

WATER QUALITY MEMORANDUM

Utah Coal Regulatory Program

March 13, 2008

TO: Internal File

THRU: Daron R. Haddock, Permit Supervisor 

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

RE: 2007 Fourth Quarter Water Monitoring, West Ridge Resources, Inc, West Ridge Mine, C/007/0041-WQ07-4, 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-3	Water Temperature	0.3 °C	2.15	11.44 °C
ST-3	Total Cations	8.25 meq/L	2.35	6.94 meq/L
ST-3	Dissolved Magnesium	48.04 mg/L	2.10	40.11 mg/L
ST-3	Total Hardness	344.08 mg/L	2.56	290.75 mg/L
ST-3	Total Dissolved Solids	437 mg/L	2.25	359.76 mg/L
ST-3	Sulfate	79 mg/L	2.34	52.31 mg/L
ST-5	Flow	583.44 gpm	2.48	80.70 gpm
ST-9	Total Cations	9.9 meq/L	2.15	8.21 meq/L
ST-9	Dissolved Calcium	63.12 mg/L	2.40	53.70 mg/L
ST-9	Dissolved Magnesium	60.49 mg/L	2.17	49.16 mg/L
ST-9	Total Hardness	406.71 mg/L	2.57	336.51 mg/L
ST-9	Total Dissolved Solids	510 mg/L	2.17	427.56 mg/L
SP-12	Total Cations	10.09 meq/L	2.40	8.74 meq/L
SP-12	Dissolved Calcium	49.56 mg/L	2.38	42.09 mg/L
SP-12	Dissolved Magnesium	70.62 mg/L	2.55	60.89 mg/L
SP-12	Total Hardness	414.56 mg/L	2.62	356.16 mg/L
SP-13	Total Alkalinity	423 mg/L	2.07	353.67 mg/L
SP-13	Total Cations	14.62 meq/L	2.58	10.15 meq/L
SP-13	Dissolved Calcium	59.72 mg/L	2.57	43.49 mg/L
SP-13	Dissolved Magnesium	104.4 mg/L	2.67	71.40 mg/L
SP-13	Total Hardness	579.04 mg/L	2.66	402.62 mg/L
SP-13	Total Dissolved Solids	762 mg/L	2.19	529.91 mg/L
SP-13	Specific Conductivity	1117 µmhos/cm	2.22	793.94 µmhos/cm
SP-13	Dissolved Sodium	68.6 mg/L	2.37	47.3 mg/L
SP-16	Total Dissolved Solids	491 mg/L	3.05	422.27 mg/L
SP-8	Total Cations	26.03 meq/L	2.47	23.45 meq/L
SP-8	Dissolved Magnesium	153.9 mg/L	2.18	142.65 mg/L
SP-8	Dissolved Sodium	209.2 mg/L	2.16	177.59 mg/L
SP-101	Dissolved Calcium	37.25 mg/L	2.54	52.92 mg/L
SP-101	Dissolved Magnesium	53.36 mg/L	2.01	50.44 mg/L
SP-101	Total Hardness	312.75 mg/L	2.29	339.86 mg/L

SP-101	Dissolved Sodium	41.02 mg/L	2.14	33.87 mg/L
SP-101	Chloride	5.5 mg/L	2.27	3.20 mg/L
SP-102	Total Alkalinity	340 mg/L	2.41	316.38 mg/L
SP-102	Dissolved Calcium	61.36 mg/L	2.60	38.86 mg/L
SP-102	Total Hardness	370.36 mg/L	2.32	316.32 mg/L
SP-102	Total Dissolved Solids	482 mg/L	2.30	419 mg/L
SP-102	Bicarbonate as CaCO ₃	340 mg/L	2.42	312.50 mg/L
SP-102	Dissolved Sodium	34.16 mg/L	2.19	40.22 mg/L
SP-102	Sulfate	105 mg/L	2.40	84.54 mg/L
DH86-2	Dissolved Sodium	338.7 mg/L	2.01	226.32 mg/L

The total alkalinity was unusually high at SP-13, and SP-102. The bicarbonate as CaCO₃ at SP-102 is also high. The statistics for SP-102 are based on just eight samples, and the total spread is just 42 mg/L for bicarbonate and 32 mg/L for alkalinity. There are at best very weak upward trends in these parameters ($R^2 < 2.7$).

There is no trend in chloride at SP-101 ($R^2 = 0.1303$), and the current concentration is well below any level of concern.

There are just very weak upward trends in the dissolved calcium and dissolved magnesium concentrations at the listed sites ($R^2 < 3$). There are no criteria for these metals, but they do contribute to water hardness. The hardness at these sites has always fallen into the hard (150-300 mg/l) to very hard (>300 mg/l) classifications and remains there.

There is a fairly strong upward trend in dissolved sodium at SP-101 ($R^2 = 0.6023$), but it is based on just eight samples, and the concentrations at SP-101 are below 50 mg/L. There is a weak upward trend in dissolved sodium at SP-8 ($R^2 = 0.4714$) and SP-13 ($R^2 = 0.3388$), and no trend at SP-102 or DH86-2. There is no water quality standard for sodium, but it does increase the salinity of water. There is no trend in salinity at any of these sites. The water at SP-101 and SP-102 has always been in the "fresh" category (<500 mg/L), and continues in that range. SP-13 has always fluctuated between fresh and "brackish" (500-30,000 mg/L), and continues to do so. The water at SP-8 and DH86-2 has always been at the low end of brackish.

ST-5 is an ephemeral streams that mostly flows from the mine water discharge. The flow this quarter is right in line with that of the discharge. The flow at ST-6, an ephemeral stream down-channel flowed at 314 gpm this quarter.

There is a weak upward trend in specific conductivity at SP-13 ($R^2 = 0.4281$). There is no standard for specific conductivity, but it is closely related to total dissolved solids (TDS).

There is a weak upward trend in the total amount of cations at SP-8 ($R^2 = 0.4933$), and no trend at any of the other listed sites. The cation anion balance is within

recommended limits at each site. Total cations are also related to total dissolved solids.

There is a weak upward trend in the total amount of cations at SP-102 ($R^2 = 0.5169$), and no trend at any of the other listed sites. There are only eight samples in the statistical population for SP-102.

There is a fairly strong upward trend in sulfate at SP-102, and no trend at ST-3. Again, there are only eight samples in the statistical population for SP-102.

