# WATER QUALITY MEMORANDUM

Utah Coal Regulatory Program

January 25, 2008

TO: Internal File

THRU: Pamela Grubaugh-Littig, Permit Supervisor

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

RE: 2006 Third Quarter Water Monitoring, Canyon Fuel Company, LLC, Skyline Mine, C/007/0005-WQ06-3, Task ID #2639

The Skyline Mine is an operating longwall mine. Current operations are in the North Lease area of the mine. Many mined-out areas of the mine have been sealed-off. Water monitoring requirements can be found in Section 2, especially pages 2-36, 2-36a, 2-36b, 2-37, 2-37a, and 2-39aa of the MRP.

There are 42 stream sampling sites in the North Lease where the Permittee will measure flow on a monthly basis for 12 months prior to, during and 12 months after longwall mining below each site. The Division will check this monitoring in conjunction with the Annual Report.

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

***Springs***

*The MRP requires third quarter sampling at 25 springs (S10-1, S12-1, S13-2, S13-7, S14-4, S15-3, S17-2, S22-5, S22-11, S23-4, S24-1, S24-12, S26-13, S34-12, S35-8, S36-12, 2-413, 3-290, 8-253, WQ1-39, WQ3-6, WQ3-26, WQ3-41, WQ3-43, and WQ4-12).*

The Permittee submitted all required samples for the spring sites.

***Streams***

*The MRP requires third quarter sampling at 36 stream-sites (CS-3, CS-4, CS-6, CS-7, CS-8, CS-9, CS-10, CS-11, CS-12, CS-13, CS-14, CS-16, CS-17, CS-18, CS-19, CS-20, CS-21, CS-22, CS-23, MD-1, SRD-1, F-9, F-10, UP&L-10, VC-6, VC-9, VC-10, VC-11, VC-12, WRDS-1, WRDS-2, WRDS-3, WRDS-4, EL-1, and EL-2).*

The Permittee submitted all required samples for the stream sites.

***Wells***

*The MRP requires third quarter sampling at 18 wells (JC-1, JC-3, ELD-1, W79-10-1-B, W79-14-2A, W79-26-1, W79-35-1A, W79-35-1B, W2-1, W20-4-1, W20-4-2, W99-4-1, W99-21-1, W99-28-1, W20-28-1, 91-26-1, W91-35-1, and 92-91-03).*

The Permittee submitted all required samples for the well sites.

***UPDES***

*The UPDES Permit/MRP require* ***weekly*** *monitoring of 3 outfalls: 001, Sedimentation Pond Discharge to Eccles Creek at the Portal; 002, Sedimentation Pond Discharge to Eccles Creek at the Loadout; and 003, the Sedimentation Discharge at the Waste Rock Disposal Site. Well JC-3 is permitted as a UPDES point, but PacifiCorp is the Permittee, and JC-3 has not discharged since July of 2004.*

The Permittee submitted all required samples for the UPDES sites. Only outfall 001 reported flow.

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

Tritium was not reported at 2-413, or JC-1. JC-1 was also missing Oxygen 18, Carbon 14, and Deuterium. The laboratory that provides the age dating data quite often takes a long time to report the data back to the Permittee. The Permittee has always been quite prompt at getting the data to the Division as soon as they receive it from the lab.

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

Some 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 |
|---|---|---|---|---|
| CS-3 | Chloride | 61 mg/L | 2.82 | 14.61 mg/L |
| S35-8 | Specific Conductivity | 605 µmhos/cm | 2.02 | 445.88 µmhos/cm |
| WQ3-6 | Chloride | 5 mg/L | 2.01 | 3.92 mg/L |
| WQ3-41 | Bicarbonate as $CaCO_3$ | 270 mg/L | 2.02 | 297.75 mg/L |
| WQ4-12 | Flow | 3 gpm | 3.04 | 1.06 gpm |
| WQ4-12 | Water Temperature | 10.8 ° C | 3.73 | 6.93 °C |
| WQ4-12 | Total Suspended Solids | 164 mg/L | 5.82 | 34.30 mg/L |

There is no trend in the bicarbonate as $CaCO_3$ at WQ3-41 ($R^2 = 0.0005$). There are only seven samples in the population and this, the lowest concentration is just 41 mg/L less than the highest recorded.

