Pinto Creek Dissolved Copper TMDL

Salt River Watershed

April 2017

Open File Report 16-05

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List of Acronyms

A&Wc	Aquatic and wildlife, coldwater
A&We	Aquatic and wildlife, ephemeral
A&Ww	Aquatic and wildlife, warmwater
A.A.C.	Arizona Administrative Code
AgI	Agricultural Irrigation
AgL	Agricultural Livestock Watering
ADEQ	Arizona Department of Environmental Quality
AZPDES	Arizona Pollution Discharge Elimination System
EE/CA	Engineering Evaluation/Cost Analysis
EPA	United States Environmental Protection Agency
FBC	Full Body Contact
FC	Fish Consumption
GIS	Geographic Information System
HSPF	Hydrologic Simulation Program-Fortran
HUC	Hydrologic Unit Code
kg/day	kilograms per day
LA	Load Allocation
mg/L	milligram per liter
MPI	Malcolm Pirnie, Inc.
MOS	Margin of Safety
MSGP	Multi Sector General Permit
MS4	Municipal Separate Storm Sewer System
NB	Natural Background
NPDES	National Pollution Discharge Elimination System
PASI	Preliminary Assessment/Site Investigation
PBC	Partial Body Contact
SSS	Site-specific Standard
TMDL	Total Maximum Daily Load
TSD	Technical Support Document for Water Quality-based Toxics Control
ug/L	micrograms per liter
USFS	United States Forest Service
WLA	Waste Load Allocation
WQBEL	Water Quality Based Effluent Limit
WQS	Water Quality Standards

1.0 Introduction

In 2001 the United States Environmental Protection Agency (EPA) completed a Copper Total Maximum Daily Load (TMDL) for Pinto Creek (EPA, 2001). EPA used available National Pollution Discharge Elimination System (NPDES) monitoring data and limited in-stream water quality data to develop the TMDL. The Arizona Department of Environmental Quality (ADEQ) began sampling for a Phase II TMDL in 2001 with the intent of filling data gaps identified in the 2001 EPA TMDL, namely comprehensive watershed sampling under baseflow and stormflow conditions, determining naturally occurring copper concentrations and quantifying the loads emanating from the many abandoned and inactive mines throughout the watershed.

Early in the Phase II monitoring, ADEQ determined that portions of the watershed exceeded the default dissolved copper surface water quality standards (WQS) due solely to natural conditions. Since areas that had not been impacted by anthropogenic activities exceeded WQS, ADEQ developed a sampling strategy to derive a site-specific dissolved copper standard for Pinto Creek.

ADEQ collected samples throughout the watershed under variable flow conditions, above and below suspected sources, and from the various lithologies and tributaries minimally impacted by anthropogenic activities. The data were used in developing a dynamic hydrologic model that calculated existing loads, predicted future conditions under various flow conditions, natural dissolved copper concentrations and potential improvements that could be realized through remedial activities. The initial Phase II modeling was completed in 2006 (Malcolm Pirnie (MPI), 2006) followed by site specific standard (SSS) modeling completed in 2009 (MPI, 2008 and 2009). ADEQ adopted a site specific dissolved copper standard equal to 34 micrograms per liter (ug/L) through a formal rule-making process in 2016. The SSS is applied to Pinto Creek from the confluence with the “Ellis Ranch” tributary (river mile 32.31) located at latitude 33º19’26.7”, longitude 110º54’57.5”, continuing downstream 15.55 river miles to the confluence with the West Fork Pinto Creek (river mile 16.76) located at 33º27’32.3”, 111º0’19.7”, as shown in Figure 1. The SSS only applies to reach 15060103- 018B. ADEQ’s site specific development is summarized in the Pinto Creek Site-Specific Water Quality Standard for Dissolved Copper report (ADEQ, 2015).

Consistent with 2001 EPA TMDL, the Gibson mine remains the single largest copper source within the watershed. However, ADEQ relied upon watershed wide sampling under variable flow conditions to identify and quantify both natural background and anthropogenic contributions. The larger dataset allowed ADEQ to employ a robust hydrologic and chemical model that could account for the variation in hardness and copper concentrations in the watershed which formed the basis for the site specific copper standard. Therefore, this TMDL, once approved by EPA Region 9, will supersede and replace the 2001 TMDL completed by EPA.

