LMS/DUP/S04674

Verification Monitoring Report for the Durango, Colorado, Processing Site

September 2008

U.S. Department of Energy

Office of Legacy Management

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Acronyms and Abbreviations

ACL	alternate concentration limit
DOE	U.S. Department of Energy
DWEL	Drinking Water Equivalent Level
EPA	U.S. Environmental Protection Agency
ft	foot (feet)
ft^3/day	cubic foot (feet) per day
GCAP	Ground Water Compliance Action Plan
MCL	maximum concentration limit
mg/L	milligram(s) per liter
POC	point-of-compliance
UMTRA	Uranium Mill Tailings Remedial Action

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1.0 Introduction

The Durango processing site is located in La Plata County, Colorado, approximately 0.25 mile southwest of the central business district of Durango, Colorado (Figure 1). The site consists of two separate areas: (1) the mill tailings area, which is the setting of former uranium-ore milling and storage of residual solid wastes (mill tailings), and (2) a raffinate ponds area where liquid process-wastes were impounded during milling operations. The former mill tailings area encompasses about 40 acres on a bedrock-supported river terrace between Smelter Mountain to the west, the Animas River to the east and south, and Lightner Creek to the north (Figure 2). The raffinate ponds area occupies about 20 acres on a separate river terrace located 1,500 feet (ft) south (downstream) of the mill tailings area.

The compliance strategy for groundwater cleanup at the former mill tailings area of the Durango site is natural flushing, institutional controls to prevent exposure to contaminated groundwater, water quality monitoring, and an alternate concentration limit (ACL) for selenium (DOE 2003). This strategy was based in part on groundwater flow and solute transport modeling that predicted acceptable cleanup times for each contaminant, except possibly cadmium, by natural flushing processes at the site, and in part on historical trends of decreasing contaminant concentrations, particularly since the completion of contaminant source removal in 1991. Baseline conditions of contaminant concentration in the model correspond to results of the June 2002 groundwater sampling. The groundwater model is fully documented in the Site Observational Work Plan (DOE 2002).

The compliance strategy for the raffinate ponds area is no further action in conjunction with supplemental standards, and it requires no further discussion in this report.

The purpose of this verification monitoring report is to evaluate the predicted and observed progress of passive groundwater restoration at the Durango mill tailings area, based on the water quality data through June 2008, and compare them against each other. The goal is to confirm that natural flushing is progressing and remains a viable compliance strategy for the site.

2.0 Site Conditions

2.1 Hydrogeology

The uppermost aquifer at the mill tailings area consists of alluvial deposits associated with the Animas River and Lightner Creek, and poorly sorted colluvium derived from adjacent Smelter Mountain, rising steeply to the southwest. Approximately 70 ft of colluvium overlies bedrock along the base of the mountain. These deposits thin eastward and transition to sand and gravel deposits up to 15 ft thick closer to the Animas River. The portion of the aquifer underlying the site occupies a narrow fringe (at most, about 250 ft wide) along the Animas River. Depth to groundwater increases from about 5 ft on the river terrace to about 60 ft near the base of Smelter Mountain. The saturated zone is thin (less than 10 ft), unconfined, and directly underlain by Mancos Shale bedrock. The surficial aquifer is of limited extent and has a low yield. Groundwater flow is generally northwest to southeast, parallel to the Animas River, at an average gradient of approximately 0.02 ft/ft. Hydraulic conductivity of the alluvium ranges from 10 to 70 ft/day.

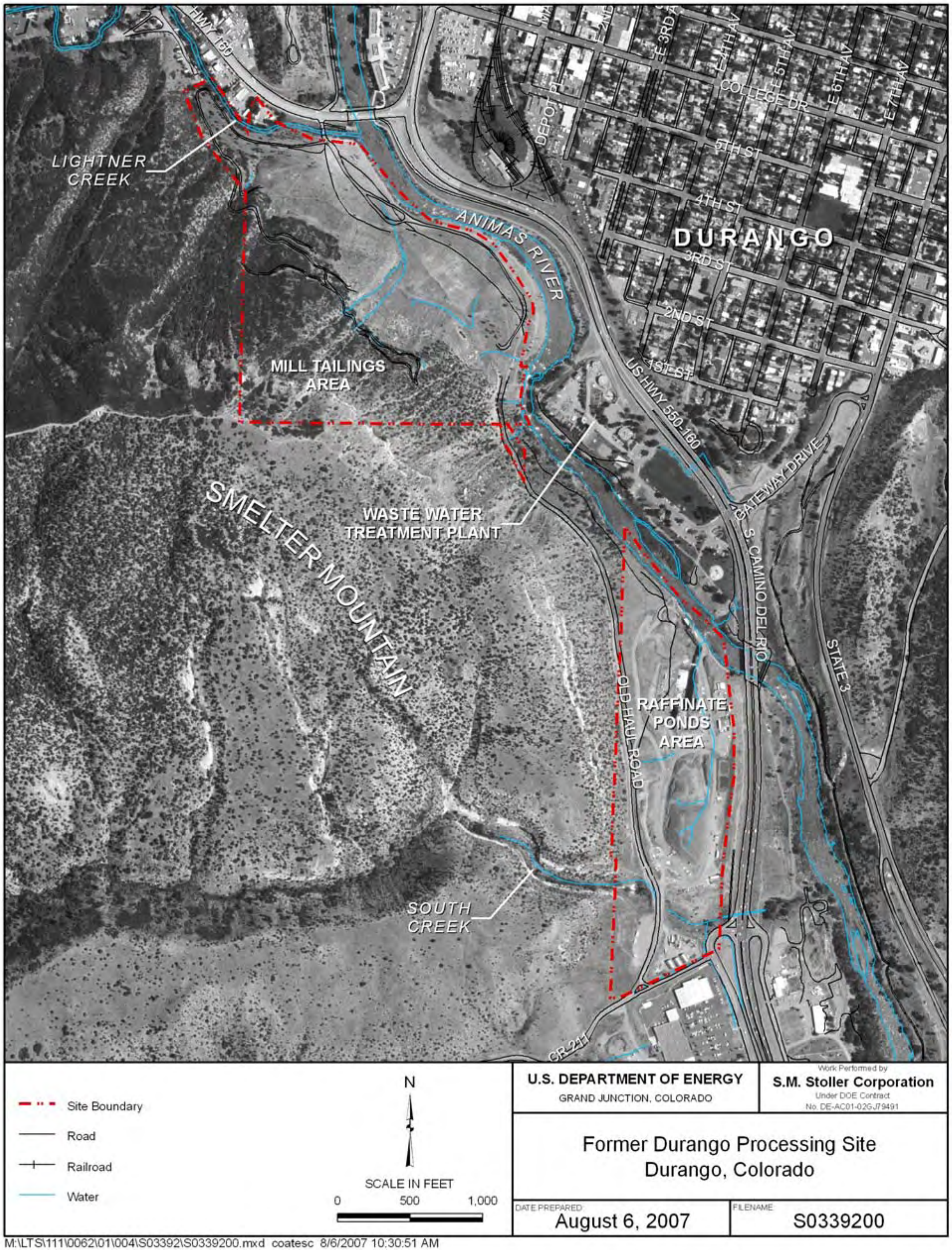

Figure 1. Durango Processing Site

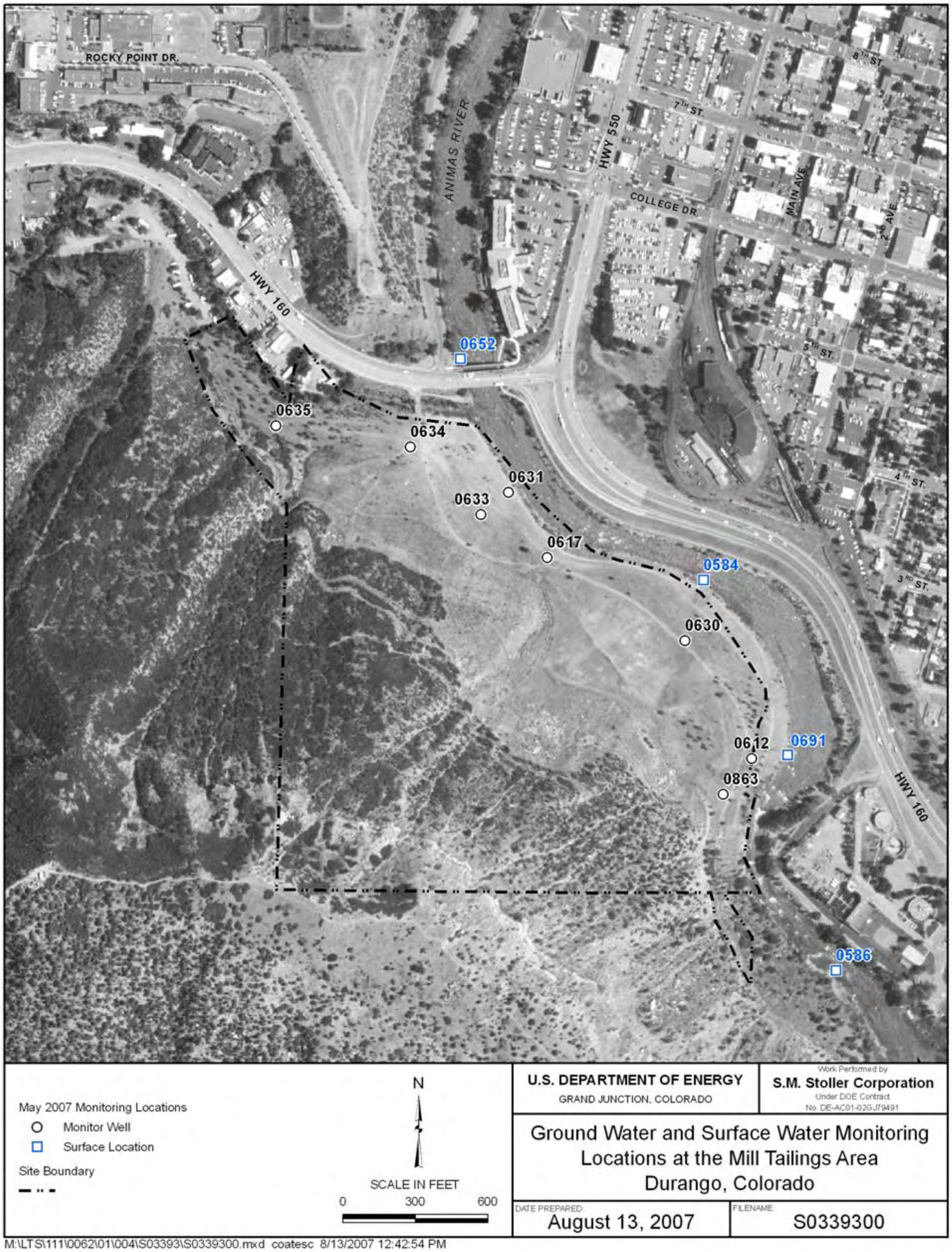

Figure 2. Monitoring Network in the Mill Tailings Area at the Durango Site

The colluvium is recharged primarily by runoff and infiltrating precipitation, while the river alluvium receives water from Lightner Creek and from river loss along the upstream reach of the prominent meander. Groundwater discharge occurs to the Animas River along the upper and lower thirds of the reach adjacent to the mill tailings area. Under average conditions, the estimated volume of groundwater discharge from the mill tailings area is 1,480 cubic feet per day (ft^3/day); approximately 840 ft^3/day enters the Animas River near the mouth of Lightner Creek, and the remaining 640 ft^3/day enters the Animas River east of the former east tailings pile (DOE 2002). The alluvial aquifer pinches out against bedrock cliffs near the southeast corner of the site, at which point groundwater discharge to the river is complete (DOE 2002).

