SourceWater Consulting

MEMORANDUM

Date: April 9, 2008

To: Stan Christensen, Mike Wireman, Hays Griswold, US EPA

CC: Doug Jamison, CDPHE WQCD

From: Jord Gertson, SourceWater Consulting

Subject: California Gulch, CERCLA Site, Ground Water Elevation Update

On Wednesday, February 27, 2008, the U.S. Environmental Protection Agency (EPA) began an emergency response action that involves primarily pumping ground water out of the Gaw shaft near downtown Leadville to relieve pressure on the Leadville Mine Drainage Tunnel (LMDT) within Operable Unit 6/12 (OU6/12) of the California Gulch Superfund site (the Site) in Leadville, Lake County, Colorado. The goal of the emergency response action is to lower ground water levels in the vicinity of the LMDT.

After approximately one month of emergency ground water extraction via Gaw Shaft pumping, I compiled ground water elevation data for 12 monitoring wells in the vicinity of the LMDT: DWWOB1, LDT36+77, LDT46+66, LDT75+05, LDT96+44, BMW5, OU6MP-ELK, OU6MP-DW2, NW5A, AP1TMW13D, AP1TMW7, and AP1TMW18. Data was downloaded and calibrated from March 27 through 31th, 2008. At two additional monitoring locations (wells NW5D and BMW8), Insitu pressure transducers (dataloggers) were replaced to monitor the de-watering affects. Additional water level data, flow measurements, and field water quality parameters were also collected manually at 13 monitoring wells or shafts by students at Colorado Mountain College, Natural Resource Management.

(1) As a result of emergency response pumping, approximately 50 acre-feet of water at an average rate of 464 gallons per minute (gpm) has been removed from the Gaw Shaft, according to data collected hourly by Environmental Restoration, LLC. This is approximately 16 million gallons of water pumped and redirected as surface water to lower elevations at California Gulch.

(2) Bedrock wells are being directly influenced by Gaw shaft pumping while shallow alluvial wells are not.

(3) The bedrock wells that are being influenced by Gaw shaft pumping are all located in the downtown Leadville mining district and all are west of the Pendery Fault.

Sourcewater Consulting has collected 1.95 million water level measurements using Insitu pressure transducers at the Site since the initial deployment of dataloggers in June 2004. Drawing on that historical data, several plots of ground water elevations are attached, as follows:

Plot 1: Average daily ground water elevations in the eight monitoring wells at the lower LMDT (elevations) from September 1997 to January 2008 demonstrate that over the ten year period water levels historically have not been this high — water levels kept getting higher and peaked in February 2008.

Plot 2: Average daily ground water elevations in the 19 monitoring wells at the upper LMDT (elevations) at a five year scale from January 2003 to January 2008 depict that levels are falling — some are falling due to Gaw shaft pumping and some are falling due to seasonal variation.

Plot 3: Average daily ground water elevations in the 19 monitoring wells in the upper LMDT (elevations) depicted more finely at a scale of the last 18 months from October 2006 to April 2008 illustrate that wells below 10,135 feet and west of the Pendery Fault are affected by Gaw Shaft pumping.

Plot 4: Average daily ground water elevations in the 19 monitoring wells in the upper LMDT (elevations) for just the last six months depict more clearly that wells below 10,135 feet and west of the Pendery Fault are affected by Gaw Shaft pumping and have dropped about 10 feet.

Plot 5: Average daily ground water elevations for two bedrock monitoring wells (LMDT36+77 and DWW0B1) in the lower LMDT (elevations) from May 2004 to May 2008 show variability, yet pressure in the two wells tends to run in tandem — the two bedrock monitoring wells are 2600 feet apart and demonstrate there is no major blockage between these two points in the lower LMDT contributing to a change in storage.

Plot 6: Average daily water elevations from May 2004 to May 2008 for five monitoring locations document that bedrock wells are being influenced by Gaw shaft pumping while alluvial wells are not. Two bedrock monitoring wells on the west side of the Pendery Fault (NW5D, the bedrock well closest to the GAW shaft, and AP1TMW7, the bedrock well NE of the Gaw shaft) are directly affected by Gaw shaft pumping. Moreover, the deep alluvial well next to NW5D known as NW5C is most likely also affected by GAW shaft pumping but, since it stopped flowing a week or so after the start of Gaw shaft pumping and now has a frozen ice plug, water levels have not been measured. AP1TMW13D is an alluvial well west of the Pendery fault located about 120 yards west of the Gaw shaft not affected by Gaw shaft pumping. AP1TMW18 is not affected by Gaw shaft pumping but most directly influenced from surface water and meltoff from downtown Leadville streets. The completed well within the Gaw Shaft is screened well below the alluvial bedrock interface so that alluvium is not a source of water pumped from the Gaw shaft; but alluvial levels are affected by surface water.

Plot 7: The draw-down characteristics of the Gaw Shaft bedrock well and its adjacent GAWALL deep alluvial well depict the effects of pumping the Gaw Shaft. The Gaw Shaft water level has been drawn down over 66 feet while the adjacent deep alluvial well is down over 38 feet. That alluvial well is directly influenced by pressure head from the Gaw Shaft.