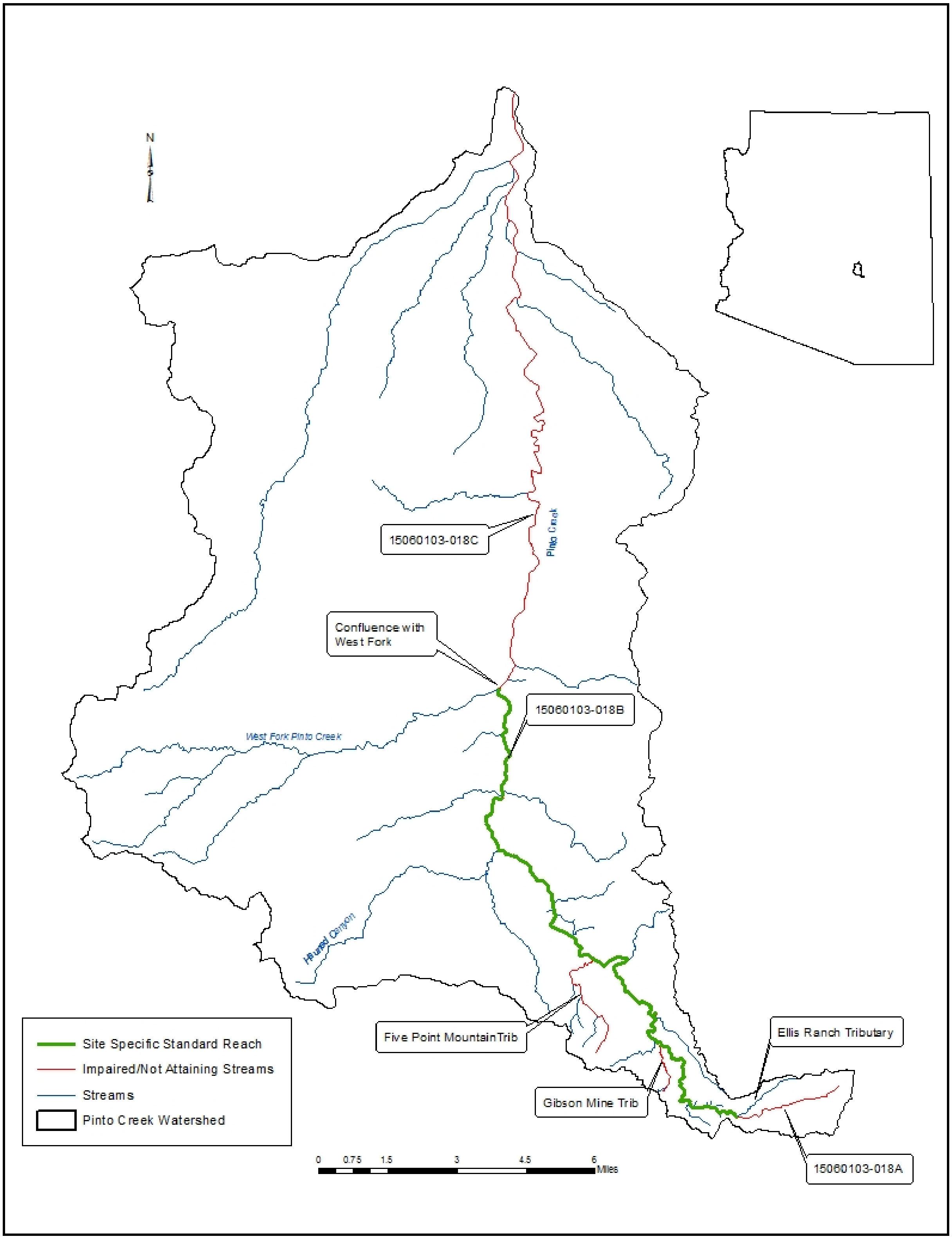

Figure 1. Stream Reaches, Tributaries and the Extent of the Pinto Creek Dissolved Copper Site Specific Standard

2.0 Background Information

Pinto Creek (15060103-018) first appeared on Arizona's 1998 303(d)-List of impaired waters due to exceedances of the dissolved copper surface water quality standard. The original listing resulted from data collected by ADEQ in response to unauthorized discharges from the Gibson mine in the early 1990's. Continued data collection and subsequent 305(b) Water Quality Assessments resulted in Pinto Creek being segmented into reaches 15060103-018A, 018B, and 018C. Current impairments are summarized in Table 1 and include the Five Point Mountain and Gibson mine tributaries, in addition to the three Pinto Creek reaches. This TMDL applies to the five reaches described on Table 1.

Table 1. Current Impairments within the Pinto Creek Watershed

Stream Segment (Hydrologic Unit Code (HUC))	Impairment(s)
Pinto Creek- Headwaters to tributary at 33º19'27"/110º54'56" (15060103-018A)	Dissolved copper
Pinto Creek- Tributary at 33º19'27/110º54'56" to West Fork Pinto Creek (15060103-018B)	Dissolved copper
Pinto Creek- West Fork Pinto Creek to Roosevelt Lake (15060103-18C)	Total selenium, dissolved copper
Five Point Mountain Tributary- Headwaters to Pinto Creek (15060103-885)	Dissolved copper
Gibson Mine Tributary- Headwaters to Pinto Creek (15060103-887)	Dissolved copper

The physical characteristics and mining history of the Pinto Creek watershed have been summarized in the 2001 Copper TMDL (EPA, 2001) and the Pinto Creek Site-Specific Water Quality Standard for Dissolved Copper (ADEQ, 2015). Therefore, they will not be repeated in detail here, rather the reader is referred to those documents for a more in depth discussion of those topics.

