MALCOLM PIRNIE

Technical Memorandum

Date: September 9, 2008

To: Gregory S. Olsen, ADEQ

From: Clifton F. Bell, Malcolm Pirnie

Re: Revisions to Pinto Creek Background/Ambient Model Scenario

Project No.: 1761-117

The purpose of this memo is to describe revisions to the calibration run and "background/ambient" scenario of the HSPF model of copper concentrations in Pinto Creek. The starting point for the revisions was the HSPF model as documented in the *Pinto Creek Phase II TMDL Modeling Report* (Malcolm Pirnie, 2006). Simulated background copper concentrations from selected lithologies/land covers were adjusted based on ADEQ's 2008 re-evaluation of the potential impact of mining-related sources at specific locations. Adjustment of model parameters associated with the Cactus Breccia was necessary to re-calibrate the revised model. The background/ambient scenario was then re-run to calculate average copper concentrations associated with specific storm events and locations.

REVISIONS TO BACKGROUND CONCENTRATIONS

Table 3-1 of Malcolm Pirnie (2006) lists the original assumptions of the simulated background copper concentrations from different lithologies/locations in the Pinto Creek watershed, as well as the sampling locations that were used to determine these concentrations. ADEQ's 2008 re-evaluation of these locations resulted in the following changes:

- Site 102689 (Unnamed trib. to Five Point Mountain trib.) was not used to estimate the natural background concentration for granite.
- Sites 102647 (Ellis Ranch trib. above Forest Road 349) and 102648 (Ellis Ranch Trib. at Forest Service Road 349) were not used to estimate the natural background concentration for schist.
- Site 102941 (Tributary above Ripper Springs) was not used to estimate the natural background concentration for alluvium.

Concentrations for other lithologies and locations were unchanged from the original 2006 model. The original and revised assumptions regarding background concentrations are listed in Table 1. Within the HSPF input (*.uci) file, the concentrations were revised by adjustment of the POTFW, AOQC, and IOQC values.

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TABLE 1
Simulated Background Concentrations of Dissolved Copper Of Runoff in the Pinto Creek Basin
[Shaded rows indicate revisions from 2006 model]

Lithology/Location	Revised Representative Sample Locations	2006 Diss. Cu Conc. (µg/L)	Revised Diss. Cu Conc. (µg/L)
Schultz Granite	102657, 102687, 102688, 102690	39.5	35.1
Schist	102650, 102651, 102652, 102653,102654, 102656	32.2	27.8
Dacite	102665, 102668	25	25
Alluvium upstream of confluence with W. Fork Pinto Creek	100346, 101068, 101070, 102434, 102435	24	15
Other alluvium			12
Mixed; West Fork Pinto Creek	102433	7.5	7.5
Mixed; Haunted Canyon	101072, 101131	7.9	7.9
Mixed; Powers Gulch	102665	21	21
Mixed; Above Henderson Ranch Mines	102428, 101039	12	12
Mixed; Mowing Machine Basin	102667	19	19
Mixed; Pinto Creek Below PC-300	101070, 100346	7.5	7.5

For the 2006 model, the copper-related parameters associated with the Cactus Breccia were adjusted through the calibration process to simulate the observed increase in dissolved copper concentration in Pinto Creek downstream of this unit. These loadings reflect not only copper in runoff from this unit, but also internal loading directly from the stream bed. When revising model, it was noticed that one PERLND (111) of the 2006 model had incorrect copper-related parameters, and that model results were sensitive to this error at one of the ten locations of interest (Pinto Creek below Cactus Breccia). After the correction of this error and revision of the background model scenarios, it was necessary to re-calibrate model parameters associated with the Cactus Breccia deposit. The revised calibration run gives very similar results to the original 2006 model at the four calibration stations (Figures 1-2).

For the 2006 model, the background/ambient scenario included in the assumption that mining-related sources would be remediated to 10 times the background concentration. For the 2008 revision, a second background/ambient scenario was evaluated that included the assumption that mining-related sources would be remediated all the way to background concentrations.

