

WATER QUALITY MEMORANDUM

Utah Coal Regulatory Program

February 6, 2008

TO: Internal File

THRU: Pamela Grubaugh-Littig, Permit Supervisor *Page*

FROM: *D* Dana Dean, P.E., Senior Reclamation Hydrologist

RE: 2007 Second Quarter Water Monitoring, West Ridge Resources, Inc, West Ridge Mine, C/007/0041-WQ07-2, Task ID #2732

The West Ridge Mine is a currently operational longwall mine. Water monitoring data is evaluated from the data that is submitted quarterly by the mine to the Division EDI database. Water monitoring protocols, and surface, groundwater and monitoring wells, and UPDES sample parameters are outlined in the mine's MRP on Tables 7-1 to 7-6.

1. Was data submitted for all of the MRP required sites? YES NO

Springs

The MRP requires the Permittee to monitor 10 springs each quarter.

The Permittee submitted all required samples for the spring sites.

Streams

The MRP requires the Permittee to sample 12 streams each quarter.

The Permittee submitted all required samples for the stream sites.

Wells

The MRP requires the Permittee to monitor one well each quarter.

The Permittee submitted the required well site sample.

UPDES

The UPDES Permit/MRP require monthly monitoring of two outfalls: 001, Sedimentation Pond Discharge; and 002, Mine Water Discharge.

The Permittee submitted all required samples for the UPDES sites. Only outfall 002 reported flow.

2. Were all required parameters reported for each site? YES NO

3. Were any irregularities found in the data? YES NO

Several parameters fell outside of two standard deviations from the mean encountered at the respective sites. They were:

Site	Parameter	Value	Standard Deviations from Mean	Mean
ST-5	Flow	942.48 gpm	4.45	74 gpm
ST-6	Flow	942.48 gpm	3.49	106.55 gpm
ST-6	Cation/Anion Balance	14.46%	3.61	2.70%
SP-15	Sulfate	129 mg/L	2.59	87.14 mg/L
SP-15	Total Dissolved Solids	487 mg/L	3.38	402.52 mg/L
SP-15	Total Hardness	223.72 mg/L	2.15	193.20 mg/L
SP-15	Dissolved Sodium	24.53 mg/L	3.41	18.41 mg/L
WR-1	Cation/Anion Balance	9.71 %	2.84	2.11 %
WR-1	Total Cations	5.58 meq/L	2.44	4.69 meq/L
WR-1	Dissolved Calcium	49.57 mg/L	2.70	37.98 mg/L
WR-2	Cation/Anion Balance	9.42 %	4.00	1.49 %
WR-2	Dissolved Calcium	36.92 mg/L	3.21	49.74 mg/L
WR-2	Total Hardness	192.3 mg/L	2.61	226.38 mg/L
DH-86-2	Total Cations	37.04 meq/L	2.47	24.20 meq/L
DH-86-2	Dissolved Sodium	387 mg/L	3.05	223.58 mg/L
DH-86-2	Dissolved Potassium	13.69 mg/L	2.19	9.84 mg/L
DH-86-2	Chloride	270 mg/L	3.12	58.77 mg/L

ST-5 and ST-6 are ephemeral streams that mostly have flow only from the mine water discharge. At times, though they have had some base flow pushing their flows above the mine water discharge. This seems to be the case this quarter.

The cation anion is well above the expected value (<5% absolute value) at ST-6, WR-1, and WR-2. As mentioned below, this is something that could bring into question the accuracy of the sample.

There is a weak upward trend in the chloride at DH-86-2, however it has a sharp increase in the last two years. The drinking water criterion for chloride is 250 mg/L. This is the first time that has been exceeded, but this well is not used for drinking water, and regardless of the origin, the chloride levels are not of concern at this time.

There is no trend in dissolved calcium at WR-1, or WR-2 ($R^2 = 0.0621$ and

0.0286, respectively).

There is no trend in dissolved potassium at DH-86-2 ($R^2 = 0.1971$).

There is no trend in dissolved sodium at DH-86-2, or SP-15 ($R^2 = 0.0794$ and 0.09 , respectively).

