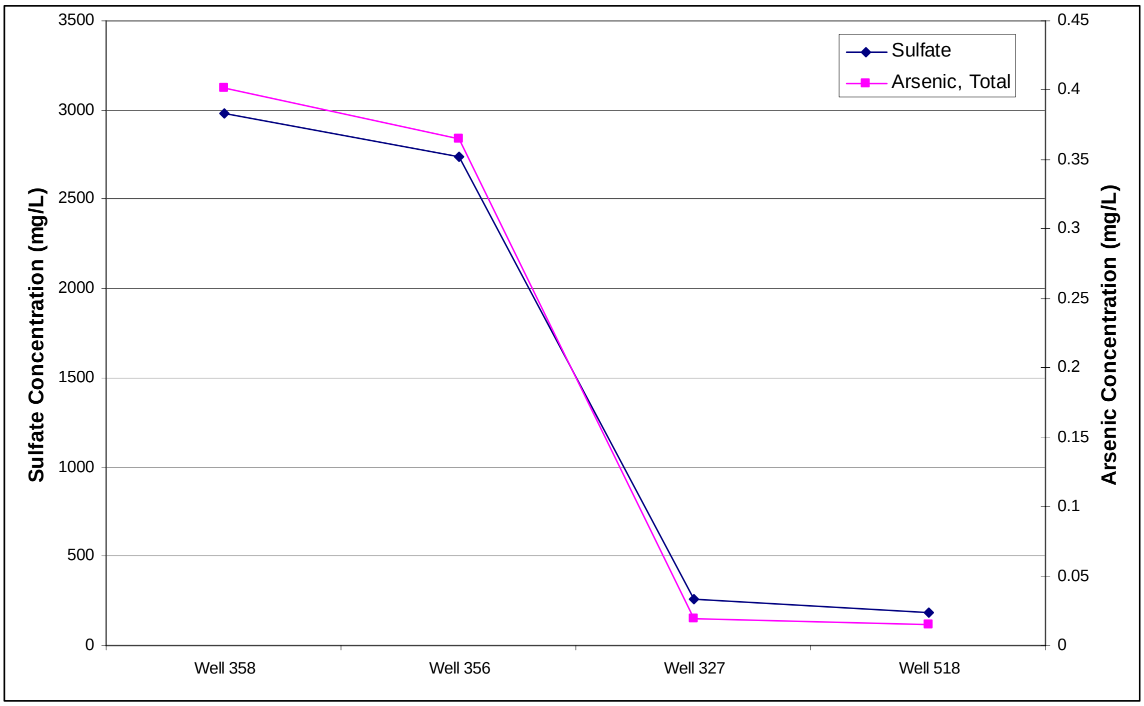


Figure 4-16: Arsenic and Sulfate Concentrations Along an Approximate Flow Path Downgradient of the Upper Zone Extraction Area

4.2.2 Lower Zone

Lower Zone groundwater extraction and monitoring wells in the East Plant area are shown on Figure 4-17.

NEWFIELDS

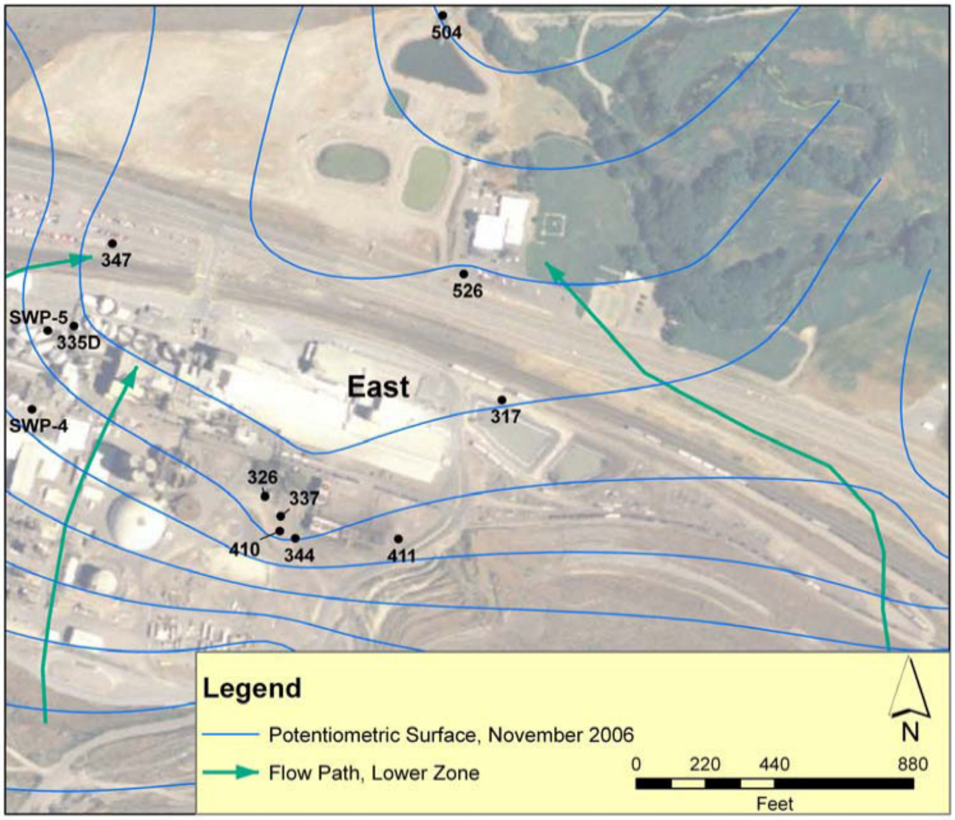


Figure 4-17: East Plant Lower Zone Monitoring Wells.

As described above, East Plant Lower Zone extraction wells 410 and 411 began routine operation in June 2004. Arsenic concentrations in extracted groundwater and nearby Lower Zone areas have remained relatively constant, typically between 0.3 and 0.5 mg/L (see Figure 4-18). There were no significant concentration changes in 2006.

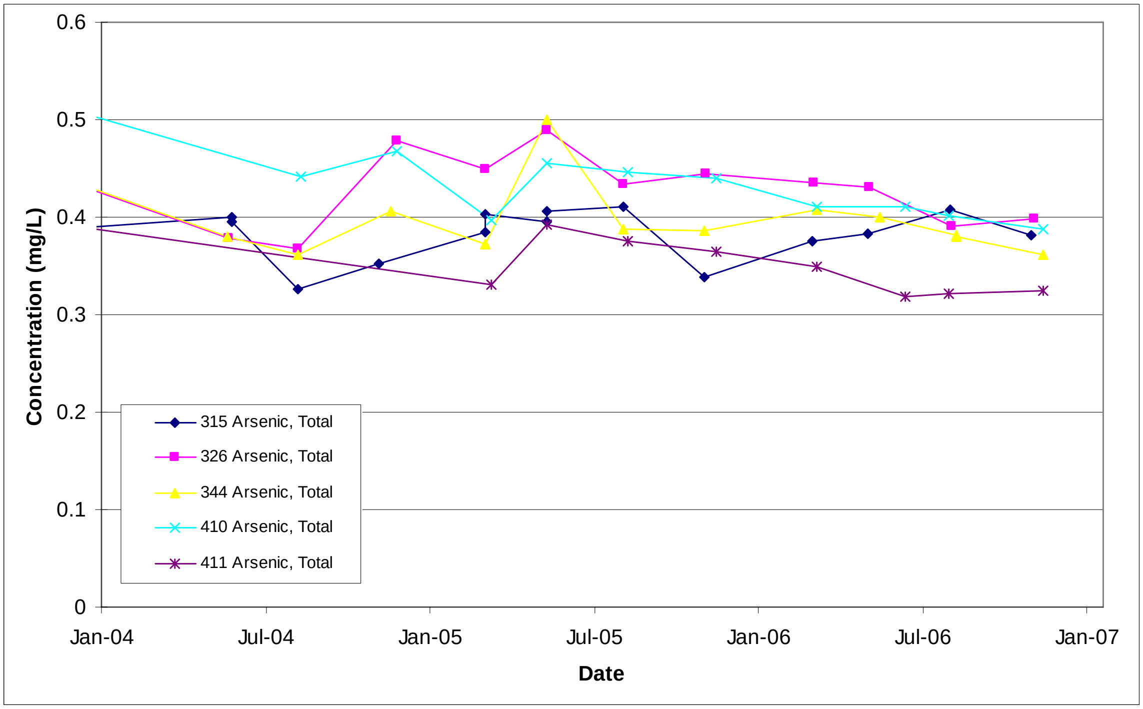


Figure 4-18: Arsenic Concentrations – East Plant Lower Zone Extraction Wells and Nearby Monitoring Wells

Concentrations of constituents in groundwater downgradient of the East Plant Lower Zone extraction system decreased after the test extraction system became operational and remained at those levels in 2006. This indicates that extraction is having a significant and sustainable effect on downgradient constituent concentrations. Figure 4-19 show Arsenic and Orthophosphate (as Total Phosphorus) concentrations measured in well 526 with time.

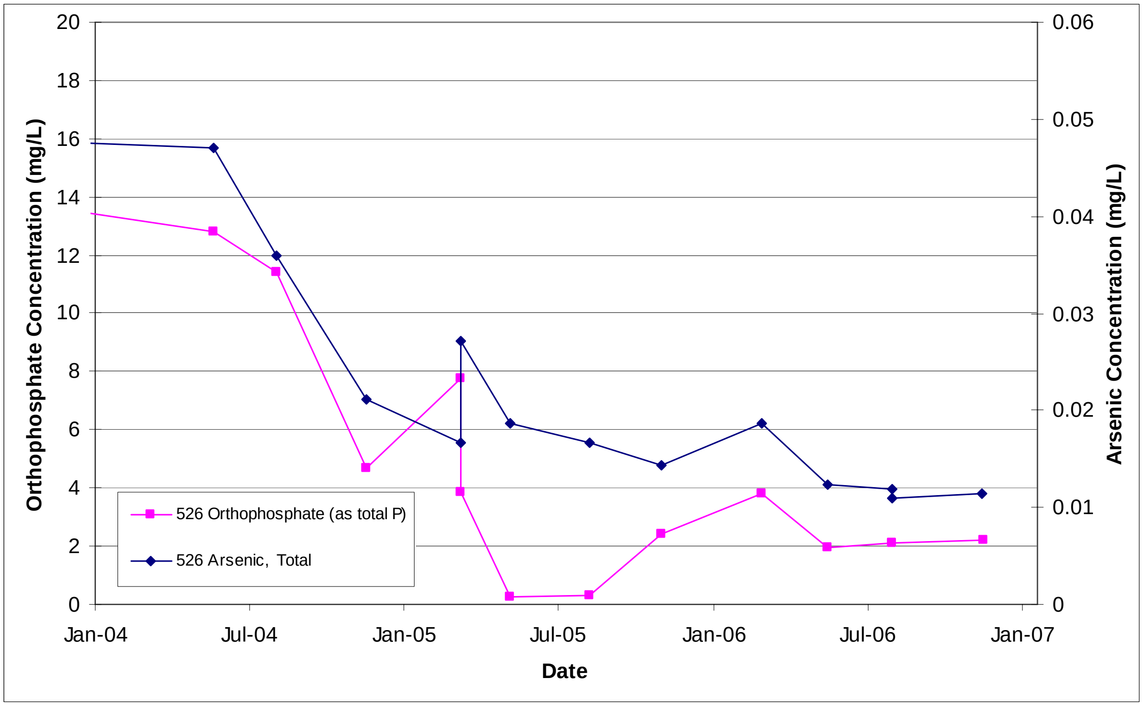
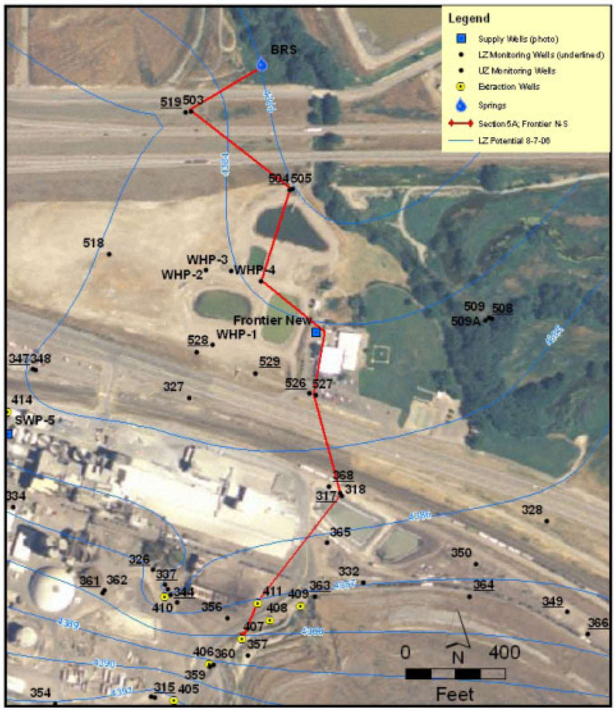