Several routine reliability checks fell outside of standard values:

Site	Reliability Check	Value Should Be...	Value is...
ST-3	Conductivity/Cations	>90 & < 110	84
ST-3	Mg/(Ca + Mg)	< 40 %	58%
ST-5	TDS/Conductivity	>0.55 & <0.75	0.94
ST-5	Conductivity/Cations	>90 & < 110	69
ST-5	Mg/(Ca + Mg)	< 40 %	66%
ST-5	Ca/ (Ca + SO4)	> 50 %	16%
ST-6	TDS/Conductivity	>0.55 & <0.75	0.94
ST-6	Conductivity/Cations	>90 & < 110	63
ST-6	Mg/(Ca + Mg)	< 40 %	57%
ST-6	Ca/ (Ca + SO4)	> 50 %	22%
ST-8	Conductivity/Cations	>90 & < 110	86
ST-8	Mg/(Ca + Mg)	< 40 %	59%
ST-9	Conductivity/Cations	>90 & < 110	82
ST-9	Mg/(Ca + Mg)	< 40 %	61%
SP-12	Conductivity/Cations	>90 & < 110	79
SP-12	Mg/(Ca + Mg)	< 40 %	70%
SP-12	Ca/ (Ca + SO4)	> 50 %	49%
SP-13	Conductivity/Cations	>90 & < 110	76
SP-13	Mg/(Ca + Mg)	< 40 %	74%
SP-13	Ca/ (Ca + SO4)	> 50 %	38%
WR-1	Conductivity/Cations	>90 & < 110	89
WR-1	Mg/(Ca + Mg)	< 40 %	53%
SP-16	Conductivity/Cations	>90 & < 110	88
SP-16	Mg/(Ca + Mg)	< 40 %	64%
SP-8	TDS/Conductivity	>0.55 & <0.75	0.82
SP-8	Conductivity/Cations	>90 & < 110	66
SP-8	Mg/(Ca + Mg)	< 40 %	75%
SP-8	Ca/ (Ca + SO4)	> 50 %	26%
SP-101	Conductivity/Cations	>90 & < 110	83
SP-101	Mg/(Ca + Mg)	< 40 %	70%
SP-101	Ca/ (Ca + SO4)	> 50 %	49%
SP-102	Conductivity/Cations	>90 & < 110	84
SP-102	Mg/(Ca + Mg)	< 40 %	59%

S-80	Conductivity/Cations	>90 & < 110	76
S-80	Mg/(Ca + Mg)	< 40 %	55%
DH-86-2	TDS/Conductivity	>0.55 & <0.75	0.80
DH-86-2	Conductivity/Cations	>90 & < 110	66
DH-86-2	Mg/(Ca + Mg)	< 40 %	71%
DH-86-2	Ca/ (Ca + SO4)	> 50 %	38%
UTG040023-002 Oct. 6	TDS/Conductivity	>0.55 & <0.75	0.92
UTG040023-002 Nov. 1	TDS/Conductivity	>0.55 & <0.75	0.90

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. A geological influence is most likely, since the same inconsistencies occur in many different samples and from quarter to quarter.

The total iron at Outfall 002 was greater than the current UPDES limit of 1.3 mg/L a total of five times before 2007, but never during more than 2 consecutive months. From January 8 to October 16 of 2007, the total iron exceeded 1.3 mg/L each time it was sampled. The Division of Water Quality wrote West Ridge Resources a Notice of Violation for the exceedences recorded through May on June 20, 2007. The Division of Water Quality finalized a settlement agreement with West Ridge Resources on March 11, 2008. The settlement agreement requires West Ridge Resources to pay a fine of \$28,321.00 within 30 days. The Division defers to the Division of Water Quality on UPDES violations, unless a separate violation occurs. West Ridge Resources has been complying with the Division of Water Quality's requirements to date, and the concentration of iron at Outfall 002 has been in compliance since October 24, 2007.

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.

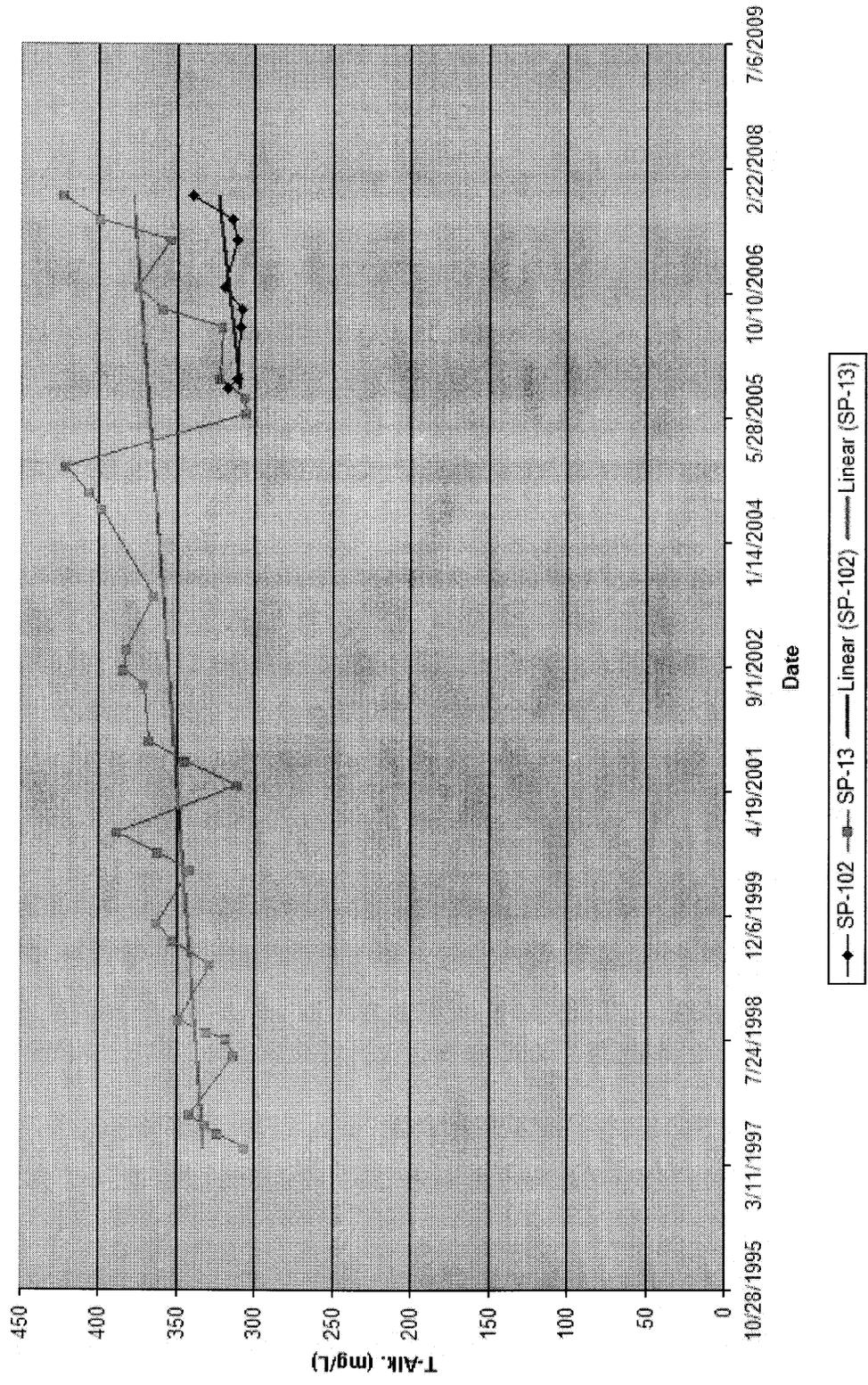
5. Based on your review, what further actions, if any, do you recommend?