There is a weak upward trend in the sulfate at SP-15 ($R^2 = 0.4899$), but the level remains well below any water quality standards.

The total amount of cations is slightly higher than usual at WR-1 and DH-82-6. The cation anion balance is within recommended limits at DH-82-6, but is high at WR-1. The increased number of cations could be the reason why. The number of cations and anions relate to the total dissolved solids in the water sample, and that number is not out of the ordinary at either site.

There is a weak upward trend in total dissolved solids at SP-15 ($R^2 = 0.4619$), with a weak negative correlation to flow ($R^2 = 0.276$). The number is down from last quarter.

There is no trend in total hardness at WR-2, or SP-15 ($R^2 = 0.0201$ and 0.195 , respectively). The water at WR-2 has always fallen into the "hard" category (150-300 mg/L), and at SP-15 it has always fluctuated between "hard" and "very hard" (>300 mg/L).

Several routine reliability checks fell outside of standard values:

Site	Reliability Check	Value Should Be...	Value is...
ST-3	TDS/Conductivity	>0.55 & <0.75	0.55
ST-3	Mg/(Ca + Mg)	< 40 %	59%
ST-5	Conductivity/Cations	>90 & < 110	88
ST-5	Mg/(Ca + Mg)	< 40 %	64%
ST-5	Ca/ (Ca + SO4)	> 50 %	16%
ST-6	Conductivity/Cations	>90 & < 110	88
ST-6	Mg/(Ca + Mg)	< 40 %	58%
ST-6	Ca/ (Ca + SO4)	> 50 %	20%
ST-8	TDS/Conductivity	>0.55 & <0.75	0.55
ST-8	Mg/(Ca + Mg)	< 40 %	58%
ST-9	Mg/(Ca + Mg)	< 40 %	60%
ST-10	TDS/Conductivity	>0.55 & <0.75	0.55
ST-10	Mg/(Ca + Mg)	< 40 %	50%
SP-12	Mg/(Ca + Mg)	< 40 %	70%
SP-13	Mg/(Ca + Mg)	< 40 %	73%
SP-13	Ca/ (Ca + SO4)	> 50 %	40%
SP-15	Mg/(Ca + Mg)	< 40 %	60%

SP-15	Ca/ (Ca + SO4)	> 50 %	49%
WR-1	Cation/Anion Balance	<5%	9.7%
WR-1	Conductivity/Cations	>90 & < 110	77
WR-1	Mg/(Ca + Mg)	< 40 %	45%
WR-2	Cation/Anion Balance	<5%	9.5%
WR-2	Conductivity/Cations	>90 & < 110	117
WR-2	Mg/(Ca + Mg)	< 40 %	52%
SP-16	Mg/(Ca + Mg)	< 40 %	65%
SP-8	Conductivity/Cations	>90 & < 110	90
SP-8	Mg/(Ca + Mg)	< 40 %	76%
SP-8	Ca/ (Ca + SO4)	> 50 %	24%
SP-101	Conductivity/Cations	>90 & < 110	90
SP-101	Mg/(Ca + Mg)	< 40 %	61%
SP-102	Mg/(Ca + Mg)	< 40 %	72%
S-80	Conductivity/Cations	>90 & < 110	86
S-80	Mg/(Ca + Mg)	< 40 %	55%
S-80	Ca/ (Ca + SO4)	> 50 %	48%
DH-86-2	TDS/Conductivity	>0.55 & <0.75	1.65
DH-86-2	Conductivity/Cations	>90 & < 110	34
DH-86-2	Mg/(Ca + Mg)	< 40 %	71%
DH-86-2	Ca/ (Ca + SO4)	> 50 %	29%

These inconsistencies do not necessarily mean that a sample is wrong, but it does indicate that something is unusual. An analysis and explanation of the inconsistencies by the Permittee would help to increase the Division's confidence in the samples. The Permittee should work with the lab to make sure that samples pass all quality checks so that the reliability of the samples does not come into question. The Permittee can learn more about these reliability checks and some of the geological and other factors that could influence them by reading Chapter 4 of *Water Quality Data: Analysis and Interpretation* by Arthur W. Hounslow.

