APPENDIX A
Memo from Mike McVay

MEMO

State of Idaho
Department of Water Resources
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Date: March 2, 2009

To: Dennis Owsley

From: Mike McVay

cc: Sean Vincent and Rick Raymondi

Subject: Evaluation North Ada County historical water level trends

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Introduction

Per you request, I have reviewed the water level data for 10 wells located in the North Ada County investigation area. This review is intended as a supplemental to the analysis entitled "Evaluation North Ada County historical water level trends, January 28, 2009." The data were reviewed to assess water level trends for the years 1996 – 2008.

IDWR Review

The water level data available were collected over different time-frames and varying collection schedules. Therefore, it was necessary to filter the data and select a common evaluation time-span. The following steps were taken to prepare the data for analyses.

1. Depth-to-water measurements were converted to water level elevations using the land surface datum values listed in the "well-log" database. Elevation accuracy is reported to be +/- 11 feet in well-log. Wells used in this review are presented in Table 1.
2. The data was filtered for yearly spring measurements in each well. Spring measurements were defined as those taken between 03/01 and 05/31 of each year. All attempts were made to choose the most similar date for each year; with preference given to the earliest date in the spring range.
3. **For the January 28, 2009 analysis**, the data period 1996 – 2003 was chosen for comparison. Due to data constraints, wells 04N01E10ACB2, 04N01E03DAD1, 04N02W06CDD1, and 05N01E26DCD1 were evaluated for the period 1996 – 2002; and well 05N03W12CCA1 was evaluated for the period 1996 – 2004. This general period allowed the comparative analyses of 16 wells.

4. **For this analysis,** the data period 1996 – 2008 was chosen for evaluation. This period was chosen to determine water level trends up to the most current data. Data constraints allowed for the comparative analysis of 10 wells.
5. Water level data from all wells were plotted on the same X-Y scale for visual comparison.
6. Linear trends of the spring water level data were developed using the linear function option in Grapher©, and were plotted with the data.
7. Well logs were reviewed to determine if each well was located in the upper undifferentiated sediments (Undifferentiated), the Pierce Gulch sands (Pierce Gulch), Terteling Springs mudstones (Terteling Springs), or shallow water table system (Shallow). These classifications were based on well location and production zone depth, geologic material inventoried in the driller's logs, and comparison with nearby wells that were identified by HLI.
8. Well locations were plotted in ArcMap to give spatial reference (Figure 1).

Table 1. Wells included in water level data review.

Well	Trend Slope	Average Spring WL	Geology ID	Area ID
04N01E-03DAD1	-0.187	2639.1	Undiff	NAda
04N01E-11BBB1	0.127	2582.3	Undiff	NAda
05N01W-36ABB1	-0.398	2539.5	PG	NAda
05N03W-12CCA1	-0.322	2426.6	PG	NAda
05N03W-15DDC1	-0.489	2439.6	Undiff	NAda
05N01E-34DBB1	-0.198	2648.3	Tert	NAda
04N02W-07AAC1	-0.071	2391	Shallow	NAda
[1]05N01E-35ACA1	-0.01	2747.9	Tert	Dry Creek
[1]05N01E-36AAB1	-0.272	2760.2	UNK	Dry Creek
[2,3]05N01E-32DBD1	-1.06	2575.7	PG	NAda

[1] Water level data suggest that wells in the Dry Creek area are completed in a different aquifer system than other North Ada wells. These wells were not included in the average trend estimation.

[2] No spring water level data is available for well 05N01E32DBD1.

[3] Fall water level data for years 1996 - 2004 were used for well 05N01E32DBD1.

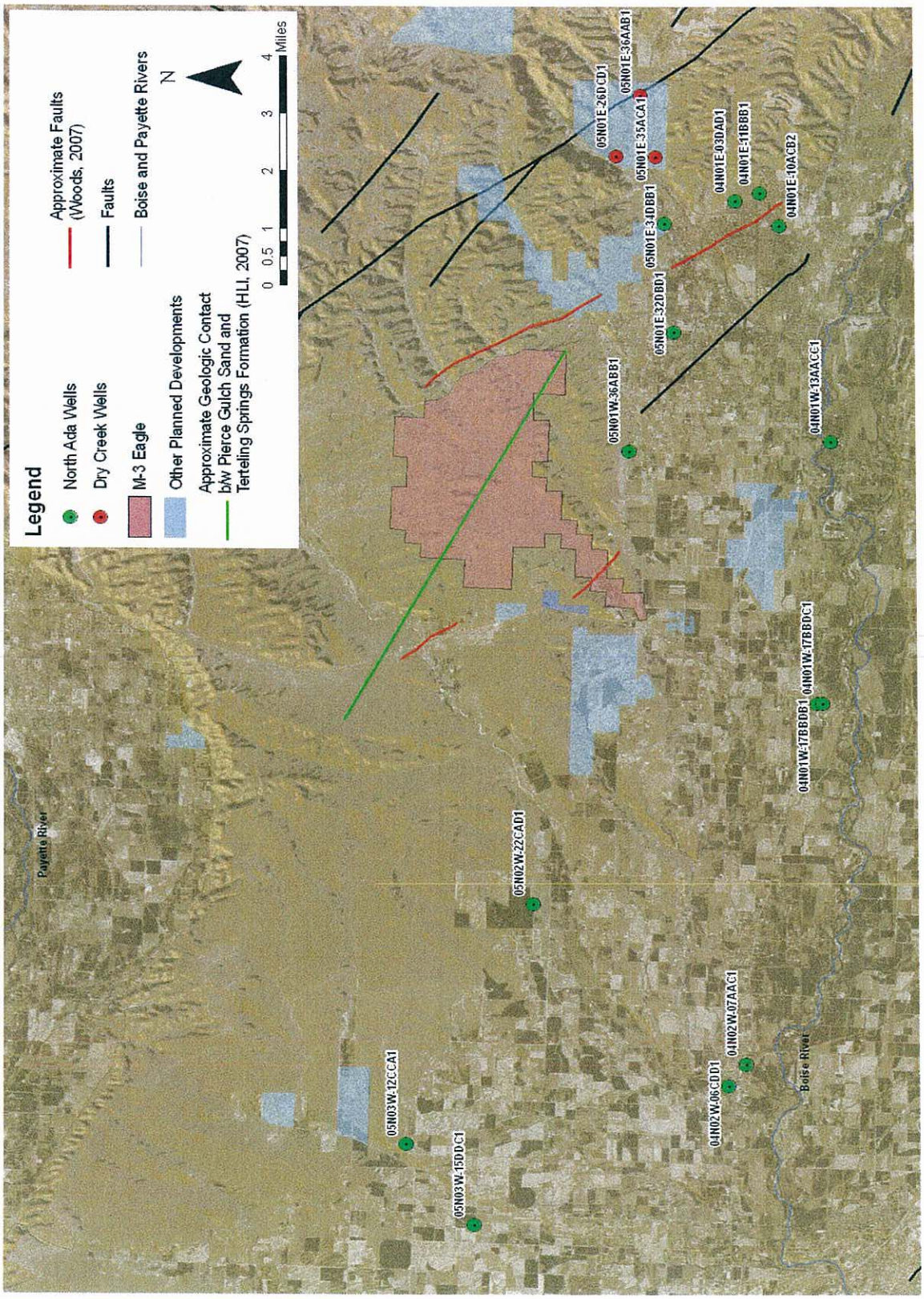


Figure 1. Location of wells used for historical water-level review.