There is a no trend in chloride at WQ3-6. There are only 14 samples in the population, eleven of which are 4 mg/L, one is 3 mg/L, and now two are 5mg/L. This level is well below any water quality standards, and is not of concern. There is a fairly strong upward trend in chloride at CS-3 ($R^2 = 0.6535$), but levels are well below the drinking water criterion of 250 mg/L, and the criteria for protection of aquatic life of 600 mg/L.

The flow at WQ4-12 was at an all time high this quarter. Monitoring of this site began in 2002. Both the Palmer Hydrologic Drought Index (PHDI) and Surface Water Supply Index (SWSI) show 2001-2004 as "dry" years, and there is an upswing during this quarter.

There is a weak upward trend in the specific conductivity at S35-8 ($R^2= 0.2472$). There is no standard for specific conductivity, but it is closely related to total dissolved solids (TDS). The TDS at S35-8 is within the expected range.

There is a weak upward trend in the TSS at WQ4-12 ($R^2 = 0.2897$). Total suspended solids readings at springs can be influenced by many factors, and unless the trend continues upward, this is not of concern.

Several routine Reliability Checks were outside of standard values. They were:

| Site | Reliability Check | Value Should Be... | Value is... |
|---|---|---|---|
| CS-3 | Na/(Na + Cl) | > 50% | 20% |
| CS-4 | Conductivity/Cations | >90 & < 110 | 83 |
| CS-4 | Na/(Na + Cl) | > 50% | 49% |
| CS-6 | Conductivity/Cations | >90 & < 110 | 89 |
| CS-6 | Mg/(Ca + Mg) | < 40 % | 51% |
| CS-6 | Ca/ (Ca + SO4) | > 50 % | 45% |
| CS-9 | Conductivity/Cations | >90 & < 110 | 84 |
| CS-11 | Conductivity/Cations | >90 & < 110 | 87 |
| CS-11 | Na/(Na + Cl) | > 50% | 47% |
| CS-12 | Conductivity/Cations | >90 & < 110 | 81 |
| CS-12 | Mg/(Ca + Mg) | < 40 % | 52% |
| CS-12 | Ca/ (Ca + SO4) | > 50 % | 37% |
| CS-13 | Conductivity/Cations | >90 & < 110 | 85 |
| CS-13 | Na/(Na + Cl) | > 50% | 46% |
| CS-14 | Mg/(Ca + Mg) | < 40 % | 46% |
| CS-19 | Conductivity/Cations | >90 & < 110 | 88 |
| CS-20 | Conductivity/Cations | >90 & < 110 | 78 |
| CS-21 | Conductivity/Cations | >90 & < 110 | 85 |
| F-10 Sep 21 | Conductivity/Cations | >90 & < 110 | 75 |
| F-10 Sep 21 | K/(Na + K) | < 20% | 21% |
| UPL-10 | Conductivity/Cations | >90 & < 110 | 82 |
| UPL-10 | Na/(Na + Cl) | > 50% | 39% |
| VC-6 | Conductivity/Cations | >90 & < 110 | 87 |

| | | | |
|---|---|---|---|
| VC-6 | Mg/(Ca + Mg) | < 40 % | 49% |
| VC-6 | Ca/ (Ca + SO4) | > 50 % | 47% |
| VC-9 | Conductivity/Cations | >90 & < 110 | 88 |
| VC-9 | Mg/(Ca + Mg) | < 40 % | 51% |
| VC-9 | Ca/ (Ca + SO4) | > 50 % | 45% |
| S10-1 | Conductivity/Cations | >90 & < 110 | 86 |
| S10-1 | K/(Na + K) | < 20% | 39% |
| S10-1 | Na/(Na + Cl) | > 50% | 46% |
| S13-7 | Conductivity/Cations | >90 & < 110 | 89 |
| S17-2 | Conductivity/Cations | >90 & < 110 | 88 |
| S17-2 | Na/(Na + Cl) | > 50% | 44% |
| WQ3-6 | Conductivity/Cations | >90 & < 110 | 74 |
| WQ3-26 | Conductivity/Cations | >90 & < 110 | 119 |
| WQ3-26 | K/(Na + K) | < 20% | 25% |
| WQ3-41 | Conductivity/Cations | >90 & < 110 | 87 |
| WQ3-43 | Conductivity/Cations | >90 & < 110 | 85 |
| WQ4-12 | Conductivity/Cations | >90 & < 110 | 76 |
| WQ4-12 | K/(Na + K) | < 20% | 24% |
| 92-91-03 | TDS/Conductivity | >0.55 & <0.75 | 0.77 |
| 92-91-03 | Conductivity/Cations | >90 & < 110 | 82 |
| UT0023540-001 Jul 13 | TDS/Conductivity | >0.55 & <0.75 | 0.79 |
| UT0023540-001 Sep 21 | TDS/Conductivity | >0.55 & <0.75 | 0.87 |