4. On what date does the MRP require a five-year re-sampling of baseline water data.

There is no commitment in the MRP to resample for baseline parameters.

5. Based on your review, what further actions, if any, do you recommend?

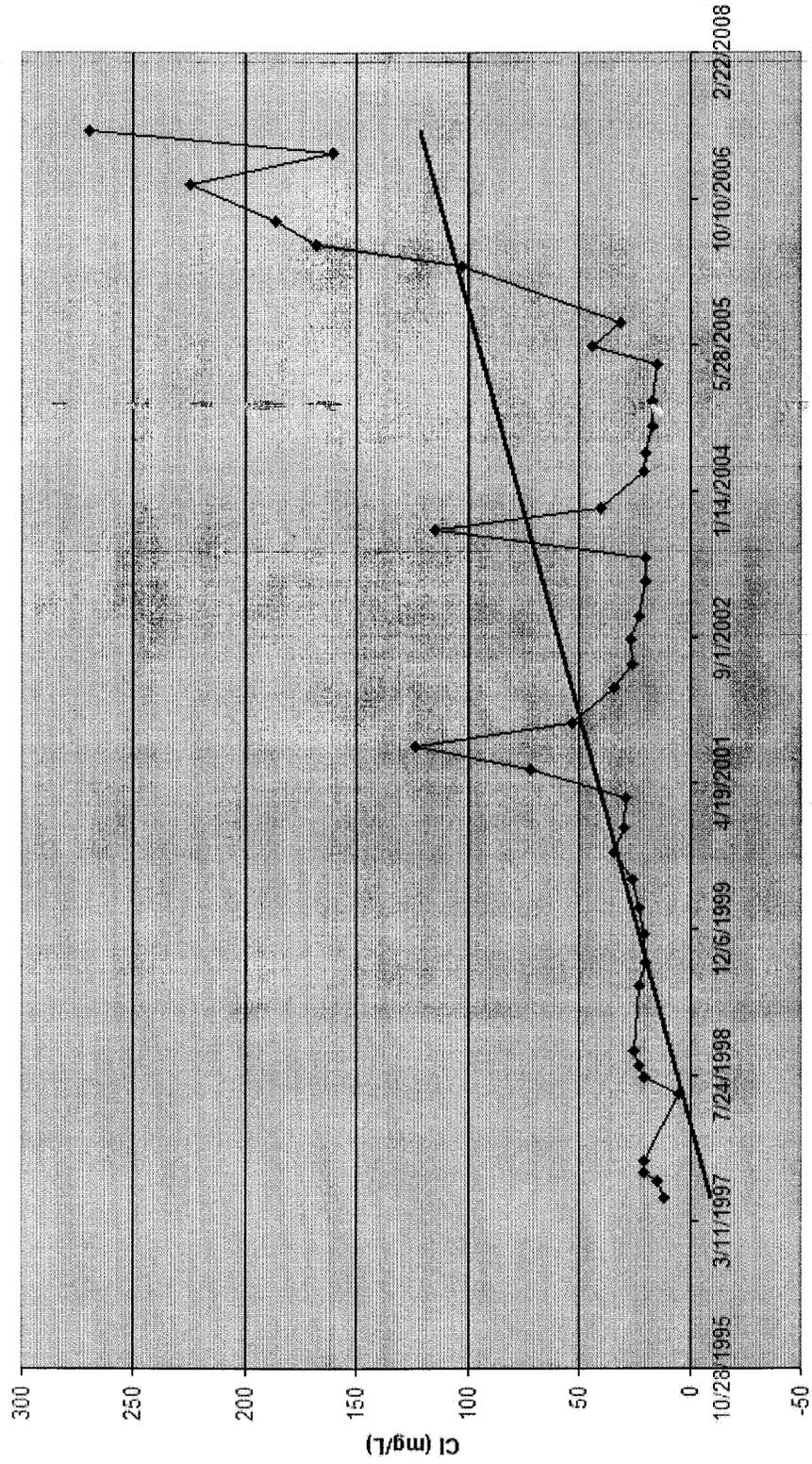
No further actions are necessary at this time.