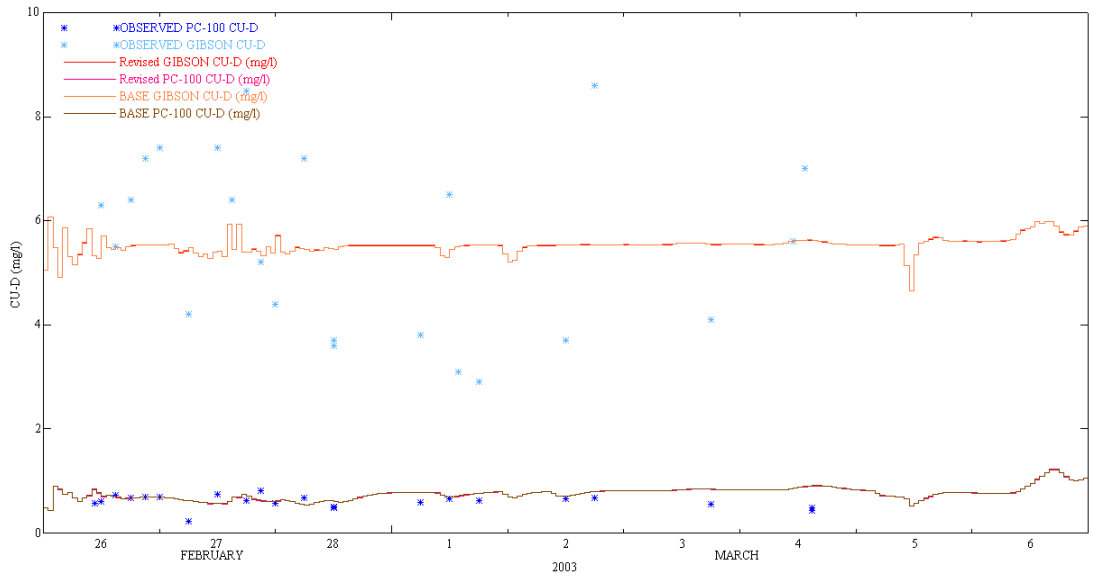

Figure 1: Revised model water quality calibration plot for stations PC-100 and Gibson tributary.

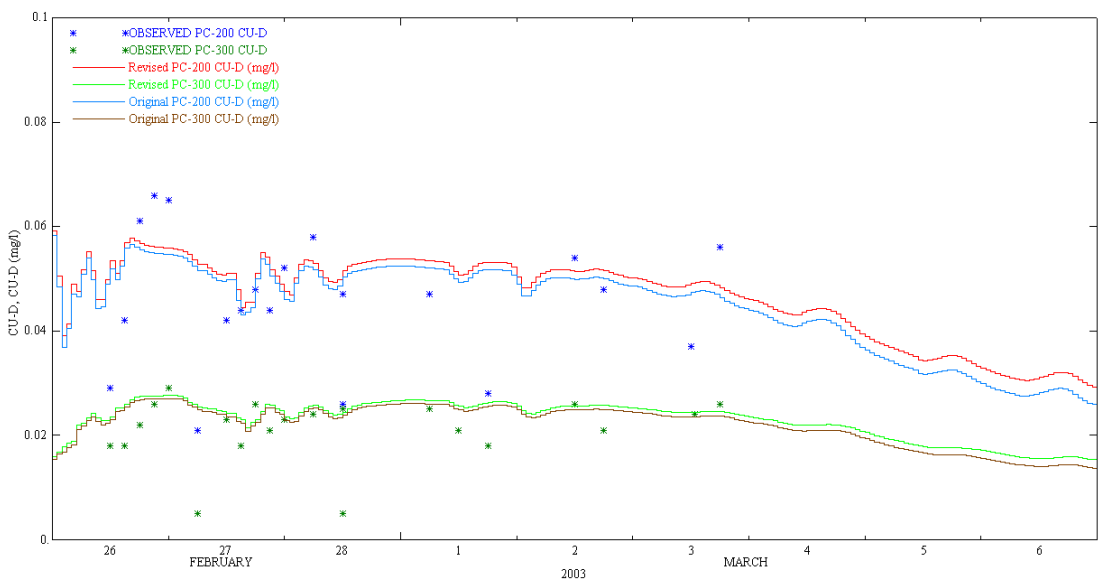

Figure 2: Revised model water quality calibration plot for stations PC-200 and PC-300.

RESULTS OF REVISED BACKGROUND/AMBIENT SCENARIOS

As in 2006, the HSPF model was constructed to output in-stream concentrations at ten different locations in the Pinto Creek watershed for five different storm conditions. Table 2 provides model results at these locations for three different versions of the

background/ambient scenario: (1) the 2006 background/ambient scenario; (2) the 2008 background/ambient scenario with mining sources at 10 times background concentrations; (3) and the 2008 background/ambient scenario with mining sources at background concentrations.