Plot 8: The potentiometric surface near the LMDT including wells near the Apache Tailings Impoundment (API) depicts the impact of the Pendery fault between LMDT36+77 and LMDT46+66 — the strongest gradient is at the lowest elevation demonstrating that there is a pathway toward the LMDT portal.

Highlights of recent ground water levels can be characterized by the following:

•Water levels historically have not been this high (since 1996). Data from the Robert Emmet Shaft (RES) presents the longest data series (September 1996 to the present) in the upper elevations of the LMDT to document this. The RES data set encompasses at least two seasons with above average snow pack (1995/96 and 1998/99) where maximum RES water elevations did not exceed 10,140. RES peaked in December 2007 at 10,151, after four years of average snow pack including a drought in 2002. Historically high water levels are seen not only in RES data, but also in historic data presented in Plot 1. For instance, water levels below station LDT36+77 reached a record high during the 2007/2008 winter season, extending more than 50 feet above the LMDT.

•Water pressure levels within both the lower and the upper LMDT have dropped about 8 feet since their peak in November 2007.

•Of all the 27 wells monitored, there was notable water level decrease of 10 feet on average at four bedrock wells (NW5D, AP1TMW7, BMW8, and BMW3). Pumping the Gaw Shaft has lowered water level elevations at bedrock wells located west of the Pendery Fault near the mine voids near the Leadville downtown mining District. Continued monitoring of these four key locations is important.

• Discharge from the Valentine Shaft located west of the Gaw Shaft at lower elevations has reduced to 30 gpm, the minimum recorded rate for 2007. It appears that pumping the Gaw Shaft has lowered the discharge rate from the Valentine Shaft. Both the Gaw and Valentine shafts extend to the same deep bedrock lithology, the Leadville Limestone.

•Pumping at the Gaw Shaft has not influenced the bedrock wells near the LMDT located east of the Pendery Fault.

•There has been a reduction in discharge at locations in close proximity to the Gaw Shaft. For instance, wells near the Gaw Shaft such as NW5D, NW5C and WO3 have stopped flowing; field reconnaissance indicates that flow from several springs near the Gaw Shaft has decreased.

• When evaluating seasonal variation, the rising limb and falling limb of LMDT monitoring well ground water hydrographs (Plots 3 and 4), during the rising limb, the well water elevations are very close to each other indicating that recharge is greater than discharge from the mine workings and tunnel, as the network gains storage. During the falling limb, there is a significant separation in water elevation between the LMDT monitoring wells. This indicates a gradient toward the LMDT portal during the falling limb and a lack of gradient during the rising limb. This seasonal change in potentiometric slope appears to be a controlling factor when delivering constituents from the Marian Shaft to the treatment plant. During the months of April and May there is a strong slope toward the LMDT portal resulting in high constituent recovery. During the months of June, July and August this gradient is reduced significantly as recharge overwhelms discharge.

• Currently, the water elevation difference between LDT36+77 and LDT46+66 is 120 feet; the Pendery fault separates those two monitoring locations.

• Shallow alluvial wells NW6, NW6A, and NW15A near California Gulch below the Apache Tailings Impoundment indicate an increase of 2/10 of a foot in water elevation, a small increase, likely due to increased discharge in California Gulch from snow-melt or discharge into the Gulch of water pumped from the Gaw Shaft. It is possible that redirecting more than 4.65 billion gallons of water from the Gaw Shaft to California Gulch affects shallow alluvial wells.

- One bedrock well (WCCPZ1)located on the face of or east of the Pendery Fault system continues to overflow into California Gulch directly below the Yak Surge Pond at a ground elevation 3.5 feet higher than the MAB or Emmet Shaft water elevation. The ground elevation of WCCPZ1 is higher than the highest water elevations near the LMDT. As WCCPZ1 flows, it indicates there is a potential source of water from the California Gulch to Graham Park east of the Pendery Fault.

These are some of the observations that I have made during my investigation, field reconnaissance and update of water level data. Please feel free to contact me with any questions or comments regarding this data.