3.0 Numeric Targets

Water quality standards, which TMDL targets and reductions are calculated to attain, are based upon the designated uses that a particular waterbody carries and vary from use to use.

3.1 Designated Uses

ADEQ codifies surface water quality regulations in Arizona Administrative Code (A.A.C.) Title 18, Chapter 11, Article 1 (ADEQ, 2009). Designated uses, such as fish consumption, recreational contact, agriculture, and aquatic biota, are described in A.A.C. R18-11-104 and are listed for specific surface waters in Appendix B of A.A.C. 18-11-1. For those waters not specifically mentioned in Appendix B, such as the Gibson mine and Five Point Mountain tributaries, A.A.C. R18-11-105 (Tributary Rule) is used to determine the appropriate designated uses. Since the two streams are ephemeral, they are assigned the A&We (ephemeral) and PBC (partial body contact) designated uses per the Tributary Rule. Table 2 summarizes the designated uses applied to the stream reaches covered by this TMDL.

Table 2. Designated Uses within the Pinto Creek Watershed

Stream Segment	Designated Uses
Pinto Creek (018A)	Aquatic and Wildlife- cold water (A&Wc), Full Body Contact (FBC), FC Fish Consumption (FC), Agricultural Irrigation (AgI), Agricultural Livestock Watering (AgL)
Pinto Creek (018B and 018C)	A&Ww (warmwater), FBC, FC, AgI, AgL
Five Point Mountain Tributary	A&We, PBC
Gibson Mine Tributary	A&We, PBC

3.2 Applicable Water Quality Standards

The default dissolved copper water quality standards (A.A.C. R18-11, Appendix A) vary based on the designated use as shown in Table 3.

Table 3. Default Numeric Water Quality Criteria for Copper Applicable to Pinto Creek

A&Wc and A&Ww (dissolved copper[1])	A&We (dissolved copper[1])	FBC and PBC (total copper)	AgI (total copper)	AgL (total copper)
Acute 0.18 – 49.62[2] Chronic 0.18 – 29.28	Acute 0.3 – 85.88 Chronic Not applicable to ephemeral waters	1,300	5000	500

[1]- default dissolved copper standards are hardness-dependent
[2]- all numeric values are ug/L

The most stringent default dissolved copper water quality standard is applied to the chronic A&W designated uses. However, water quality data collected from natural and minimally impacted sites indicate that the default standard cannot be achieved under storm conditions, as detailed in the Pinto Creek Site-Specific Water Quality Standard for Dissolved Copper (ADEQ, 2015). Therefore, in 2003 ADEQ began a sampling program to aid in developing a site-specific dissolved copper standard for Pinto Creek.

The dissolved copper criteria applicable to the SSS reach of Pinto Creek is 34 µg/L (or 0.034 milligrams per liter (mg/L)). This value is equal to the estimated maximum natural background concentration of dissolved copper in Pinto Creek throughout the identified

SSS reach. The SSS standard is a static value and, therefore, is not adjusted for variations in hardness for the dissolved chronic copper criterion. The SSS also applies to the acute dissolved copper criterion when hardness values are less than 268 mg/L. When the hardness is lower than 268 ug/L the acute standard is not attainable as the applicable WQS are less than 34 ug/L. At hardness values equal to or above 268 mg/L the acute dissolved copper criterion will be based on the hardness dependent-formula listed in A.A.C. R18-11 Appendix A, Table 10.

The stream reach that the SSS is applied begins on Pinto Creek at the confluence with the "Ellis Ranch" tributary (river mile 32.31) located at 33º19'26.7", 110º54'57.5", continuing downstream 15.55 river miles to the confluence with the West Fork Pinto Creek (river mile 16.76) located at 33º27'32.3", 111º0'19.7", which is the origin of reach 15060103-018B.

4.0 Source Assessment

Sources of copper within the watershed include active and inactive mines, natural background and aerial deposition.