Figure 4-19: Well 526 Arsenic and Orthophosphate (as Total Phosphorus) Concentrations versus Time – East Plant Lower Zone Downgradient of Test Extraction Wells

The 2006 monitoring data confirm that the extraction of Lower Zone groundwater has resulted in the reductions of constituent concentrations at well 526. Figure 4-20 shows the geologic cross section along the direction of groundwater flow from the extraction wells downgradient to the north. The timeframe for concentration reductions measured in 2006 is generally consistent with groundwater travel times, estimated from aquifer properties and potentiometric surfaces, being around the order of one year from the extraction wells to the area of well 526. A likely effect is that unimpacted deep groundwater is replacing the impacted groundwater at the well locations, resulting in lower constituent concentrations.

It is also noted that no lag in concentration reduction is apparent between Arsenic and Orthophosphate (as Total Phosphorus). Orthophosphate (as Total Phosphorus) is predicted to be significantly attenuated in the aquifer. Ongoing desorption/dissolution from aquifer solids into downgradient groundwater after the extraction system becomes fully operational is a technical issue related to the Portneuf River TMDL. These data indicate that this desorption/dissolution effect is not significant. Reductions of Orthophosphate (as Total Phosphorus) loading to the river from Simplot sources are expected to reduce over the same timeframe as Arsenic; consistent with groundwater travel times.



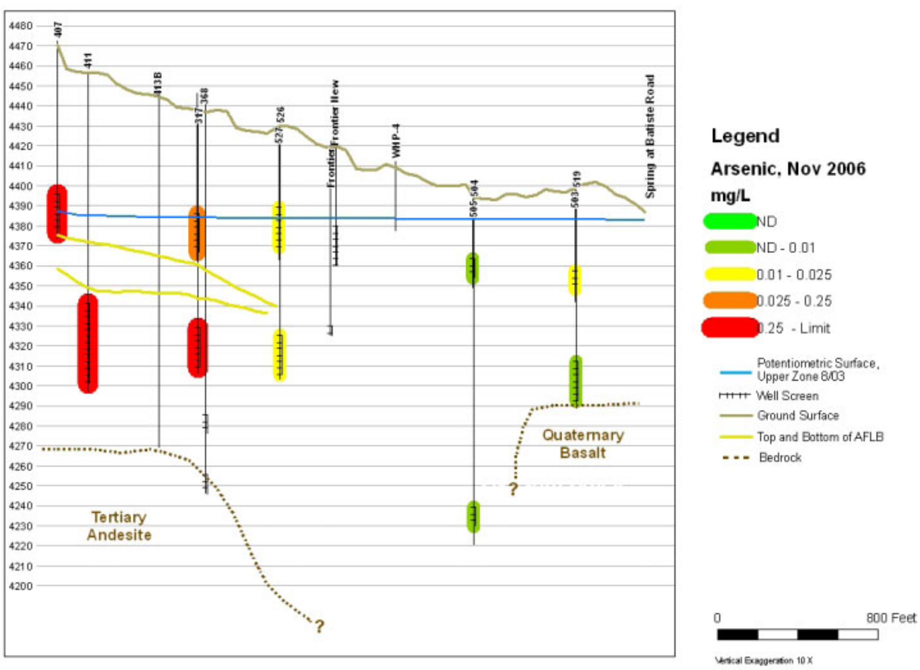


Figure 4-20: East Plant Lower Zone Cross Section – Downgradient From Extraction Wells

4.3 Central Plant

4.3.1 Upper Zone

Central Plant Upper Zone groundwater monitoring wells locations are shown on Figure 4-21.

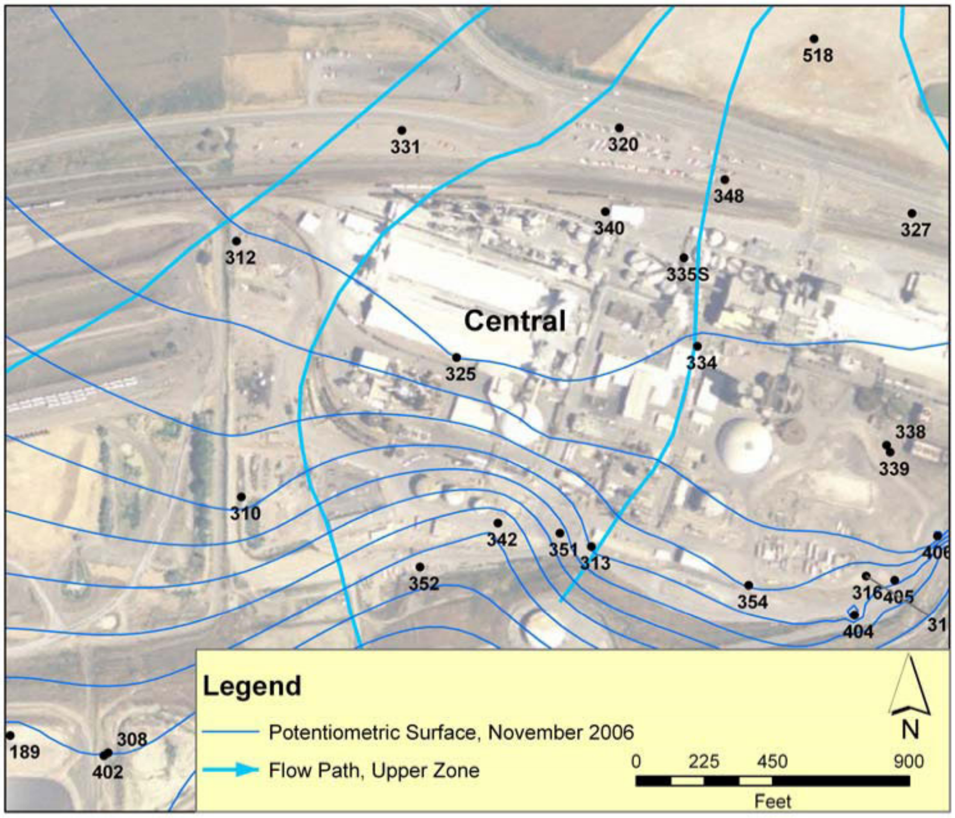


Figure 4-21: Central Plant Upper Zone Monitoring Wells

Central Plant Upper Zone groundwater is impacted by two distinct sources: the gypsum stack and the Phosphoric Acid Plant. The area is downgradient of the bedrock knob and constituent concentrations are lower than in the East and West Plant Areas (see Figure 4-5).

Arsenic and Orthophosphate (as Total Phosphorus) concentrations in wells 335S and 340, within the Phosphoric Acid Plant facility area, were higher than would be expected for stack impacts alone (i.e. well 334), indicating the presence of a distinct facility-related source or sources (see Figures 4-22 and 4-23). Sulfate concentrations are not elevated compared to stack-only effects (see Figure 4-24). This is consistent with expectations of a facility source in this area: Sulfate is associated with the gypsum (process byproduct) and the Phosphoric Acid facility area around well 335S is associated with processing and storage of phosphoric acid materials. Sulfate concentrations in wells 334 and 335S began to decrease in 2005 and that trend continued in 2006. In addition, Arsenic and Orthophosphate (as Total Phosphorus) concentrations in well 334 (upgradient of the Phosphoric Acid Plant, but downgradient of the gypsum stack) decreased rapidly in the second half of 2006. It is possible that these concentration decreases may reflect effects of the upgradient Upper Zone extraction system or in changes in Sulfate mass flux in stack-affected groundwater in this area. Another possible explanation for the rapid decreases of concentrations in well 334 during the second half of 2006 may be effects from reduction of pumping rates at the nearby production well SWP-4 (see flow data in Section 3.0). Continued monitoring will allow for an assessment of these various factors.

Orthophosphate (as Total Phosphorus) concentrations at wells 335S and 340 ranged up to approximately 3,500 mg/L in 2006, which is significantly higher than upgradient at well 334, where concentrations were in the range of 60 to 120 mg/L. Although the concentrations at wells 335S and 340 are relatively high, they reduce quickly downgradient. For example, at well 348, which is approximately 300 feet north of well 335S, the concentration ranged between approximately 13 and 50 mg/L in 2006. This appears to indicate that the source is localized with a relatively small mass flux. Arsenic concentrations were also elevated at wells 335S and 340, ranging from approximately 0.35 to 0.6 mg/L in 2006, compared with upgradient concentrations (well 334) in the range of 0.2 to 0.45 mg/L. This area was targeted for further investigation in the Phase 2 field work and data will be reported in the spring of 2007.