Conclusions

The variable length of data records and sporadic data collection intervals did not allow a statistically rigorous data evaluation. However, linear trend estimations provided the following conclusions:

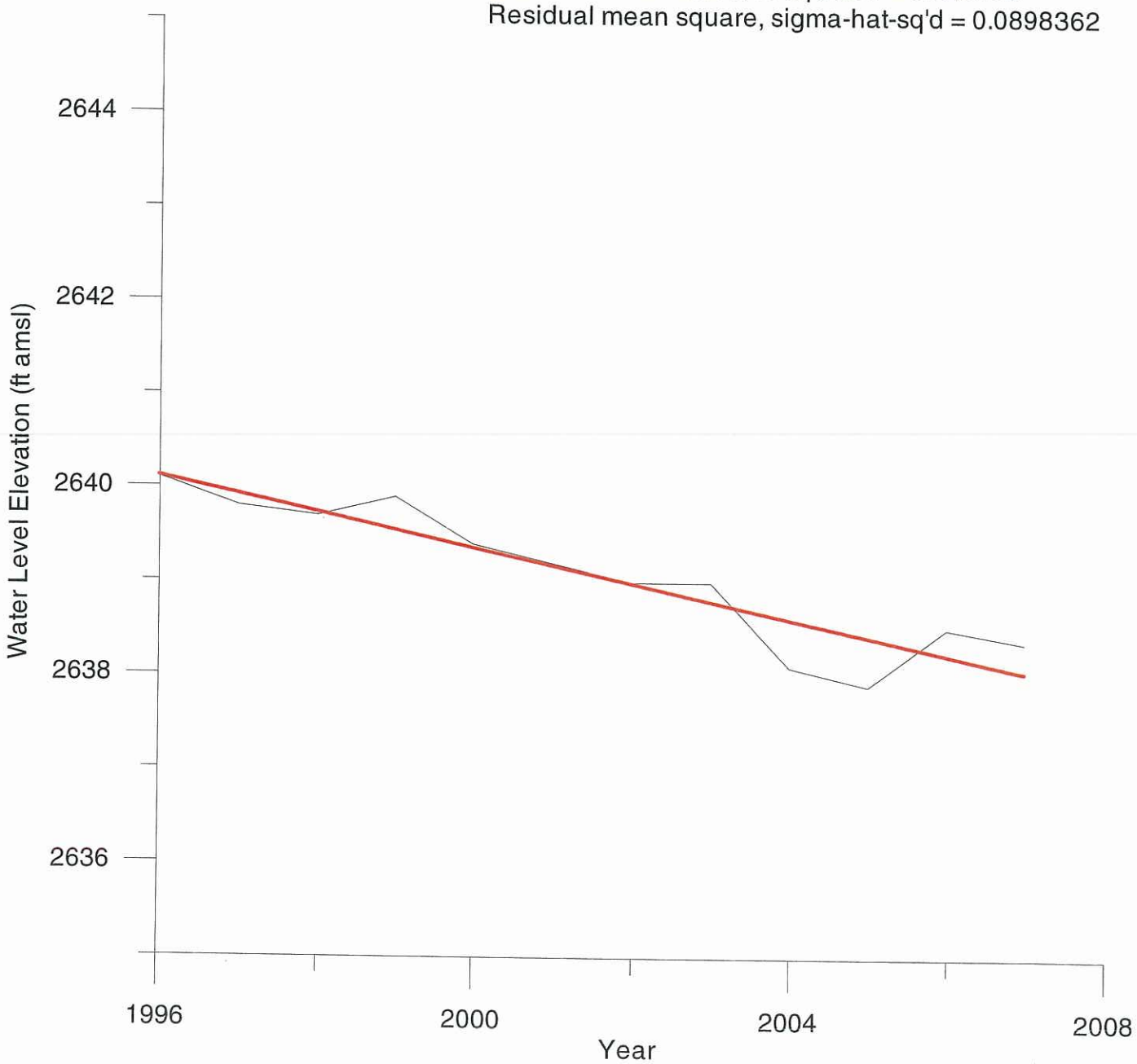
1. Grouping wells based on visual inspection of gross water level behavior leads to three conclusions;
    a. Wells in the Dry Creek area show similar behavior that is different than the other wells in the area.
    b. There is no serial water level behavior present that allows the identification of Pierce Gulch completions.
2. All wells in the area (except 04N01E11BBB1) exhibit negative water level trends that range from -0.11 ft/year to -1.06 ft/year, with an average trend for all wells of -0.29 ft/year.