2008 model results for Pinto Creek above Henderson Ranch Mines and Haunted Canyon were unchanged from the 2006 model, because background concentrations in their contributing subbasins were not altered. The 2008 scenarios predicted slightly lower (1-5 ug/L) background/ambient copper concentrations at most other stations. The geographic pattern of exceedance of the existing copper criterion is the same. *i.e.*, exceedance of both chronic and acute criteria between the Henderson Ranch Mines to PC-100, exceedance of the chronic criterion in Pinto Creek below the Cactus Breccia, and attainment of the criteria at PC-200 and points downstream.

In most locations, the 2008 scenario with remediation of mining-related sources all the way to background concentrations gave results that were 0-2 ug/L lower than the scenario that only remediated these sources to 10 times background concentrations. However, the Gibson tributary was much more sensitive to this assumption, and the more complete remediation was predicted to result in concentrations 13-15 ug/L lower than the less complete remediation scenario.

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Attachments

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TABLE 2

Model Predictions of Dissolved Copper Concentrations for Background/Ambient Model Scenarios (ug/L)

Location	Scenario	Storm Event				
		2-yr, 1-hr	2-yr, 24-hr	10-yr, 24-hr	25-yr, 24-hr	100-yr, 24-hr
1. Pinto Cr above H.R. Mine	2006 - Mines to 10x Background	11	11	11	11	11
Chronic criterion = 16.2 ug/L	2008 - Mines to 10x Background	11	9	11	11	11
Acute criterion = 25.8 ug/L	2008 - Mines to Background	11	9	11	11	11
2. Pinto Creek above Gibson	2006 - Mines to 10x Background	22	17	21	21	22
Chronic criterion = 6.6 ug/L	2008 - Mines to 10x Background	19	15	18	19	19
Acute criterion = 9.6 ug/L	2008 - Mines to Background	19	14	18	18	19
3. Gibson Tributary	2006 - Mines to 10x Background	50	52	48	49	49
Chronic criterion = 6.1 mg/L	2008 - Mines to 10x Background	42	38	42	42	42
Acute criterion = 8.8 ug/L	2008 - Mines to Background	28	25	27	27	27
4. PC-100	2006 - Mines to 10x Background	28	19	26	27	27
Chronic criterion = 8.2 ug/L	2008 - Mines to 10x Background	23	16	22	22	22
Acute criterion = 12.2 ug/L	2008 - Mines to Background	22	15	21	21	21
5. Unnamed Tributary #2	2006 - Mines to 10x Background	42	36	42	42	42
Chronic criterion = 3.1 ug/L	2008 - Mines to 10x Background	33	30	33	33	33
Acute criterion = 4.2 ug/L	2008 - Mines to Background	31	28	30	30	31
6. Below Catus Breccia	2006 - Mines to 10x Background	34	28	32	31	30
Chronic criterion = 22.8 ug/L	2008 - Mines to 10x Background	26	22	24	24	24
Acute criterion = 37.7 ug/L	2008 - Mines to Background	25	21	24	23	23
7. Haunted Canyon	2006 - Mines to 10x Background	12	11	12	12	12
Chronic criterion = 14.1 ug/L	2008 - Mines to 10x Background	12	11	12	12	12
Acute criterion = 22.2 ug/L	2008 - Mines to Background	12	11	12	12	12
8. PC-200	2006 - Mines to 10x Background	21	18	20	21	20
Chronic criterion = 12.7 ug/L	2008 - Mines to 10x Background	20	18	19	19	19
Acute criterion = 19.7 ug/L	2008 - Mines to Background	18	16	18	18	18
9. PC-300	2006 - Mines to 10x Background	13	10	12	12	12
Chronic criterion = 29.3 ug/L	2008 - Mines to 10x Background	11	9	10	10	10
Acute criterion = 49.6 ug/L	2008 - Mines to Background	10	8	9	9	9
10. Basin Exit	2006 - Mines to 10x Background	13	9	12	12	12
Chronic criterion = 16.6 ug/L	2008 - Mines to 10x Background	11	8	10	10	10
Acute criterion = 26.4 ug/L	2008 - Mines to Background	10	7	9	9	9

Exceeds Acute criterion

Exceeds Chronic criterion but not Acute criterion