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 here, since most samples have the same inconsistencies, and they recur each quarter.

The Utah Division of Water Quality (DWQ) issued the current UPDES permit on Nov. 23, 2004. It allows for a daily maximum of total dissolved solids discharged (TDS) of 1310 mg/l and a 30-day average of 500 mg/l. There is no tons per day (tpd) daily maximum, unless the 30-day average exceeds 500 mg/l; then a 7.1-tpd limit is imposed. The permit also states:

*Upon determination by the Executive Secretary that the permittee is not able to meet the 500 mg/L 30-day average or the 7.1 tons per day loading limit, the permittee is required to participate in and/or fund a salinity offset project to include TDS offset credits, within six (6) months of the effective date of this permit.*

*The Division of Water Quality approved a Salinity Offset Plan for the Skyline Mine on January 5, 2005.* A copy of the agreement can be found in the Division's Incoming files, and at:

https://fs.ogm.utah.gov/FILES/COAL/PERMITS/007/C0070005/2005/INCOMING/0006.pdf.

For the third quarter of 2006, the Permittee has not exceeded the daily max of 1310 mg/L for TDS. However, at Outfall 001 the 30-day average has remained above 500 mg/l and the tons per day are much greater than 7.1. Because of these exceedences, Canyon Fuel Company continues to participate in the salinity-offset program.

The Permittee reported total iron to be 1.37 mg/L at Outfall 001 on July 19, and 1.05 mg/L on August 15. A one-time exceedence is generally not thought to be a problem, and the Division of Water Quality is charged with overseeing the UPDES program. The Permittee reported the exceedences to the Division of Water Quality as required (Jeffrey Studenka contacted by CFC on August 3, and 21). The Division of Water Quality did not feel that it warranted any action on their part, nor does the Division at this time.

**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. However, they are required to monitor 8 stream sites (CS-1, CS-7, CS-8, CS-10, CS-16, CS-17, CS-18, and VC-10) and 13 springs (S13-2, S14-4, S15-3, S22-5, S22-11, S23-4, S24-12, S26-13, S34-12, S35-8, S36-12, 2-413, and 3-290) for all operational parameters at high and low flow (where accessible) once every five years (2010, 2015, etc.), and whenever abrupt changes in flow occur.