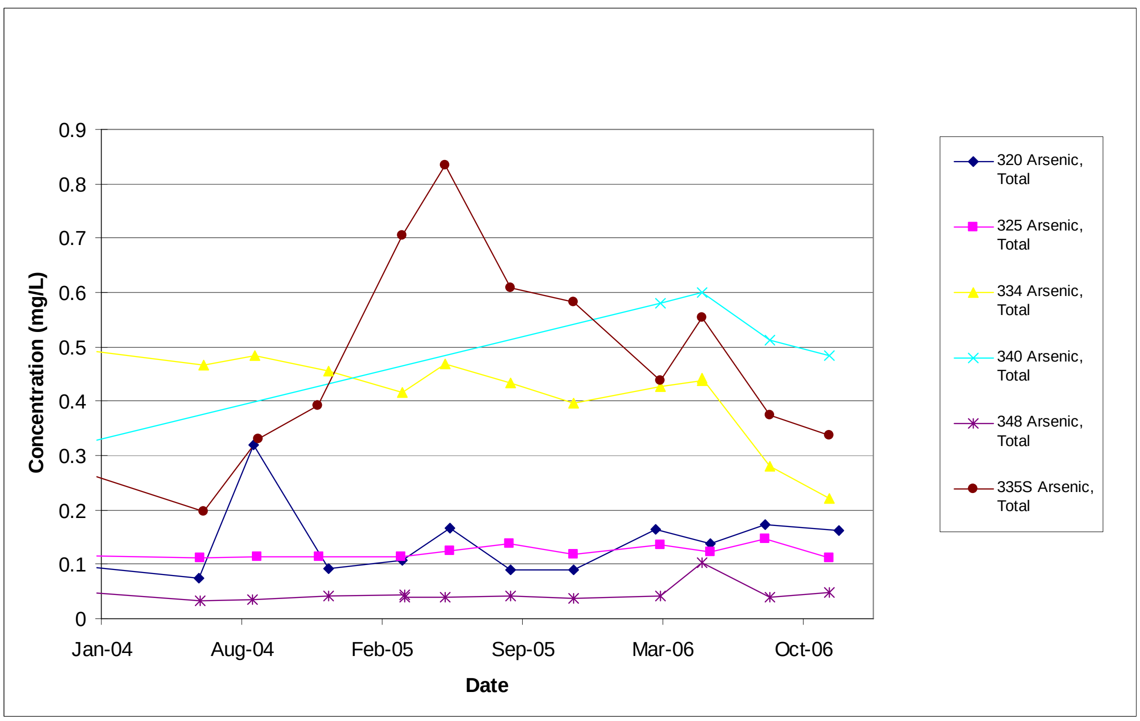


Figure 4-22: Central Plant Upper Zone Arsenic Concentrations

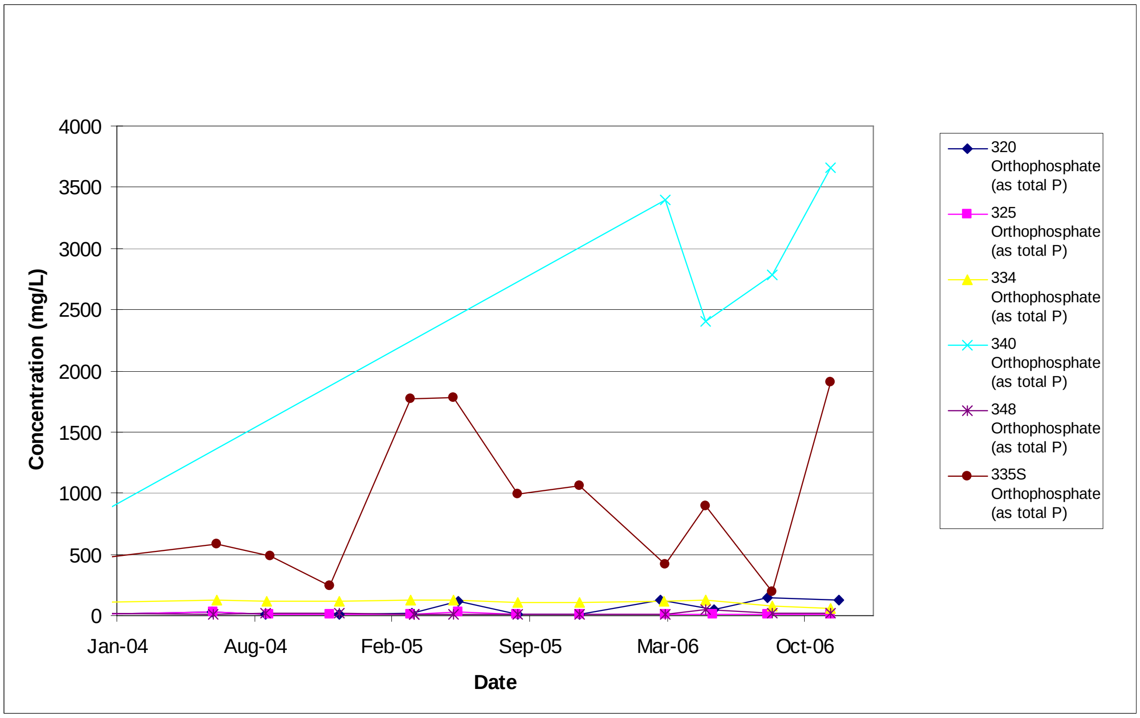


Figure 4-23: Central Plant Upper Zone Orthphosphate (as Total Phosphorus) Concentrations

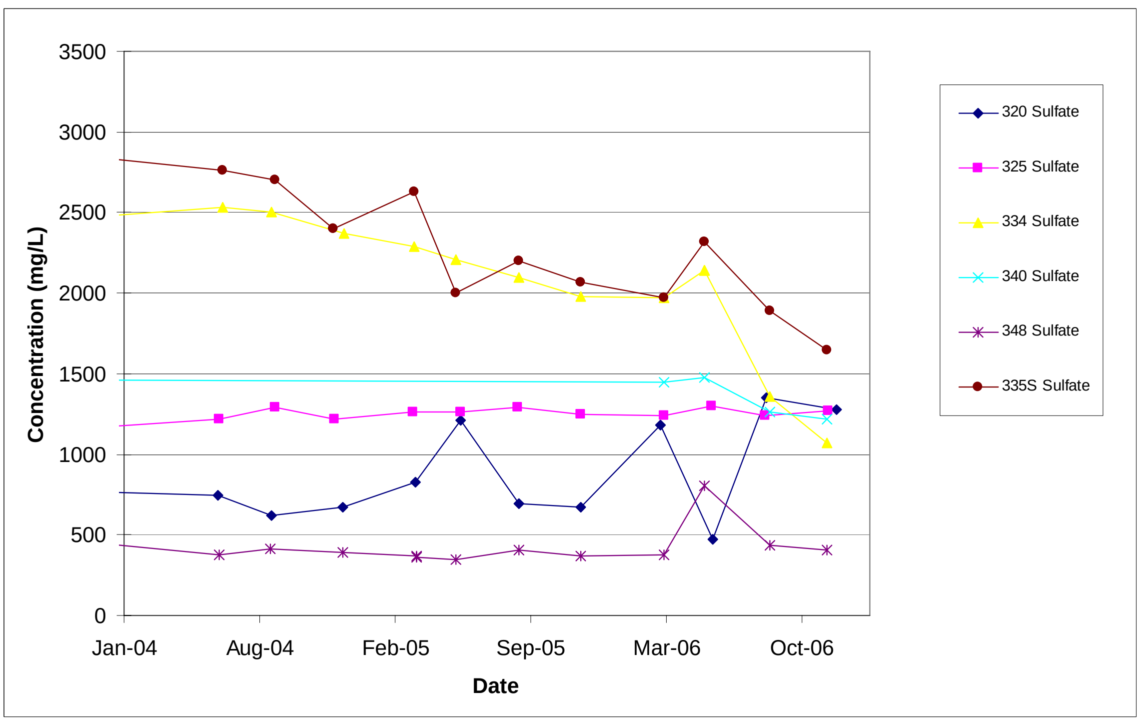


Figure 4-24 Central Plant Upper Zone Sulfate Concentrations

4.3.2 Lower Zone

Central Plant Lower Zone wells locations are shown on Figure 4-25.

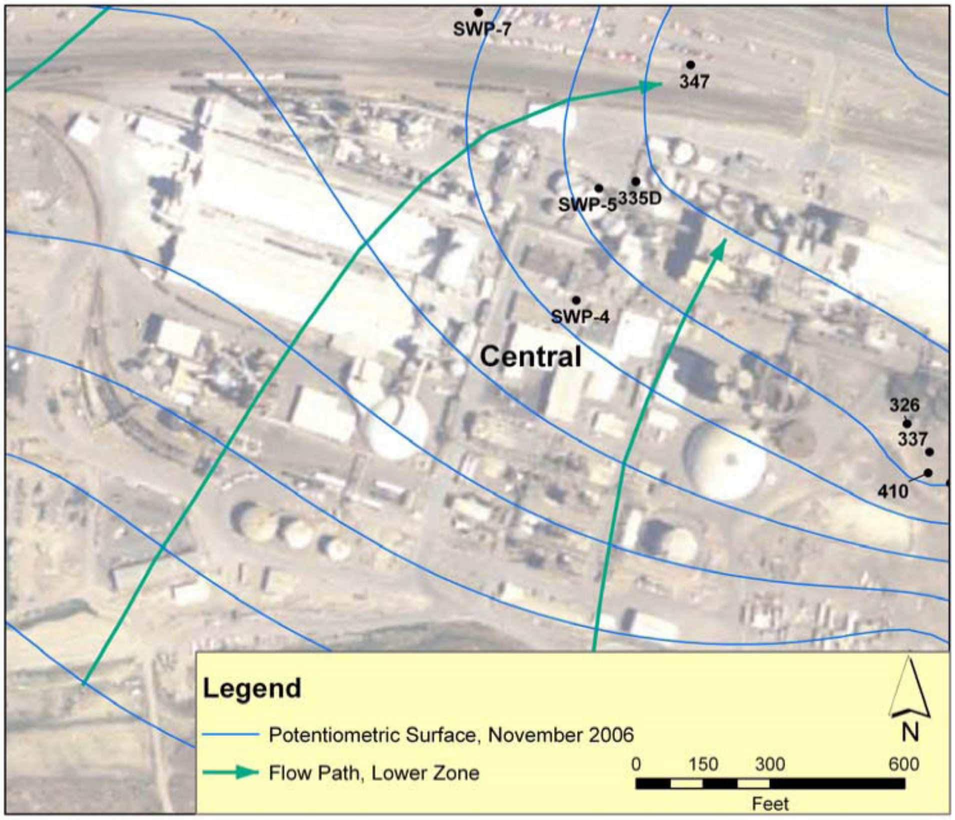


Figure 4-25: Central Plant Lower Zone Well Locations

Conditions in the Central Plant Lower Zone are dominated by the presence of facility production wells that pump approximately 4,000 gpm on a consistent basis (see Section 3.0).

Constituent concentrations are elevated in groundwater pumped from production well SWP-4 (see Figures 4-26 and 4-27). Based on a simple mass balance for Arsenic and Sulfate (measured concentrations, background concentrations and total production well flow), it is estimated that the well captures approximately 185 gpm of stack-affected groundwater (NewFields 2005). Concentrations of Arsenic and Sulfate in SWP-4 have been decreasing since 2004. Concentrations in monitoring wells downgradient of SWP-4 (wells 335D and 347) are in the range of background levels, or only slightly elevated, indicating the SWP-4 is effective in capturing stack-affected groundwater in this area. The Arsenic concentration measured at SWP-7 in November 2006 was higher than historical levels (0.012 mg/L, compared to typical values in the 0.06 to 0.08 mg/L range). Concentrations of Orthophosphate (as Total Phosphate) and Sulfate were consistent with historical levels. The well discharge was resampled on February 7, 2007 and the measured Arsenic concentration was 0.07 mg/L. The November result appears to be an anomaly. This will continue to be evaluated as 2007 monitoring data become available.