Undiff

Fit Results

04N01E-03DAD1

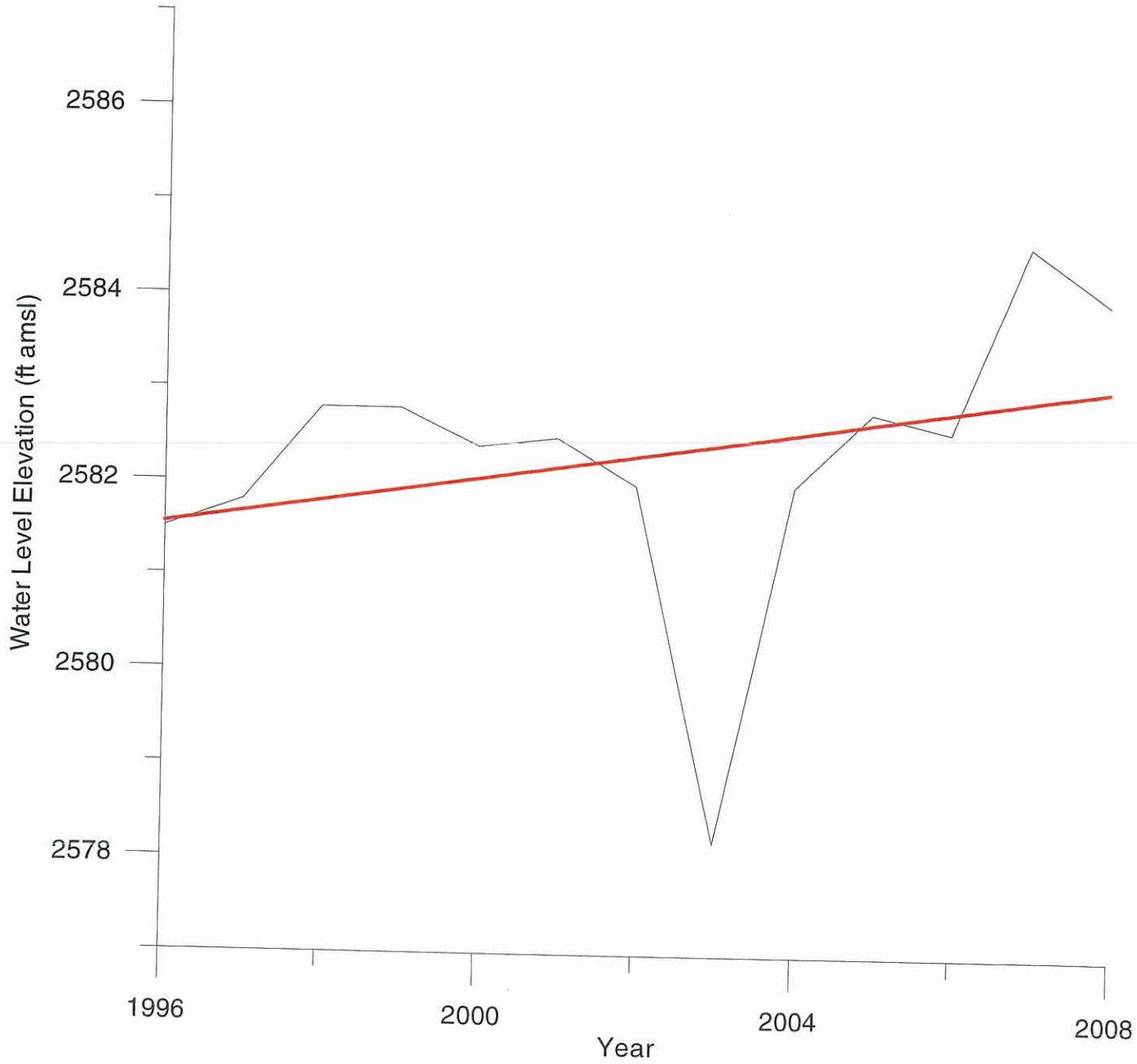
Fit 1: Linear
Equation Y = -0.1874708625 * X + 3014.304876
Number of data points used = 12
Average X = 2001.5
Average Y = 2639.08
Residual sum of squares = 0.898362
Regression sum of squares = 5.02578
Coef of determination, R-squared = 0.848356
Residual mean square, sigma-hat-sq'd = 0.0898362



Undiff

04N01E-11BBB1

Fit 1: Linear
Equation Y = 0.1269230769 * X + 2328.207692
Number of data points used = 13
Average X = 2002
Average Y = 2582.31
Residual sum of squares = 24.0173
Regression sum of squares = 2.93192
Coef of determination, R-squared = 0.108794
Residual mean square, sigma-hat-sq'd = 2.18339