4.1 Summary of Point Sources

Point source pollution originates from a single identifiable source; an example would be the end of pipe discharge from a waste water treatment facility or, in the case of Pinto Creek, a stormwater outfall from a mine overburden rock pile. The Pinto Valley and Carlota operations are the only mines in the watershed with current Arizona Pollution Discharge Elimination System (AZPDES) permit coverage. Numerous inactive mines are located throughout the watershed with the majority falling under federal land management, namely the US Forest Service (USFS). See Table 4 and Figure 2 for mines located within the watershed that have been determined to be sources of copper. Waste load allocations (WLA) for permitted point sources are discussed in Section 6.4.1

Table 4. Mines located within the Pinto Creek Watershed

Name	Location	Owner
Pinto Valley mine (active)	33º 24' 39"/110º 57' 58"	Capstone Mining Corp
Carlota mine (active)	33º 23' 02"/110º 58' 54"	KGHM International
Gibson mine	33º 19' 58"/110º 59' 36"	Franciscan Friars
Yo Tambien mine	33 º 22'33"/110 º 58'32"	USFS
Bronx mines	33º 21' 57"/110º 59' 02"	USFS
Cracker Jim mine	33º 21' 24"/110º 58' 09"	USFS
Henderson Ranch mines	33º 19' 33"/110º 55' 10"	USFS
Blue Gate mine	33º 19' 26"/110º 55' 20"	USFS
Ellis mine	33º 20' 06"/110º 52' 47"	USFS

4.2 Summary of Nonpoint Sources

Nonpoint source pollution comes from diffuse sources, not an end of pipe discharge, and is caused by precipitation or snowmelt moving over or through the ground. Although most mining related discharges within the watershed occur as a direct result of storm events those types of discharges from active mines are regulated under AZPDES permitting programs and, as such, were included in Section 4.1. Nonpoint sources within the watershed include natural background, aerial deposition and other sources. Unpermitted inactive mines are the largest source of copper in Pinto Creek watershed. Load allocations (LA) will be assigned to nonpoint sources in Section 6.4.2

4.2.1 Natural Background

Elevated copper concentrations are expected in a watershed that has had an extensive history of mining as is the case for the Pinto Creek watershed. In mineralized areas weathering and erosive processes result in naturally high metal concentrations in stormwater runoff. This fact is the reason that the Pinto Creek SSS was required. The data used to derive the SSS includes 670 stream water quality samples collected at 48 sites by the ADEQ, predominantly, between the years 2000 thru 2005. Of these water samples, approximately 126 were obtained from 21 sites in sub-watersheds judged to be representative of natural, pre-anthropogenic conditions. See the Pinto Creek Site-Specific Water Quality Standard for Dissolved Copper (ADEQ, 2015) for additional information regarding the development of the SSS. Naturally-occurring copper concentrations exceeded the default copper criteria, meaning that reductions needed to attain those standards could not be meet.

4.2.2 Aerial Deposition

As discussed in the Pinto Creek Site-Specific Water Quality Standard for Dissolved Copper (ADEQ, 2015) aerial deposition of copper is a potential source to the watershed. Several active and historic mining and smelter operations are located in and within 30 miles of the watershed. Since the local prevailing wind is from the southeast (USFS, 1997), locations northwest of potential aerial sources would be expected to have elevated copper concentrations if aerial deposition had occurred. However, monitoring data from sample sites located northwest of the Pinto Valley mine typically showed the lowest copper levels in the watershed. ADEQ concedes that aerial deposition is a source of copper but the local natural and on-the-ground anthropogenic sources make its impact negligible.

4.2.3 Additional Nonpoint Sources

Activities that occur in the watershed that disturb natural vegetative cover and increase weathering and erosion may increase copper concentrations. Road development, recreational use, grazing, and forest fires are examples of additional non-point source activities that are ongoing or have occurred in the watershed.