2.2 Water Quality

Groundwater in the alluvial aquifer is contaminated as a result of uranium-ore processing and tailings storage at the mill tailings area. Although the primary source of groundwater contamination (mill tailings) was removed from the site by 1991, concentrations of arsenic, cadmium, lead, molybdenum, net alpha, radium-226+228, selenium, and uranium in the underlying aquifer remained in excess of Uranium Mill Tailings Remedial Action (UMTRA) Project maximum concentration limits (MCLs). Concentrations of arsenic, lead, and radium have since decreased to levels below the MCLs, and net alpha was detected only sporadically in a few wells. Monitoring for arsenic, lead, radium, and net alpha was discontinued in 2002 in accordance with provisions of the Ground Water Compliance Action Plan (GCAP) (DOE 2003).

Table 1 compares the maximum concentrations of the remaining site contaminants detected in June 2008 to the corresponding compliance goals. The compliance goals for cadmium, molybdenum, and uranium are UMTRA Project MCLs. The compliance goal for selenium (0.05 milligram per liter [mg/L]) is adopted from the U.S. Environmental Protection Agency (EPA) Safe Drinking Water Act as an ACL (the MCL is 0.01 mg/L). An ACL was established for selenium because of naturally abundant selenium in groundwater above the MCL. There are no MCLs for manganese and sulfate. The compliance goal for manganese is the EPA Drinking Water Equivalent Level (DWEL). This is a lifetime exposure concentration protective of adverse, non-cancer health effects; it assumes that all of the exposure to a contaminant is from drinking water (EPA 2004). The sulfate goal is equivalent to its average background concentration in groundwater.

Table 1. Current Groundwater Contaminants and Compliance Goals

Contaminant of Concern	Compliance Goal (mg/L)	Compliance Goal Source	Maximum Concentration Observed in June 2008 (mg/L)
Cadmium	0.01	UMTRA Project MCL	0.042
Manganese	1.6	DWEL (EPA 2004)	4.5
Molybdenum	0.1	UMTRA Project MCL	0.11
Selenium	0.05	ACL (DOE 2002)	0.012
Sulfate	1,276	Average Background (DOE 2002)	3,200
Uranium	0.044	UMTRA Project MCL	1.40

Current monitoring of the Animas River verifies previous findings in the baseline risk assessment (DOE 1995) that past milling operations have negligible effect on surface water quality. Historical results indicate that constituent concentrations adjacent and downstream of the mill tailings area are indistinguishable from background.

2.3 Surface Remediation Activities

The U.S. Department of Energy (DOE) began surface cleanup of the mill tailings and raffinate ponds areas in November 1986 to meet the EPA standards for radium in soil. A total of 2.5 million cubic yards of contaminated material was relocated to the Bodo Canyon disposal cell several miles southwest of the Durango site. Supplemental cleanup standards were applied to steep slopes of Smelter Mountain and two regions along the banks of the Animas River. In addition, a small lens of uranium ore was left in place at the mill tailings area below layers of slag along portions of the river. The slag deposits, which are 10 to 15 ft thick in some areas (including the location of well 0612), are associated with a lead smelter that operated on the site from 1880 to 1930. To restore the site, approximately 230,000 cubic yards of uncontaminated soil was backfilled, contoured, and seeded. Riprap was placed in some sensitive areas along the Animas River to prevent erosion. Remedial action was completed in May 1991.

2.4 Water and Land Use

The primary water source for the city of Durango is the Florida River upstream of its confluence with the Animas River. Additional water is withdrawn from the Animas River during high-demand periods (usually during the summer) from a location approximately 2 miles upstream of the mill tailings area. The Animas River bordering the mill tailings area of the Durango site is popular for seasonal boating and fishing. Development plans for the mill tailings area include municipal but not residential use (DOE 2002).

2.5 Institutional Controls

As part of the compliance strategy, public health will be protected during the natural flushing period through an environmental covenant between the State of Colorado and the City of Durango (landowner) that restricts access to contaminated alluvial groundwater. Additionally, deed restrictions (which serve as a notice to the public) for the mill tailings area prohibit access to groundwater without written permission from DOE and the Colorado Department of Public Health and Environment.

3.0 Monitoring Program

Annual groundwater and surface water monitoring will continue through the first 5 years following U.S. Nuclear Regulatory Commission concurrence with the GCAP (DOE 2003). Monitoring for cadmium will continue annually for the first 10 years following concurrence because of the greater uncertainty of this constituent to naturally flush within the allotted 100-year period under the regulations. Monitoring data obtained through the initial 5-year period will measure the actual progress of natural flushing of the constituents listed in Table 1. After the 5-year annual monitoring period, the scope of subsequent monitoring will be addressed in a Long-Term Management Plan.

Monitor wells 0612, 0617, 0630, 0631, 0633, 0634, 0635, and 0863 have been established as point-of-compliance (POC) wells that will be used to monitor the progress of natural flushing in groundwater in the alluvial aquifer (Figure 2). In accordance with provisions of the GCAP (DOE 2003), natural flushing for a given analyte is complete when its concentration no longer exceeds the respective compliance goal at the compliance wells for three consecutive annual sampling events. Monitoring for that constituent may then be discontinued.

Surface water locations 0652, 0584, 0691, and 0586, located along the Animas River, will be monitored on schedule with groundwater monitoring to verify continued protection of the aquatic environment (Figure 2). Compliance monitoring requirements and rationale are summarized in Table 2.

Table 2. Annual Groundwater and Surface Water Compliance Monitoring Requirements

Sampling Location	Monitoring Purpose	Analytes	Location
Groundwater Monitoring			
0617, 0630, 0631, 0633, 0634, 0635	POC/verify natural flushing	Manganese Molybdenum Selenium Sulfate Uranium	On site
0612, 0863	POC/verify natural flushing; verify cadmium flushing	Cadmium Manganese Molybdenum Selenium Sulfate Uranium	On site downgradient
Surface Water Monitoring			
0652	Surface water background	Cadmium Molybdenum Selenium Uranium	Off site upstream
0584, 0691	Verify no site-related increase above background		Off site; site groundwater discharge area
0586	Verify no site-related increase above background		Off site; downstream of site groundwater discharge

4.0 Results of 2008 Monitoring

Table 3 summarizes the amount of time the model predicts for natural flushing to achieve the compliance goal for cadmium, manganese, molybdenum, selenium, sulfate, and uranium in groundwater. The progress of each, based on water quality data through June 2008, is addressed separately in the following subsections. Important reference dates for comparing observed concentration trends to model-predicted trends include 1992 to 2008, when water quality was monitored after removal of the primary source of groundwater contamination, and June 2002, which was established as the groundwater model baseline condition (time zero) for contaminant transport. The predicted compliance times listed in Table 3 differ because the contaminants initially were not distributed evenly and vary in degree of contamination above the respective compliance goal, and because each contaminant varies in its mobility in groundwater in the aquifer.

Table 3. Model-Predicted Groundwater Restoration Times

Analyte	Compliance Goal (mg/L)	Predicted Compliance Time (year)[a]	Predicted Compliance Date[b]
Cadmium	0.01	>100	>2102
Manganese	1.6	70	2072
Molybdenum	0.1	5	2007
Selenium	0.05	60	2062
Sulfate	1,276	100	2102
Uranium	0.044	80	2082

[a] Source: DOE 2002, Appendix G, Table 18.
[b] Model time zero (baseline) is June 2002.

Plots of predicted compliance time based on modeling continue to show mixed results; some 2008 sampling data show concentrations above those predicted by the model. Variation in concentrations in groundwater is to be expected on an annual basis, and the success of natural flushing needs to be assessed over an extended period. Even with some of the observed increases in concentrations for several of the constituents in 2008, linear trends of measured data since 1992 show that concentrations of all constituents, except cadmium at well 0612 and sulfate at some locations, will naturally flush within the 100-year timeframe allotted under EPA regulations.

4.1 Groundwater

Groundwater was sampled from the eight POC locations (Figure 2) and analyzed for constituents shown in Table 2. Sampling results for 2008 are provided in Appendix A and are discussed below by constituent.

4.1.1 Cadmium

Figure 3 is a map view of the site showing the concentration of cadmium in groundwater at the compliance wells in June 2008. Figure 4 shows observed cadmium concentrations versus time at the compliance wells since completion of remedial action in 1992. Historically, and in June 2008, cadmium in excess of the MCL occurs only at well 0612, while the remaining monitor wells contained only trace levels of this constituent. Groundwater modeling predicted a flushing period of about 500 years for cadmium (Figure 5). This result is not consistent with historical trending at well 0612, which (if projected linearly from 1992 beyond June 2008) implies compliance for cadmium by about year 2021, or 19 years from the model baseline (Figure 5). Projecting this trend too far into the future may underestimate the actual restoration period because of nonlinear effects that lead to a long tail in the predicted concentrations at the end of the process. This is commonly observed in nature and predicted by the solute transport models. Natural flushing of cadmium, however, remains a potential strategy because of the very limited distribution of cadmium at the site and the observed net decrease in concentration over time. Since it is early in the 100-year natural flushing timeframe, DOE will continue to monitor cadmium concentrations in groundwater and will reevaluate the strategy later, if required.