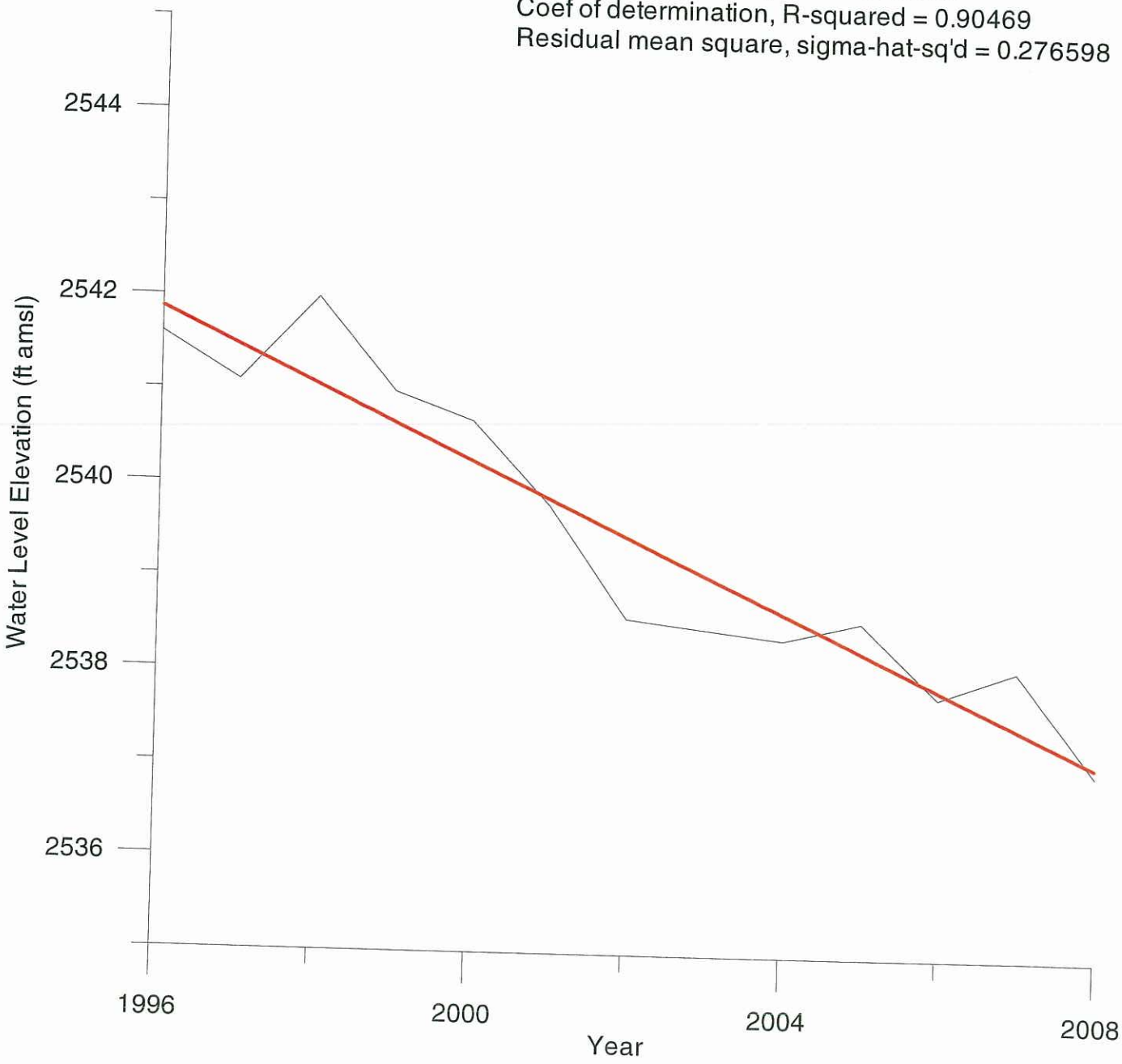


FG

Fit Results

05N01W-36ABB1

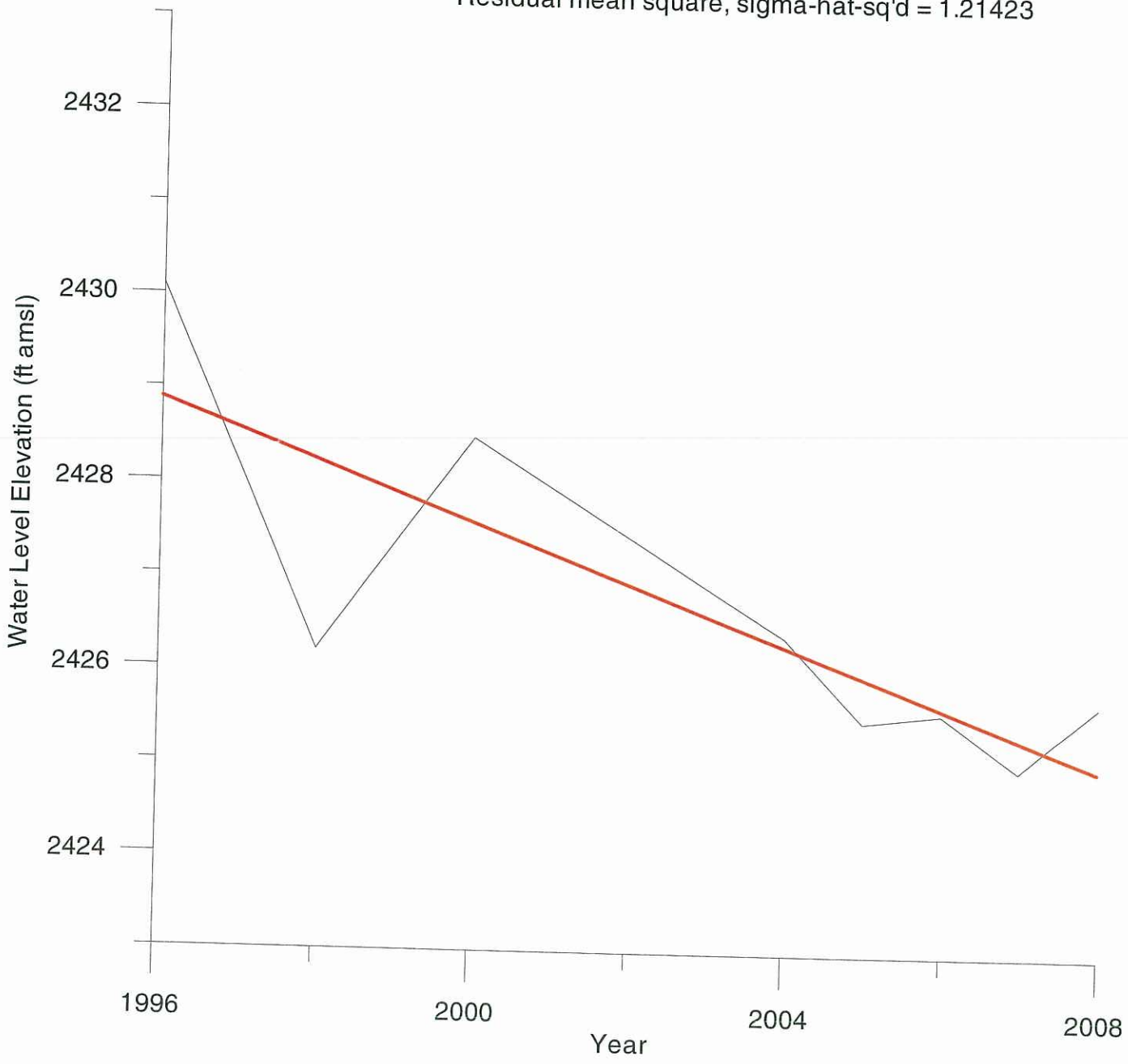
Fit 1: Linear
Equation Y = -0.3983516484 * X + 3336.976923
Number of data points used = 13
Average X = 2002
Average Y = 2539.48
Residual sum of squares = 3.04258
Regression sum of squares = 28.8805
Coef of determination, R-squared = 0.90469
Residual mean square, sigma-hat-sq'd = 0.276598



Fit Results

Fit 1: Linear
Equation Y = -0.3224637681 * X + 3072.519928
Number of data points used = 8
Average X = 2003
Average Y = 2426.63
Residual sum of squares = 7.28536
Regression sum of squares = 14.3496
Coef of determination, R-squared = 0.66326
Residual mean square, sigma-hat-sq'd = 1.21423