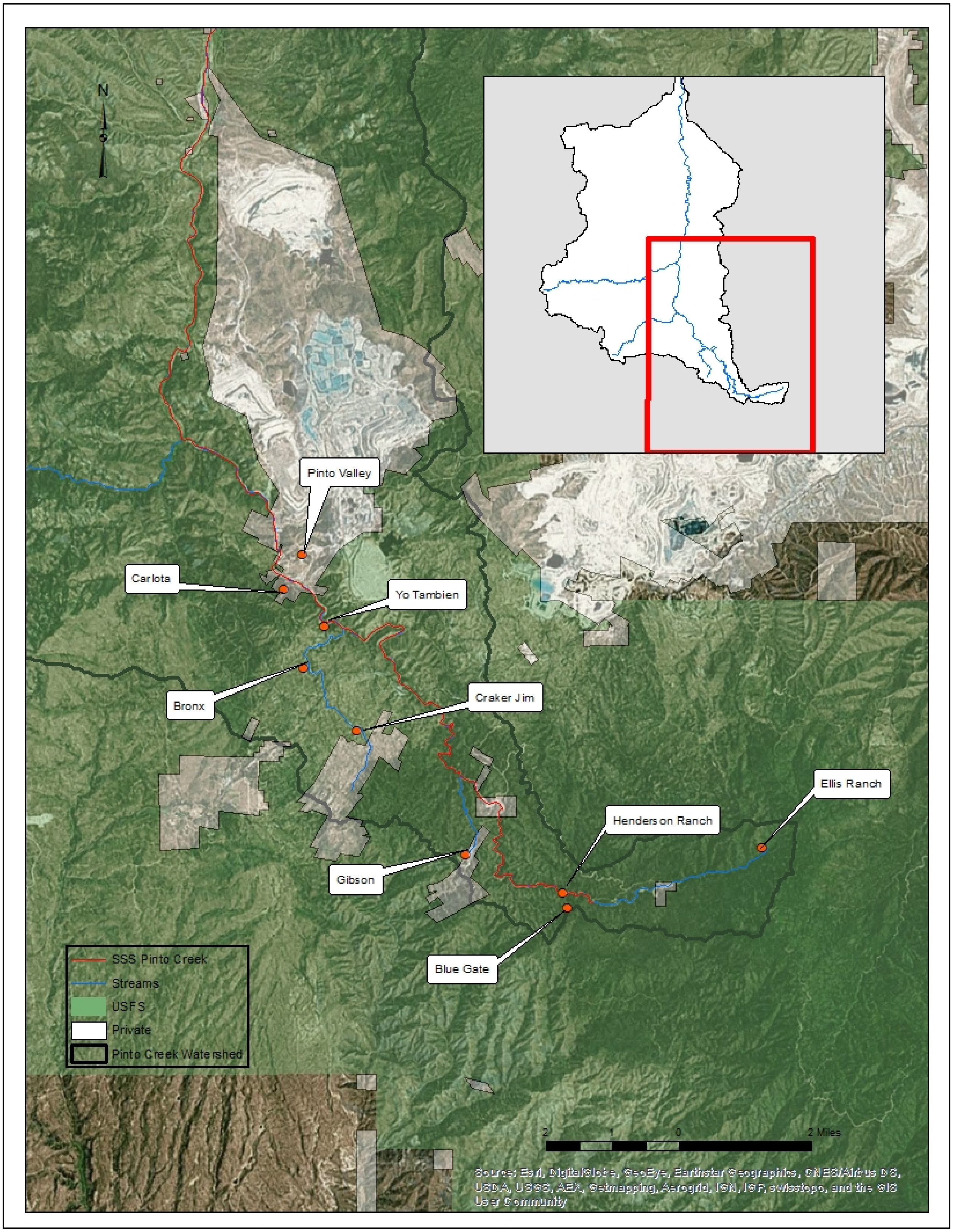

Figure 2. Mines Located in the Upper Pinto Creek Watershed

5.0 Modelling Approaches

In 2006, ADEQ contracted MPI to develop a hydrologic model for the Phase II TMDL based on additional hydrologic, water quality and meteorological data collected from 2002-2005 (MPI, 2006). The Hydrologic Simulation Program-Fortran (HSPF) was chosen as the model framework based on its ability to simulate a wide range of hydrologic and pollutant transport processes, interface with Geographic Information Systems (GIS), and wide acceptance as an appropriate tool for TMDL development. Once calibrated the model was used to predict changes in copper concentrations and loads under various scenarios. Scenarios looked at current conditions, various remedial efforts and the implementation of the Carlota project, which had not been constructed at that time. The major conclusions included:

- The Gibson mine is the largest source of copper to Pinto Creek
- Remediation of other mining sources, in addition to the Gibson mine, will improve the water quality of Pinto Creek
- The upper Pinto Creek watershed exceeds the default dissolved copper water quality criteria even after remediation of mining related sources

Recognition that the default copper criteria could not be attained led to additional modeling in 2008. The goal was to determine natural background copper concentrations as the basis to set the appropriate SSS (MPI, 2008). After the completion of the 2008 modeling effort it was discovered that several sites used in the SSS modeling did not represent background conditions. Those sites were subsequently removed from consideration and the model was revised in 2009 (MPI, 2009) and arrived at the proposed SSS equal to 34 ug/L.

6.0 TMDL Calculations

A TMDL is the maximum amount of a pollutant that a waterbody can receive and still attain applicable water quality standards. TMDLs must be expressed as daily maximum load values, e.g. kilograms/day (kg/day). In the case of Pinto Creek, the TMDL describes how much copper (kg/day) the stream can assimilate and still meet water quality standards. The classic TMDL equation is expressed as:

$$TMDL = \sum WLA + \sum LA + NB + MOS$$

When calculating a TMDL, point (WLA) and nonpoint (LA) sources, natural background (NB) and a margin of safety (MOS) are summed to arrive at the total maximum daily load.

6.1 Numeric Targets

The TMDL is based upon attaining the SSS for Pinto Creek, 34 ug/L. The model predicted natural background concentrations begin to exceed the default standard at approximately the Ellis Ranch tributary. The natural background concentration continues to exceed the default standard until approximately the confluence with West Fork Pinto Creek. Downstream of West Fork to Lake Roosevelt, the default chronic A&W standard is predicted to be met under natural conditions. The segment where natural background conditions exceed the default copper standards corresponds to segment 018B.