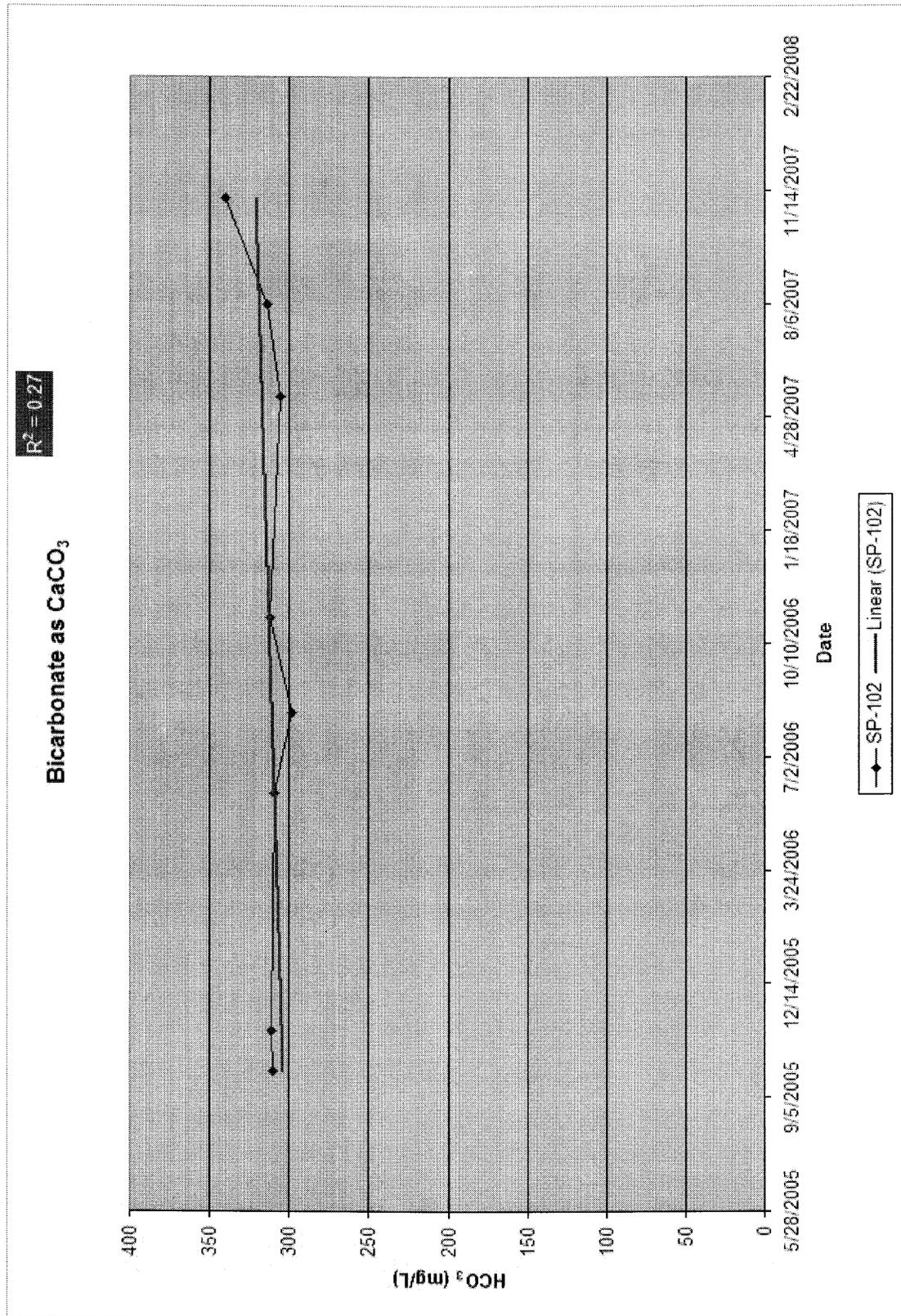
No further actions are necessary at this time.