05N03W-12CCA1

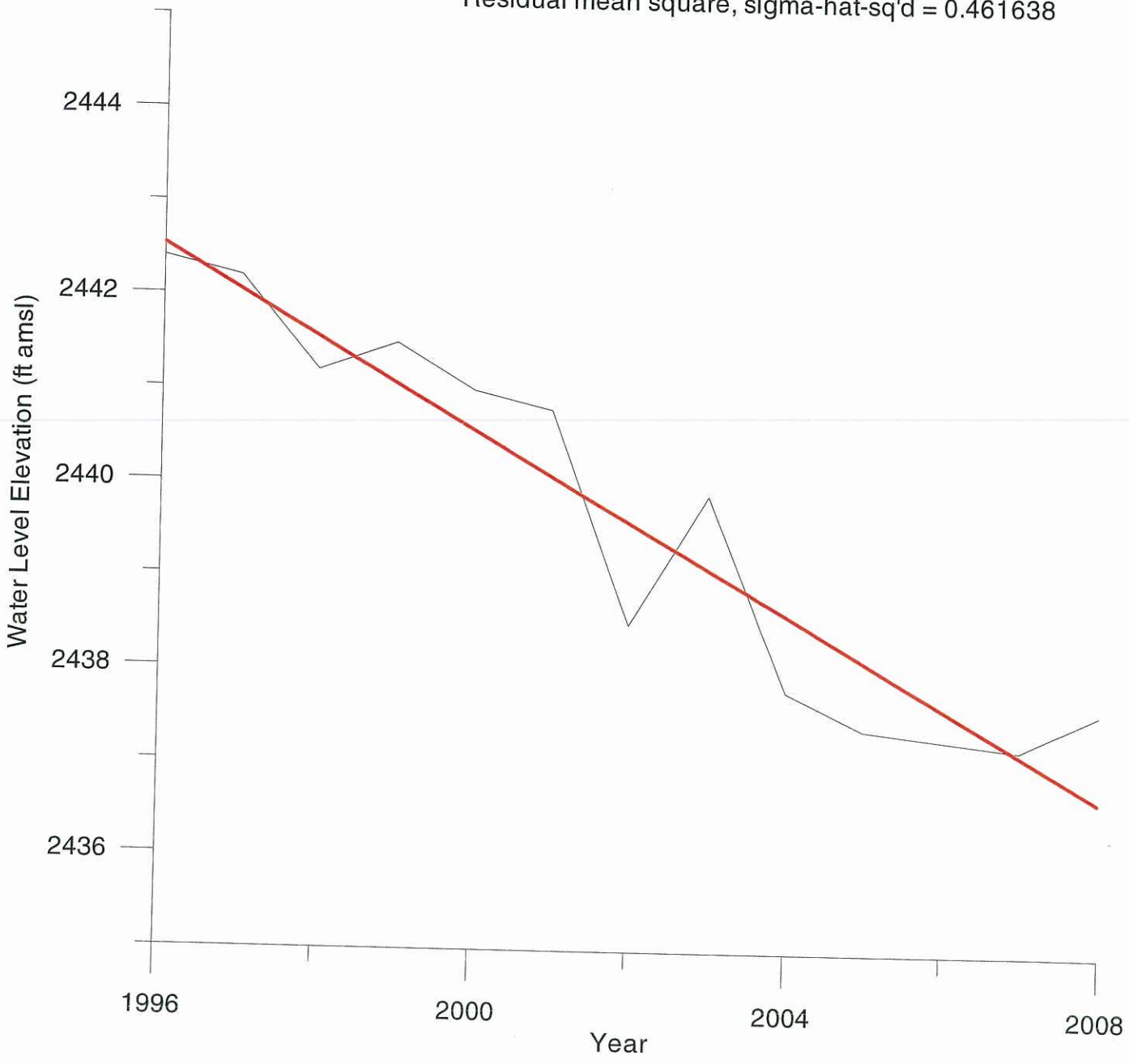


Undiff

Fit Results

05N03W-15DDC1

Fit 1: Linear
Equation Y = -0.489010989 * X + 3418.6
Number of data points used = 13
Average X = 2002
Average Y = 2439.6
Residual sum of squares = 5.07802
Regression sum of squares = 43.522
Coef of determination, R-squared = 0.895514
Residual mean square, sigma-hat-sq'd = 0.461638

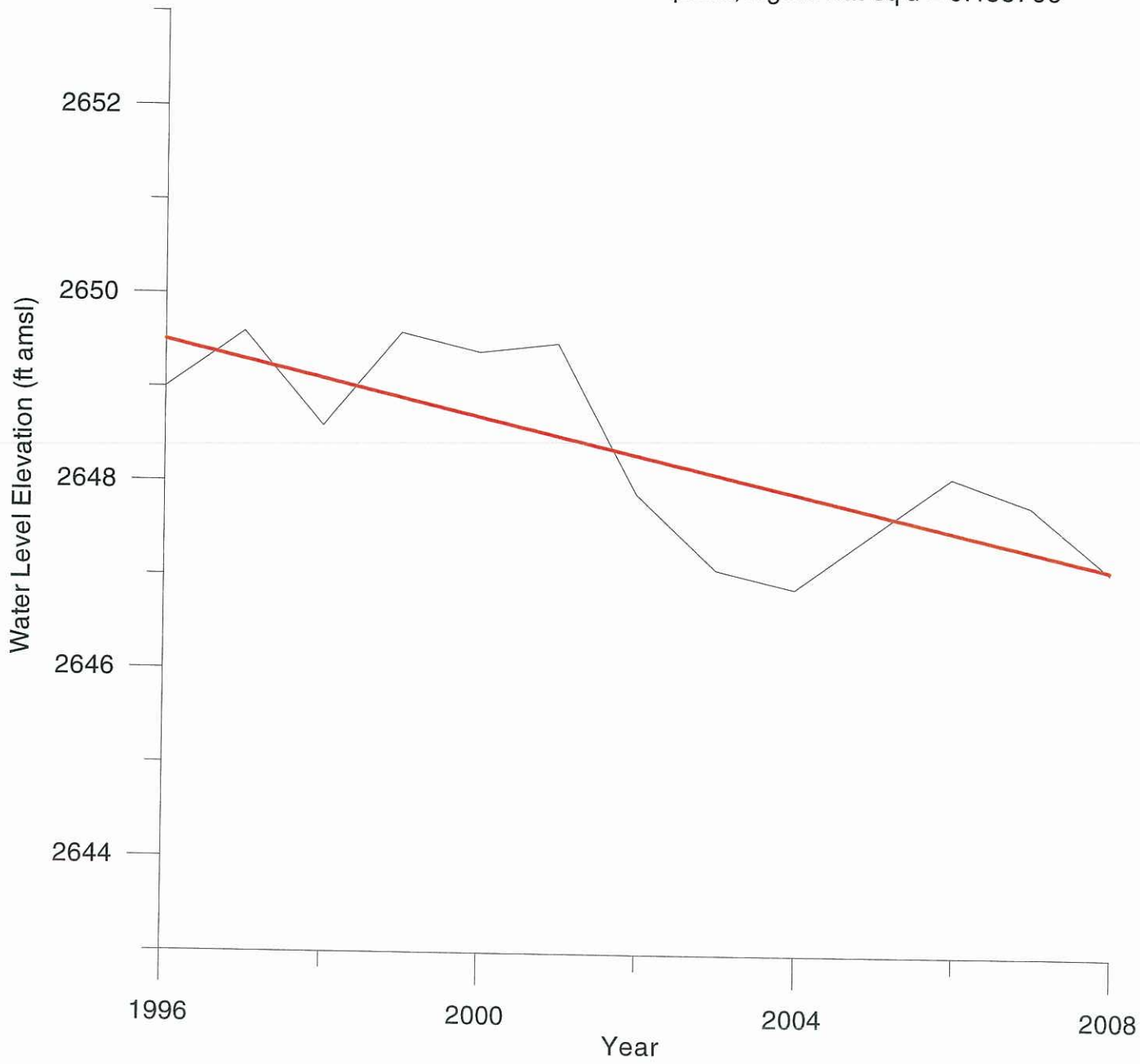


Fit Results

1ert

05N01E-34DBB1

Fit 1: Linear
Equation Y = -0.1983516484 * X + 3045.415385
Number of data points used = 13
Average X = 2002
Average Y = 2648.32
Residual sum of squares = 5.37643
Regression sum of squares = 7.16049
Coef of determination, R-squared = 0.571152
Residual mean square, sigma-hat-sq'd = 0.488766