Although the SSS is only applicable to a portion of Pinto Creek (reach 018B), the targets for the other tributaries and sources are based upon attainment of the SSS standard in Pinto Creek reach 018B. Modeling results indicate that the SSS can be attained in Pinto Creek even though some tributaries discharge at concentrations greater than the SSS. However, it should be noted that copper loading reductions are still necessary for Pinto Creek to attain the SSS.

6.2 Modeling Scenarios and Linkage Analysis

Water quality exceedances are only observed under storm conditions, therefore, the modeling effort developed loading scenarios under five design storm events at 13 points throughout the basin based on current conditions, ambient conditions set to background and ambient conditions with mine sources set at 10 times background (see MPI 2009 Tables 5-7). A reduction to 10 times background represents a reduction of 95-99.9 percent from mine sources. The SSS standard is based upon the 2-yr, 1-hr design storm (1.03 inches of rain in one hour) as are the TMDL calculations discussed below. This recurrence interval was chosen as it best represents a large, intense monsoon storm with a 50 percent chance that this magnitude storm will occur every year (MPI, 2006).

6.3 Margin of Safety

A MOS must be included in every TMDL and accounts for the uncertainty in the TMDL analysis. The MOS may be expressed explicitly (a portion of the TMDL is allocated to the MOS) or implicitly by making environmentally conservative analytical assumptions.

An implicit MOS is built into the TMDL calculations based on several conservative factors:

- The TMDL protects the chronic aquatic and wildlife designation use under storm conditions
- Abandoned/inactive mines were modeled as non-point sources and assigned uniform areas of 5 acres (except Gibson mine which is approximately 15 acres) regardless of their actual aerial extent. The larger areas assigned to mines may over estimate their contribution to the watershed
- When comparing the model predictions at the USGS Gage on Pinto Creek below Haunted Canyon to the A&W chronic standard, a hardness of 150 mg/L was used to calculate the criterion, instead of the mean of all samples (477 mg/L). An

analysis of the variability of hardness at this location indicates substantially lower hardness levels of approximately 150 mg/L during stream flows greater than 10 cfs (cubic feet per second). Since the model was designed and calibrated to predict the copper concentrations under the critical (storm) flow conditions, it is more appropriate to use hardness data representative of those conditions

6.4 TMDL Loads and Allocations

TMDLs have been calculated for five points within the watershed, which correspond to the five stream reaches described in Table 5. The loads are cumulative; for example the loading for reach 018C includes the loads from the upstream stream reaches. The mass based WLAs listed in Table 5 include allocations for both current and potential future permitted discharges.

Table 5. TMDL Calculations by Reach

Site	Reach	TMDL[1] (kg/day)	WLA (kg/day)	LA[2] (kg/day)
Pinto Creek above Henderson Ranch mine (14.2 cfs)[3]	18A	0.38		0.38
Gibson mine Tributary (2.9 cfs)	887	0.30		0.30
Five Point Mountain Tributary (12.8 cfs)	885	1.17		1.17
Pinto Creek Above West Fork (277 cfs)	18B	7.92	0.001[4]	7.92
Basin Exit (323 cfs)	18C	8.85		8.85

1- includes implicit margin of safety
2- NB and LA have been summed into one allocation
3- flow rate used in calculating TMDL for each reach
4- includes 0.001 kg/day WLA for Pinto Valley outfall 005 and concentration based WLAs

6.4.1 Waste Load Allocations

Waste load allocations (WLAs) are assigned to point sources which typically require AZPDES permits. Currently there are three permittees that have permit coverage as detailed in Table 6, all of these sources discharge to tributaries to or directly to reach 018B. The Pinto Valley mine has both an individual AZDPES permit and a Multi-Sector General Permit (MSGP). There are no active Construction General Permits within the watershed at this time.

Table 6. Active AZDPES Permits within the Pinto Creek Watershed

Facility	Authorization/Permit Number	Permit Type
Pinto Valley mine	AZ0020401	Individual AZPDES
Pinto Valley mine	AZMSG-78423	MSGP
Carlota Copper mine	AZMSG-71495	MSGP
ADOT	AZS000018	Individual MS4

6.4.1.1 Mass Based WLAs

The only permitted mass based WLA within reach 018B is applied to the Pinto Valley mine individual AZPDES permit (AZ0020401). The permit allows discharges from four designated outfalls but does not contain maximum flow limits. Only outfall 005 has a continuous discharge which has been calculated equal to 7.49 gallons per minute or 0.17 cubic feet per second (cfs) (ADEQ, 2014). Outfalls 002, 003, and 004 are designated stormwater outfalls and are designed to contain flow from a 10-yr, 24-hr precipitation event. No discharges have occurred from outfalls 002, 003, or 004 in the last 15 years.