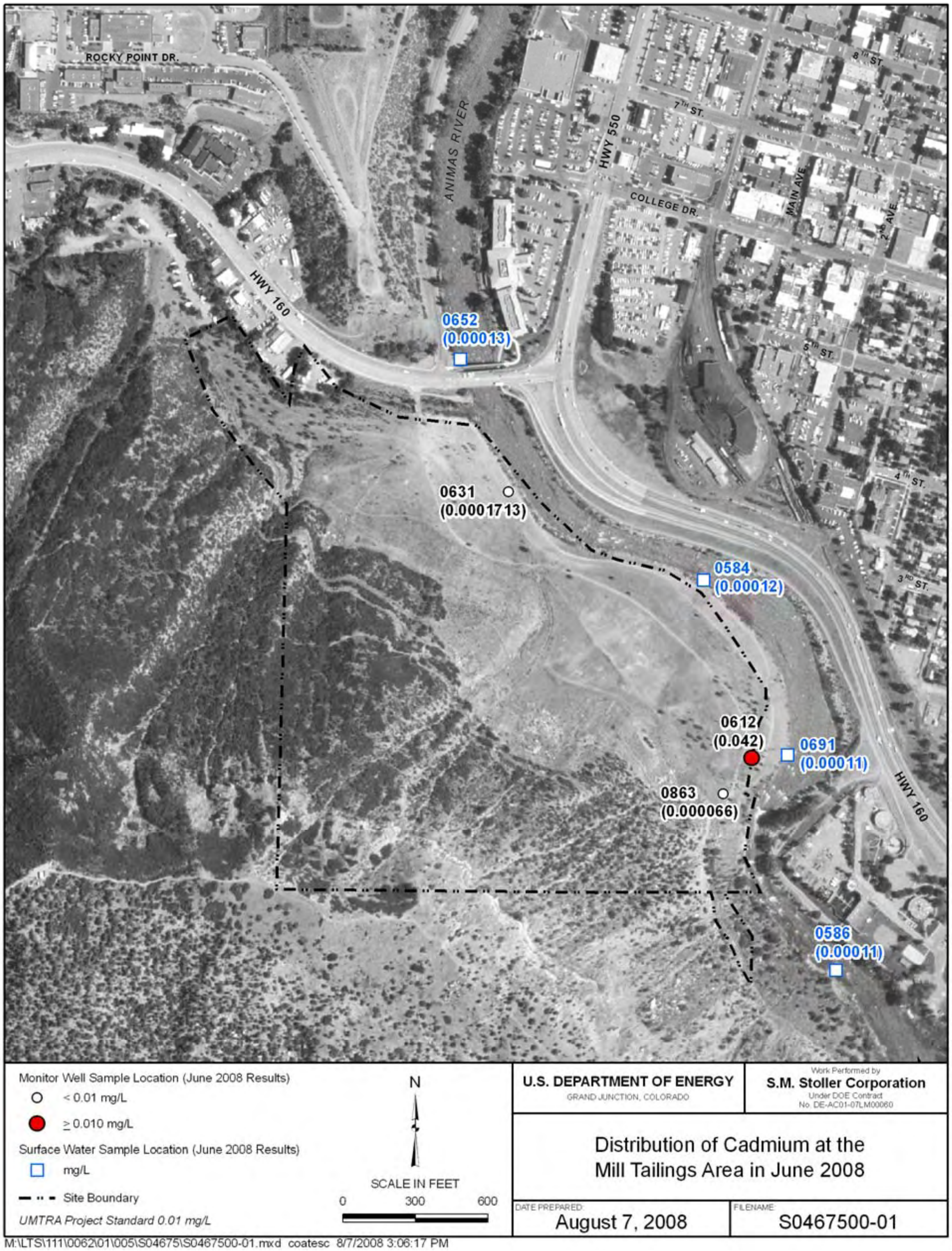

Figure 3. Distribution of Cadmium at the Durango Site

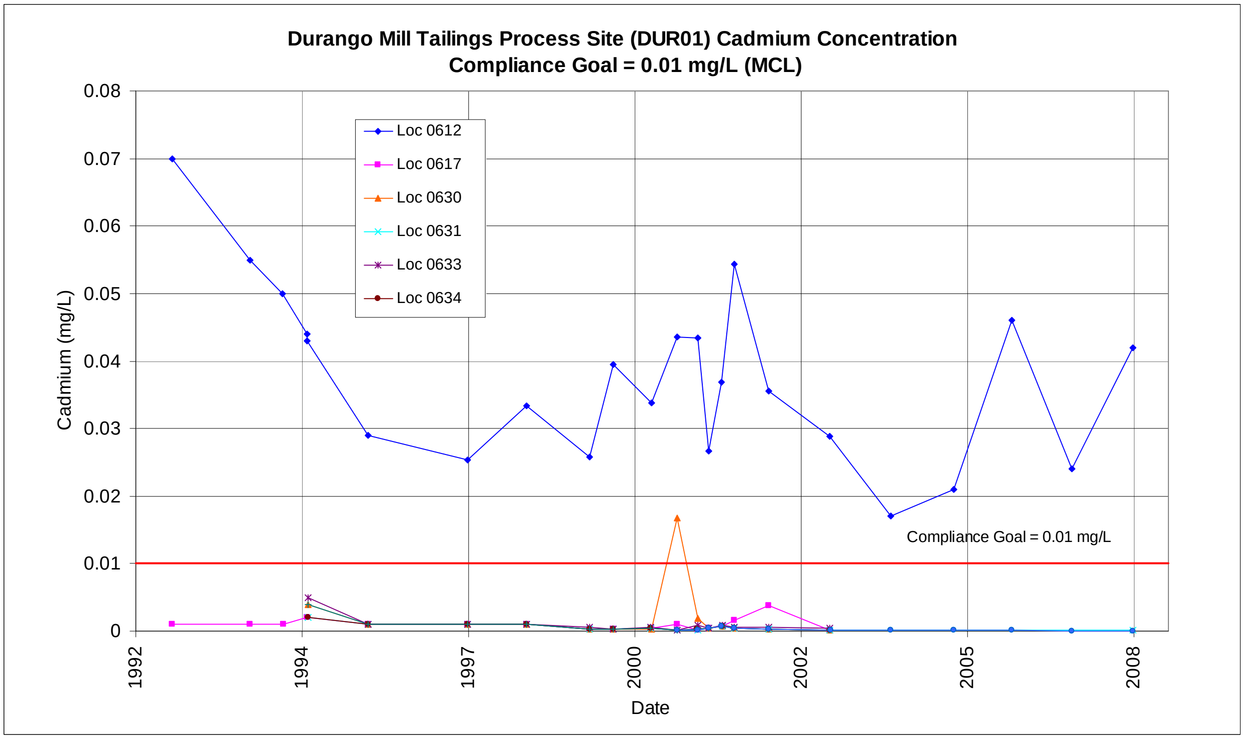

Figure 4. Historical Cadmium Concentrations in Groundwater at the Durango Site

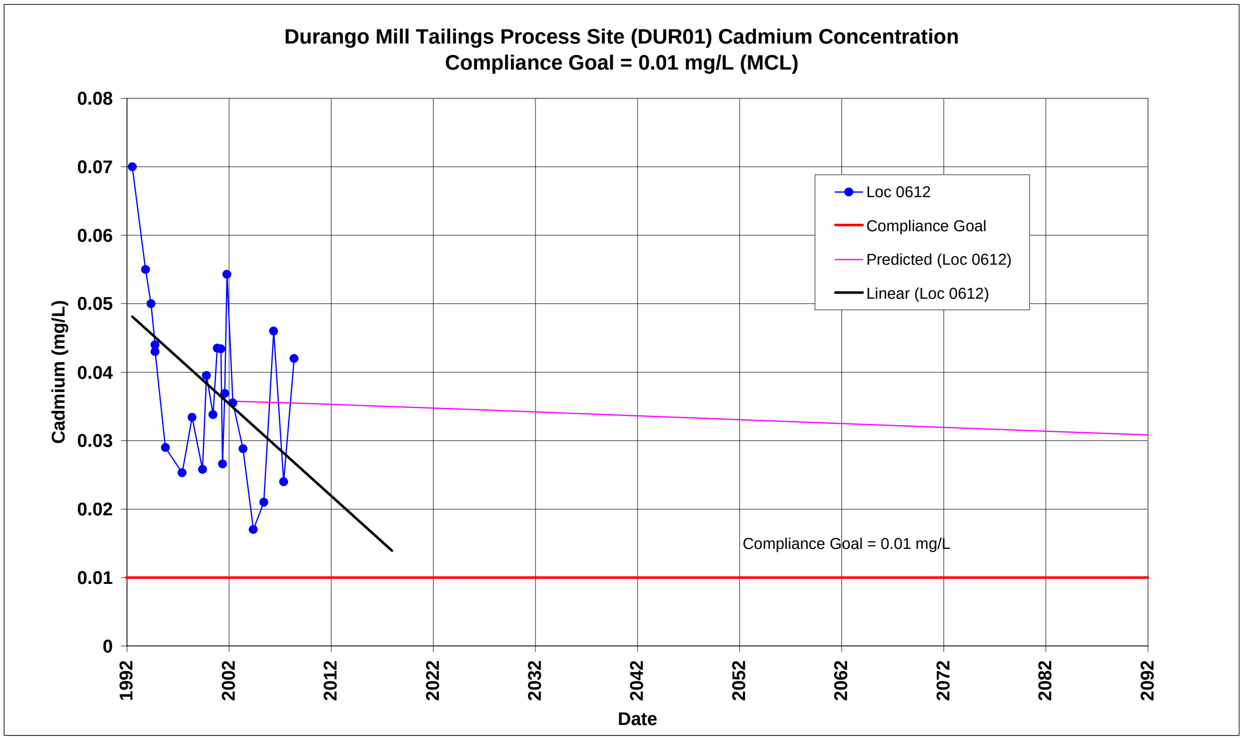

Figure 5. Predicted and Measured Cadmium Concentrations at the Durango Site

4.1.2 Manganese

Figure 6 and Figure 7, respectively, illustrate the distribution of manganese concentrations in groundwater in June 2008 and the historical variations of manganese concentrations at the compliance wells. The June 2008 results are typical for manganese in that the compliance goal was exceeded only at well 0612 (Figure 7). Projecting the linear trend of the observed concentration at well 0612 implies that natural flushing will be complete at that location in about the year 2046, well within the 100-year time allotment and in close agreement with the model prediction (Figure 8). The net variation in the concentration of manganese observed through the relatively brief period since 2002 is not inconsistent with the model prediction for this location. Because well 0612 is very close to the downgradient discharge boundary of the aquifer, contaminant migration from that area will not affect other regions of the aquifer. The flushing period for well 0612, therefore, represents a site-wide maximum for manganese because the compliance goal is not exceeded at any other location.

4.1.3 Molybdenum

Molybdenum concentrations in June 2008 were less than the compliance goal of 0.1 mg/L at all locations except at well 0612, which remained slightly above the compliance goal again this year (Figure 9 and Figure 10). Since the completion of the remedial action at the site, molybdenum in excess of the compliance goal has been limited to well 0612 (Figure 10). The linear trend of observed concentrations at well 0612 forecast molybdenum flushing to be complete in 2009 (Figure 11).

4.1.4 Selenium

Figure 12 shows, in map view, that the compliance goal for selenium (0.05 mg/L) was exceeded only at well 0633. Selenium concentrations commonly exceeded the compliance goal at wells 0617 and 0633 from 1992 until 2005 (Figure 13). Since the completion of source removal in 1992, well 0617 has shown a net decline and has been below the compliance goal for 3 years. The linear trend implies that natural flushing was complete at well 0617 in about year 2002, and has occurred within the model-predicted time (Figure 14). The model-predicted selenium concentrations would drop below the ACL by 2017 at this location (Figure 14).

Well 0633 is screened 90 percent in Mancos Shale, a recognized source of readily mobilized selenium (DOE 2002). The low-level selenium contamination at the site may in part be site-related; however, some contribution from natural sources is likely, as evidenced by concentrations greater than 0.01 mg/L at background well 0622 (not shown in figures) (see DOE 2002). The linear trend line, based on the measured concentrations at well 6033, indicates that the compliance goal was reached this year, though the current measured data exceeds the ACL. Annual measurements are expected to fluctuate around the trend line.