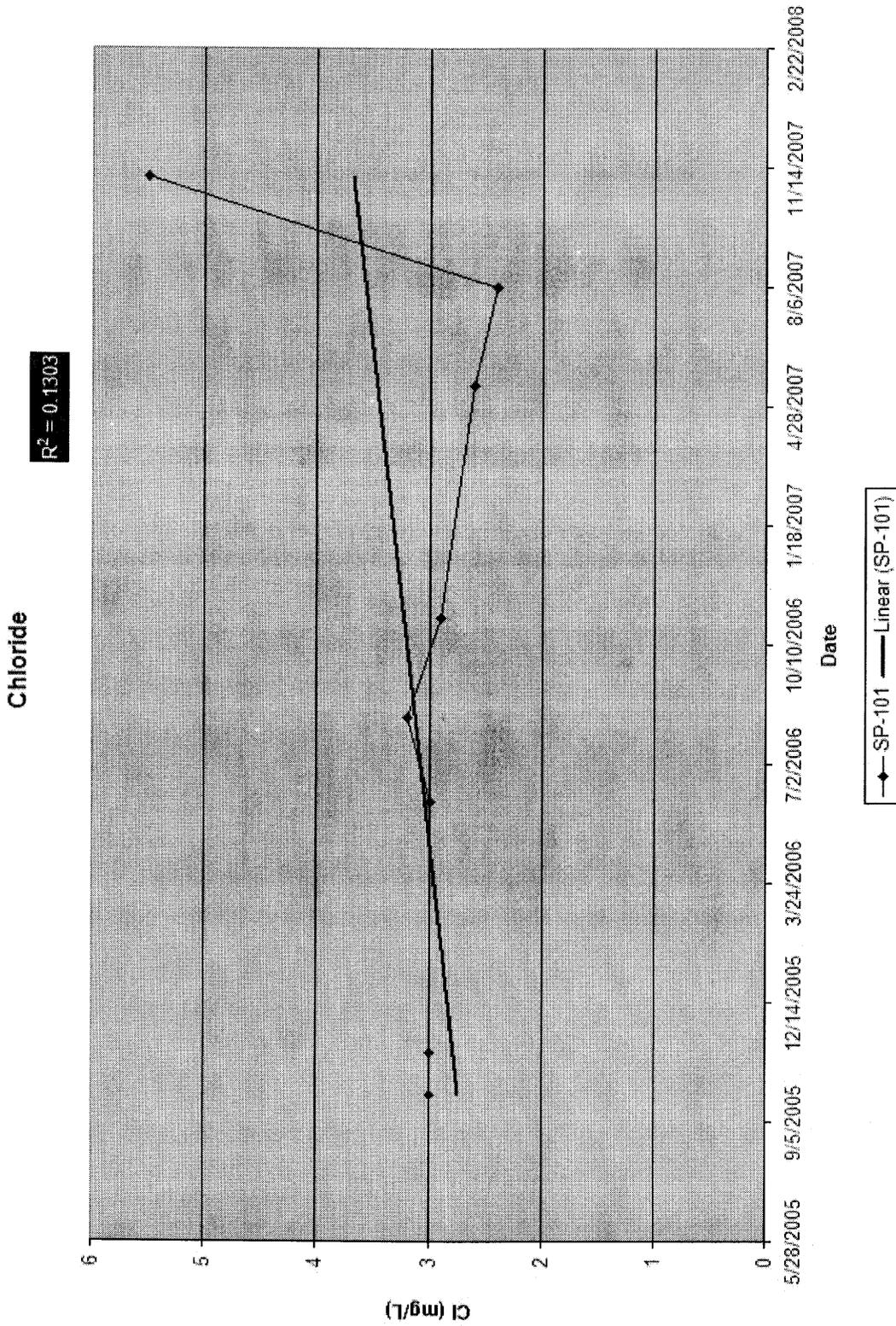
Total Alkalinity

$R^2 = 0.2382$

$R^2 = 0.1835$

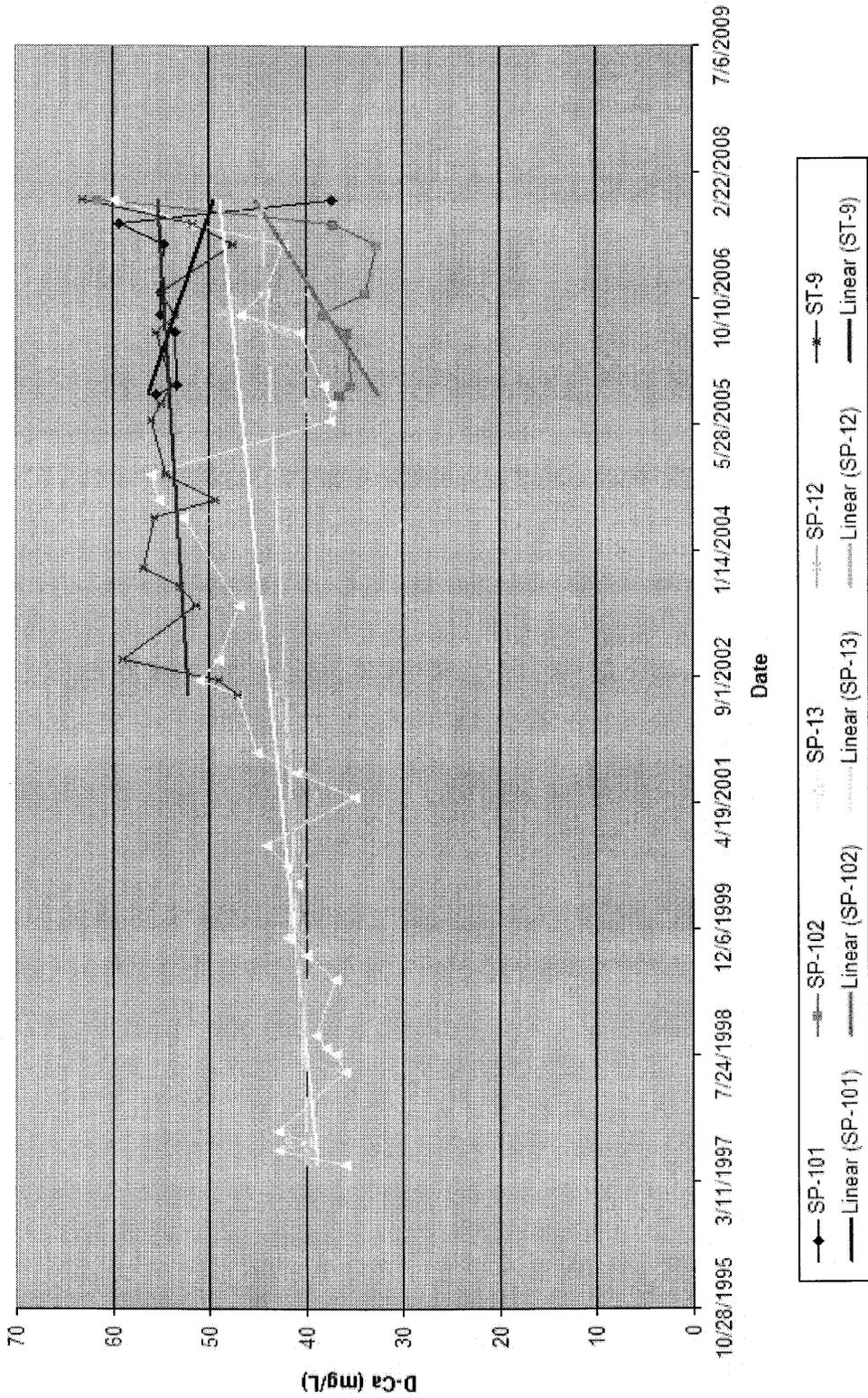