The water quality based effluent limits (WQBELs) for copper, as stated in the Pinto Valley permit, equal 24 ug/L as a monthly average and 48 ug/L as a daily maximum limit. These are applied to all four outfalls. The limits were calculated based upon the maximum applicable default chronic dissolved copper standard equal to 29.3 ug/L which occurs at a hardness of 400 mg/L. The maximum value is applicable since the average hardness of the 005 discharge is greater than 400mg/L. The applicable water quality standard was translated into WQBELs using the methods outlined in the EPA Technical Support Document for Water Quality-based Toxics Control (TSD) (EPA, 1991).

The mass based WLA for outfall 005 equals 0.001 kg/day. This value is calculated from the average discharge (0.17 cfs), water quality standard (29.3 ug/L) and a conversion factor (0.0024468).

Rather than basing the Pinto Valley WQBELs on the higher SSS, they will remain based upon the lower default maximum chronic dissolved copper standard. Discharge monitoring results from Pinto Valley discharges are below their current WQBELs indicating current performance is meeting the applicable WQBELs.

6.4.1.2 Concentration Based WLAs

Concentration based WLAs equal to 29.3 ug/L will be assigned to the Pinto Valley stormwater outfalls (002, 003, and 004) covered under AZPDES AZ0020401. As described in 6.4.1.1 the WLA has been translated into WQBELs equal to 24 ug/L as a monthly average and 48 ug/L as a daily maximum based on the EPA TSD method.

The additional general permittees (Pinto Valley and Carlota) and ADOT are assigned concentration based WLAs equal to 34 ug/L for discharges with hardness values less than 268 mg/L. For stormwater discharges where the hardness is greater than 268, the WLA will be based upon the applicable aquatic and wildlife acute copper standard according A.A.C. R18-11 Appendix A, Table 10. The concentration based WLAs and associated WQBELs, calculated using the EPA TSD method, are also applicable to future permits.

Permittees must demonstrate compliance with the WLA as specified in their permits. If sample results exceed the WLA, permittees should evaluate the effectiveness of BMPs, modify or implement new BMPs, or provide additional measures to improve water quality.

6.4.2 Load Allocations

Typically the nonpoint source mass based LAs are calculated as the remaining balance once the WLAs, MOS and NB loads are subtracted from the TMDL. However, since the Pinto Creek SSS is based upon natural conditions, the background portion of the TMDL is significant, ranging from 60 to 100 percent of the TMDL. Therefore, the LA and NB loads have been combined into one single allocation as shown in Table 5.

Mass based LAs are assigned to known unpermitted mining sources throughout the watershed and are summarized in Table 7. The concentration targets listed in Table 7, are based upon modelling results with mining sources set to 10 times background (MPI, 2009).

The 10 times background target is based upon developing achievable remedial targets while being environmentally protective. Mines are located in areas that are highly mineralized and, as such, expecting them to reach un-mineralized background concentrations is not realistic. ADEQ will evaluate the concentration targets as effectiveness monitoring occurs. If necessary, the modeling effort will be revisited should the concentration targets be determined not to be achievable.

The inactive mines on USFS lands and the Gibson mine have had remedial projects implemented or will be implemented by the end of 2017. Currently the USFS and Gibson mines do not have AZPDES permit coverage. If permit coverage is applied in the future to these mines the mass based LAs assigned in Table 7 will be converted to WLAs and incorporated as WQBELs using the EPA TSD method discussed above.

Table 7. Mass Based Load Allocations

Source	**Reach**	**LA (kg/day)**	**Concentration Target (ug/L)**
Ellis Ranch mine	18A	0.001	10.9
Henderson Ranch mines	18B	0.04	34.0
Gibson mine	887	0.17	42.4
Bronx mines	885	0.05	37.5
Cracker Jim mine	885	0.05	37.5
Yo Tambien mine	18B	0.05	34.0

Nonpoint sources are held to the concentration targets listed in Table 7 depending on what reach they affect. For example, nonpoint source contributions to the Gibson mine tributary should not cause an exceedance of the 42.4 ug/L target.

6.5 Load Reductions

Reductions in copper loadings are required in order for Pinto Creek and its tributaries to meet the TMDL and water quality standards, see Table 8. The existing and targeted dissolved copper concentrations are also listed in Table 8. Only Reach 018A is currently meeting the TMDL; all other reaches require reductions ranging from 50-99 percent.