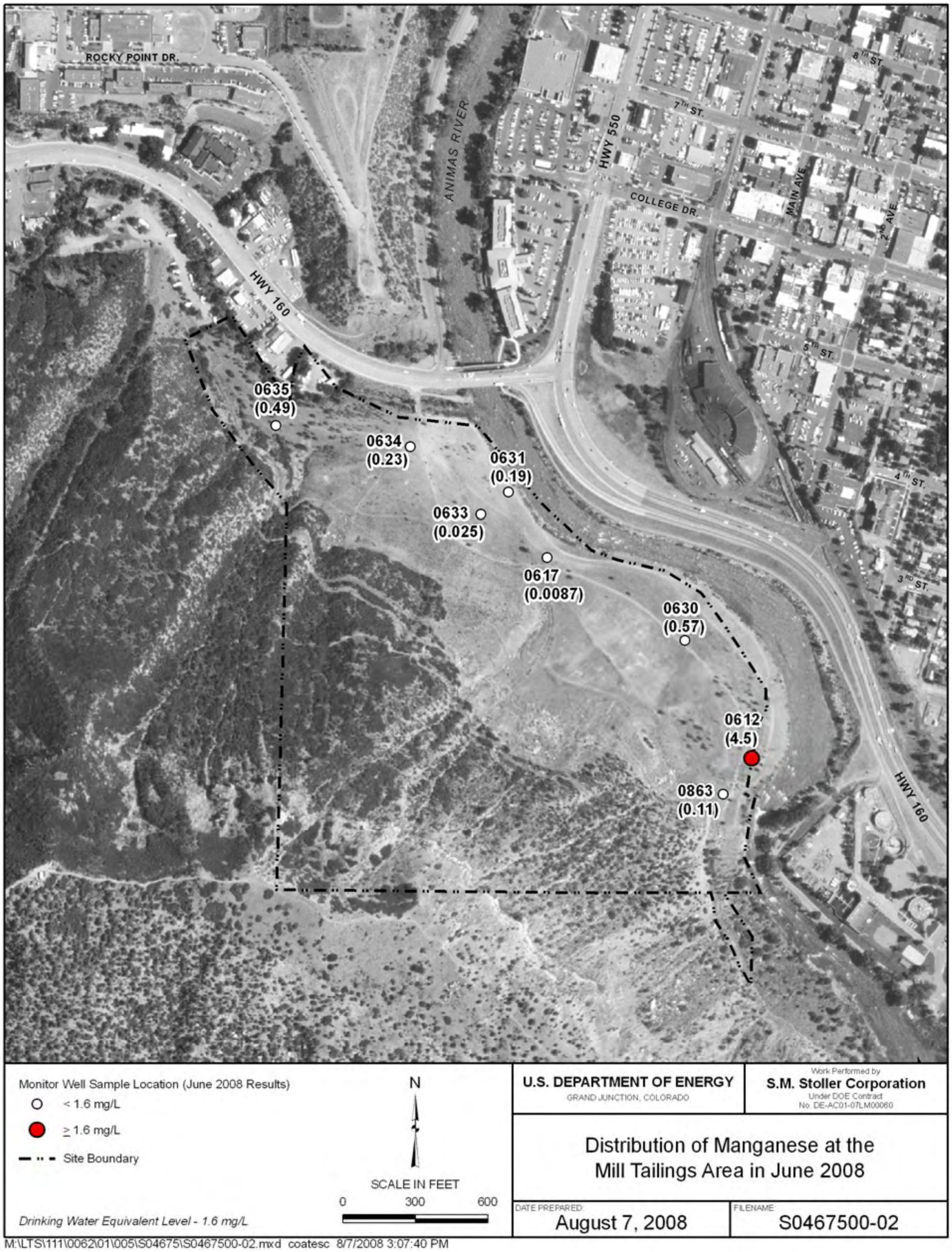

Figure 6. Distribution of Manganese at the Durango Site

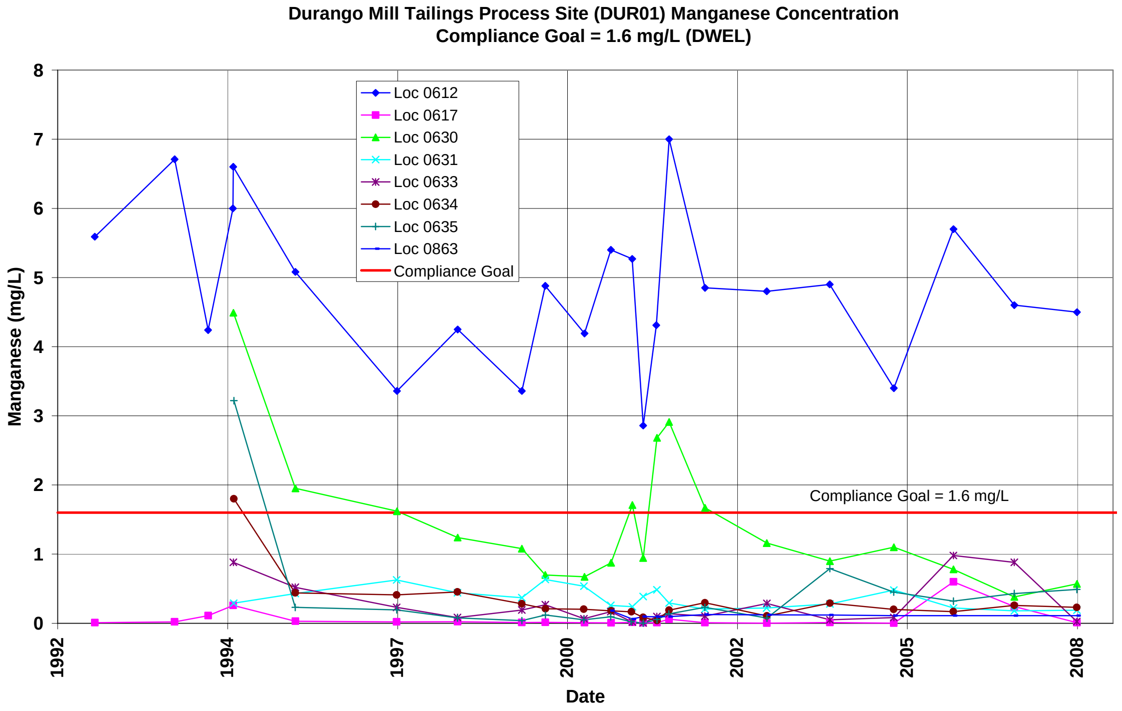

Figure 7. Historical Manganese Concentrations in Groundwater at the Durango Site

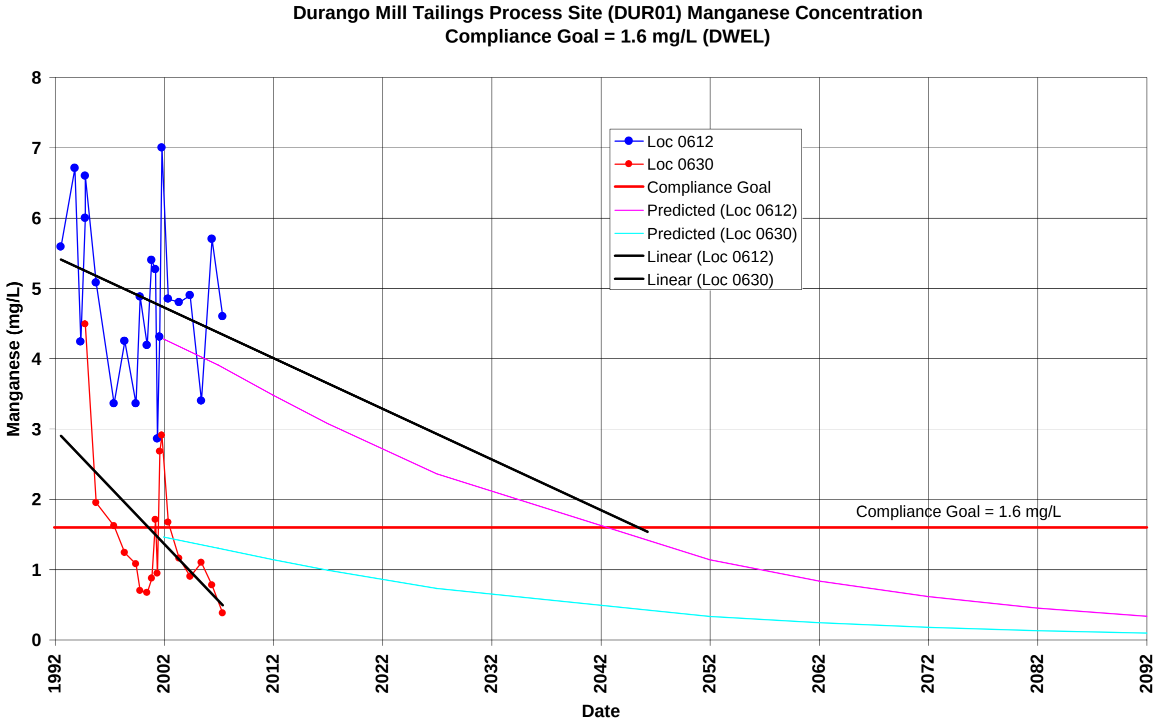

Figure 8. Predicted and Measured Manganese Concentrations at the Durango Site

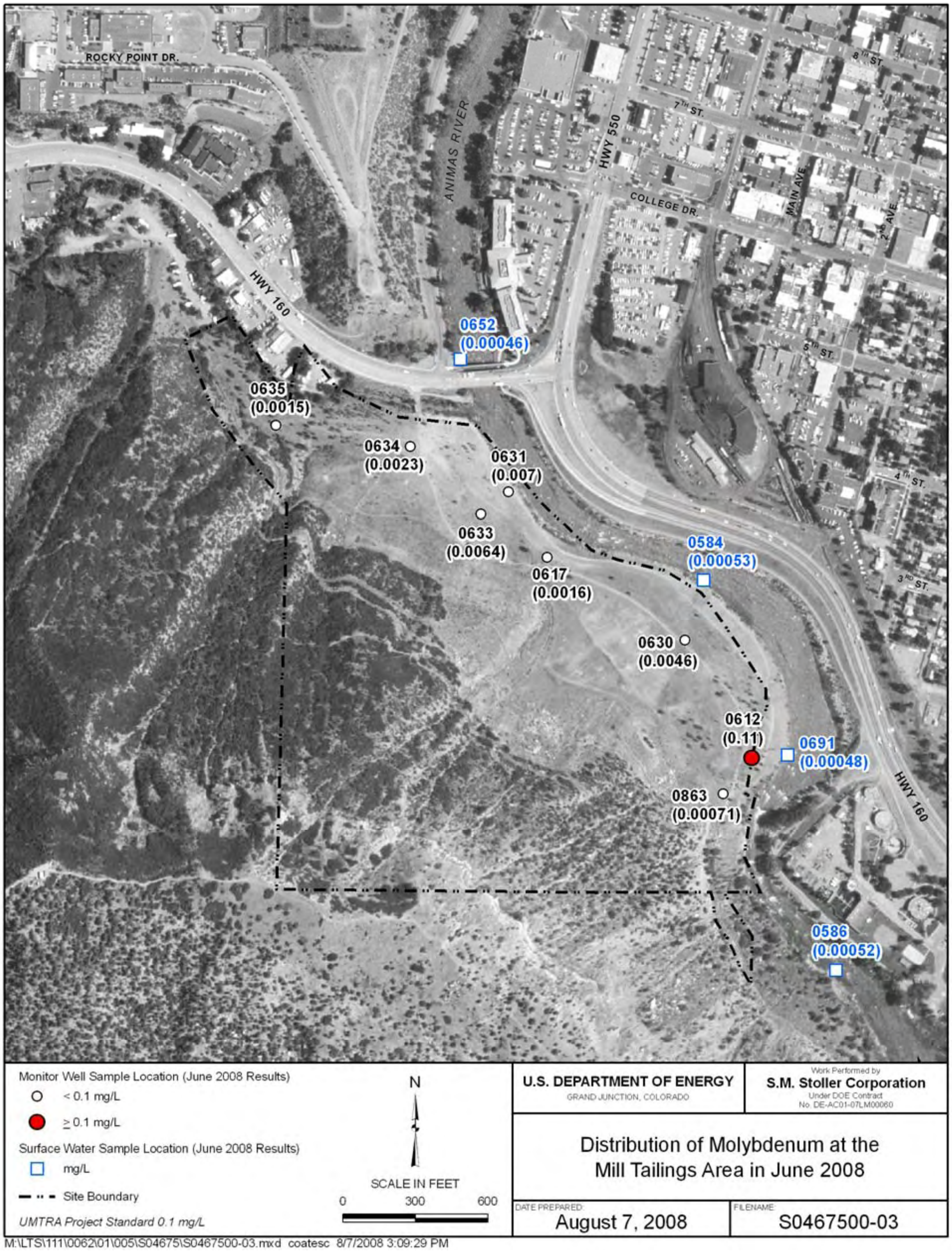

Figure 9. Distribution of Molybdenum at the Durango Site

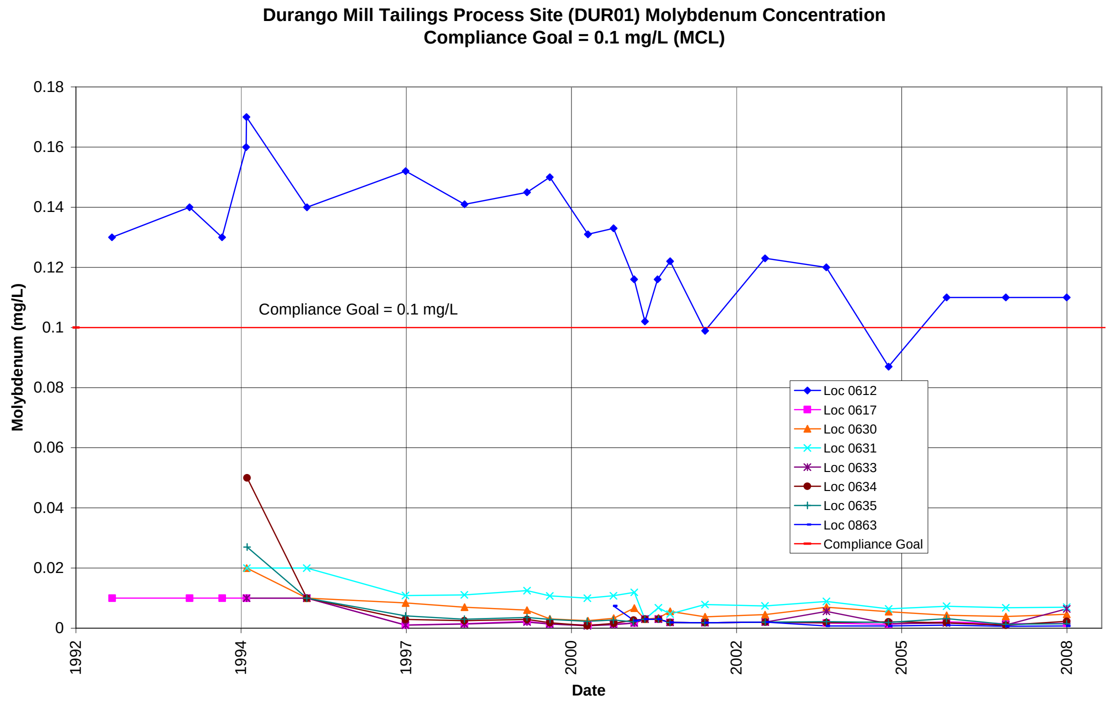

Figure 10. Historical Molybdenum Concentrations in Groundwater at the Durango Site