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$R^2 = 0.3878$

Chloride

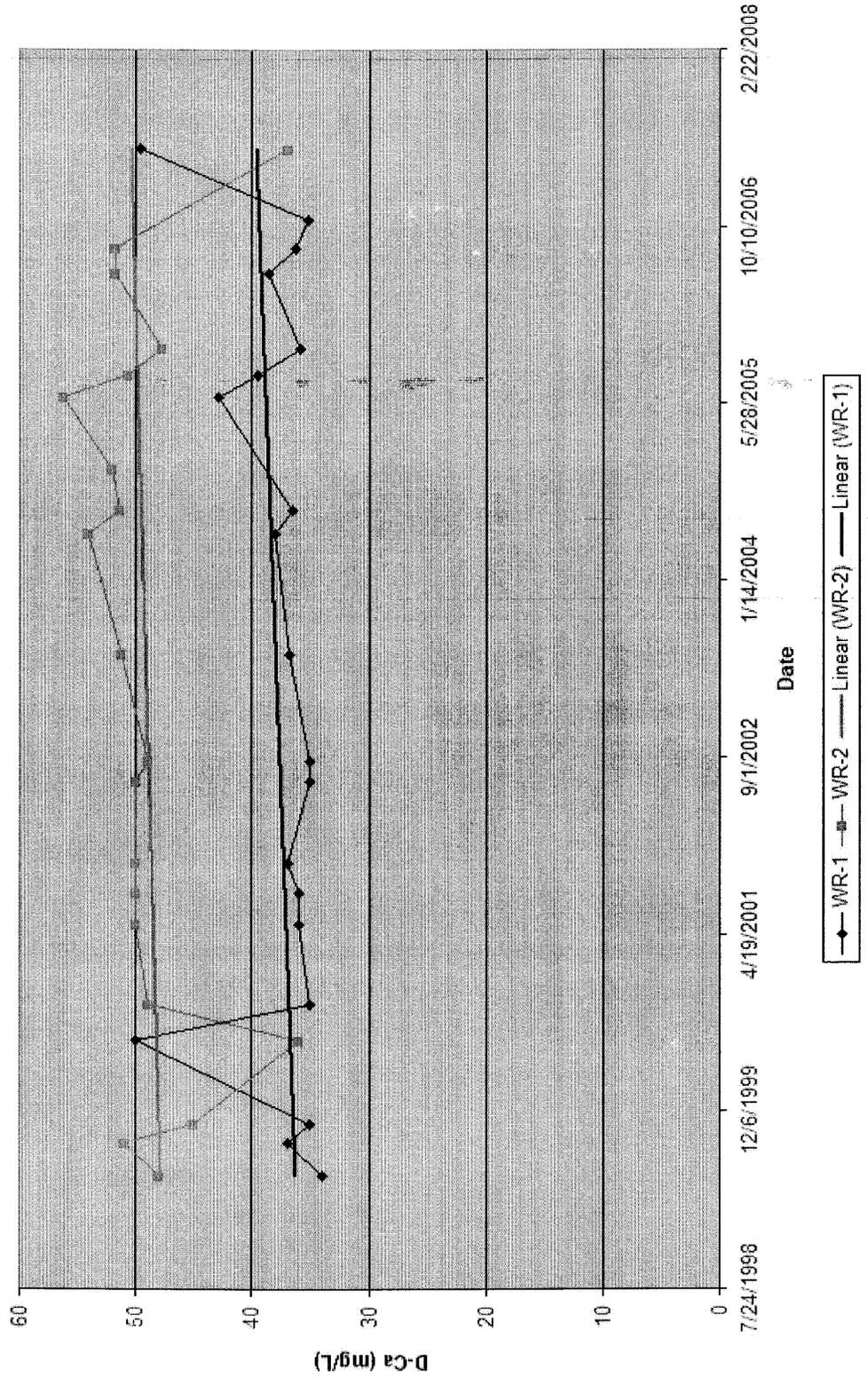