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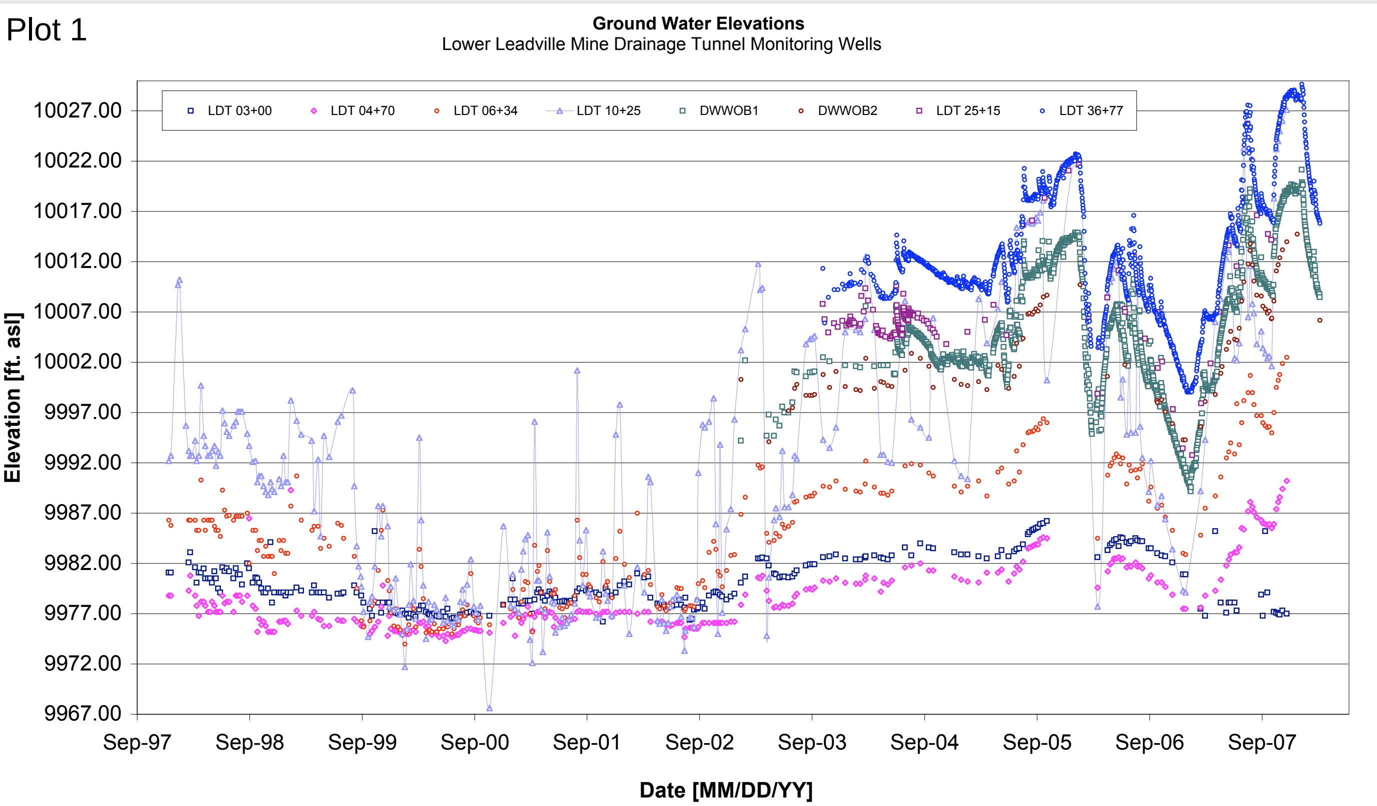