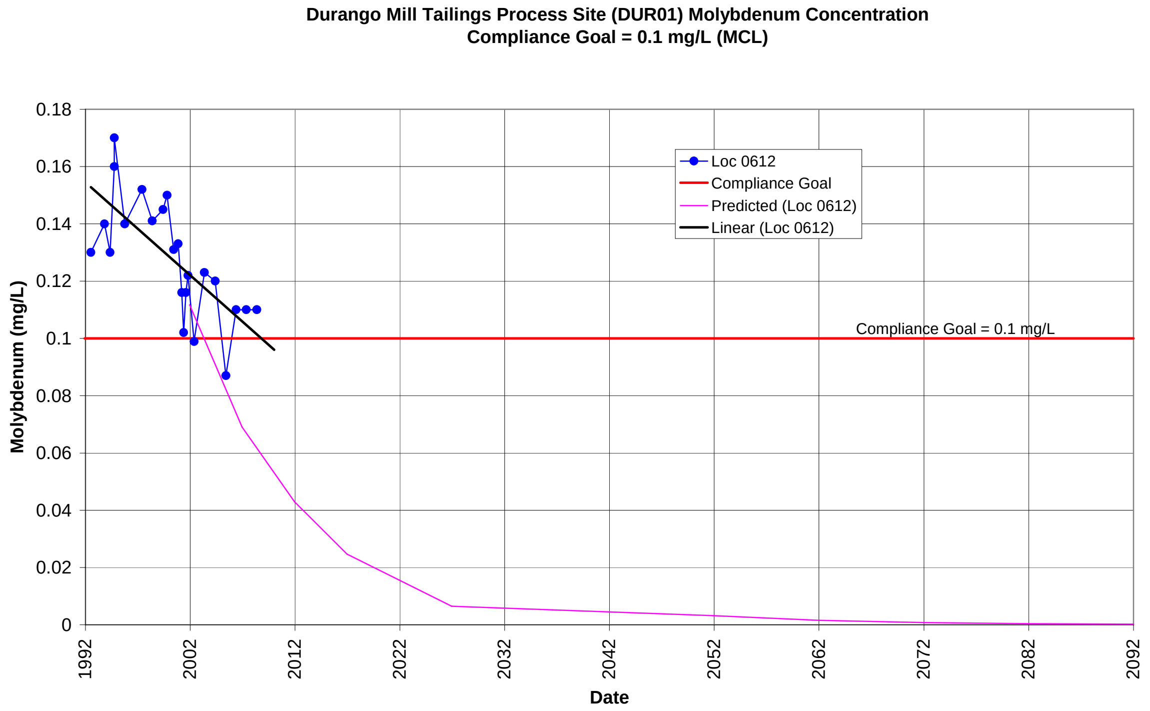

Figure 11. Predicted and Measured Molybdenum Concentrations at the Durango Site

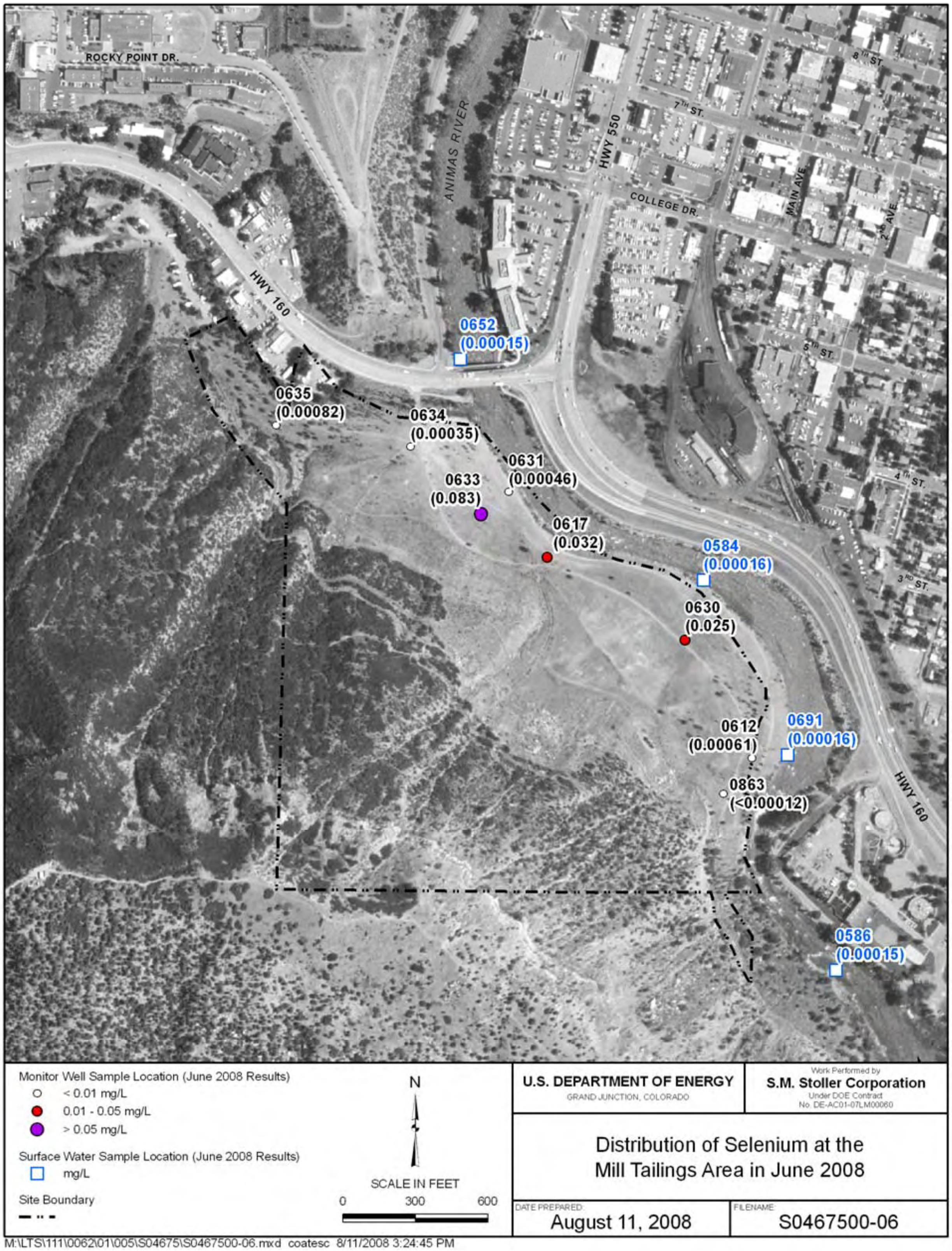

Figure 12. Distribution of Selenium at the Durango Site

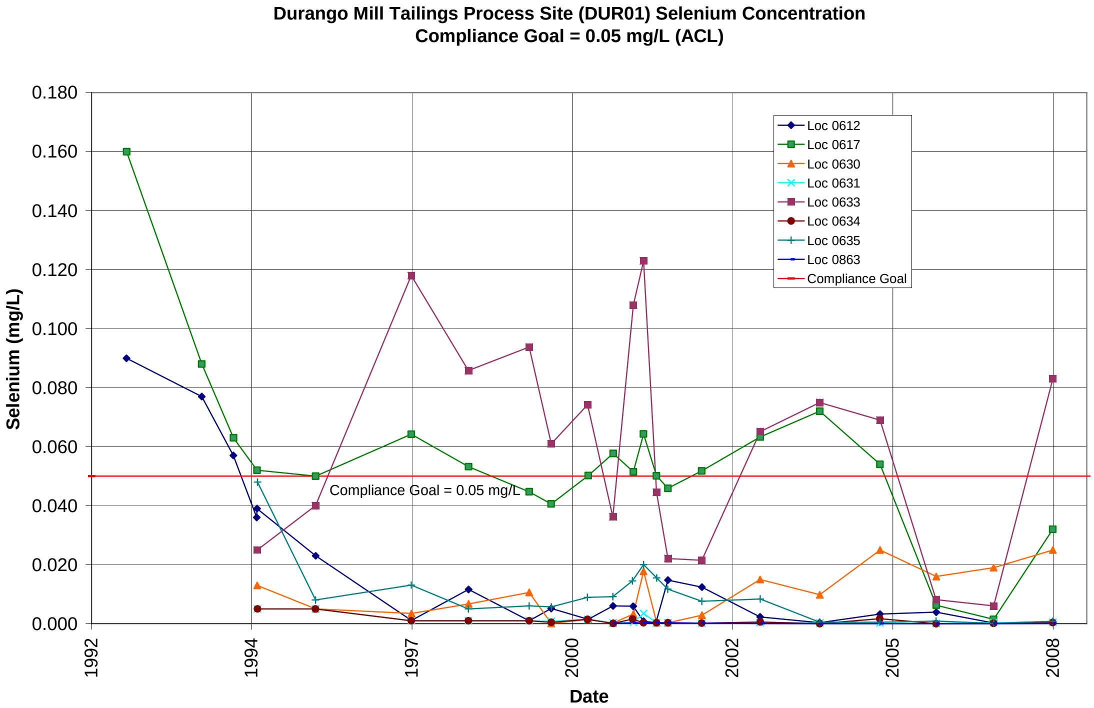

Figure 13. Historical Selenium Concentrations in Groundwater at the Durango Site

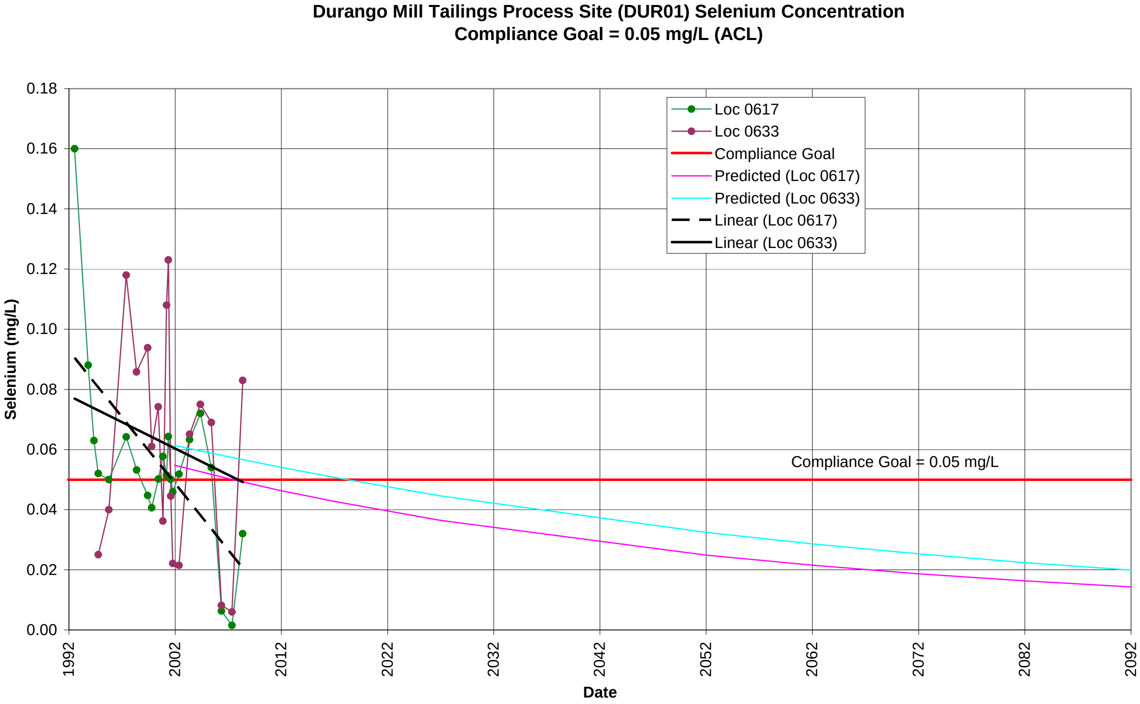

Figure 14. Predicted and Measured Selenium Concentrations at the Durango Site

4.1.5 Sulfate

Sulfate concentrations that exceed background levels are related to the former use of sulfuric acid in the milling process. In June 2008, sulfate exceeded the average background concentration at each compliance well except wells 0631and 0863 (Figure 15). All wells are less than a factor of two above the compliance goal. Observed concentrations since 1992 fluctuate considerably at a given well and generally do not show any obvious trending (Figure 16). However, projecting best-fit lines to the data reveals that sulfate flushing will be complete at most locations by about 2092. Linear trend projection of data from well 0612 shows that concentrations for that well should be below the compliance goal by about 2015 (Figure 17). Sulfate concentrations predicted by the model decrease linearly throughout the flushing period.

4.1.6 Uranium

The uranium compliance goal was exceeded at all locations except wells 0635 and 0863 in June 2008 (Figure 18). This is consistent with previous monitoring results (Figure 19). The four wells with the most-elevated uranium concentrations (0612, 0617, 0631, and 0633) have shown a decreasing-concentration trend since source removal. Groundwater model predictions indicate that site-wide uranium flushing will be complete by about 80 years after June 2002. To date, observed concentrations at the two wells that have the greatest uranium concentrations (wells 0612 and 0633) are in close agreement with the model results (Figure 20). These wells are widely separated in the aquifer. The predicted flushing period for these two wells differs from the predicted, site-wide flushing time because the last area to flush is south of the downgradient-most monitor well (well 0612). Linear projection of the observed concentration trends implies site-wide uranium flushing by about 2031. The model predicts similar rates of flushing, followed by a period of much less rapid flushing and marginal levels of contamination (concentration tailing) until the goal is attained. Uranium concentrations may remain slightly above the compliance goal during the period of reduced flushing.

4.2 Surface Water

Surface water was sampled from four locations in the Animas River during June 2008 and analyzed for cadmium, molybdenum, selenium, and uranium (Figure 2 and Table 2). Concentrations of constituents at all locations were well below the respective compliance goals and remain indistinguishable from background levels (Appendix B).

5.0 Natural Flushing Assessment

As of June 2008, the observed rate of contaminant flushing is generally consistent with groundwater model predictions, given that the validation period to date (June 2002 to June 2008) is short compared to predicted flushing periods (60 to 100 years) for the various contaminants. Only cadmium was identified in the modeling as potentially incapable of flushing to acceptable levels within 100 years. However, at the single location where cadmium is present (well 0612)

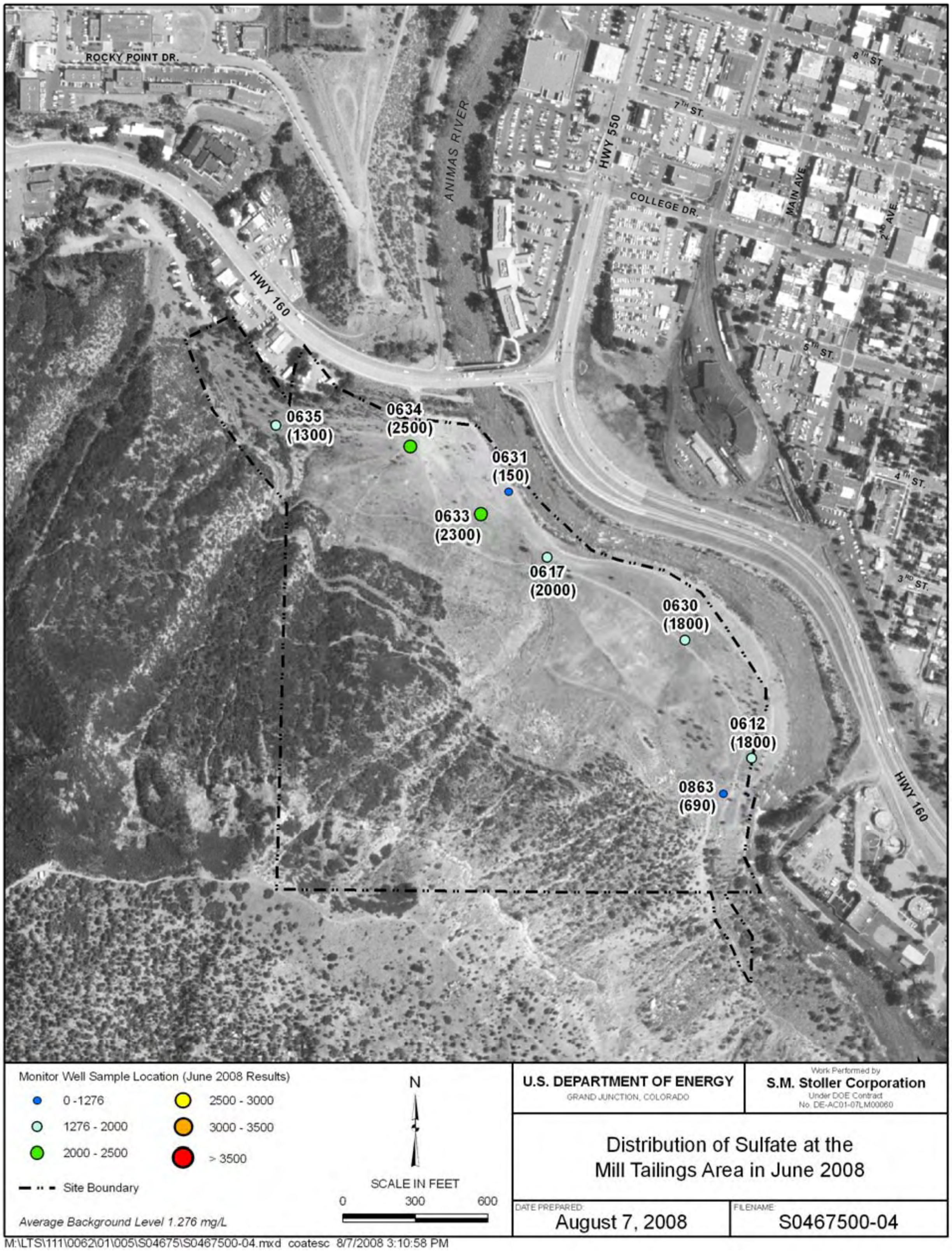

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Figure 15. Distribution of Sulfate at the Durango Site

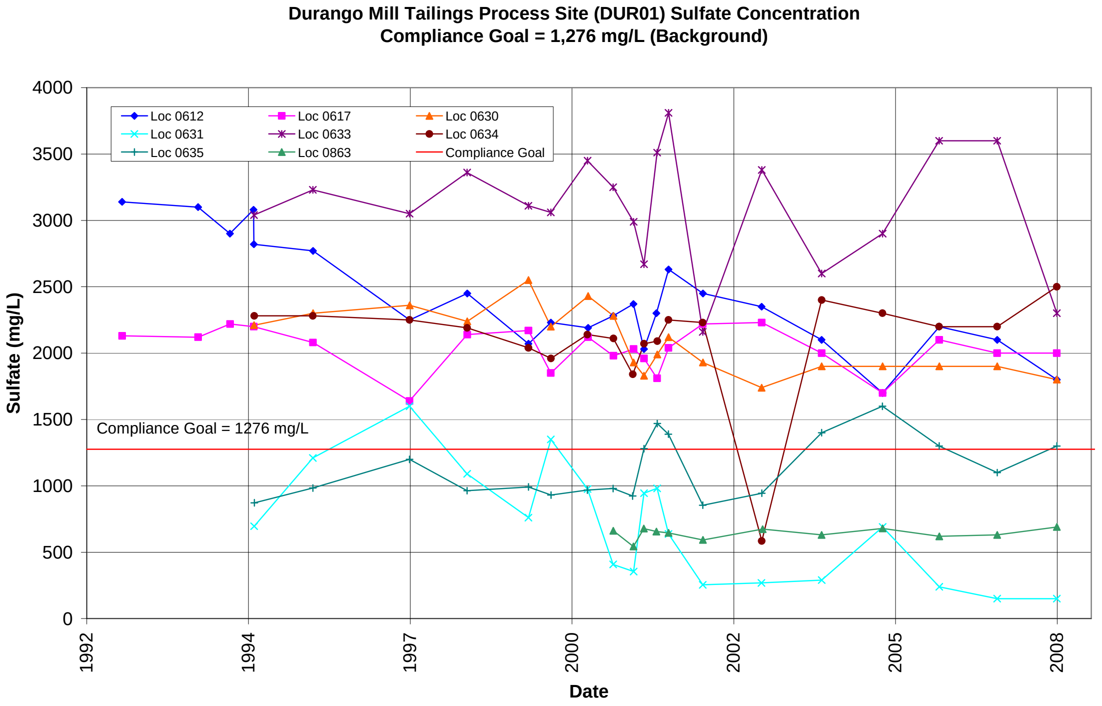
Durango Mill Tailings Process Site (DUR01) Sulfate Concentration
Compliance Goal = 1,276 mg/L (Background)