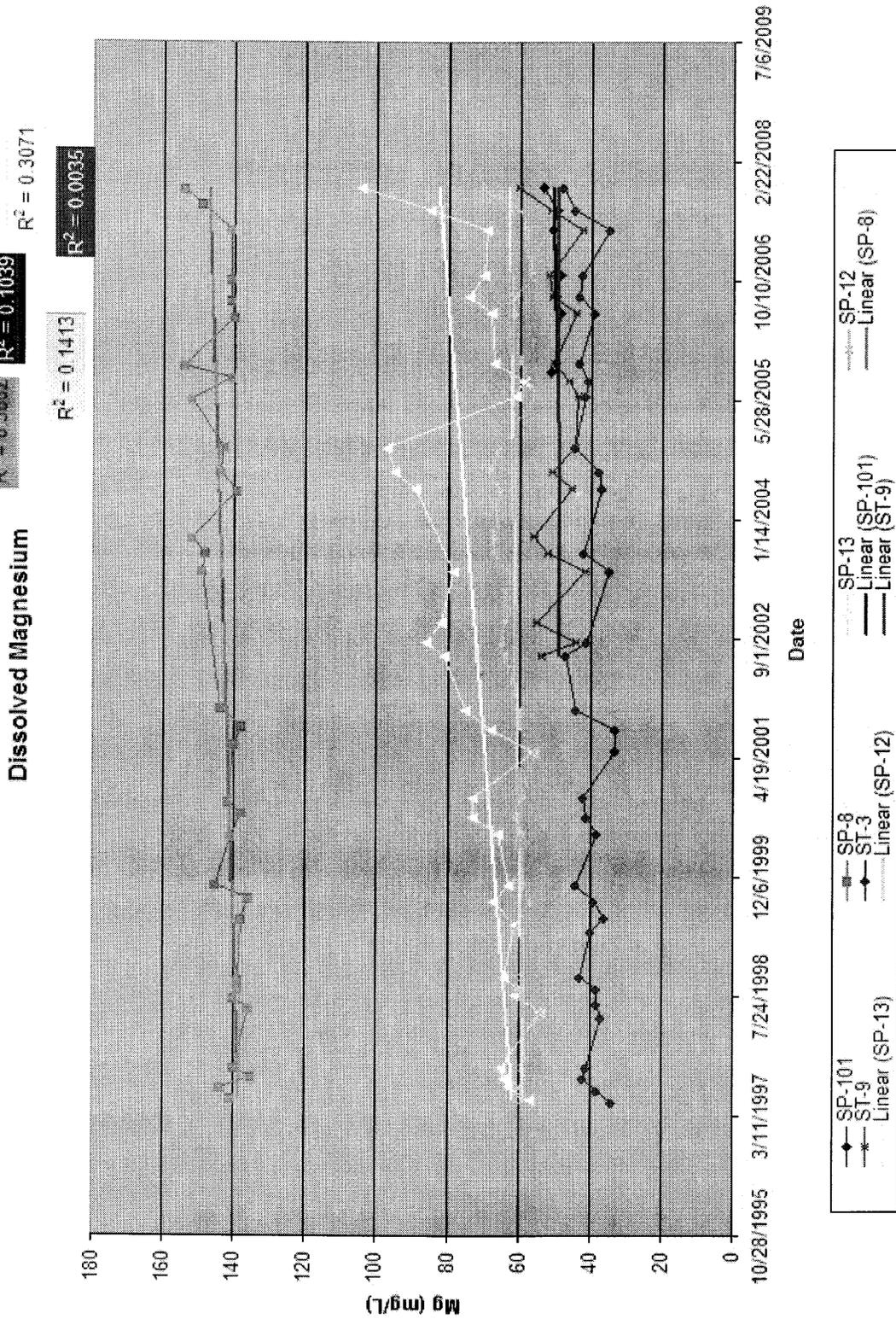


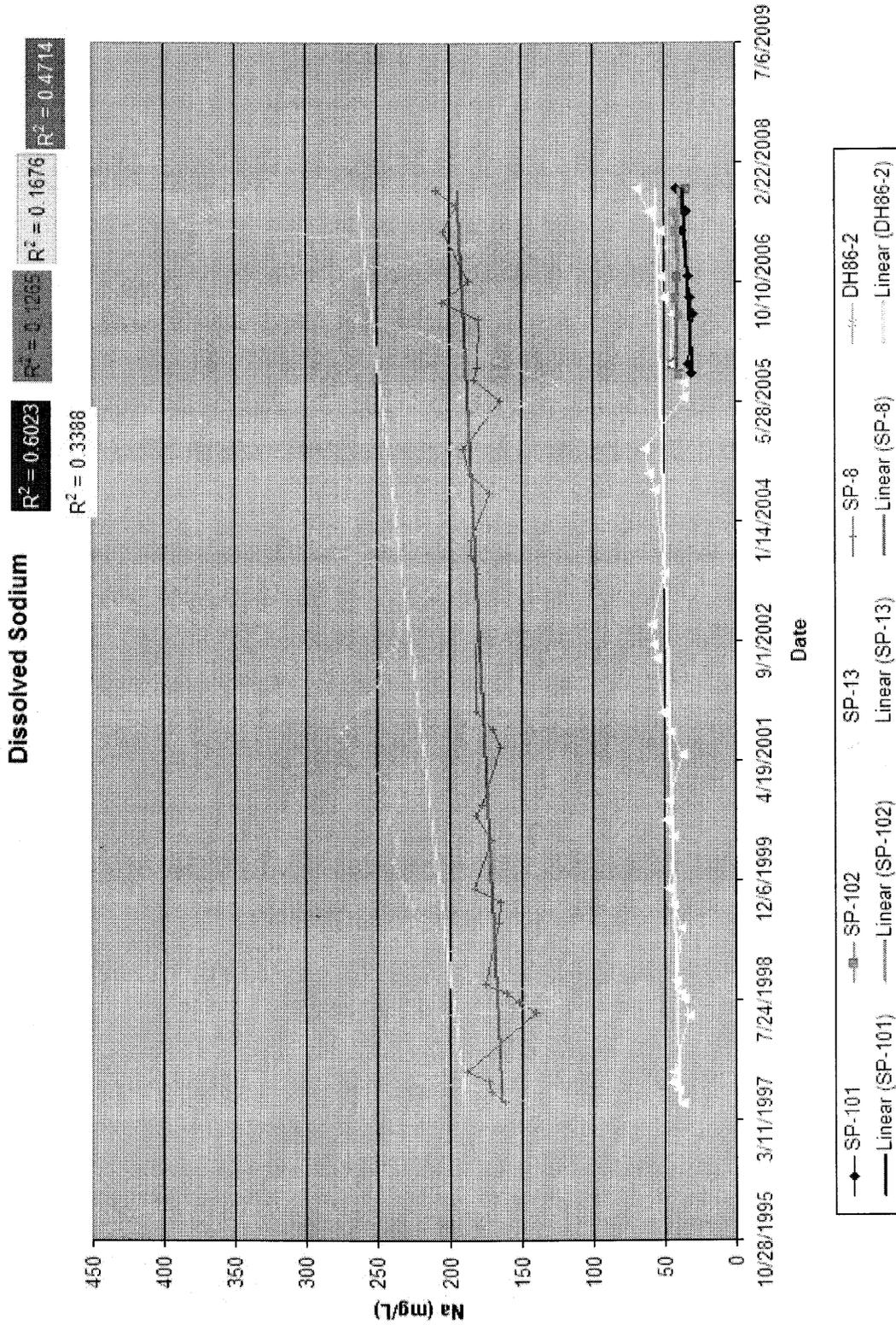


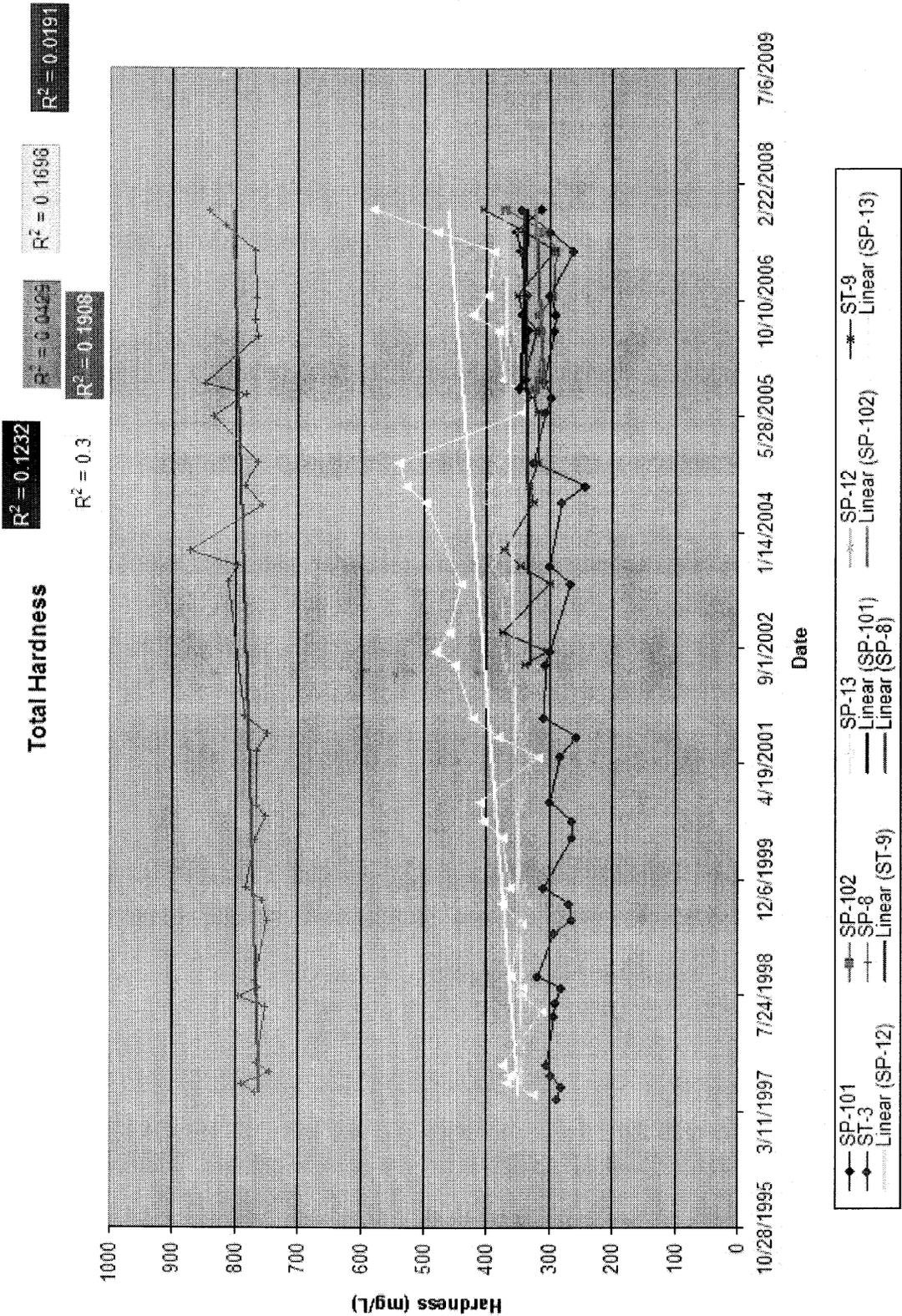