**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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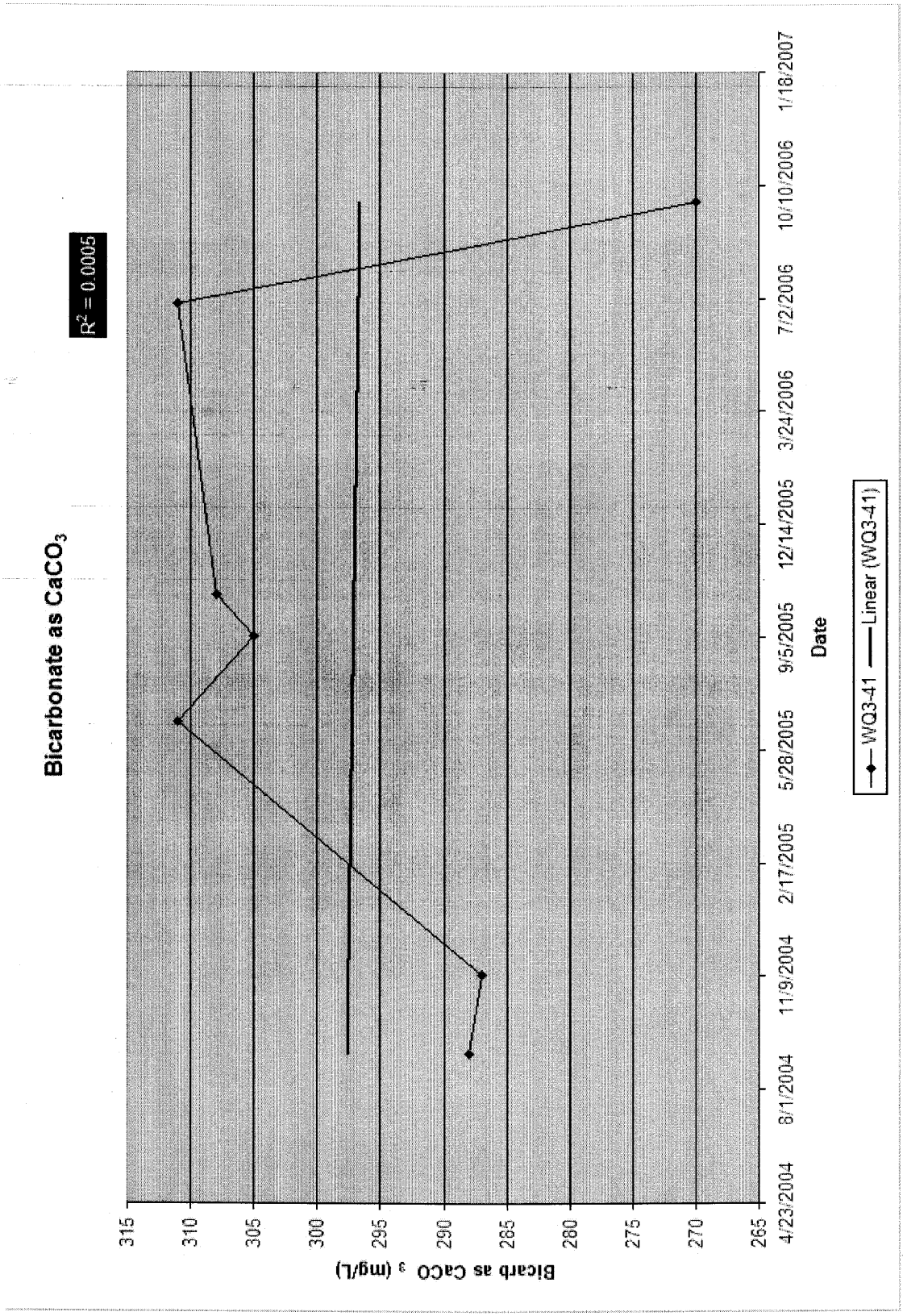