Figure 16. Historical Sulfate Concentrations in Groundwater at the Durango Site

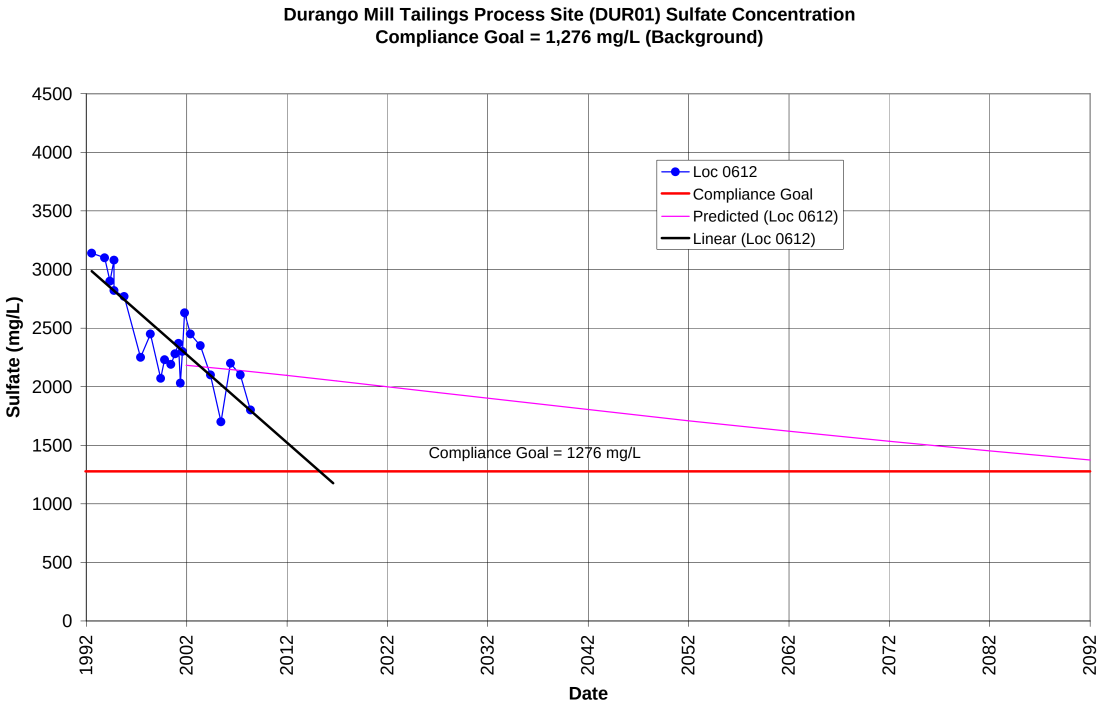
Durango Mill Tailings Process Site (DUR01) Sulfate Concentration
Compliance Goal = 1,276 mg/L (Background)

Figure 17. Predicted and Measured Sulfate Concentrations at the Durango Site

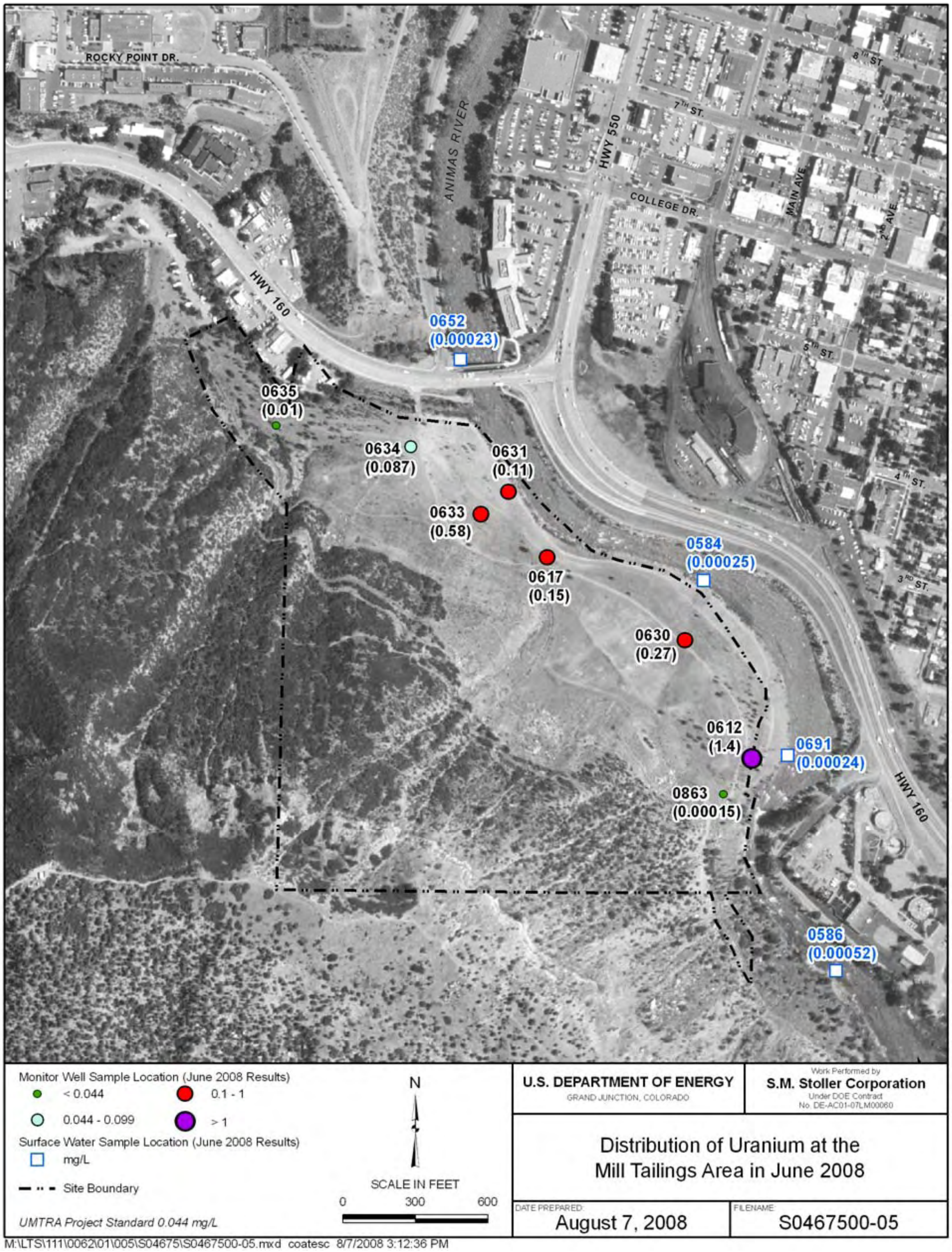

Figure 18. Distribution of Uranium at the Durango Site

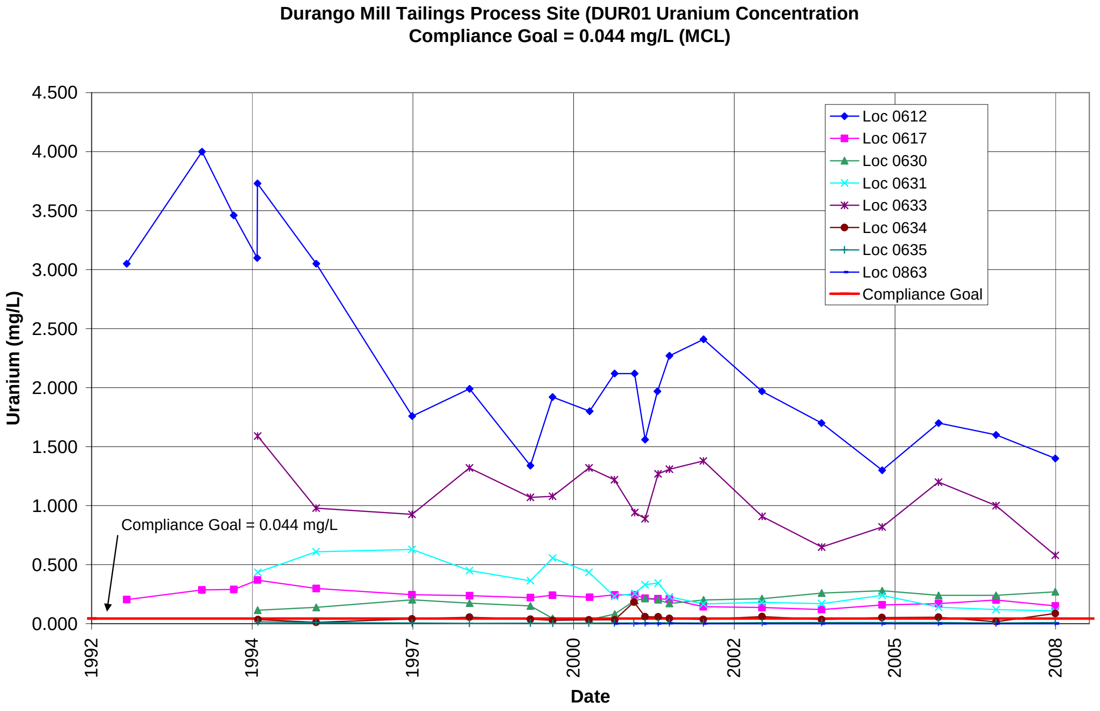

Figure 19. Historical Uranium Concentrations in Groundwater at the Durango Site

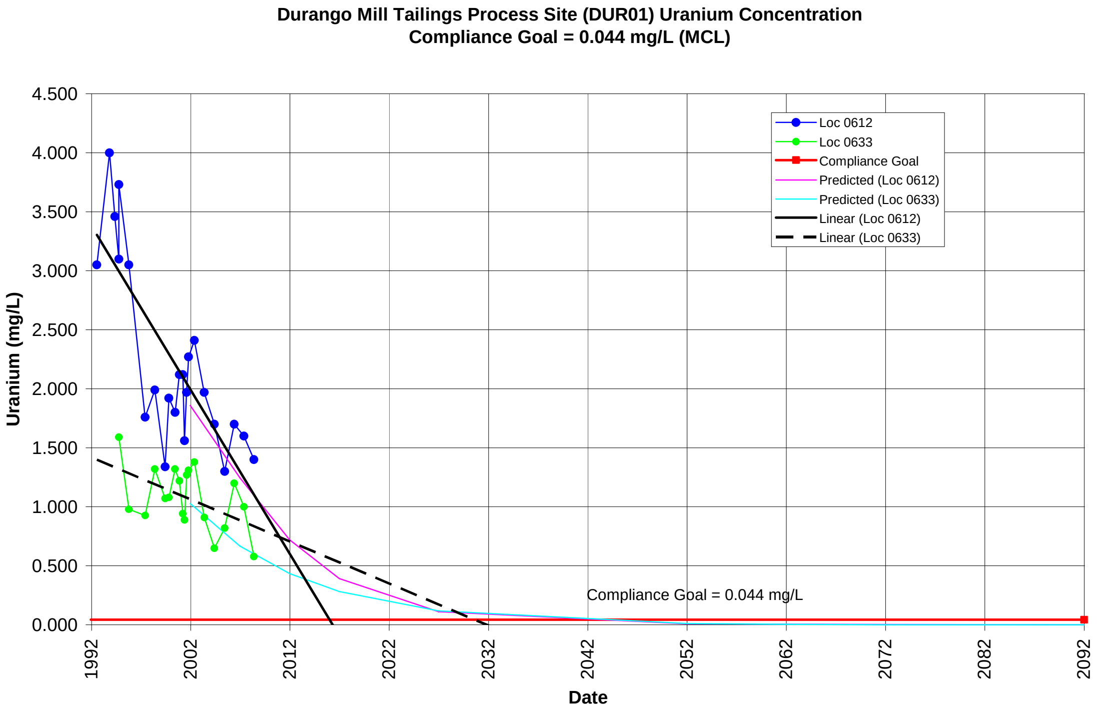

Figure 20. Predicted and Measured Uranium Concentrations at the Durango Site

above the compliance goal (0.01 mg/L), concentrations have decreased more rapidly than predicted by the model. The linear trend suggests the compliance goal will be reached by about 2021. For the remaining contaminants (with the possible exception of sulfate), modeling predictions and concentration trends imply that the respective compliance goals will likely be attained within 100 years; therefore, natural flushing remains a valid compliance strategy for these constituents, too. The impact on surface water quality from site-related contamination remains negligible.