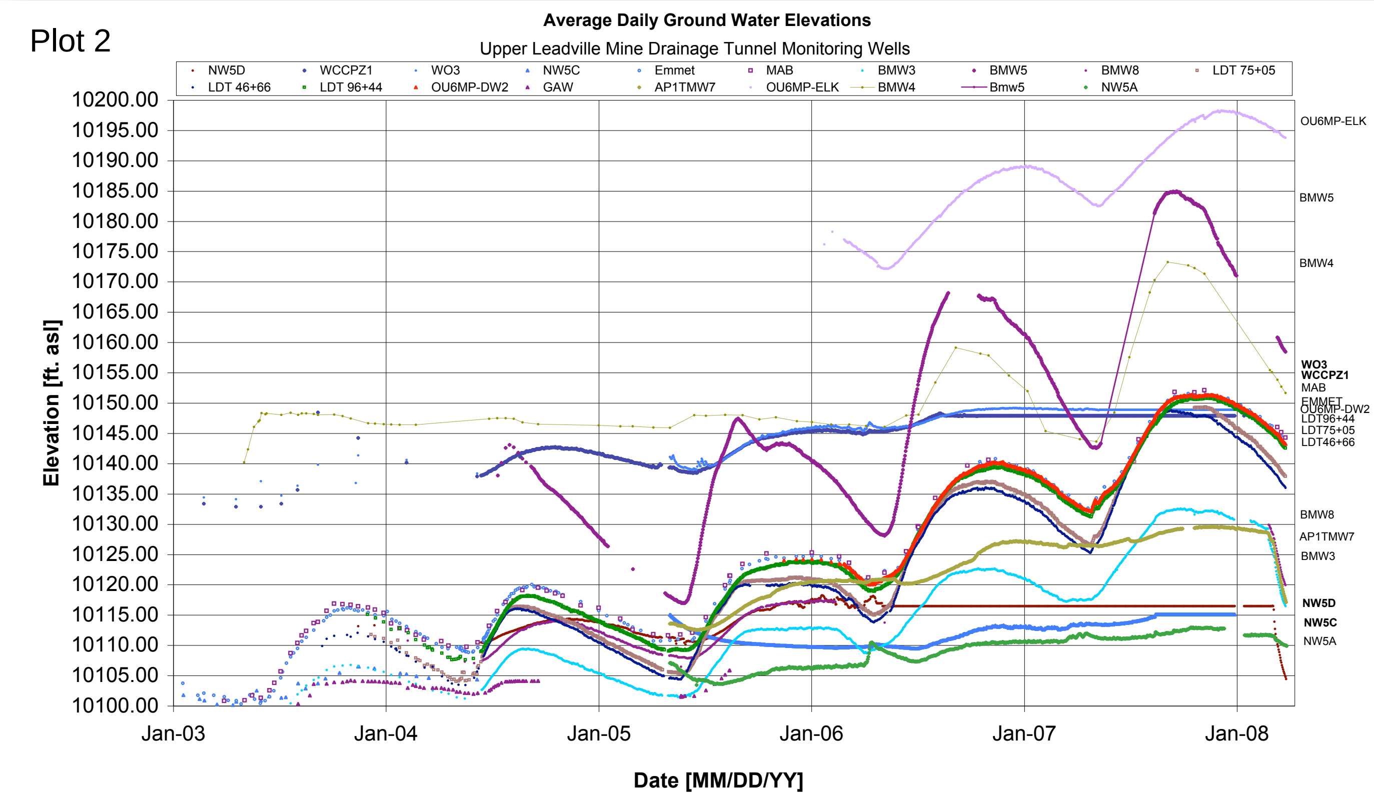