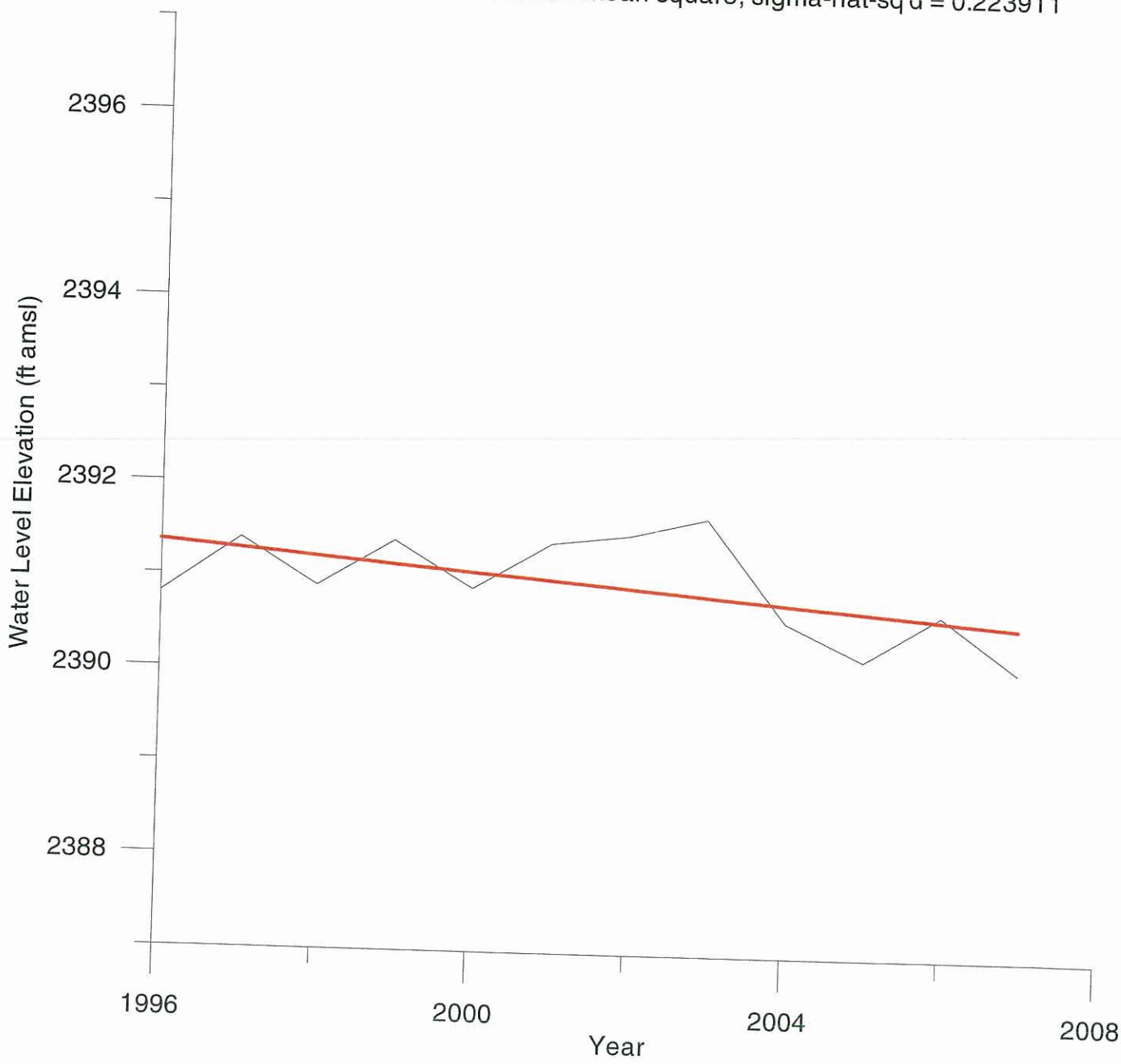


Fit Results

Shallow

04N02W-07AAC1

Fit 1: Linear
Equation Y = -0.07132867133 * X + 2533.731002
Number of data points used = 12
Average X = 2001.5
Average Y = 2390.97
Residual sum of squares = 2.23911
Regression sum of squares = 0.727552
Coef of determination, R-squared = 0.245242
Residual mean square, sigma-hat-sq'd = 0.223911