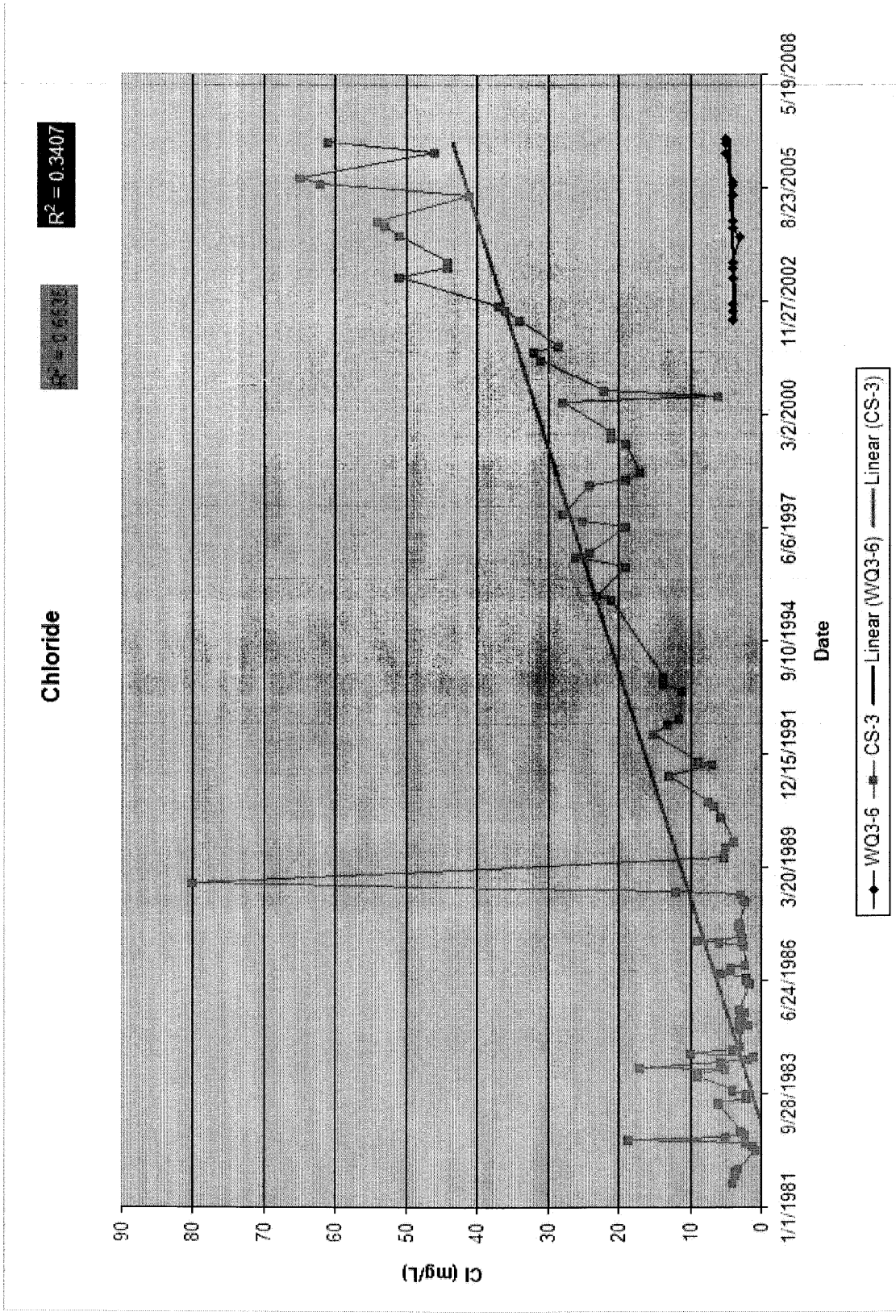
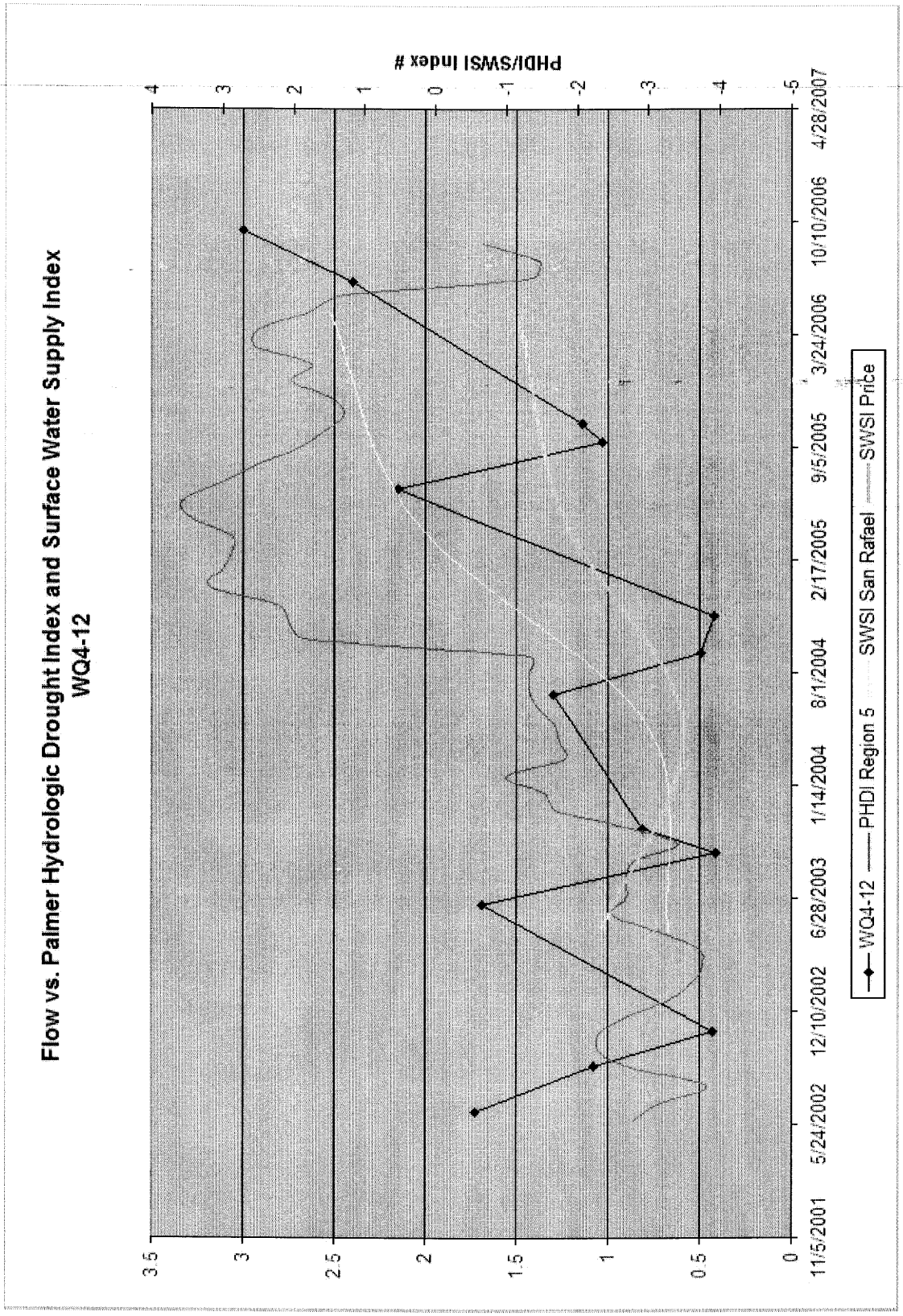