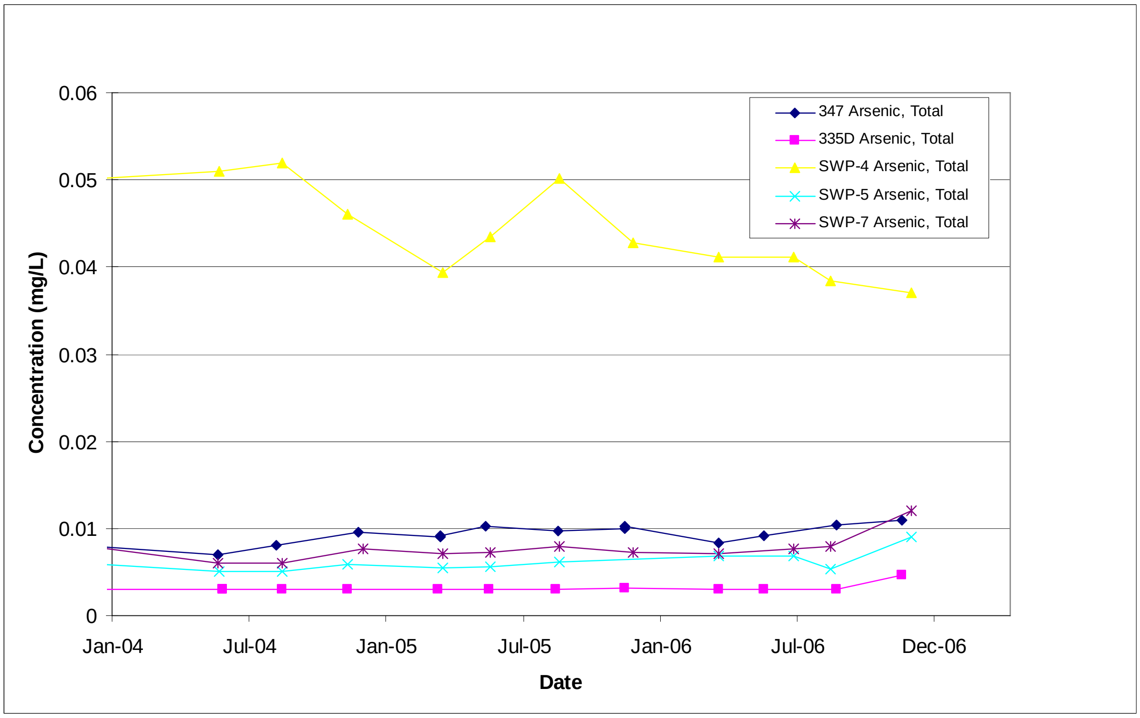


Figure 4-26: Central Plant Lower Zone Arsenic Concentrations

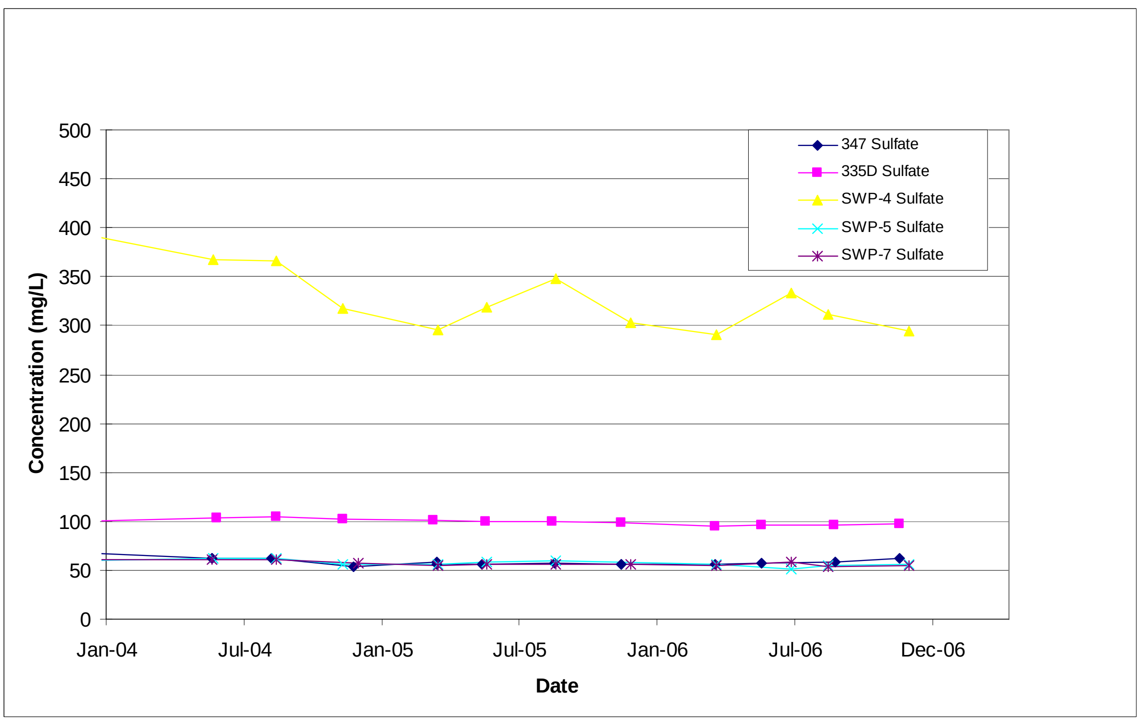


Figure 4-27: Central Plant Lower Zone Sulfate Concentrations

It is further noted that the low constituent concentrations in well 335D show that the source impacting groundwater at the Upper Zone well 335S does not affect Lower Zone groundwater. The American Falls Lake Bed is present at this location. In addition, even though the production wells extraction a significant flow of Lower Zone groundwater, there is still an upward gradient, as illustrated by the higher Lower Zone than Upper Zone groundwater surface elevations in Figure 4-28.

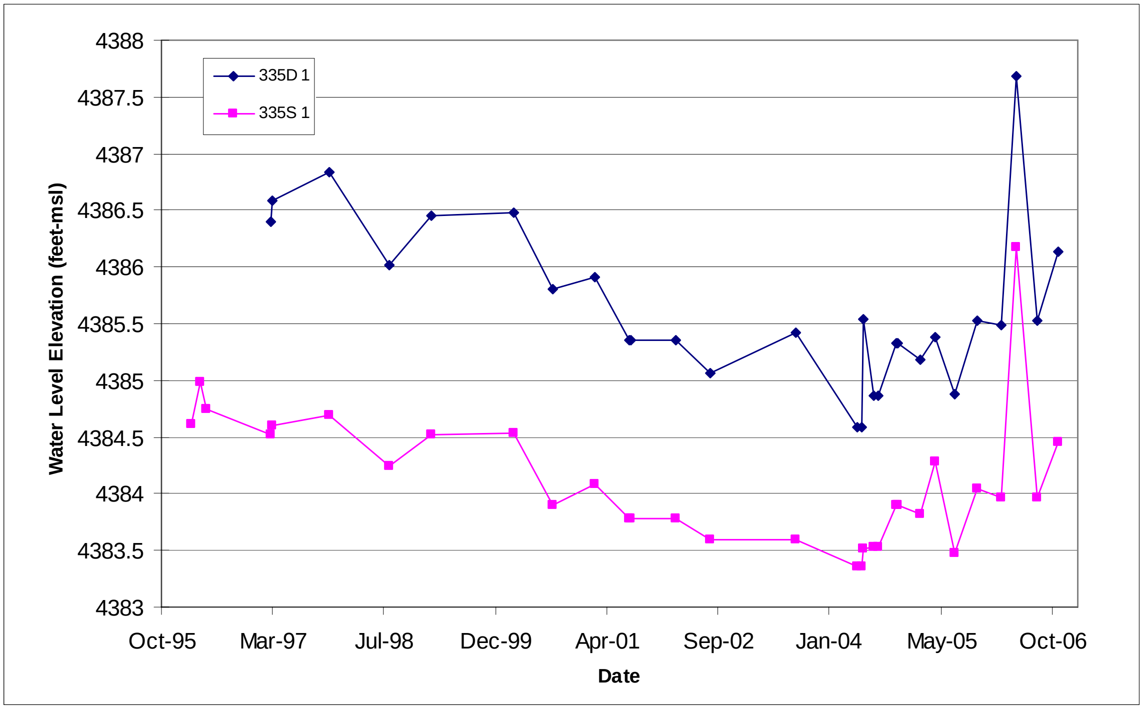


Figure 4-28: Central Plant Upper and Lower Zone Groundwater Surface Elevations 1995 to 2006

4.4 West Plant Area

The site features and groundwater wells in West Plant Area are shown on Figure 4-29 (Upper Zone wells) and 4-30 (Lower Zone Wells). Note that since the American Falls Lake Bed is absent south of wells 309/310 there is no definitive separating unit between the Upper Zone and Lower Zone in the area of the extraction wells.

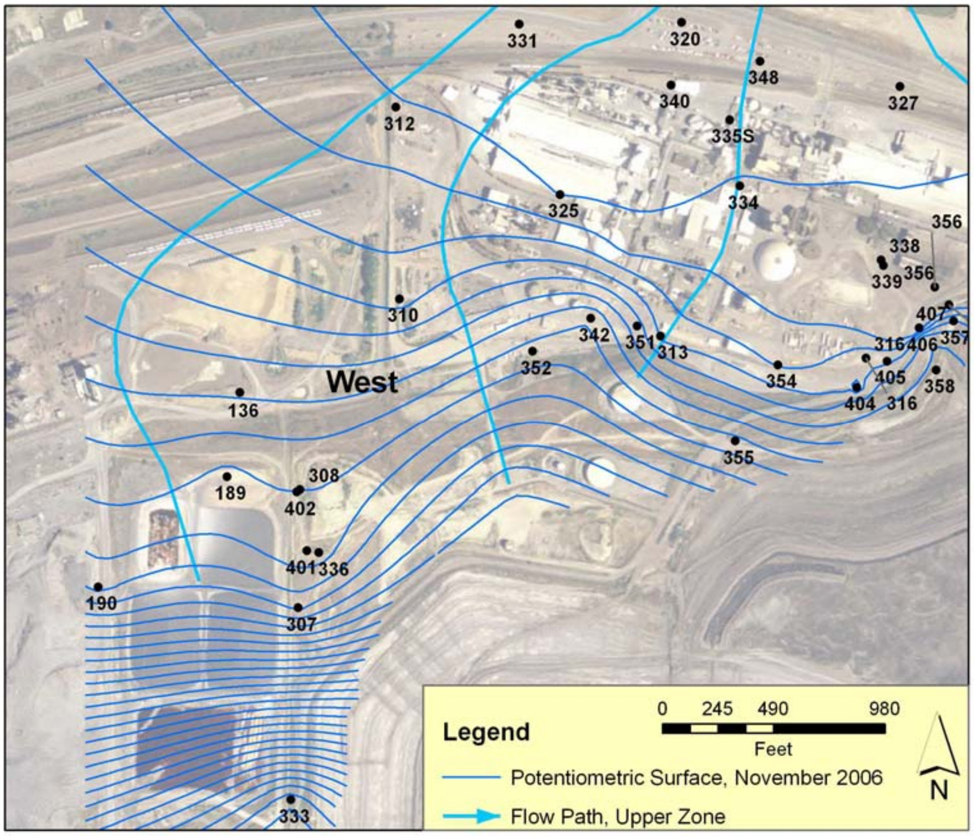


Figure 4-29: West Plant Area Upper Zone Wells

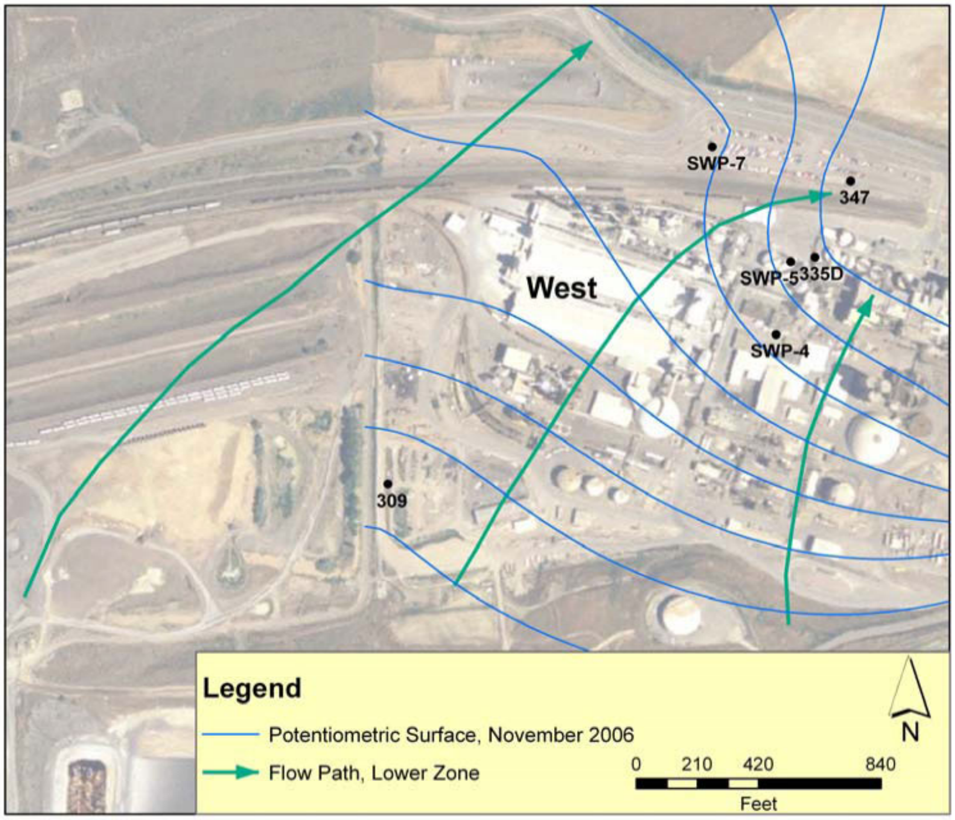


Figure 4-30: West Plant Area Lower Zone Wells

Figure 4-31 shows the groundwater level elevation measured in wells in the West Plant Area since 1992. These wells are in the unconsolidated material within the relict channel (Newfields 2005). As shown, water levels have dropped between 8 and 15 feet in the period from 1997 to 2006. This water level drop may have been caused different factors, in particular:

- Input flows from fenceline sources (gypsum stack and FMC calciner ponds) may have decreased; and
- Regional drought conditions have reduced groundwater flows from the Bannock Hills.