Table 8. Load Reductions by Reach

Reach Description	Reach	Existing Load (kg/d)	Existing Conc. (ug/L)	TMDL (kg/d)	Reduction (kg/d)	Conc. target (ug/L)	Reduction Needed
Pinto Creek above Henderson Ranch mine	018A	0.38	10.9	0.38	0.00	10.9	0%
Gibson mine Tributary	887	44.3	6,210	0.30	44.0	42.4	99%
Five Point Mountain Tributary	885	3.59	115	1.17	2.42	37.5	67%
Pinto Creek Above West Fork	018B	17.0	25.1	7.92	9.08	11.7	53%
Basin Exit	018C	17.7	22.4	8.85	8.85	11.2	50%

7.0 TMDL Implementation

The Gibson mine has historically been the single largest source of copper to Pinto Creek. Two remedial projects have been completed at the site. The first, completed in 2007, removed pregnant leach pond facilities, low grade ore and tailing material from the site. The site was then re-graded and contoured with native material. Effectiveness monitoring showed a 33 percent reduction in dissolved copper concentrations. A second project, completed in 2013, installed a soil cap, rerouted stormwater from un-impacted areas and captured stormwater from impacted areas. Monitoring data show that dissolved copper concentrations have fallen by 85 percent, overall, in the Gibson mine tributary. ADEQ will continue to work with the owners of the mine, the Franciscan Friars, and their consultant to identify additional remedial opportunities. Sampling data indicate several “hot spots” that may require additional cover material or rerouting of drainages so that additional runoff is retained on site.

In 2013, Weston Solutions, Inc. (Weston) completed a Preliminary Assessment/Site Investigation (PASI) for the USFS. The project evaluated six mine sites located on USFS lands throughout the Pinto Creek watershed, including those identified as copper sources by ADEQ. An Engineering Evaluation/Cost Analysis (EE/CA) which explored remedial options ranging from no action to complete removal of all mining-related material was completed in 2016. The USFS completed remedial efforts at the Henderson Ranch, Cracker Jim and Blue Gate mines in early 2017. Work continues at the Ellis Ranch and Bronx mines. ADEQ will expand its current effectiveness monitoring efforts in FY 2018 to measure the effectiveness of these remedial activities.

ADEQ continues to work with the Friars, USFS and their consultants to implement projects that will continue to improve water quality in Pinto Creek. Table 9 contains significant milestones and anticipated completion dates.

Table 9. Milestones for TMDL Completion and Implementation

Milestone	FY17	FY18	FY19
ADEQ conducts Gibson mine effectiveness monitoring	X	X	X
Pinto Creek SSS standard adopted	X		
TMDL approved by EPA	X		
Franciscan Friars complete additional work at Gibson mine		X	
USFS EE/CA completed	X		
USFS Implements EE/CA	X	X	
ADEQ conducts USFS implementation effectiveness monitoring		X	X

8.0 Public Participation

Public participation has been an important factor in the development of the Pinto Creek SSS and Phase II TMDL. Since the conclusion of EPA's Phase I TMDL ADEQ has held four public meetings to disseminate information, discuss issues and receive questions, comments and suggestions from the public.

Meetings were held on February 1, 2001 and December 15, 2003, at the Capstone-PVO Training Facility, July 22, 2004 at City Hall, Globe, Arizona, and June 12, 2007 at the Bullion Plaza Cultural Center & Museum, Miami, Arizona.

The SSS was included in the 2016 Arizona Surface Water Quality Standards Triennial Review rule package. Although additional public notice and the opportunity to review and comment on the SSS was provided by this rulemaking process, no comments were received.

References

Arizona Department of Environmental Quality (ADEQ), 2015. Pinto Creek Site-Specific Water Quality Standard for Dissolved Copper. Open File Report 16-04.

Arizona Department of Environmental Quality (ADEQ), 2014 Pinto Valley Mining Corp AZPDES Permit No. AZ0020401 Fact Sheet.

Malcolm Pirnie Inc., (MPI), 2006. *Pinto Creek Phase II TMDL Modeling Report*, Report prepared for the Arizona Department of Environmental Quality, February, 2006.

Malcolm Pirnie Inc., (MPI), 2008. Technical Memorandum - Project No. 1761-117, September 9, 2008.

Malcolm Pirnie Inc., (MPI), 2009. Technical Memorandum - Project No. 1761-117, Rev. November 17, 2009.

US Environmental Protection Agency (EPA), 2001. Total Maximum Daily Load for Copper in Pinto Creek, Arizona. USEPA Region 9, Water Division.

EPA,1991. Technical Support Document for Water Quality-based Toxics Control. (EPA/505/2-90-001).

US Forest Service (USFS), 1997. Final Environmental Impact Statement for Carlota Copper Project- Tonto National Forest.

Weston Solutions, Inc., 2013. Final Preliminary Assessment/Site Investigation: Upper Pinto Creek Mines, Globe Ranger District, Tonto National Forest, Arizona. Contract No. AG-8371-D-12-0047.