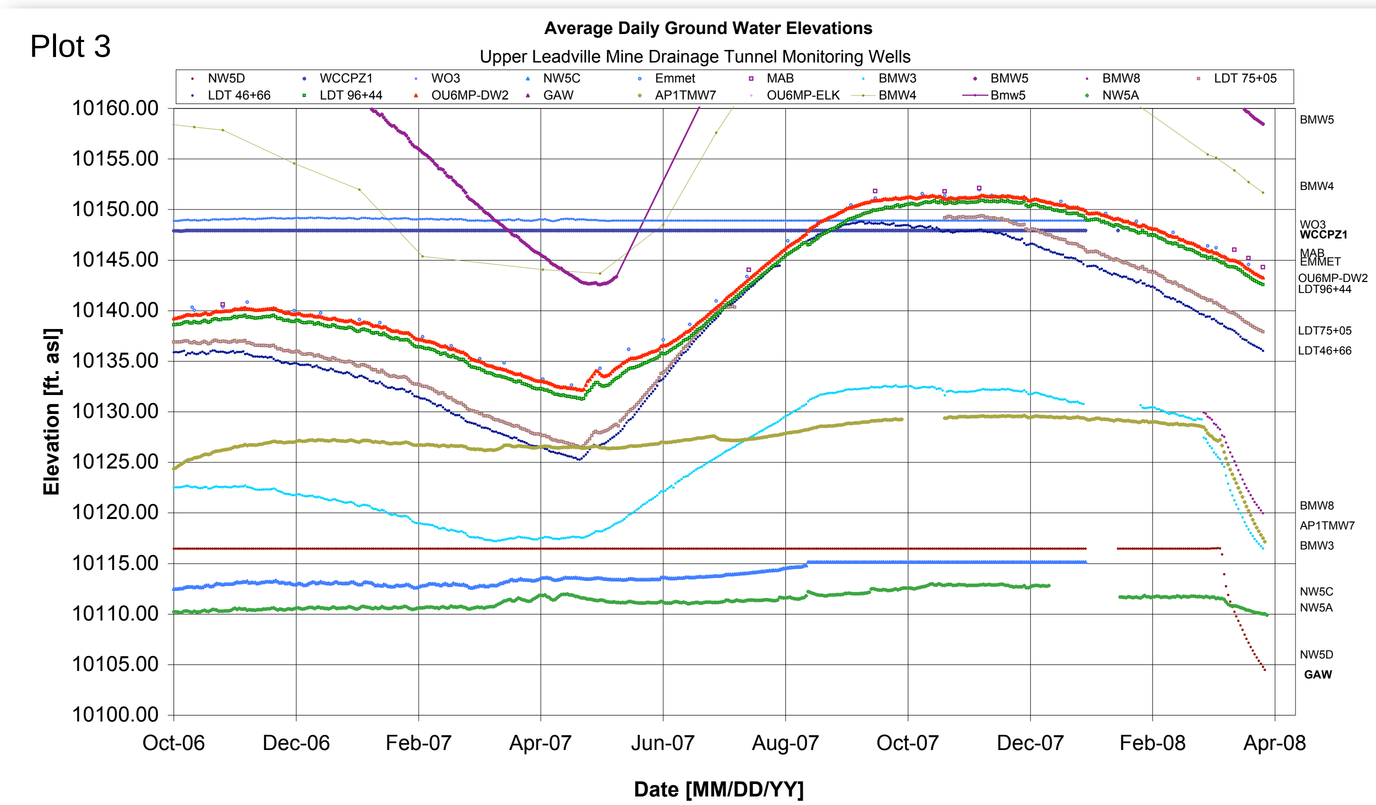
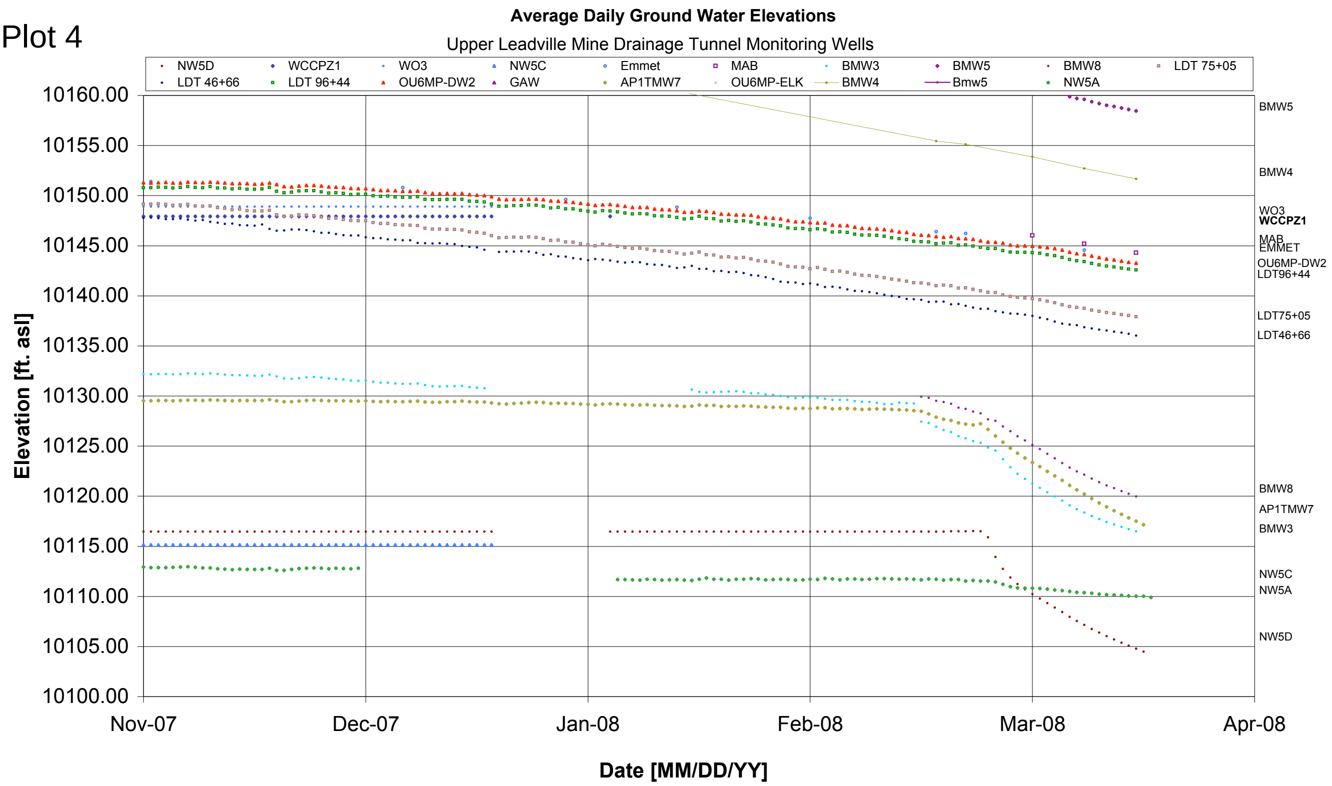
Plot 1