Water levels increased for the first time since 1997 in 2006, possibly reflecting the effect of the higher precipitation observed in 2005 and 2006 (see Section 4.1).

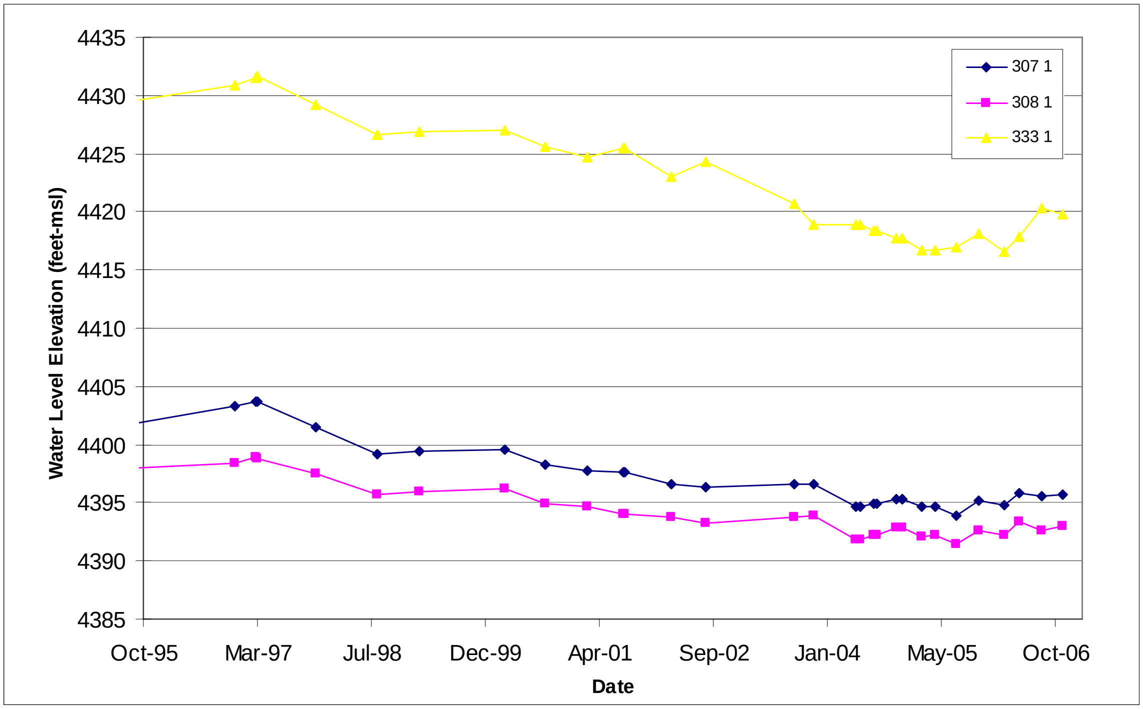


Figure 4-31: West Plant Area Groundwater Surface Elevation 1992 to 2006

During the same period, constituent concentrations in groundwater in this area have remained relatively consistent (for example, see recent Arsenic concentrations on Figure 4-32).

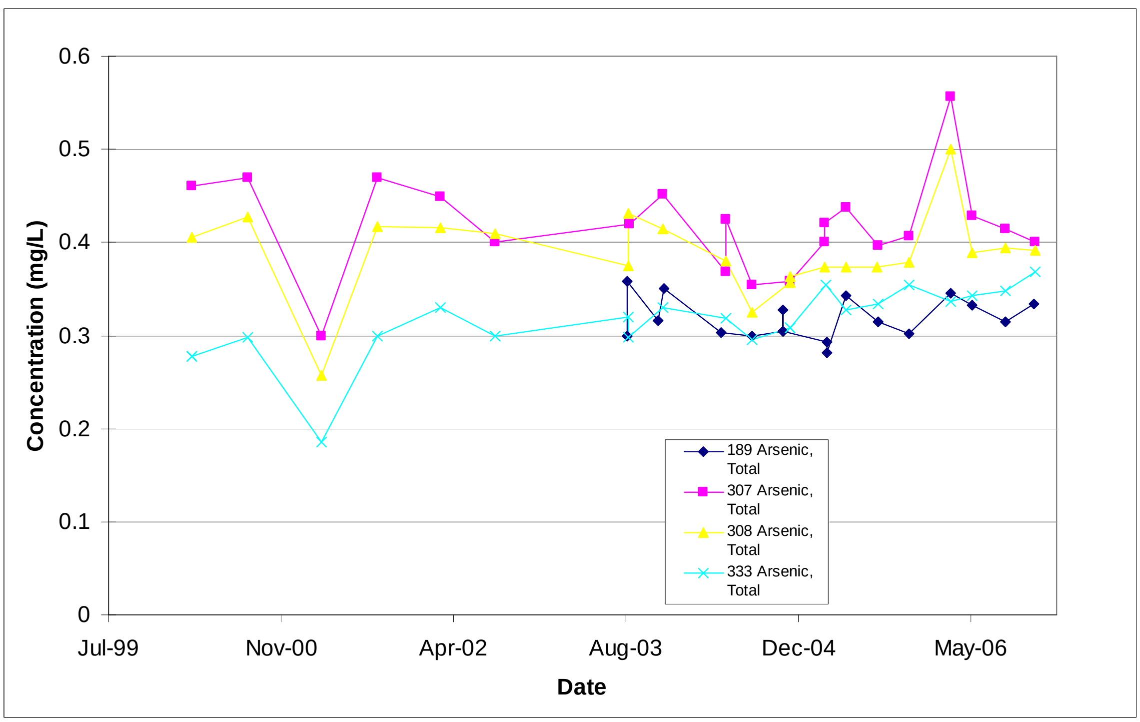


Figure 4-32 West Plant Area Arsenic Concentrations 1999 to 2006

The combination of lower water levels and relatively consistent constituent concentrations indicates that mass flux of constituents in groundwater in this area is lower than historical levels.

Arsenic and Sulfate concentrations immediately downgradient of the extraction wells are shown in Figures 4-33 and 4-34. Concentrations were increasing at well 310 in 2005, but decreased in 2006. This is an Upper Zone well that is predicted to receive stack-affected groundwater from east of the 401/402 extraction well pair. This area has been targeted for additional investigation in the Phase 2 field investigation (NewFields 2006h). Farther to the north, Arsenic and Sulfate concentrations have been relatively constant (i.e., at well 312; see Figures 4-33 and 4-34).

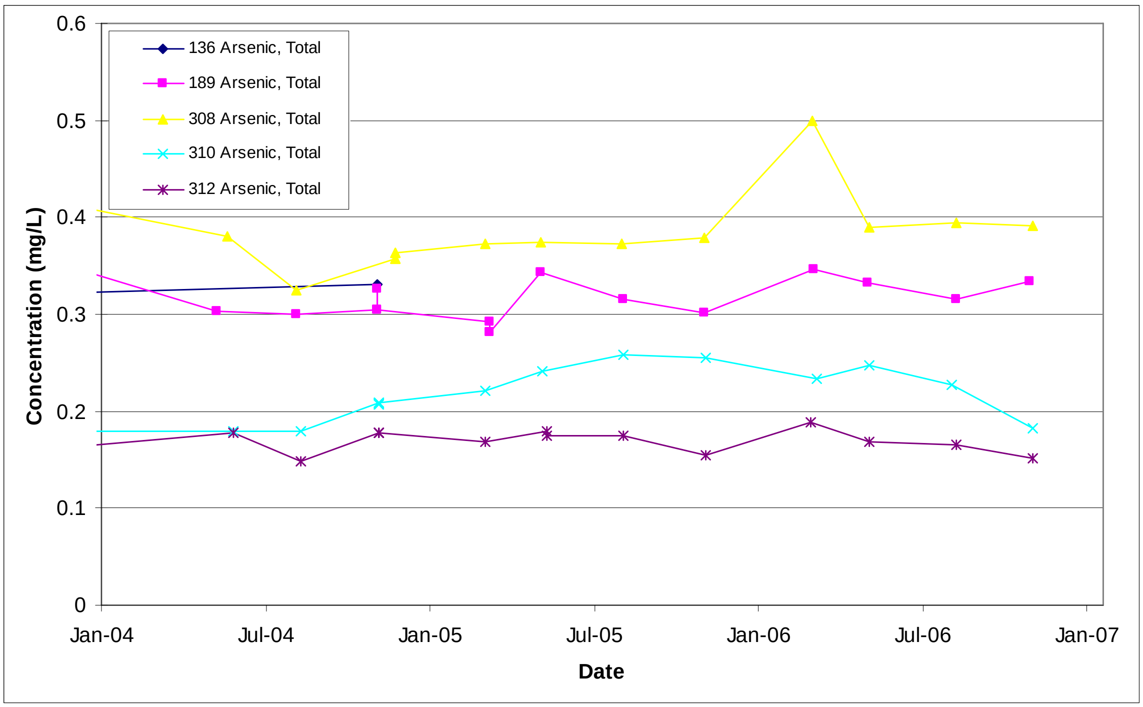


Figure 4-33: West Plant Area Arsenic Concentrations 2000 to 2006

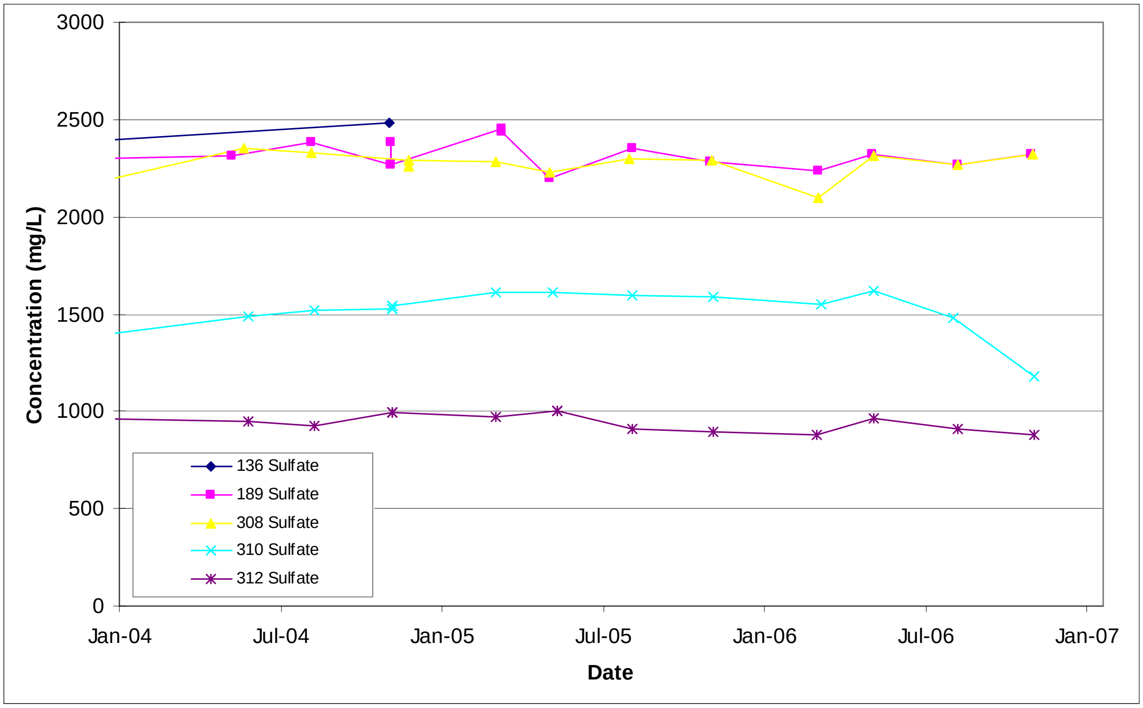


Figure 4-34: West Plant Area Sulfate Concentrations 2000 to 2006

4.5 Area North of I-86/Portneuf River Springs

Site features and groundwater monitoring wells north of I-86 and spring sampling points are shown on Figures 4-35 and 4-36.