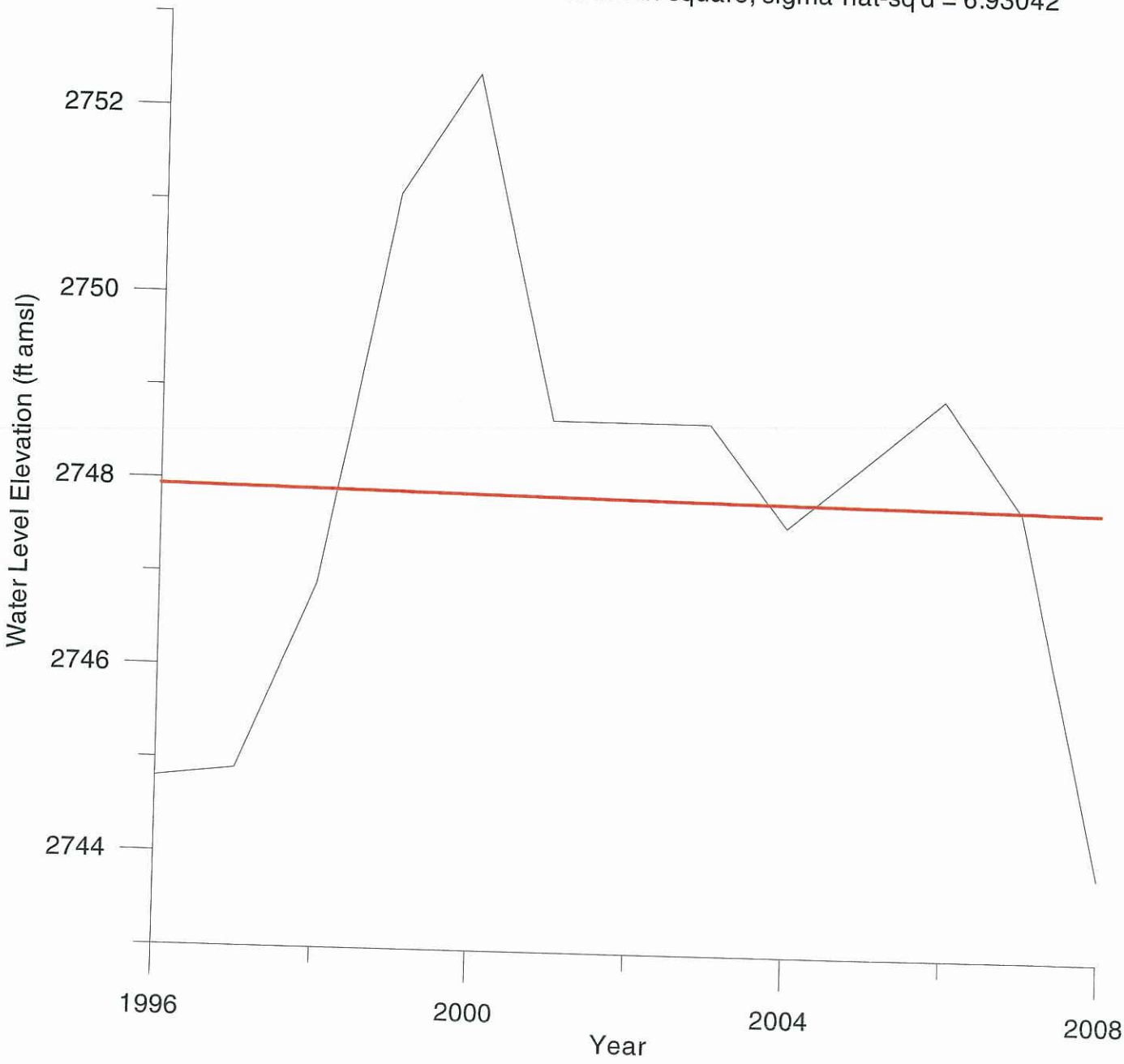


Fit Results

Pert

05N01E-35ACA1

Fit 1: Linear
Equation Y = -0.01030478955 * X + 2768.502612
Number of data points used = 12
Average X = 2001.75
Average Y = 2747.88
Residual sum of squares = 69.3042
Regression sum of squares = 0.018291
Coef of determination, R-squared = 0.000263854
Residual mean square, sigma-hat-sq'd = 6.93042

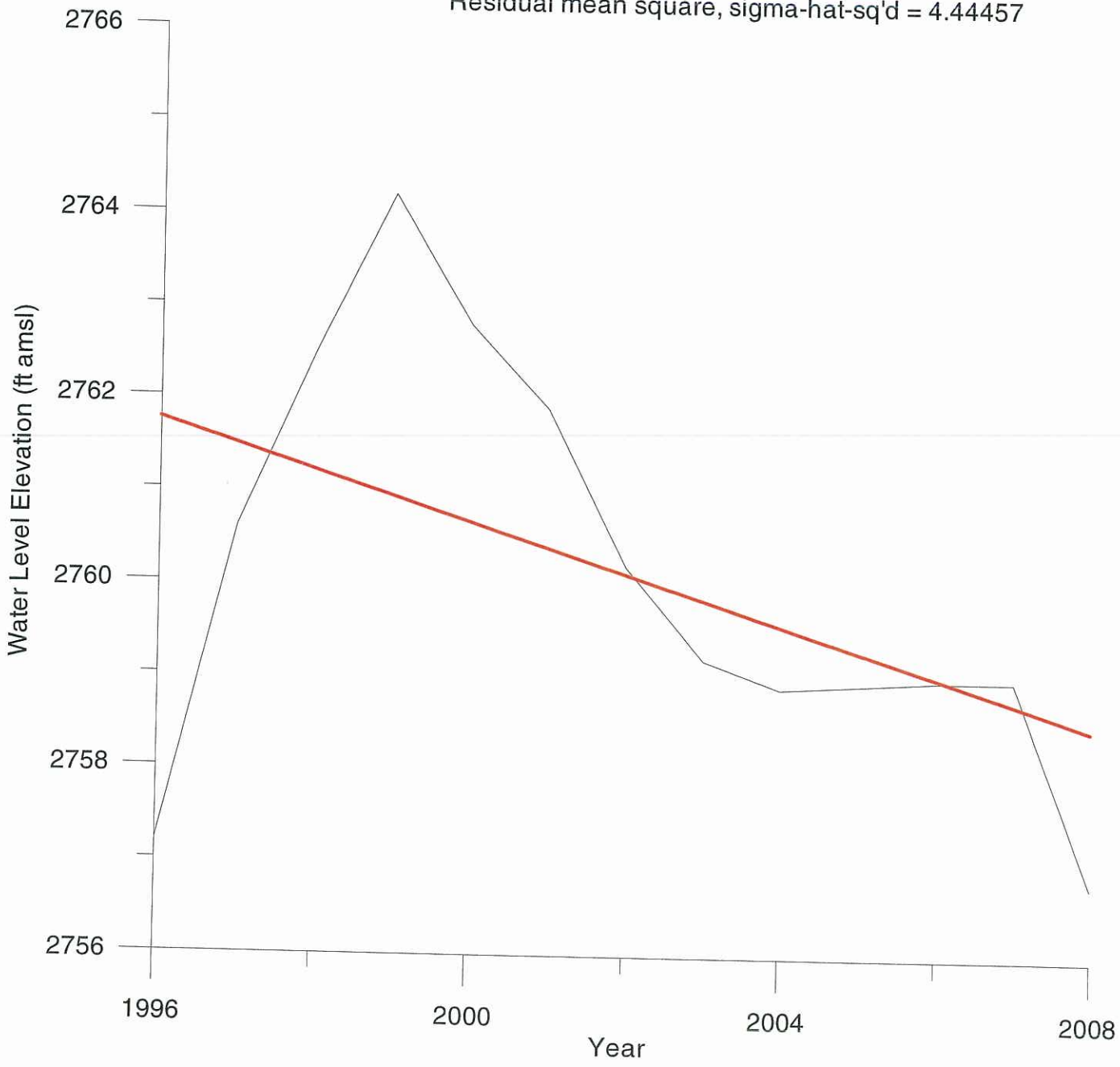


Fit Results

UNK

05N01E-36AAB1

Fit 1: Linear
Equation Y = -0.2724238026 * X + 3305.516014
Number of data points used = 12
Average X = 2001.75
Average Y = 2760.19
Residual sum of squares = 44.4457
Regression sum of squares = 12.7835
Coef of determination, R-squared = 0.223374
Residual mean square, sigma-hat-sq'd = 4.44457