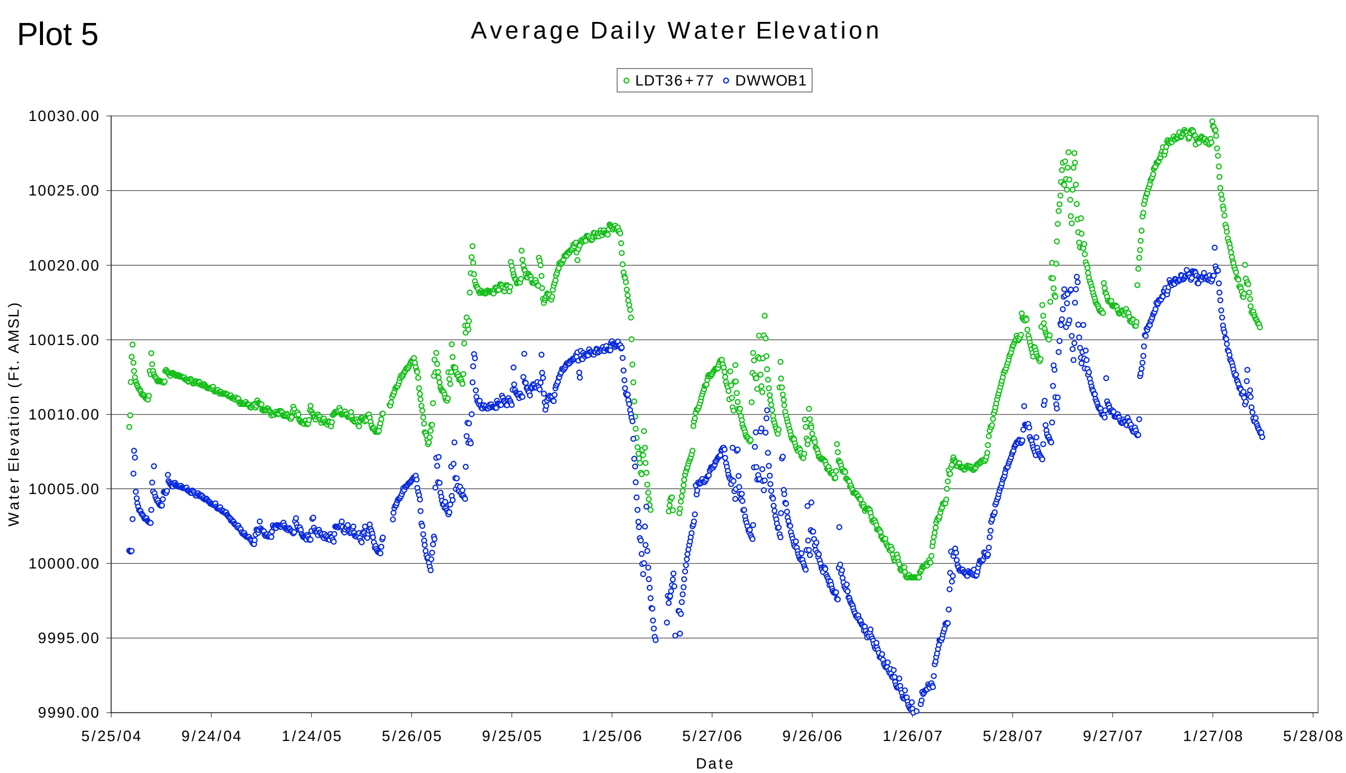

Plot 2
Average Daily Ground Water Elevations
Upper Leadville Mine Drainage Tunnel Monitoring Wells
NW5D
WCCPZ1
WO3
NW5C
Emmet
MAB
BMW3
BMW5
BMW8
LDT 75+05
LDT 46+66
LDT 96+44
OU6MP-DW2
GAW
AP1TMW7
OU6MP-ELK
BMW4
Bmw5
NW5A
Elevation [ft. asl]
Date [MM/DD/YY]
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08


Plot 3
Average Daily Ground Water Elevations
Upper Leadville Mine Drainage Tunnel Monitoring Wells
NW5D
WCCPZ1
WO3
NW5C
Emmet
MAB
BMW3
BMW5
BMW8
LDT 75+05
LDT 46+66
LDT 96+44
OU6MP-DW2
GAW
AP1TMW7
OU6MP-ELK
BMW4
Bmw5
NW5A
Elevation [ft. asl]
Date [MM/DD/YY]
Oct-06
Dec-06
Feb-07
Apr-07
Jun-07
Aug-07
Oct-07
Dec-07
Feb-08
Apr-08