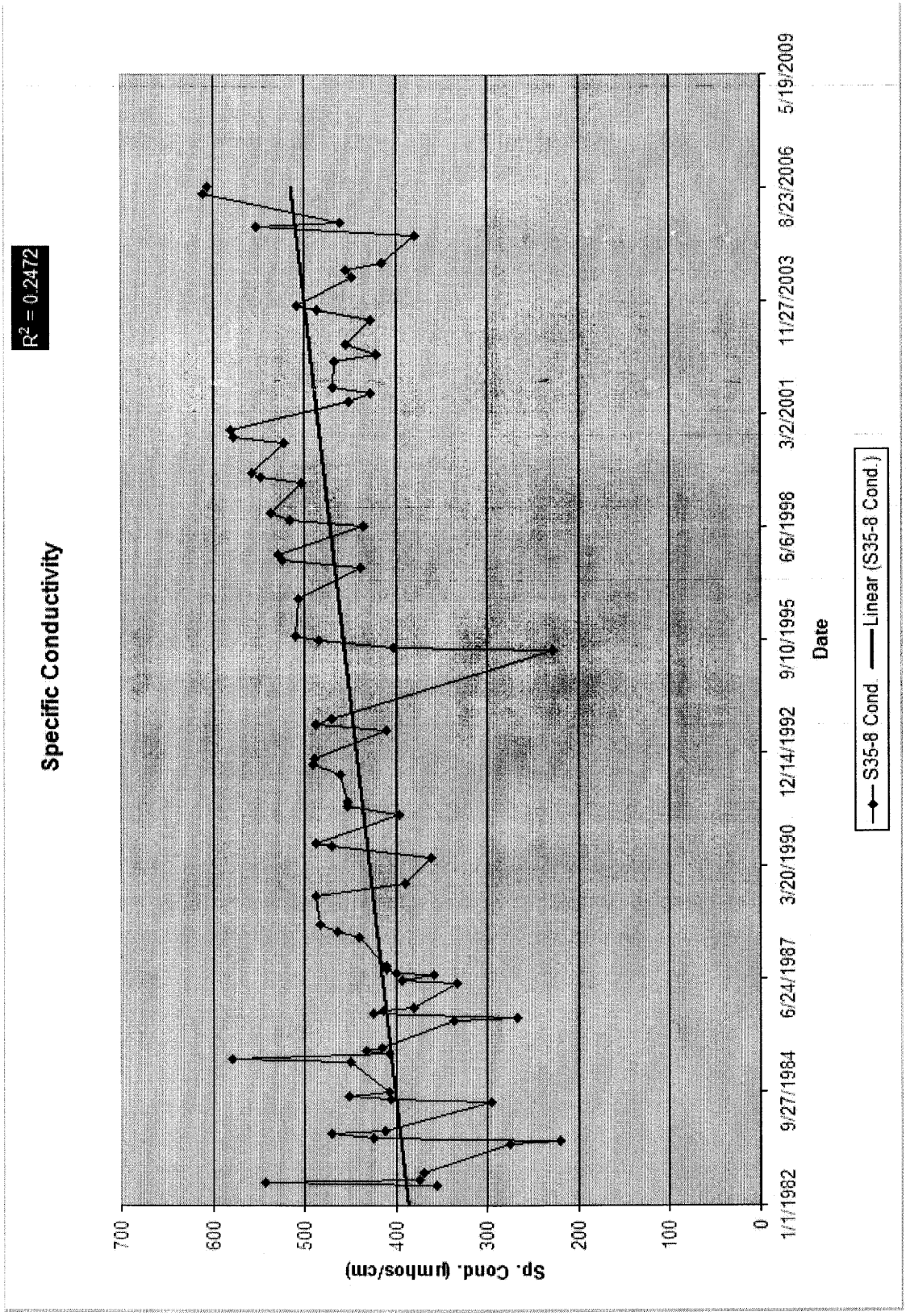
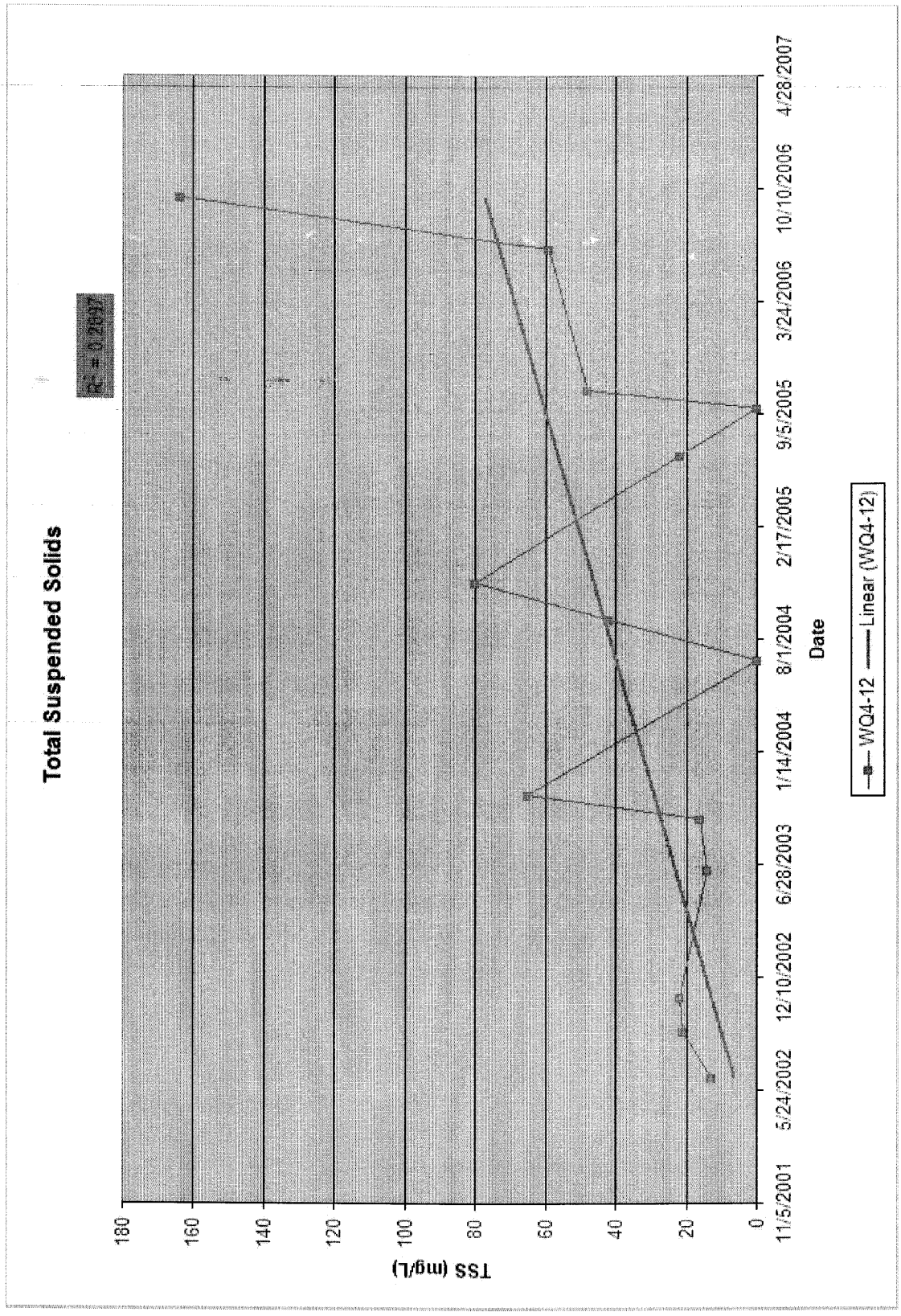