6.0 Conclusions

Based on the assessment of the June 2008 water sampling data at the mill tailings area of the Durango site, observed concentration trends, particularly since the completion of source removal, confirm that natural flushing is measurably reducing contaminant concentrations in groundwater at the site. Overall, it is too early in the 100-year natural flushing timeframe to draw definitive conclusions.

Based on these results, recommendations for ongoing monitoring at the Durango site include:

- Continued monitoring of groundwater and surface water quality at the currently established compliance network.
- Analysis of all water samples for the same suite of constituents for each sampling event to assist in evaluating contaminant migration trends.

7.0 References

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Appendix A

Durango Mill Tailings Process Site (DUR01) Groundwater Quality Data

Analyte	Well Location	Date Sampled	Result	Unit	Lab Qualifier	Detection Limit	Zone of Completion 1	Zone of Completion 2
Alkalinity, Total (As $CaCO_3$)	0612	6/3/2008	434	mg/L			AL	
	0617	6/3/2008	436	mg/L			AL	CV
	0630	6/3/2008	234	mg/L			AL	KM
	0631	6/3/2008	412	mg/L			AL	KM
	0633	6/2/2008	360	mg/L			KM	AL
	0634	6/2/2008	477	mg/L			AL	KM
	0635	6/2/2008	468	mg/L			AL	
	0863	6/3/2008	568	mg/L			CV	
Cadmium	0612	6/3/2008	0.042	mg/L		0.006	AL	
	0631	6/3/2008	0.0001713	mg/L	B	0.0006	AL	KM
	0863	6/3/2008	0.000066	mg/L	B	0.0003	CV	
Calcium	0631	6/3/2008	94	mg/L		1	AL	KM
Iron	0631	6/3/2008	0.041	mg/L	B	0.0029	AL	KM
Magnesium	0631	6/3/2008	43	mg/L		1	AL	KM
Manganese	0612	6/3/2008	4.5	mg/L		0.00013	AL	
	0617	6/3/2008	0.0087	mg/L		0.00013	AL	CV
	0630	6/3/2008	0.57	mg/L		0.00013	AL	KM
	0631	6/3/2008	0.19	mg/L		0.00013	AL	KM
	0633	6/2/2008	0.025	mg/L		0.00013	KM	AL
	0634	6/2/2008	0.23	mg/L		0.00013	AL	KM
	0635	6/2/2008	0.49	mg/L		0.00013	AL	
	0863	6/3/2008	0.11	mg/L		0.00013	CV	
Molybdenum	0612	6/3/2008	0.11	mg/L		0.02	AL	
	0617	6/3/2008	0.0016	mg/L		0.001	AL	CV
	0630	6/3/2008	0.0046	mg/L		0.001	AL	KM
	0631	6/3/2008	0.007	mg/L	E	0.002	AL	KM
	0633	6/2/2008	0.0064	mg/L		0.001	KM	AL
	0634	6/2/2008	0.0023	mg/L		0.001	AL	KM
	0635	6/2/2008	0.0015	mg/L		0.001	AL	
	0863	6/3/2008	0.00071	mg/L	B	0.001	CV	

Analyte	Well Location	Date Sampled	Result	Unit	Lab Qualifier	Detection Limit	Zone of Completion 1	Zone of Completion 2
Oxidation Reduction Potential	0612	6/3/2008	-13	mV			AL	
	0617	6/3/2008	72	mV			AL	CV
	0630	6/3/2008	11	mV			AL	KM
	0631	6/3/2008	45	mV			AL	KM
	0633	6/2/2008	-41	mV			KM	AL
	0634	6/2/2008	108	mV			AL	KM
	0635	6/2/2008	-14.3	mV			AL	
	0863	6/3/2008	-34	mV			CV	
Potassium	0631	6/3/2008	6.4	mg/L	E	1	AL	KM
Selenium	0612	6/3/2008	0.00061	mg/L		0.00004	AL	
	0617	6/3/2008	0.032	mg/L		0.0002	AL	CV
	0630	6/3/2008	0.025	mg/L		0.0002	AL	KM
	0631	6/3/2008	0.00046	mg/L		0.00004	AL	KM
	0633	6/2/2008	0.083	mg/L		0.0004	KM	AL
	0634	6/2/2008	0.00035	mg/L		0.00004	AL	KM
	0635	6/2/2008	0.00082	mg/L		0.00004	AL	
	0863	6/3/2008	0.00012	mg/L		0.00004	CV	
Sodium	0631	6/3/2008	63	mg/L		1	AL	KM
Specific Conductance	0612	6/3/2008	3961	µmhos/cm			AL	
	0617	6/3/2008	3657	µmhos/cm			AL	CV
	0630	6/3/2008	3311	µmhos/cm			AL	KM
	0631	6/3/2008	969	µmhos/cm			AL	KM
	0633	6/2/2008	4288	µmhos/cm			KM	AL
	0634	6/2/2008	4707	µmhos/cm			AL	KM
	0635	6/2/2008	2708	µmhos/cm			AL	
	0863	6/3/2008	2251	µmhos/cm			CV	

Analyte	Well Location	Date Sampled	Result	Unit	Lab Qualifier	Detection Limit	Zone of Completion 1	Zone of Completion 2
Sulfate	0612	6/3/2008	1800	mg/L		25	AL	
	0617	6/3/2008	2000	mg/L		25	AL	CV
	0630	6/3/2008	1800	mg/L		25	AL	KM
	0631	6/3/2008	150	mg/L		5	AL	KM
	0633	6/2/2008	2300	mg/L		25	KM	AL
	0634	6/2/2008	2500	mg/L		25	AL	KM
	0635	6/2/2008	1300	mg/L		25	AL	
	0863	6/3/2008	690	mg/L		10	CV	
Temperature	0612	6/3/2008	11.92	C			AL	
	0617	6/3/2008	10.99	C			AL	CV
	0630	6/3/2008	12.57	C			AL	KM
	0631	6/3/2008	10.22	C			AL	KM
	0633	6/2/2008	12.84	C			KM	AL
	0634	6/2/2008	10.66	C			AL	KM
	0635	6/2/2008	11.4	C			AL	
	0863	6/3/2008	12.21	C			CV	
Total Dissolved Solids	0612	6/3/2008	3400	mg/L		80	AL	
	0617	6/3/2008	3600	mg/L		80	AL	CV
	0630	6/3/2008	3100	mg/L		80	AL	KM
	0631	6/3/2008	600	mg/L		40	AL	KM
	0633	6/2/2008	4200	mg/L		80	KM	AL
	0634	6/2/2008	4300	mg/L		80	AL	KM
	0635	6/2/2008	2400	mg/L		40	AL	
	0863	6/3/2008	1600	mg/L		40	CV	

Analyte	Well Location	Date Sampled	Result	Unit	Lab Qualifier	Detection Limit	Zone of Completion 1	Zone of Completion 2
Turbidity	0612	6/3/2008	3	NTU			AL	
	0617	6/3/2008	1.4	NTU			AL	CV
	0630	6/3/2008	8.37	NTU			AL	KM
	0631	6/3/2008	0.67	NTU			AL	KM
	0633	6/2/2008	1.01	NTU			KM	AL
	0634	6/2/2008	10.3	NTU			AL	KM
	0635	6/2/2008	7.65	NTU			AL	
	0863	6/3/2008	1.75	NTU			CV	
Uranium	0612	6/3/2008	1.4	mg/L		0.002	AL	
	0617	6/3/2008	0.15	mg/L		0.0002	AL	CV
	0630	6/3/2008	0.27	mg/L		0.0005	AL	KM
	0631	6/3/2008	0.11	mg/L		0.0002	AL	KM
	0633	6/2/2008	0.58	mg/L		0.001	KM	AL
	0634	6/2/2008	0.087	mg/L		0.0001	AL	KM
	0635	6/2/2008	0.01	mg/L		0.0001	AL	
	0863	6/3/2008	0.00015	mg/L		0.0001	CV	
pH	0612	6/3/2008	6.83	s.u.			AL	
	0617	6/3/2008	6.94	s.u.			AL	CV
	0630	6/3/2008	6.95	s.u.			AL	KM
	0631	6/3/2008	7.32	s.u.			AL	KM
	0633	6/2/2008	7.25	s.u.			KM	AL
	0634	6/2/2008	7.03	s.u.			AL	KM
	0635	6/2/2008	6.91	s.u.			AL	
	0863	6/3/2008	7.11	s.u.			CV	

AL = Alluvium
KM = Mancos Shale
CV = Colluvium
B = Result is between the instrument detection limit and the contract required detection limit.
mg/L = milligrams per liter
mV = millivolts
µmhos/cm = micromhos per centimeter
C = Degrees Centigrade
NTU = Nephelometric Turbidity Units
s.u. = standard units

Appendix B

Durango Mill Tailings Process Site (DUR01)
Surface Water Quality Data

Analyte	Location	Date Sampled	Result	Units	Lab Qualifier	Detec-tion Limit
Alkalinity, Total (As CaCO$_3$)	0584	6/3/2008	40	mg/L		
	0586	6/3/2008	63	mg/L		
	0652	6/3/2008	38	mg/L		
	0691	6/3/2008	50	mg/L		
Cadmium	0584	6/3/2008	0.00012	mg/L	B	0.0003
	0586	6/3/2008	0.00011	mg/L	B	0.0003
	0652	6/3/2008	0.00013	mg/L	B	0.0003
	0691	6/3/2008	0.00011	mg/L	B	0.0003
Molybdenum	0584	6/3/2008	0.00053	mg/L	B	0.001
	0586	6/3/2008	0.00052	mg/L	B	0.001
	0652	6/3/2008	0.00046	mg/L	B	0.001
	0691	6/3/2008	0.00048	mg/L	B	0.001
Oxidation Reduction Potential	0584	6/3/2008	-17	mV		
	0586	6/3/2008	14	mV		
	0652	6/3/2008	-3	mV		
	0691	6/3/2008	-45	mV		
Selenium	0584	6/3/2008	0.00016	mg/L		0.00004
	0586	6/3/2008	0.00015	mg/L		0.00004
	0652	6/3/2008	0.00015	mg/L		0.00004
	0691	6/3/2008	0.00016	mg/L		0.00004
Specific Conductance	0584	6/3/2008	151	µmhos/cm		
	0586	6/3/2008	153	µmhos/cm		
	0652	6/3/2008	143	µmhos/cm		
	0691	6/3/2008	155	µmhos/cm		
Temperature	0584	6/3/2008	7.9	C		
	0586	6/3/2008	7.93	C		
	0652	6/3/2008	7.55	C		
	0691	6/3/2008	8.1	C		
Uranium	0584	6/3/2008	0.00025	mg/L		0.0001
	0586	6/3/2008	0.00052	mg/L		0.0001
	0652	6/3/2008	0.00023	mg/L		0.0001
	0691	6/3/2008	0.00024	mg/L		0.0001
pH	0584	6/3/2008	7.93	s.u.		
	0586	6/3/2008	7.87	s.u.		
	0652	6/3/2008	7.88	s.u.		
	0691	6/3/2008	8.01	s.u.		

B = Result is between the instrument detection limit and contract required detection limit.
mg/L = milligrams per liter mV = millivolts µmhos/cm = micromhos per centimeter
C = Degrees Centigrade NTU = Nephelometric Turbidity Units s.u. = standard units

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