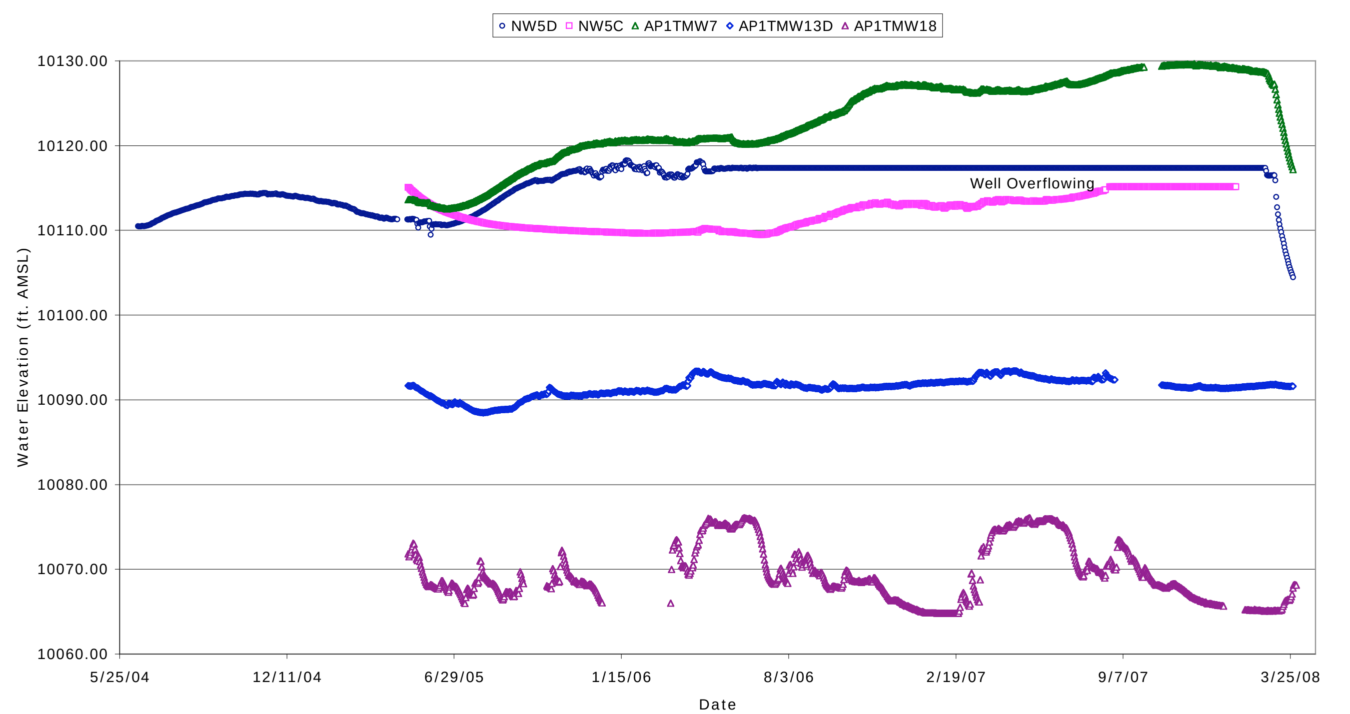
Plot 4


Average Daily Ground Water Elevations
Upper Leadville Mine Drainage Tunnel Monitoring Wells
NW5D
WCCPZ1
WO3
NW5C
Emmet
MAB
BMW3
BMW5
BMW8
LDT 75+05
LDT 46+66
LDT 96+44
OU6MP-DW2
GAW
AP1TMW7
OU6MP-ELK
BMW4
Bmw5
NW5A
Elevation [ft. asl]
10160.00
10155.00
10150.00
10145.00
10140.00
10135.00
10130.00
10125.00
10120.00
10115.00
10110.00
10105.00
10100.00
Nov-07
Dec-07
Jan-08
Feb-08
Mar-08
Apr-08
Date [MM/DD/YY]
BMW5
BMW4
WO3
WCCPZ1
MAB
EMMET
OU6MP-DW2
LDT96+44
LDT75+05
LDT46+66
BMW8
AP1TMW7
BMW3
NW5C
NW5A
NW5D

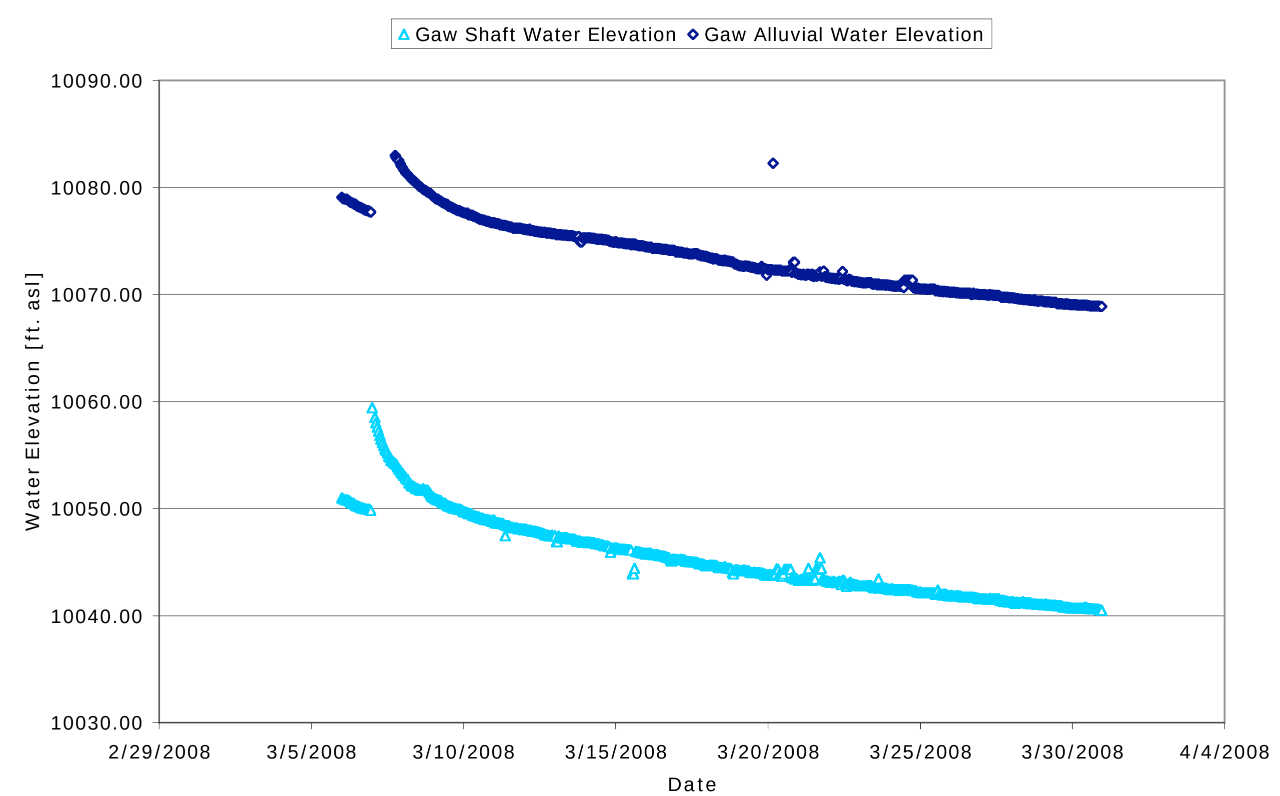
Plot 5


Average Daily Water Elevation
LDT36+77
DWWOB1
Water Elevation (Ft. AMSL)
10030.00
10025.00
10020.00
10015.00
10010.00
10005.00
10000.00
9995.00
9990.00
5/25/04
9/24/04
1/24/05
5/26/05
9/25/05
1/25/06
5/27/06
9/26/06
1/26/07
5/28/07
9/27/07
1/27/08
5/28/08
Date