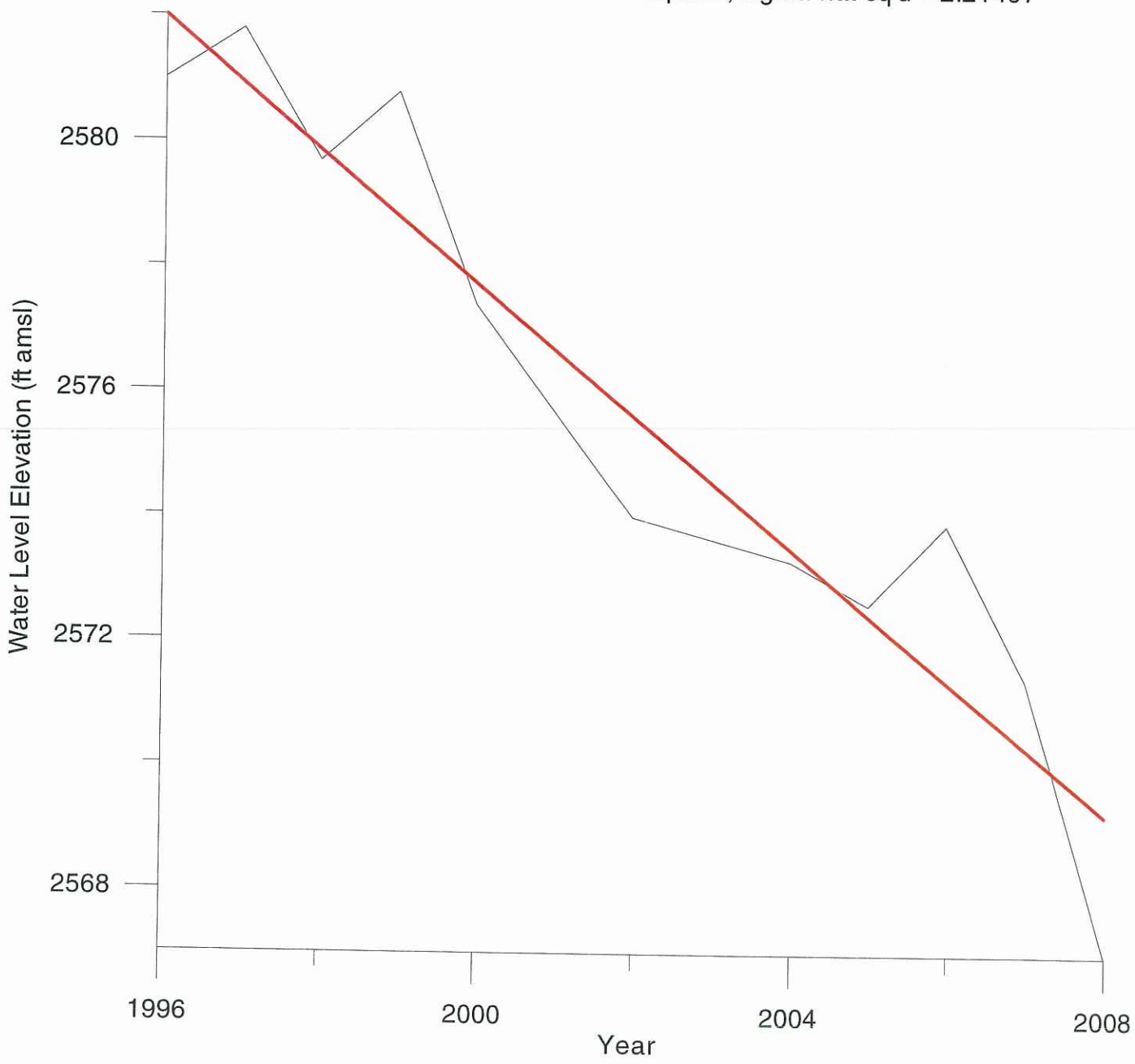


PG

Fit Results

05N01E-32DBD1

Fit 1: Linear
Equation Y = -1.061169968 * X + 4700.090511
Number of data points used = 12
Average X = 2001.92
Average Y = 2575.72
Residual sum of squares = 22.1497
Regression sum of squares = 203.727
Coef of determination, R-squared = 0.901939
Residual mean square, sigma-hat-sq'd = 2.21497



APPENDIX B
Memo from Allan Wylie

MEMO

State of Idaho
Department of Water Resources
322 E Front Street, P.O. Box 83720, Boise, Idaho 83720-0098
Phone: (208) 287-4800 Fax: (208) 287-6700

Date: January 15, 2009

To: Dennis Owsley

From: Allan Wylie

cc: Sean Vincent, Rick Raymondi

Subject: Analysis of M3 Modeling

Dennis

I have reviewed the document titled 'Modeling of Ground-Water Flow in the Pierce Gulch Sand Aquifer: Five Models: History, Updates, and Predictions of Impacts Caused by Pumping at the M3 Eagle Planned Residential Community Ada County, Idaho' prepared by Hydro Logic, Inc and PGG. I did not check the hydrogeologic conceptual model or evaluate the water balance.

There are several things I like about the M3 model: 1) they developed multiple models and this allows them some evaluation of predictive uncertainty; 2) the modeling process involved a genuine team effort; and 3) they incorporated knowledge and experience gained from previous efforts.

I found examples of things I would have done differently if I had been developing the M3 model. However, I think most of these things are matters of preference, and I don't think they would substantially alter the final result.

I found three issues that I will discuss that I think might matter.

1) I don't like constant head and general head boundaries in water supply models. These boundaries allow essentially unlimited volumes of water to enter or exit the model. The M3 model incorporates both general head and constant head boundaries. Some along the northeast edge and some on the southwest edge. PGG conducted some of their predictive model runs after replacing the general head boundary with a fixed flux boundary at the inlet of the model, this is good. I

don't see that the change was made permanent, so watch how this model is used in the future.

2) I don't think two models bracket uncertainty as claimed on page 13. Two observations do give you a better idea of the underlying variability than one, but two observations probably do not represent the possible extremes.

3) The M3 model is multilayer, so the model needs to simulate the vertical hydraulic conductivity between layers. The discussion regarding where the values used in the model come from is brief suggesting that the values are unknown and therefore are calibration parameters. Although PGG noted that vertical conductance was a sensitive calibration parameter (pg 14 Appendix A), they do not discuss its sensitivity to the prediction. Perhaps the drawdowns observed both in the shallow and deep aquifer are sensitive to reasonable adjustments in vertical conductivity.

Allan Wylie

CERTIFICATE OF SERVICE

I HEREBY CERTIFY that on this 5th day of March, 2009, a true and correct copy of the document described below was served on the following by placing a copy of the same in the United States mail, postage prepaid and properly addressed to the following:

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