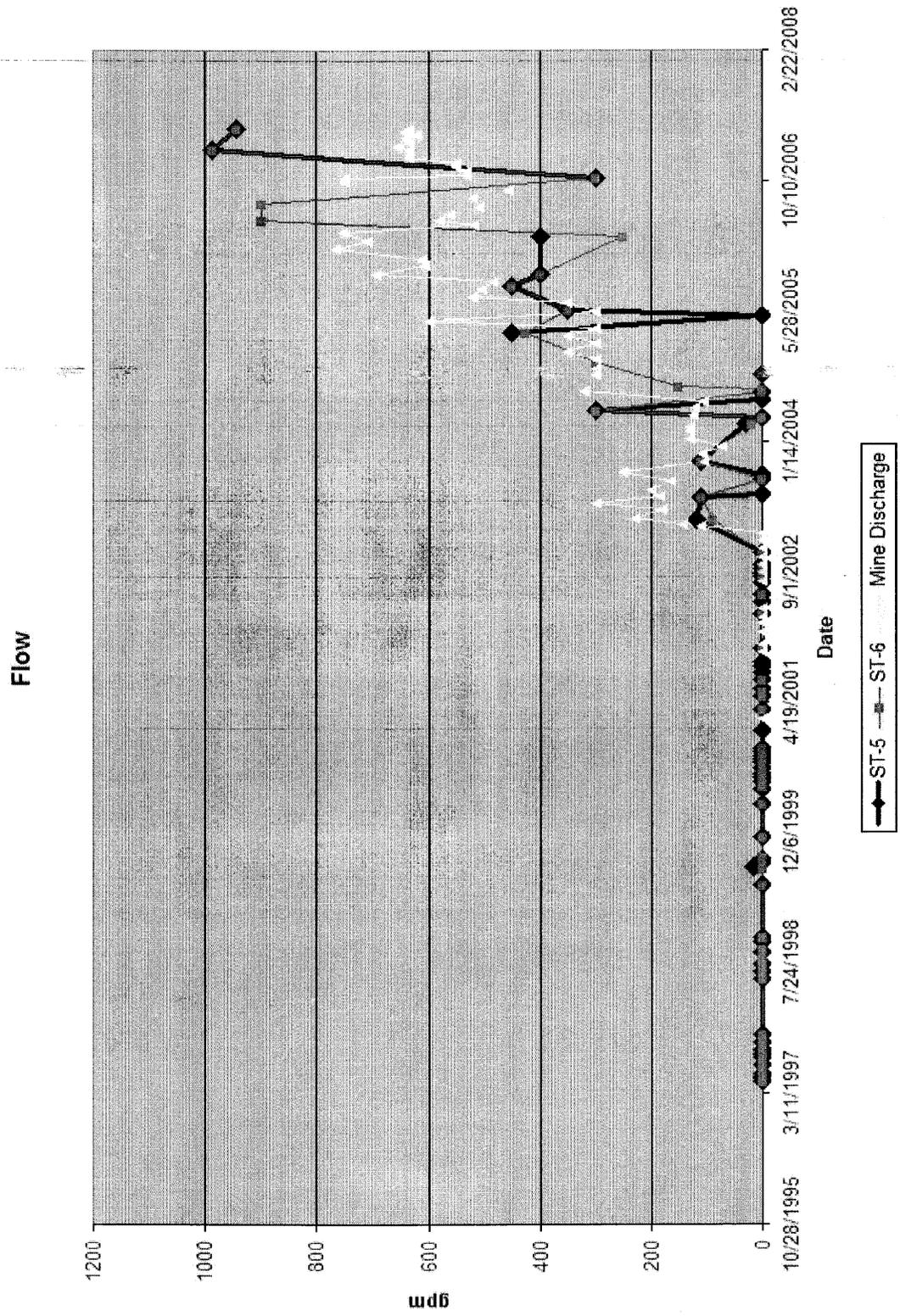
Date

◆ DH-86-2 — Linear (DH-86-2)