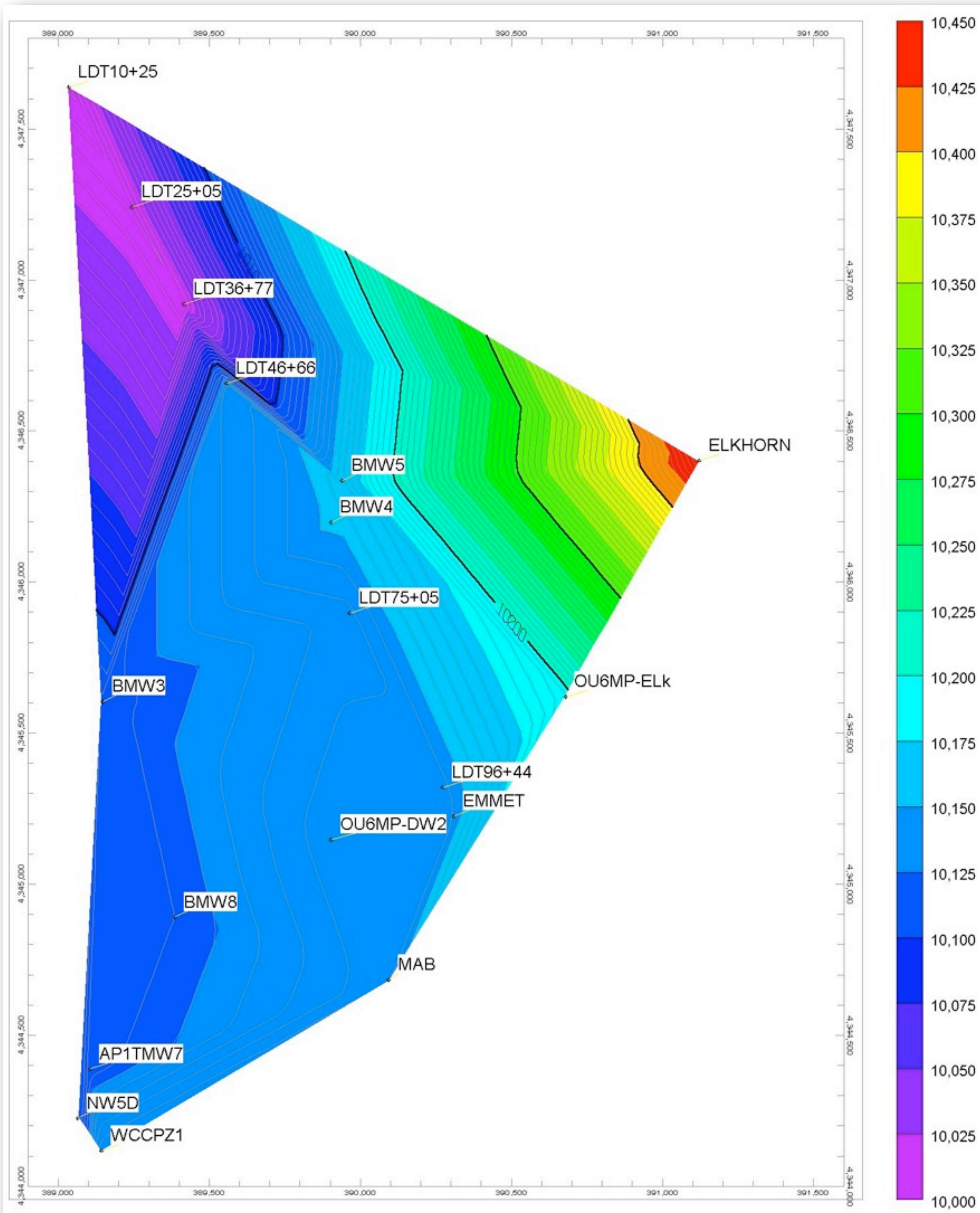
Plot 6


Average Daily Ground Water Elevations, California Gulch, Near Leadville
NW5D
NW5C
AP1TMW7
AP1TMW13D
AP1TMW18
Well Overflowing
Water Elevation (ft. AMSL)
10130.00
10120.00
10110.00
10100.00
10090.00
10080.00
10070.00
10060.00
5/25/04
12/11/04
6/29/05
1/15/06
8/3/06
2/19/07
9/7/07
3/25/08
Date

Plot 7


Hourly Water Elevations
Gaw Shaft Water Elevation
Gaw Alluvial Water Elevation
Water Elevation [ft. asl]
10090.00
10080.00
10070.00
10060.00
10050.00
10040.00
10030.00
2/29/2008
3/5/2008
3/10/2008
3/15/2008
3/20/2008
3/25/2008
3/30/2008
4/4/2008
Date

Plot 8


LDT10+25
LDT25+05
LDT36+77
LDT46+66
BMW5
BMW4
LDT75+05
ELKHORN
OU6MP-ELk
BMW3
LDT96+44
EMMET
OU6MP-DW2
BMW8
MAB
AP1TMW7
NW5D
WCCPZ1
10200
10,450
10,425
10,400
10,375
10,350
10,325
10,300
10,275
10,250
10,225
10,200
10,175
10,150
10,125
10,100
10,075
10,050
10,025
10,000