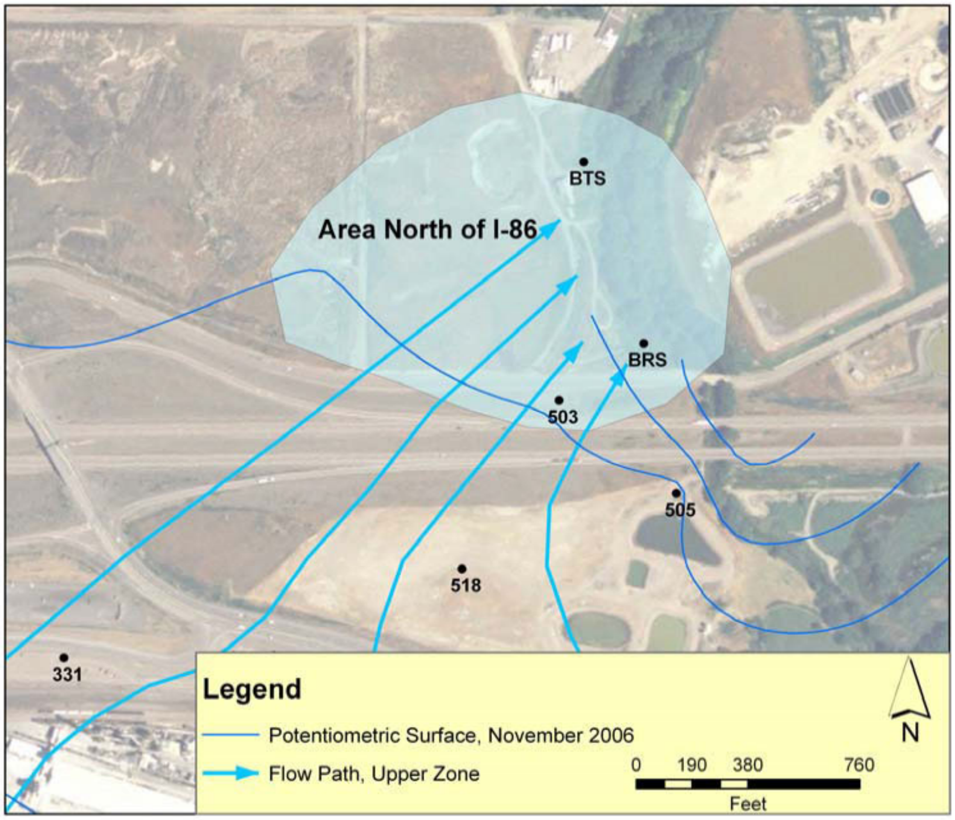


Figure 4-35: Upper Zone Wells and Spring Locations – Area North of I-86

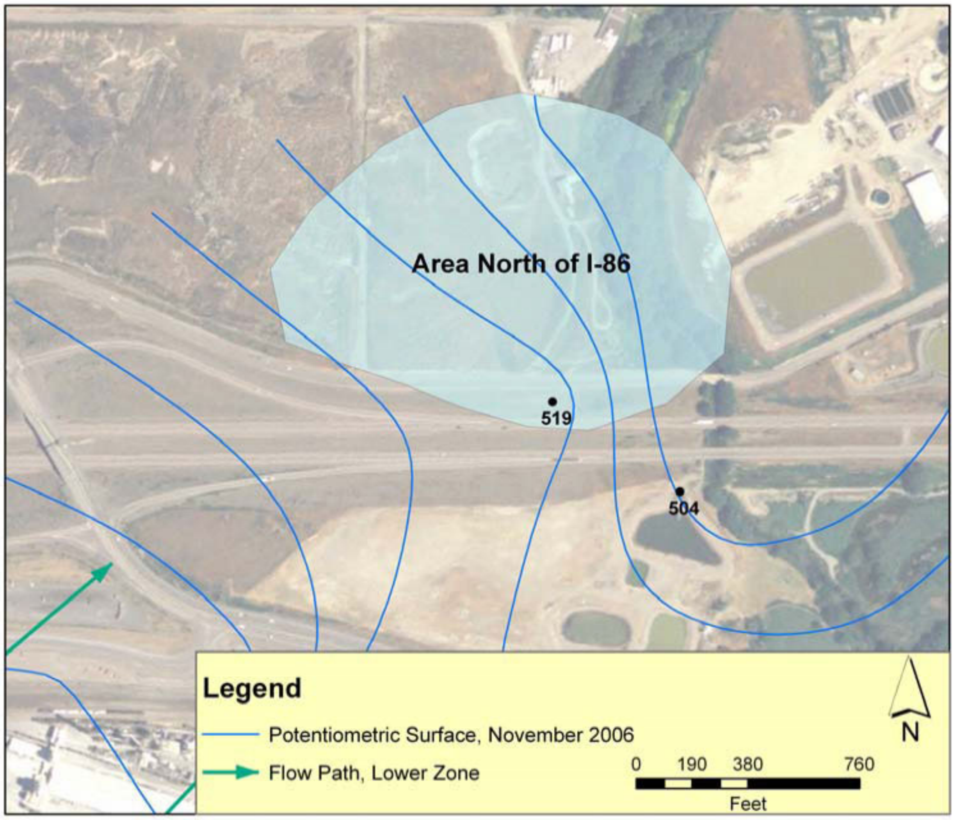


Figure 4-36: Lower Zone Wells and Spring Locations – Area North of I-86

Arsenic, Sulfate and Orthophosphate (as Total Phosphorus) concentrations in groundwater and Portneuf River springs are shown on Figures 4-37 through 4-39. Concentrations in Upper Zone well 503 are relatively constant with time (typical ranges: Arsenic 0.01 to 0.02 mg/L, Orthophosphate (as Total Phosphorus) 2 to 6 mg/L, and Sulfate 160 to 200 mg/L in the period since the August 2003 baseline monitoring event). Concentrations of Arsenic and Orthophosphate (as Total Phosphorus) were lower during the May 2006 event, most likely due to inflow of river water (see Section 4.1). Concentrations in deeper well 519 are consistent with background levels.

Batiste Spring (BTS) is located at the very northern edge of the plume and it appears that on some occasions it has historically received a proportion of background groundwater input. Recently concentrations have been generally increasing (see Figures 4-37 and 4-38). Predicted groundwater flow lines (for example, see Figures 4-3 and 4-4) indicate that constituents from FMC sources would comprise the northern edge of the plume and would be expected to be predominant at Batiste Spring. Estimated groundwater travel times from FMC source areas to Batiste Spring range up to 10 years. Concentrations were quite variable in Batiste Spring in 2006, with Arsenic concentrations ranging from 0.018 to 0.036 mg/L and Orthophosphate (as Total Phosphorus) ranging from 8 to 26 mg/L. These concentrations are higher than any measured in Simplot wells north of Highway 30. Concentrations measured in the Spring at

Batiste Road (BRS) were lower than at Batiste Spring in 2006 with average Arsenic concentrations of 0.009 mg/L and 1 mg/L Orthophosphate (as Total Phosphorus).

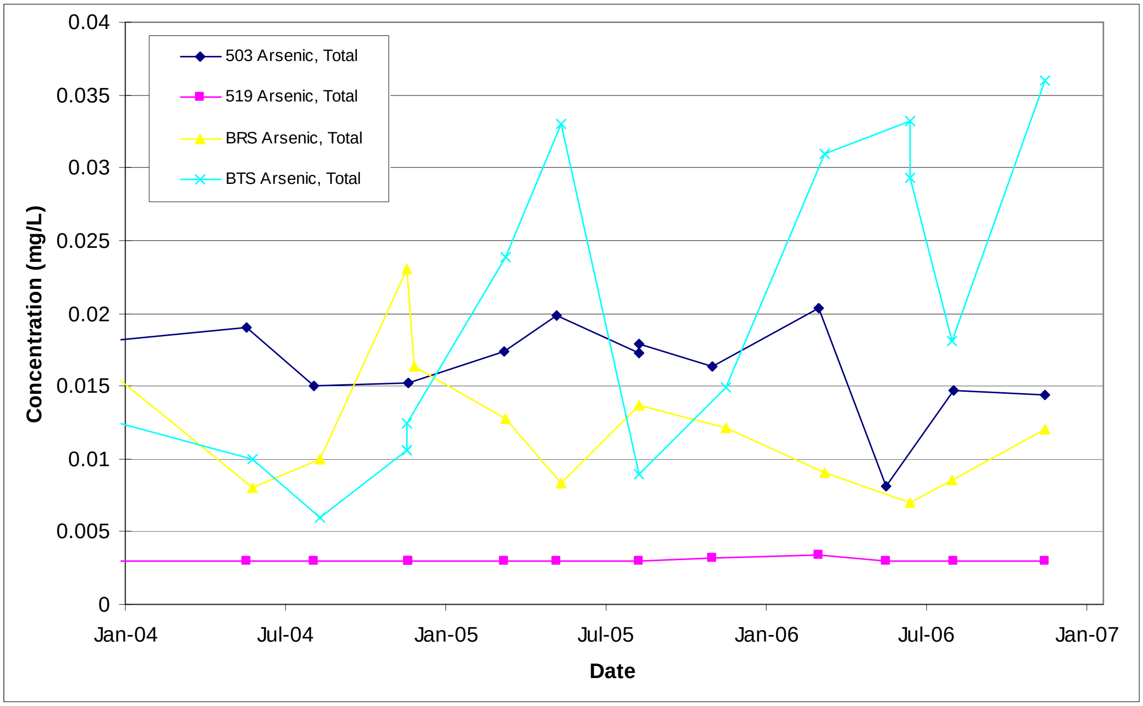


Figure 4-37: Arsenic Concentrations in Groundwater Wells North of I-86 and in Portneuf River Springs