Bicarbonate as $CaCO_3$
$R^2$ = 0.0005
Bicarb as CaCO 3 (mg/L)
315
310
305
300
295
290
285
280
275
270
265
4/23/2004
8/1/2004
11/9/2004
2/17/2005
5/28/2005
9/5/2005
12/14/2005
3/24/2006
7/2/2006
10/10/2006
1/18/2007
Date
WQ3-41
Linear (WQ3-41)


Chloride
R² = 0.6605
R² = 0.3407
Cl (mg/L)
0
10
20
30
40
50
60
70
80
90
1/1/1981
9/28/1983
6/24/1986
3/20/1989
12/15/1991
9/10/1994
6/6/1997
3/2/2000
11/27/2002
8/23/2005
5/19/2008
Date
WQ3-6
CS-3
Linear (WQ3-6)
Linear (CS-3)


Flow vs. Palmer Hydrologic Drought Index and Surface Water Supply Index
WQ4-12
PHDI/SWSI Index #
4
3
2
1
0
-1
-2
-3
-4
-5
3.5
3
2.5
2
1.5
1
0.5
0
11/5/2001
5/24/2002
12/10/2002
6/28/2003
1/14/2004
8/1/2004
2/17/2005
9/5/2005
3/24/2006
10/10/2006
4/28/2007
WQ4-12
PHDI Region 5
SWSI San Rafael
SWSI Price


Specific Conductivity
$R^2$ = 0.2472
Sp. Cond. (umhos/cm)
700
600
500
400
300
200
100
0
1/1/1982
9/27/1984
6/24/1987
3/20/1990
12/14/1992
9/10/1995
6/6/1998
3/2/2001
11/27/2003
8/23/2006
5/19/2009
Date
S35-8 Cond.
Linear (S35-8 Cond.)


Total Suspended Solids
R² = 0.7697
TSS (mg/L)
180
160
140
120
100
80
60
40
20
0
11/5/2001
5/24/2002
12/10/2002
6/28/2003
1/14/2004
8/1/2004
2/17/2005
9/5/2005
3/24/2006
10/10/2006
4/28/2007
Date
WQ4-12
Linear (WQ4-12)