Dissolved Calcium

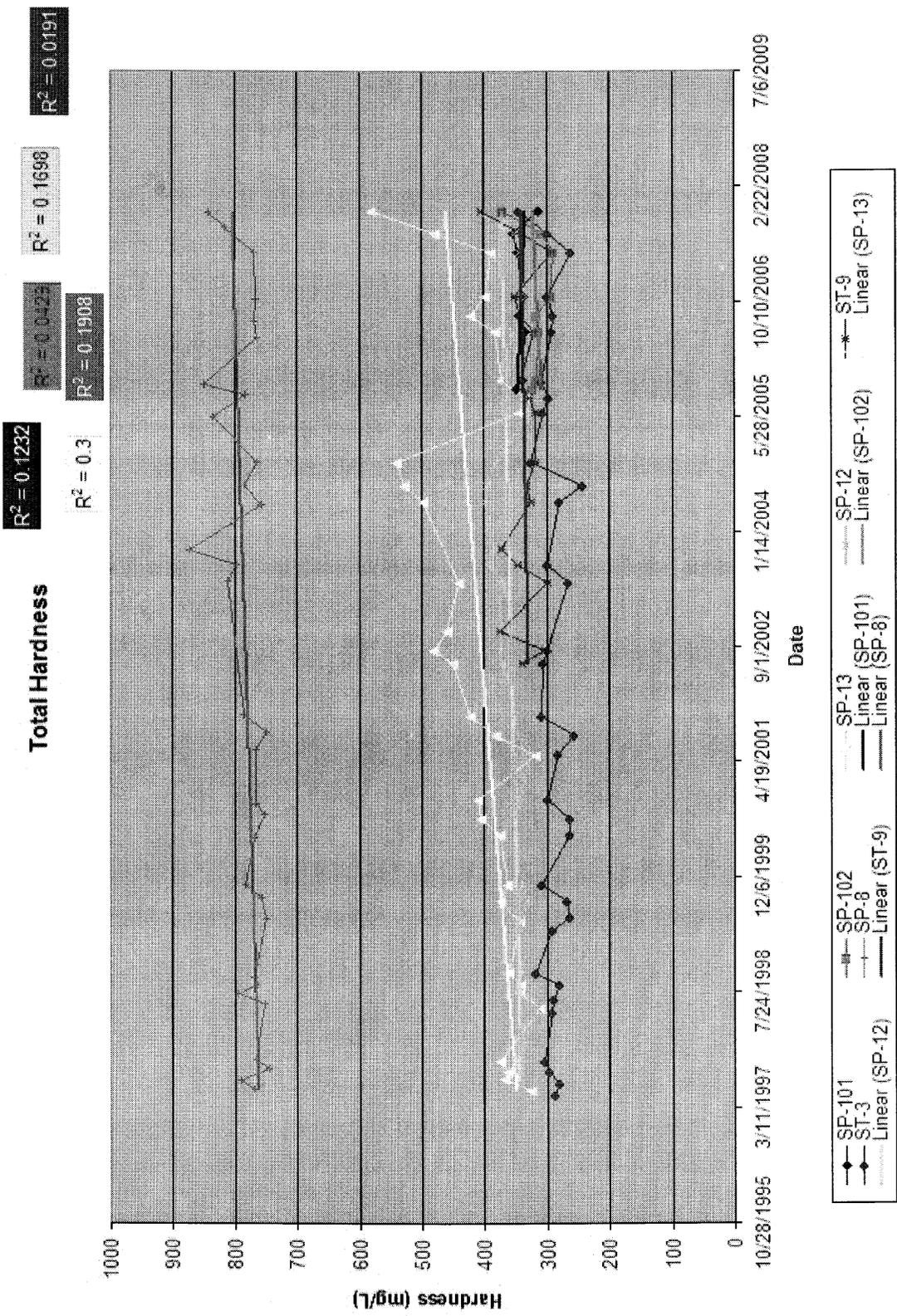
$R^2 = 0.1476$ $R^2 = 0.2645$ $R^2 = 0.0686$
 $R^2 = 0.2896$ $R^2 = 0.2348$