$R^2 = 0.0621$
 $R^2 = 0.0236$

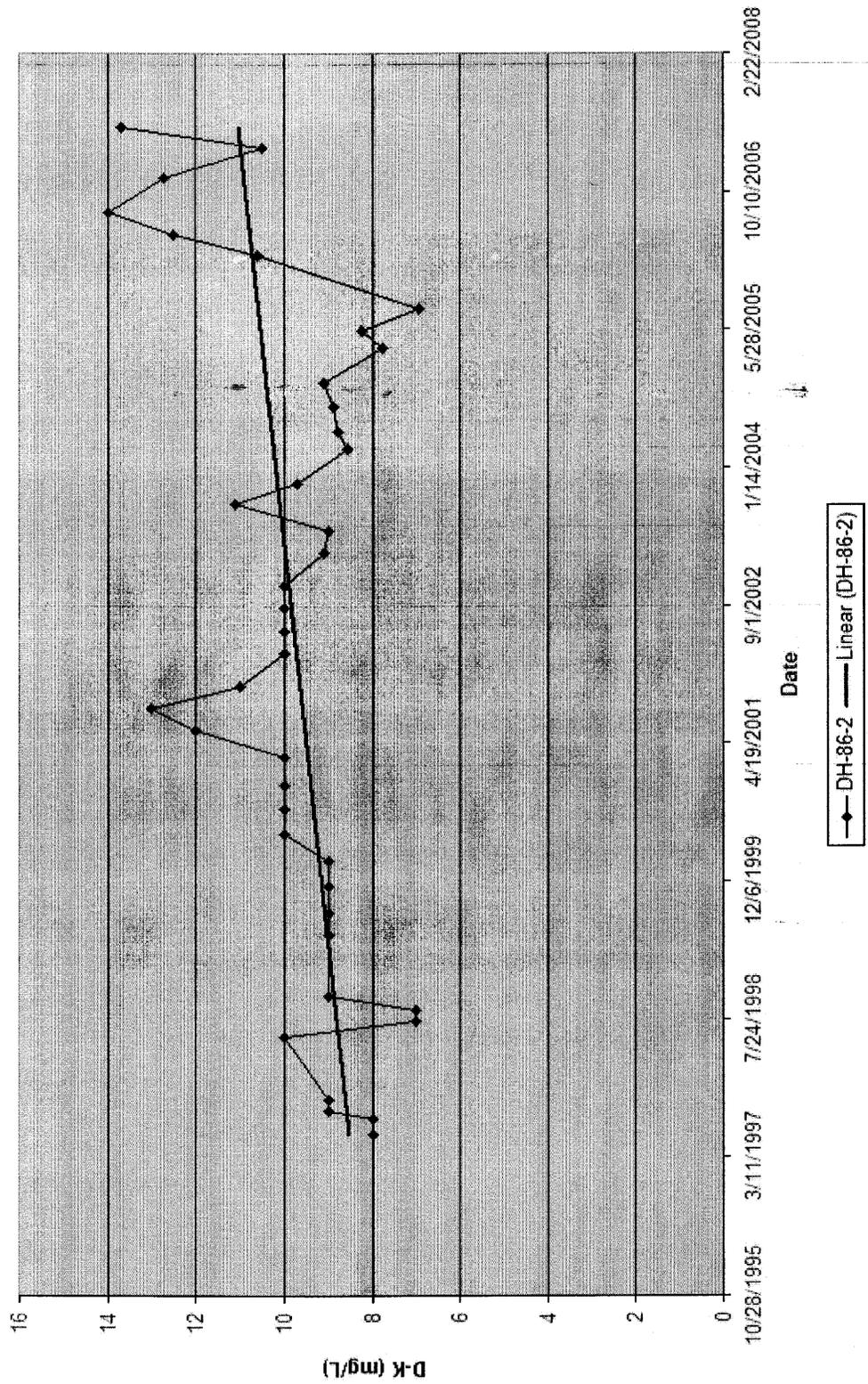
Dissolved Calcium





$R^2 = 0.1971$

Dissolved Potassium



$R^2 = 0.0794$
 $R^2 = 0.09$

Dissolved Sodium