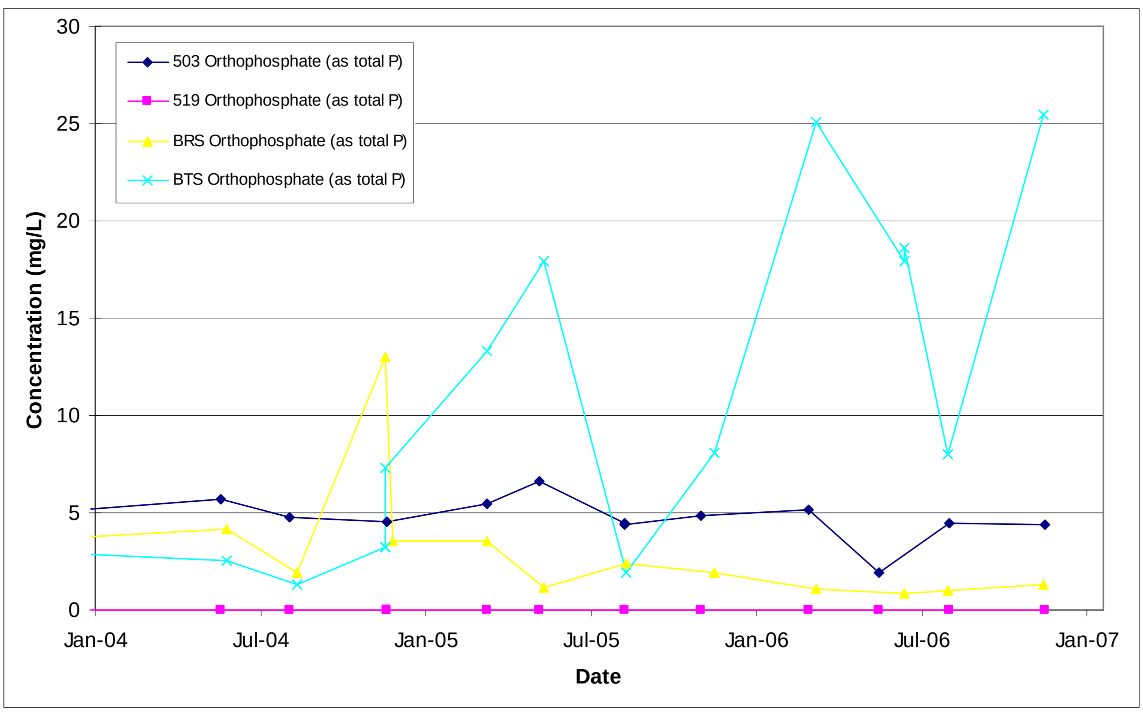


Figure 4-38: Orthophosphate (as Total Phosphorus) Concentrations in Groundwater Wells North of I-86 and in Portneuf River Springs

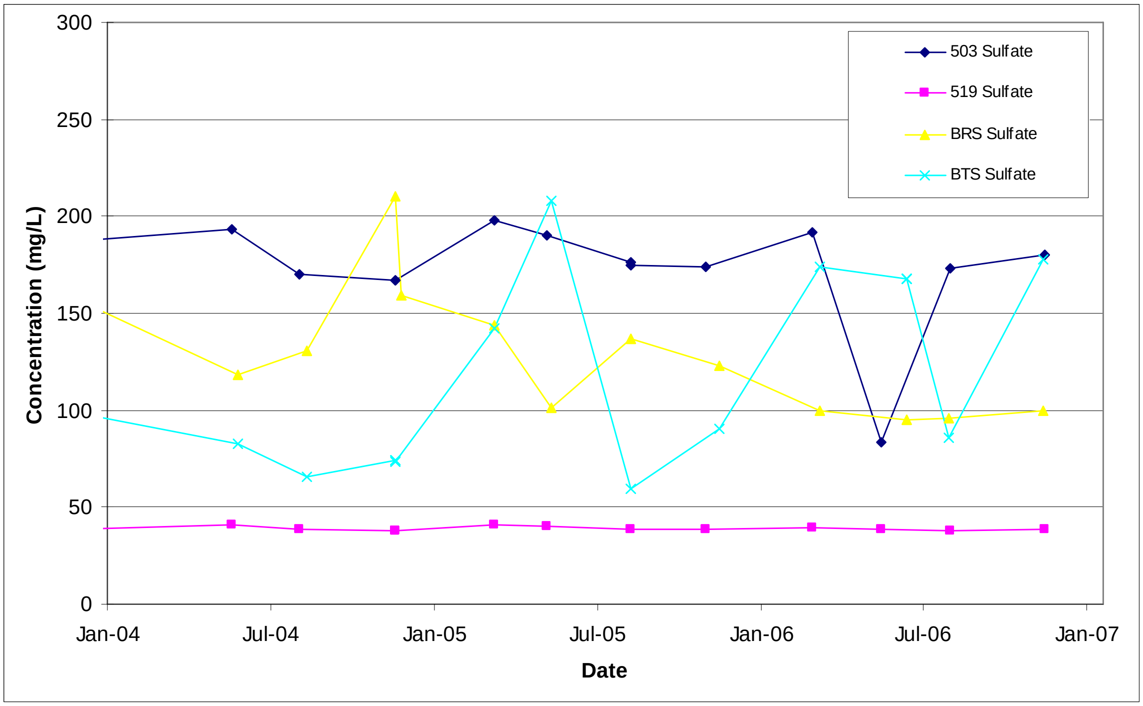


Figure 4-39: Sulfate Concentrations in Groundwater Wells North of I-86 and in Portneuf River Springs

Downward trends in Arsenic, Orthophosphate (as Total Phosphorus) and Sulfate concentrations are apparent in the Spring at Batiste Road (see Figures 4-40 through -42). Groundwater potentiometric surfaces and flow path interpretations (see Figures 4-3 and 4-4) indicate that the spring receives water from the East Plant Area; where most of the current groundwater extraction is occurring. The downward concentration trends may provide an indication of the effects of the test extraction system.

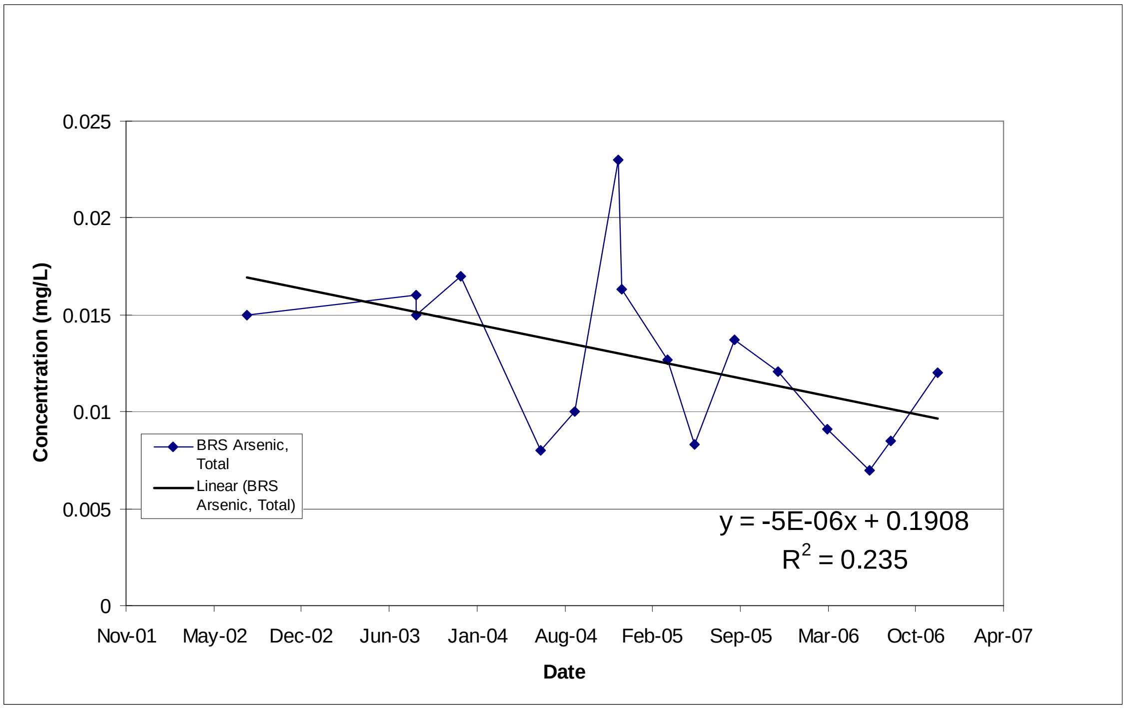


Figure 4-40: Downward Trend in Arsenic Concentration With Time at the Spring at Batiste Road

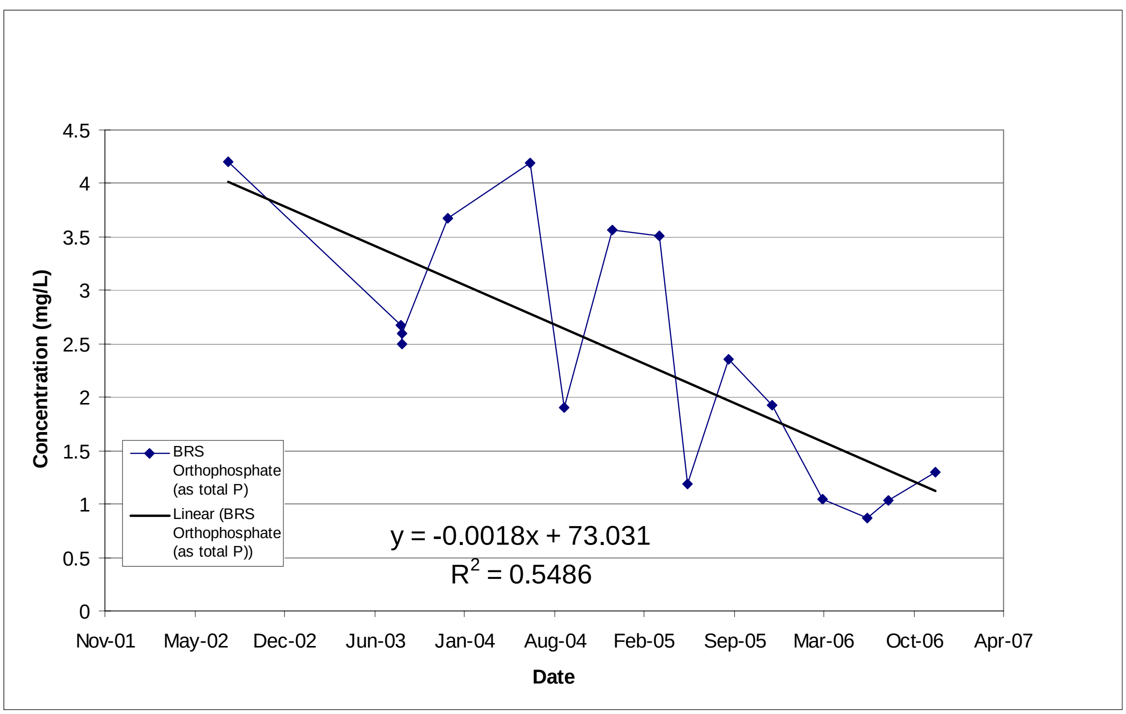


Figure 4-41: Downward Trend in Orthophosphate (as Total Phosphorus) Concentration With Time at the Spring at Batiste Road

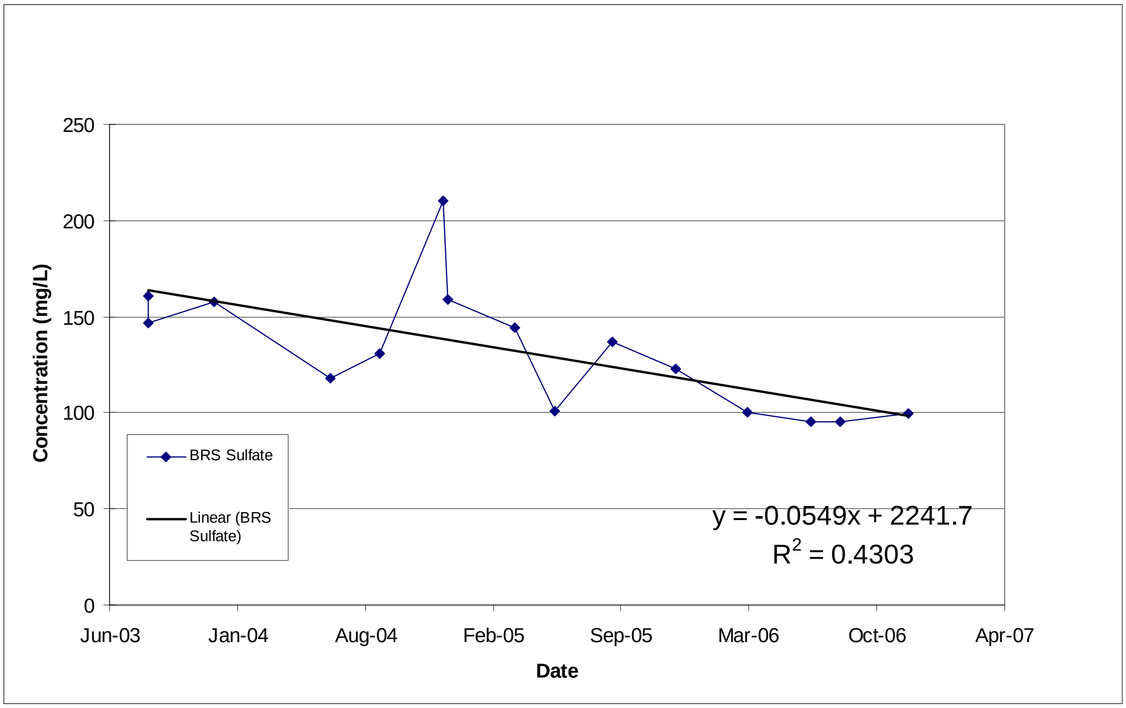


Figure 4-42: Downward Trend in Sulfate Concentration With Time at the Spring at Batiste Road

There is a strong correlation between constituent concentrations measured at the springs. For example, Figure 4-43 shows Arsenic concentrations plotted against Orthophosphate (as Total Phosphorus) concentrations measured since 2000 in Batiste Spring. Figure 4-44 shows Arsenic concentrations plotted against Sulfate concentrations from the same dataset. Concentrations are strongly correlated with Correlation Coefficients of 0.91 (Arsenic and Orthophosphate (as Total Phosphorus)) and 0.94 (Arsenic and Sulfate).