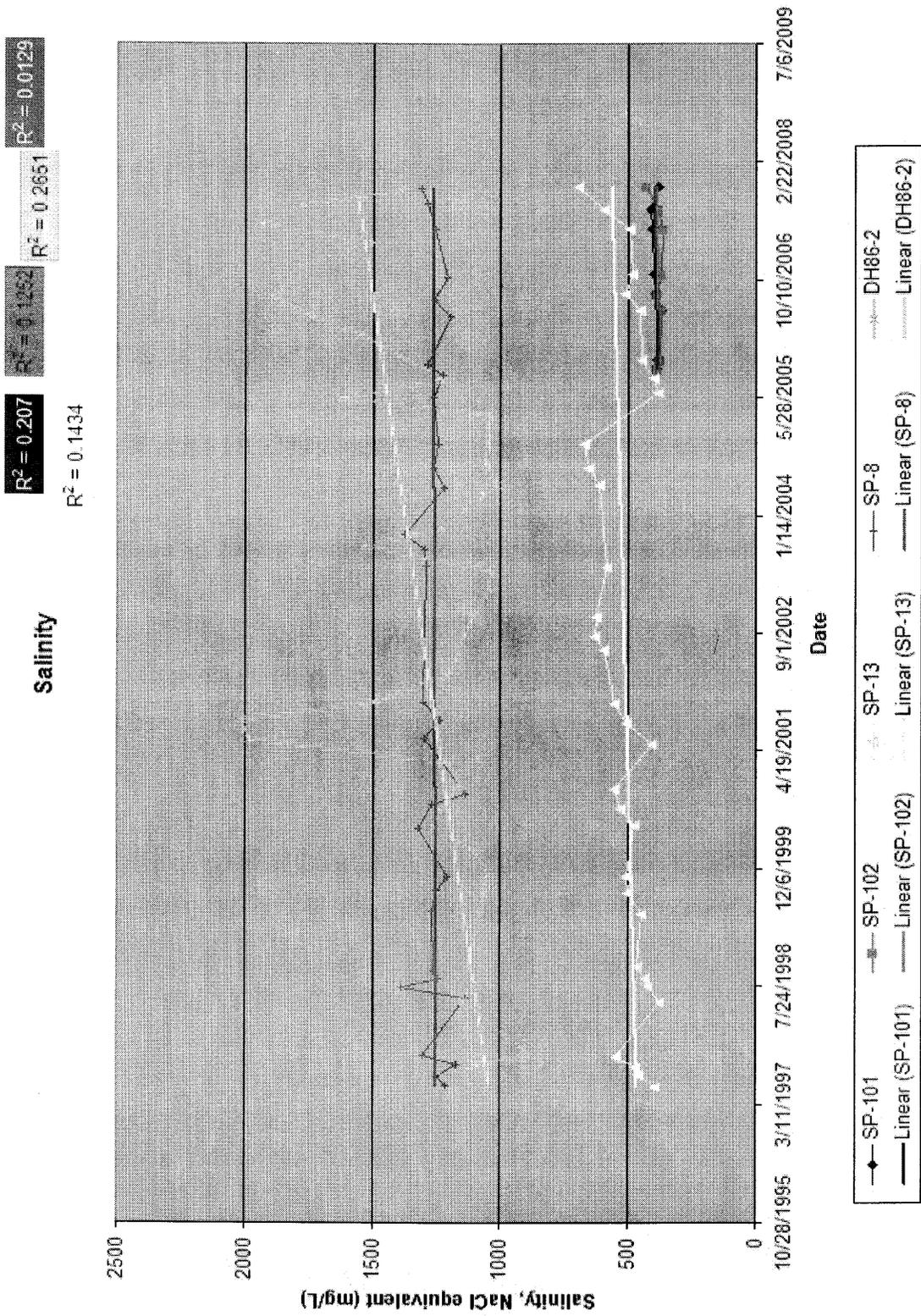






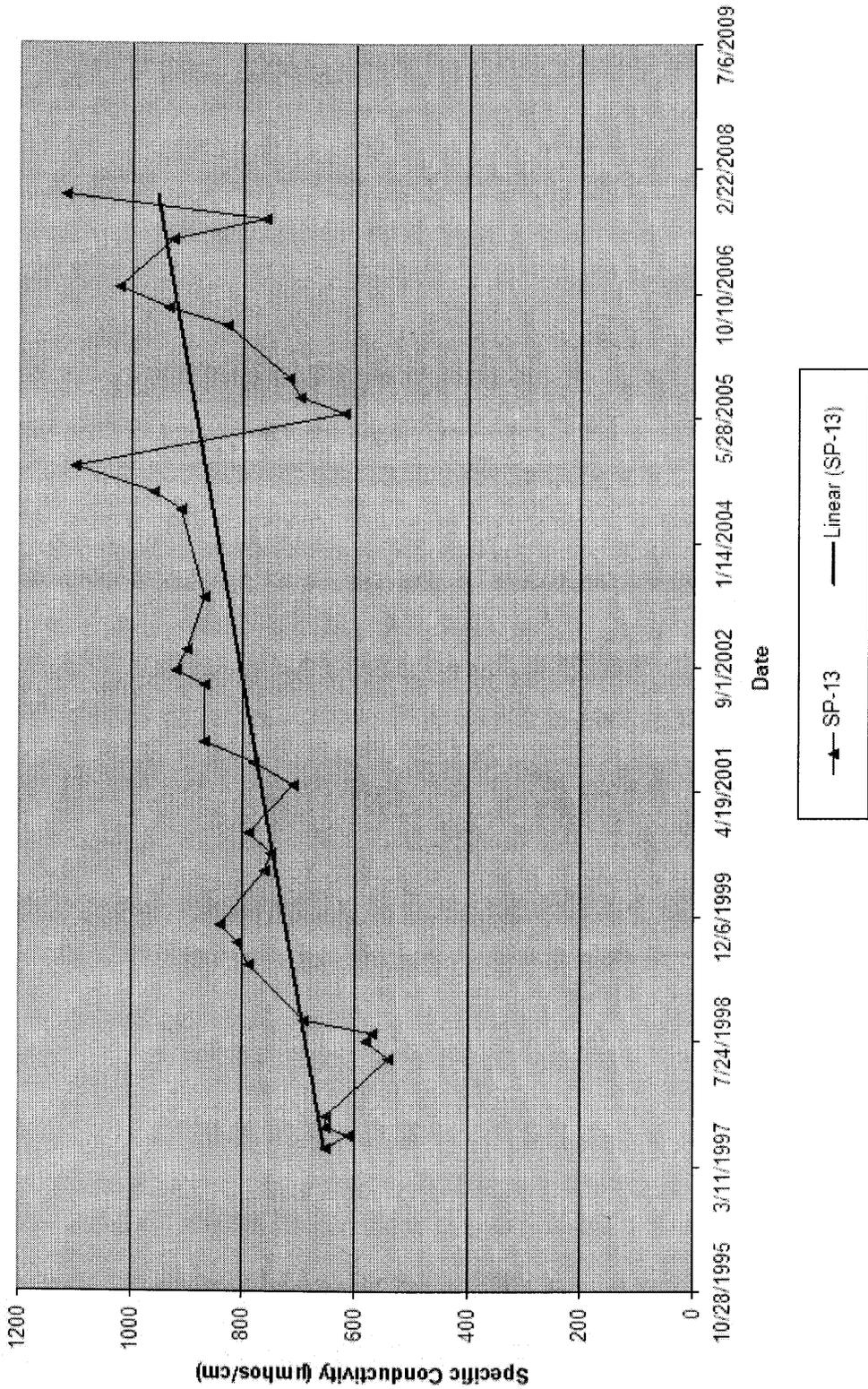






$R^2 = 0.4281$

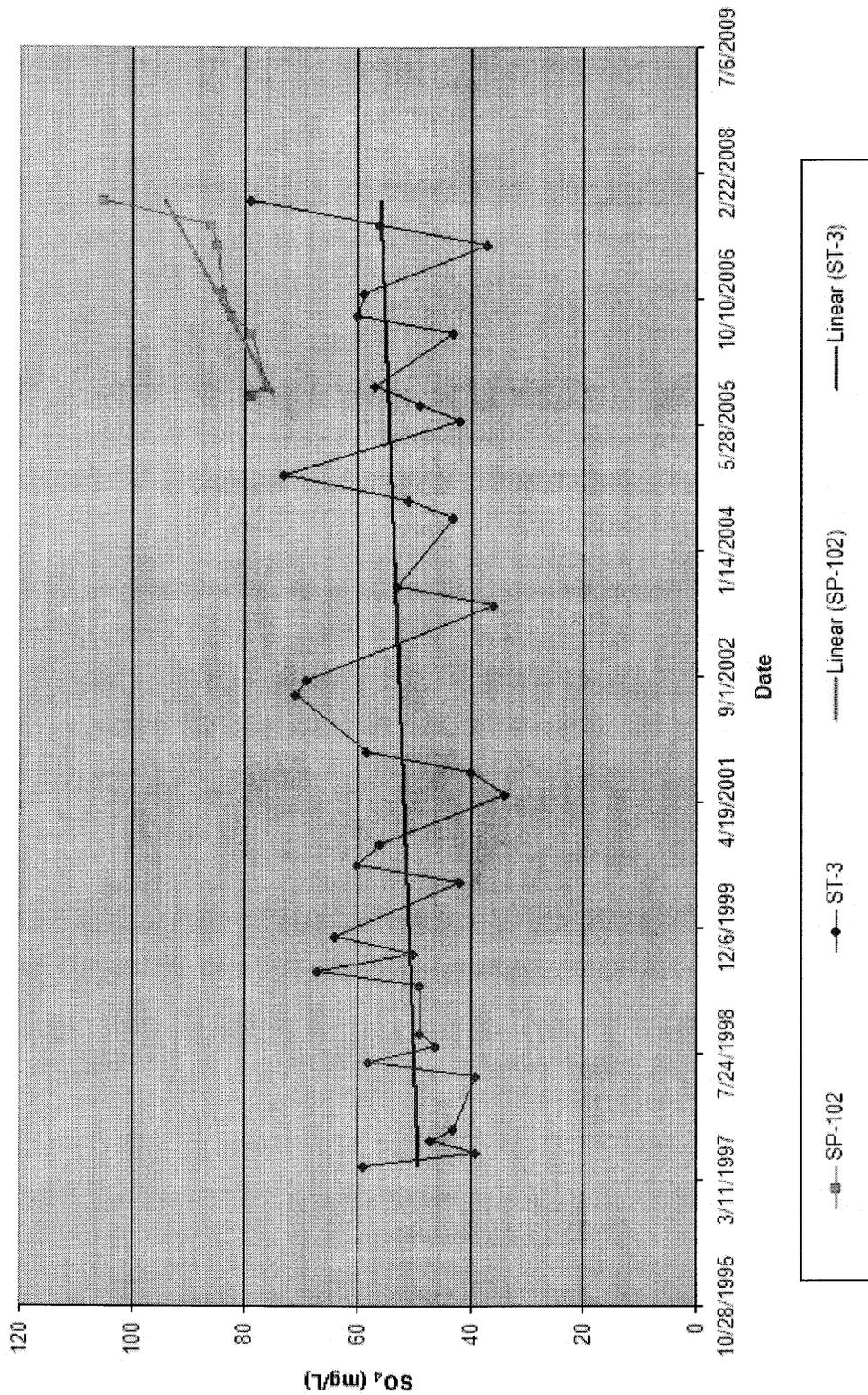
Specific Conductivity

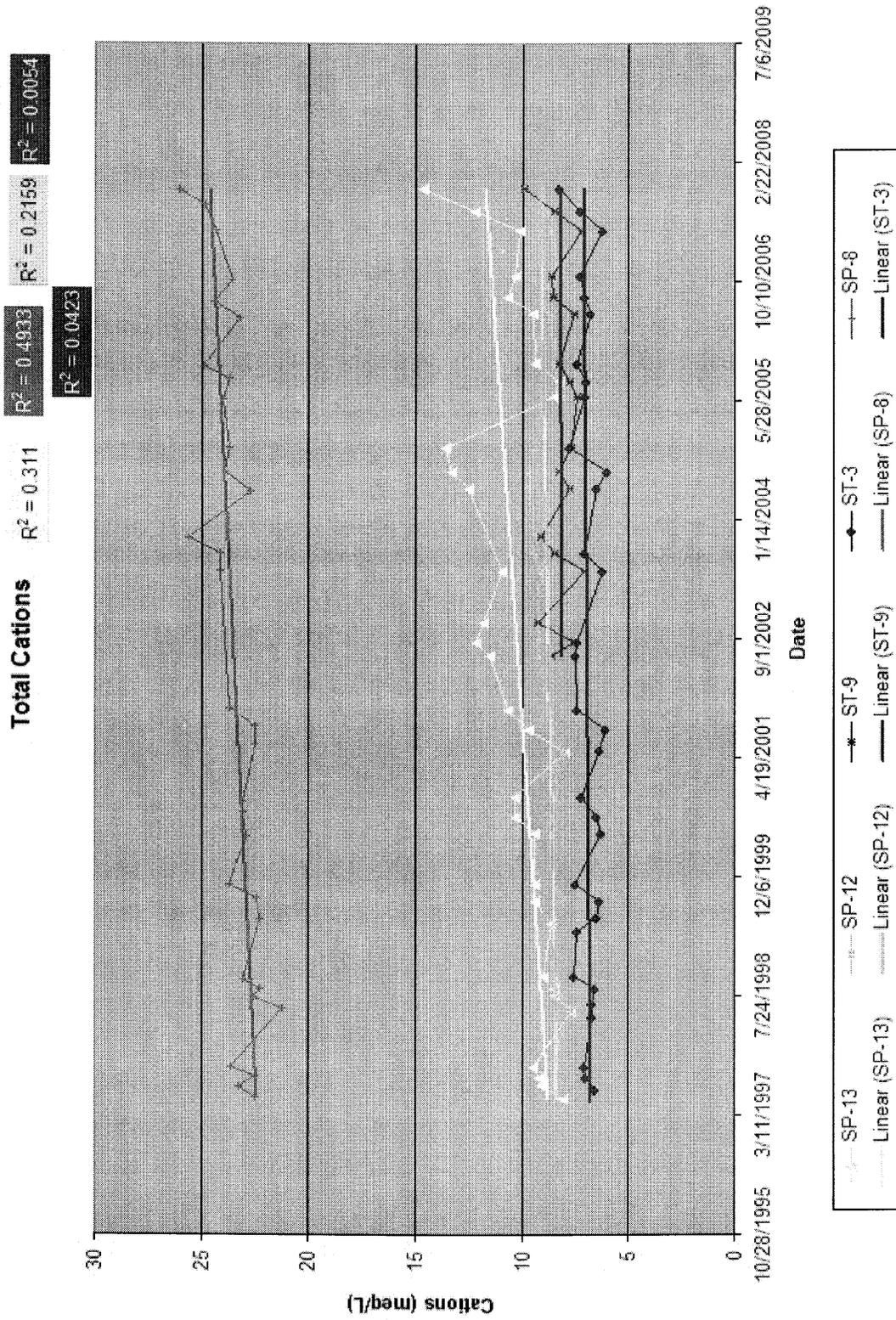


Sulfate

$R^2 = 0.0355$

$R^2 = 0.6498$





Total Dissolved Solids $R^2 = 0.1567$ $R^2 = 0.5169$ $R^2 = 0.1614$ $R^2 = 0.0546$
 $R^2 = 0.0014$