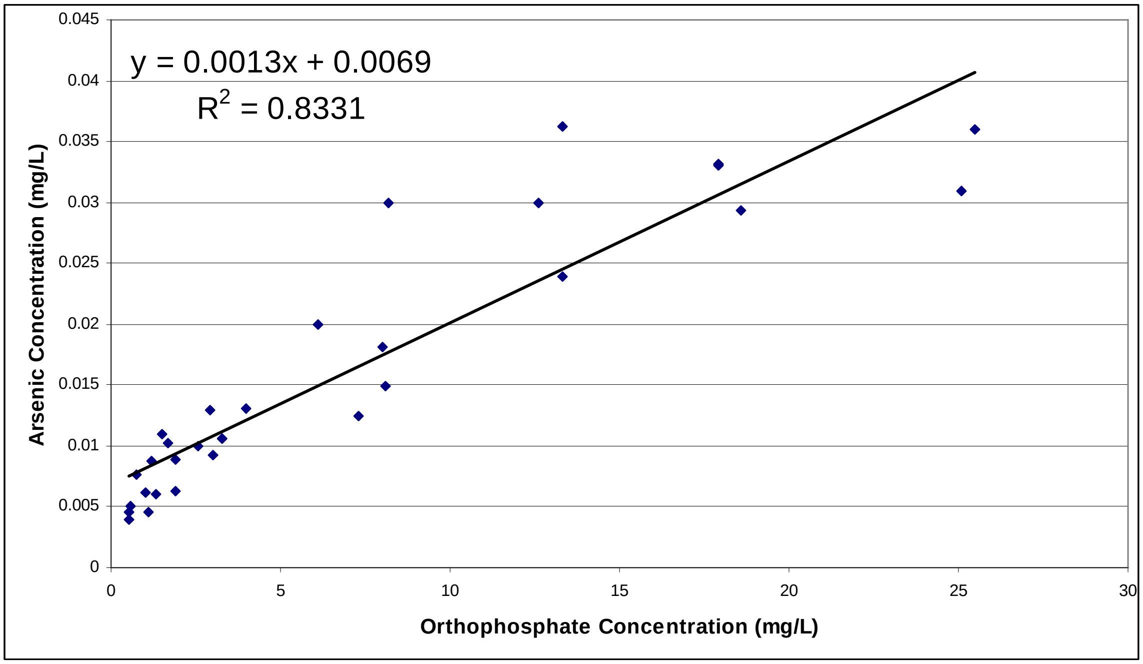


Figure 4-43: Arsenic Concentrations Plotted Against Orthophosphate (as Total Phosphorus) Concentrations – Batiste Spring 2000 to 2006 Dataset

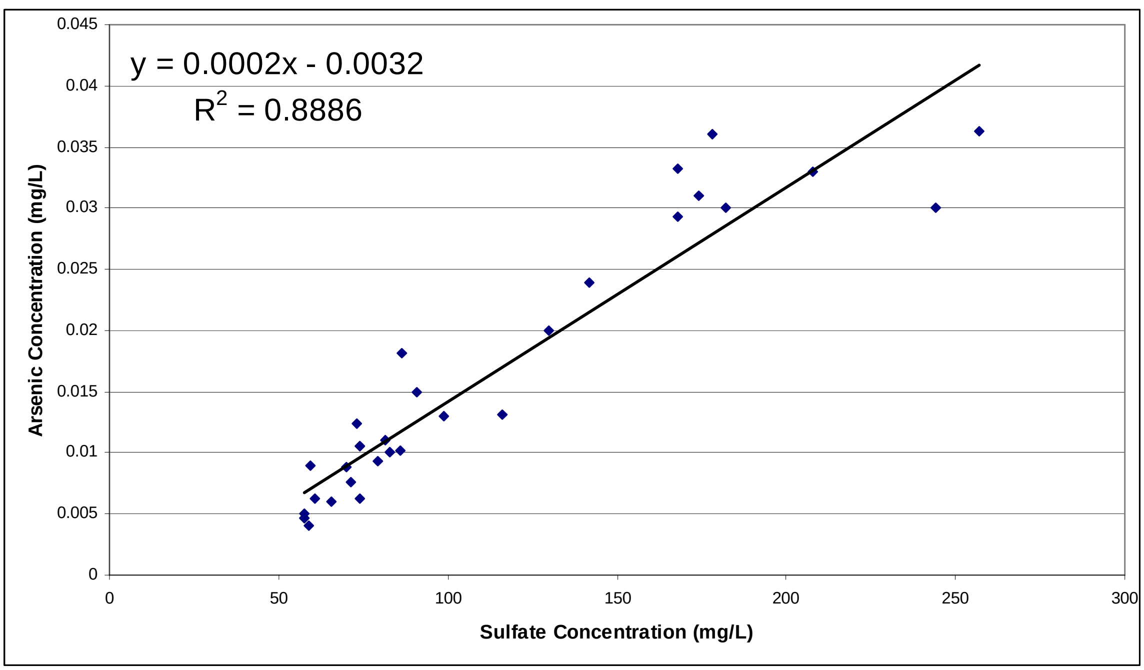


Figure 4-44: Arsenic Concentrations Plotted Against Sulfate Concentrations – Batiste Spring 2000 to 2006 Dataset

5.0 SUMMARY AND CONCLUSIONS

This report provides an evaluation of the test groundwater extraction system operation and of groundwater data collected in 2006 in the Simplot Plant Area of the Eastern Michaud Flats Superfund Site.

The test extraction system was operated throughout the year. It was shut down for approximately two weeks in late May/early June when the Don Plant was taken offline for routine maintenance ("turnaround"). Excluding turnaround, wells typically operated for 97 percent of the time or greater. It is estimated that the test extraction system, along with capture of production well SWP-4, removed approximately 35 percent of the arsenic mass flux in groundwater downgradient of the source areas. The system is also estimated to have removed 1,200 pounds of Orthophosphate (as Total Phosphorus) per day on average in 2006.

Groundwater from the test extraction system is used as makeup water in the Phosphoric Acid Plant portion of the Don Plant. Flows from the test extraction system are relatively small compared to other inputs; 340 gallons per minute from the extraction system on average compared to approximately 4,000 gallons per minute from the facility production wells. The addition of water flow from the test extraction system has resulted in a corresponding decrease in fresh water consumption in the Phosphoric Acid Plant. This is expected because addition of test extraction groundwater to the reclaim cooling system has reduced the demand for fresh water input. The overall water flow to the gypsum stack has not been affected.

Groundwater data collected in 2006 provide information on the effect of the test extraction system on downgradient constituent concentrations:

- Constituent concentrations in East Plant Lower Zone groundwater downgradient of the test extraction system decreased significantly in 2005 and remained at those levels in 2006. This appears to be a direct effect of the extraction system. Arsenic, Sulfate and Orthophosphate (as Total Phosphorus) concentrations all decreased in a similar manner. One technical concern related to the Portneuf River TMDL is that Orthophosphate (as Total Phosphorus) sorbed to or precipitated on aquifer solids downgradient of the extraction system will continue to desorb/dissolve after the extraction system becomes operational. These and other Site data show that changes in Arsenic and Orthophosphate (as Total Phosphorus) concentrations are concomitant. This provides evidence that phosphorus desorption/dissolution effects are not significant and that Orthophosphate (as Total Phosphorus) concentrations in groundwater will decline on a similar timeframe as Arsenic concentrations downgradient of the extraction system.

- Arsenic, Orthophosphate (as Total Phosphorus) and Sulfate concentrations in the Spring at Batiste Road have decreased since 2004, when the test extraction system came on line. Groundwater potentiometric surfaces and flow path interpretations indicate that the spring is directly downgradient of the Simplot East Plant Area, where most of the current groundwater extraction is occurring. Reduction in Orthophosphate (as Total Phosphorus) concentrations have been the most notable; the average concentration was 5.6 mg/L in 2004 and 1.1 mg/L in 2006. Arsenic concentrations averaged 0.014 mg/L in 2004 and 0.009 mg/L in 2006.

- Constituent concentrations in Batiste Spring were variable in 2006 and have been generally increasing in the past few years. For example, average Arsenic and Orthophosphate (as Total Phosphorus) concentrations were 0.009 and 2.6 mg/L in 2004 and 0.030 and 19 mg/L in 2006, respectively. The constituent concentrations at Batiste Spring are higher than any measured in groundwater wells north of Highway 30 that are downgradient of Simplot sources. FMC is also a potential current source of constituents to the spring, with estimated groundwater travel times from FMC source areas to the river ranging up to 10 years.

- A source, or sources, of Arsenic and Orthophosphate (as Total Phosphorus) to Upper Zone groundwater is present in the Phosphoric Acid Plant area. Constituent concentrations decrease rapidly in downgradient groundwater, indicating that the source mass flux is relatively small. The source does not impact the Lower Zone because migration is prevented by the American Falls Lake Bed and by significant upward groundwater flow gradients. Additional investigation has recently been performed in the Phosphoric Acid Plant area and source identification efforts are ongoing.

- Portneuf River flows and stage in May 2006 were the greatest measured since about 1996. This caused an increase in groundwater levels in both Upper Zone and Lower Zone wells. The increase appears to be greatest in wells located closest to the river and in wells completed in geologic units that have a high hydraulic conductivity. The response to river stage is mostly a pressure effect, however, water losses from the river during the high-flow period may also affect groundwater chemistry.

- Constituent concentrations in East Plant Upper Zone groundwater decrease rapidly downgradient of the target extraction area. This appears to be primarily due to mixing with river-influenced groundwater from the east.

- Constituent concentrations in Central Plant Lower Zone groundwater downgradient of production well SWP-4 are at or near background levels, indicating that SWP-4 effectively captures all gypsum stack-affected groundwater in the area.

- Concentrations of constituents in West Plant groundwater in the target extraction areas have been relatively stable. Downgradient concentrations show varying trends that probably reflect changes in mass fluxes from the gypsum stack and source areas at the closed FMC facility.

The evaluations provided in this report will be expanded and integrated with other Site data (including the findings of the ongoing "Phase 2" fieldwork and the quarterly monitoring program) to support final design of the groundwater extraction system and the associated groundwater monitoring program. The final design report is expected to be submitted in 2007.

6.0 REFERENCES

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